Strategic Environmental Impact Study

of the Transport Development Strategy of the Republic of Croatia 2017-2030

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Entity responsible for the preparation of the Transport Development Strategy of the Republic of Croatia:	Ministry of the Sea, Transport and Infrastructure Prisavlje 14 10 000 Zagreb
Designer of the Study:	IRES EKOLOGIJA d.o.o. za zaštitu prirode i okoliša <IRES EKOLOGIJA Ltd. for nature and environmental protection> Prilaz baruna Filipovića 21 10 000 Zagreb
Head of the Study design:	Mirko Mesarić, dipl. ing. biol.

EXPERT TEAM

Author	Signature	Section
Josip Stojak, mag. ing. silv.		Forestry, Wild game and Hunting
Boris Božić, mag. oecol. et prot. nat..		Environmental change drivers, Environmental loads
Dunja Delić, mag. oecol		Relation between the Strategy and other national plans, programs and strategies, Environmental goals established upon the conclusion of international treaties and agreements, Analysis of general, developmental, management/organizational measures, Environmental monitoring, Conclusion
Ivana Gudac, mag. ing. geol.		Introduction, Air quality and climatic characteristics, Analysis of general, developmental, governing/organizational measures
Igor Ivanek, prof. biol.		Biodiversity
Edin Lugić, dipl. ing. biol.		Appropriate Assessment

EXPERT TEAM		
Author	**Signature**	**Section**
Mateja Leljak, mag. ing. prosp. arch.		Landscape features, Analysis of general, developmental, governing/organizational measures
Martina Matijević, mag. geogr.	Martina Matijević	Socio-economic features, Tourism, Possible environmental development without implementation of the Strategy
Mario Mesarić, mag. ing. agr.		Agriculture
Danijel Stanić, mag. ing. geol.		Geodiversity, Surface and groundwater, Soil

EXTERNAL CO-OPERATORS		
Author	Signature	Section
Amelio Vekić, dipl. arheolog		Kulturno-povijesna baština

DESIGNER'S RESPONSIBLE PERSON

IRES EKOLOGIJA d.o.o. for nature and environmental protection

mr. sc. Marijan Gredelj

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1 Introduction

Strategic Environmental Impact Assessment (hereinafter: SEIA) is a procedure for assessing the likely significant environmental impacts that may arise from the implementation of a strategy, plan or programme. The implementation of the SEIA is the basis for promoting sustainable development by integrating the conditions for environmental protection into the strategies, plans and programmes of a particular area. This enables the adoption of relevant decisions on the approval of strategies, plans and programmes taking into account possible significant impacts that the strategy, plan and programme could have on the environment and provides the persons responsible for the implementation with the framework of action and the possibility to include essential environmental protection elements in decision-making (Environmental Protection Act (Official Gazette of the Republic of Croatia 80/13, 153/13, 78/15)).

The designer of the Transport Development Strategy of the Republic of Croatia for the period 2017-2030 (hereinafter: the Strategy) is the Ministry of Maritime Affairs, Transport and Infrastructure[1] (hereinafter: the Ministry of Sea, Transport and Infrastructure). The SEIA procedure started on 21 July 2015 with the adoption of the *Decision on the implementation of the procedure for Strategic Environmental Impact Assessment for the "Transport Development Strategy of the Republic of Croatia for the period 2017-2030*" (Class: 340-03/15-10/03, Reg. No.: 530-08-2-3-2-15-4).

The SEIA procedure for the Strategy is implemented on the basis of the provisions of the Environmental Protection Act, the Regulation on the Strategic Environmental Impact Assessment of the Strategy, Plan and Programme (Official Gazette of the Republic of Croatia 64/08)[2] and the Regulation on Information and Participation of the Public and Interested Public in Environmental Issues (Official Gazette of the Republic of Croatia 64/08). This procedure assesses the likely significant impacts on the environment and human health that may arise from the implementation of the Strategy.

The Strategic Environmental Impact Study (hereinafter: the Study) is developed in the SEIA procedure, a professional background attached to the Strategy and includes all the necessary data, explanations and descriptions in textual and graphic form. The study identifies, describes and assesses the likely significant impacts on the environment and human health that may arise from the implementation of the Strategy. It is intended to ensure that the consequences on the environment and human health are assessed during the preparation of the Strategy, prior to the final proposal and referral to the procedure for its adoption.
SEIA procedure consists of steps provided in the table (Table 1.1).

Table 1.1 Steps in SEIA implementation

Step	Goal
Analytical review	Determine whether the strategic assessment is mandatory under the provisions of the Environmental Protection Act
Opinion of the body competent for nature protection	Implementing the preliminary acceptability assessment of the Strategy for the Ecological Network
Opinion of the body	Obtaining an opinion on the strategic assessment from the body competent for environmental protection
Defining the content of the Strategic Study	Defining the scope and level of details that shall be addressed in the assessment
Preparation of the Strategic Study and evaluation of its integrity and professional grounds	Assessment of likely significant environmental impacts as a result of implementing the Strategy

[1] The Ministry of Maritime Affairs, Transport and Infrastructure changed its name to Ministry of Sea, Transport and Infrastructure, October 2016.
[2] From January 2017, a new Regulation on the Strategic Environmental Impact Assessment of the Strategy, Plan and Programme (Official Gazette of the Republic of Croatia 3/17) is effective.

Step	Goal
Public discussion	Discussion on the draft Strategy and Study
Evaluation of comments on the Draft Strategy and Study	Review of the comments received, alternative solutions, reasons for the selection of a variant
Report on the implemented Strategic Environmental Impact Assessment	- presentation of a manner in which the issues relating to environmental protection and ecological network have been integrated into the strategy, plan and programme - presentation of a manner in which the strategic study results, opinions of the bodies and/or persons, as well as comments, proposals and opinions of the public have been taken into account and considered when making a decision to adopt the Plan - explaining the reason for accepting a selected reasonable alternative strategy, plan or programme, compared to other considered reasonable alternatives - the method for monitoring the implementation of the measures included in the Strategy content - the method for monitoring significant environmental impacts of the Strategy adopted.

The process of implementing the SEIA also provides the stakeholders with the opportunity to participate in the process, while providing information to the public and enabling their participation during the decision-making process. Directive 2001/42 /EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment (SEA Directive) has been effective since 2001. In the Republic of Croatia, the legal framework for the development of strategic studies is aligned with the SEA Directive and in accordance with the Act on the Confirmation of the Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (Official Gazette of the Republic of Croatia 7/09).

1.1 Purpose and objectives of the Strategy

The first cycle of drafting the National Strategy was completed on 30 October 2014 by adopting the Transport Development Strategy of the Republic of Croatia for the period 2014-2030 by the Government of the Republic of Croatia, providing input data from the transport domain for the preparation of program documents for the period 2014-2020. (Operational Program "Competitiveness and Cohesion").

The 2014 Strategy is considered to be the first phase of the development of the Transport Development Strategy of the Republic of Croatia, as at the time of its construction, the Republic of Croatia did not have a transport model or tool that would generate relevant data that would allow for a quality analysis and planning of the transport sector.

The completion of the final model of the existing transport system of the Republic of Croatia was completed by the end of 2016. The model contains relevant physical components for all types of travel of passengers and goods (such as the number of vehicles on the observed sections, the technical characteristics of these sections, characteristic vehicles, significance of the type state/local type etc.) in road, railway, public urban suburban, maritime, river and air transport system of the Republic of Croatia with projections in 2020, 2030 and 2040.

The planned deadline for the completion of the Strategy was June 2016. However, due to the completeness of the transport data and the completion of the national transport model, the deadline for completing the Strategy was prolonged until April 2017, and the programming period to which the Strategy applies from 2017 to 2030.

As the goals and program bases did not change in relation to the ones that led to the decision on the beginning of the SEIA content strategic study implementation, it was not necessary to change them. For the same reason, no new decision on the eligibility of the Ecological Network Strategy was requested.

The Strategy is based on an analysis of the current situation in the Republic of Croatia, identifying opportunities and problems and analyzing the best solutions to meet the existing needs.

Also, the Strategy represents a document identifying medium and long-term development in the Republic of Croatia and represents a qualitative shift in relation to the existing situation and the realization of a new phase, namely the increase of the quality of the transport system and the traffic infrastructure itself. Given all the above, the definition of clear goals is considered the basic and key phase of the strategic planning process.

As a result of the policies and strategies of the European Union and Croatia, a list of general objectives was established, and specific objectives were derived from the analysis of the Croatian transport system.

Main goals	
G01	Change the distribution of passenger traffic in support of public transport (PT) and forms of transport with zero emission of harmful gases. This includes PT in agglomerations (trams, local bus lines, etc.), rail transport, public transport in maritime traffic and inland waterway transport, regional and remote bus services as well as pedestrians and cyclists.
G02	Change the distribution of freight transport in favour of rail and maritime transport and inland waterway transport.
G03	Develop a transport system (management, organization and development of infrastructure and maintenance) according to the principle of economic viability.
G04	Reduce the impact of the Croatian transport system on climate change.
G05	Reduce the impact of the Croatian transport system on the environment (environmental sustainability).
G06	Increase the security of the Croatian transport system.
G07	Increase the interoperability of the Croatian transport system (public transport, rail, road, maritime and air traffic and inland waterways transport).
G08	Improve the integration of transport modes in Croatia (management, intelligent transport systems (hereinafter: ITS), “park and ride” parking lots (hereinafter: P & R), etc.).
G09	Further develop the Croatian part of the Trans-European Road Network (hereinafter: TEN-T) (basic and comprehensive).

Specific objectives that apply to all traffic sectors	
SG	Better coordinate traffic management with neighboring countries (BiH - Port of Ploče, road and rail links from BiH, Slovenia, Serbia, Italy, Montenegro and Hungary).
SG	In some parts of Croatia complement, where applicable, the development of the tourism sector as the main economic factor in the adequate development of transport, in particular in favour of public transport and green mobility.
SG	Improve access to remote parts of Croatia (e.g. islands, Southern Dalmatia).
SG	Develop the potential of major logistics centers (port Rijeka, port Split, port Ploče, port Vukovar, port Osijek, Zagreb).
SG	Strengthen Croatia's position as a logistics hub of the wider region, with a special emphasis on Zagreb.
SG	Improve the integration of the transport sector into socio-economic trends in the region (concept of functional regions).
SG	Resolve the specific situation in Croatia that stems from the seasonality of traffic.
Public transport	
PT1	Develop the potential of road public transport (regional and state) where other forms of public transport are not profitable.
PT2	Increase the competitiveness of the tram transport system in Zagreb and Osijek.
PT3	Better integrate the international/national transport system into local and regional transport systems (passenger hubs, integrated billing system, etc.)
PT4	Increase efficiency and reduce the economic impact of governance and organization of public transport.
PT5	Increase the attractiveness of public transport by improving the concepts of fleet management and modernization.

Railway transport	
RT1	Improve the rail freight corridor from port Rijeka to the markets with the greatest potential for the port (Hungary, Bosnia and Herzegovina, Slovakia, Italy, South Poland and Serbia).
RT2	Better use of the Croatian railway system in larger Croatian agglomerations (Zagreb, Rijeka, Split, Varaždin, Osijek).
RT3	Improve the level of service of the railway fleet and its impact on the environment.
RT4	Better integrate the railway system into local transport systems (security and protection on railway stations, links to other modes of transport, etc.)
RT5	Increase safety on railroad crossings.
RT6	Increase the efficiency of the Croatian railway system (traffic management, business operations, etc.).
RT7	Ensure the maintenance of infrastructure while respecting aspects of economy.
Road transport	
RDT1	Improve the safety of the road transport system.
RDT2	Better use of the Croatian road system in the context of public transport (buses in the local, regional and state system).
RDT3	Reduce the impact of the oldest road sections of the Croatian motorway network on the environment.
RDT4	Optimize and match different toll collection systems in Croatia.
RDT5	Improve technical requirements in road design with emphasis on more economical technical solutions, safety standards, green mobility and integration of transport modes with zero emission of harmful gases.
RDT6	Increase the road accessibility of areas where existing infrastructure has reached the upper limit of motorway capacity, and alternative forms of transport (public railway and coastal line transport) are not economically justified (tourist centers in Adriatic Croatia), including the introduction of a sustainable transport concept in favour of public transport and transport modes with zero emission of harmful gases.
RDT7	Increase connectivity with neighboring countries in order to raise co-operation and territorial integration to a higher level.
RDT8	Increase the availability of areas in Croatia where the upper limit of motorway capacity has been reached and where there is no alternative road infrastructure (parallel motorways, etc.) - from Zagreb in the direction of Bjelovar and Varaždin in the direction of Koprivnica.
RDT9	Reduce traffic congestion in heavily loaded agglomerations, taking into account the special rules that apply to the protection of national heritage.
Air transport	
AT1	Support the development of the "Franjo Tuđman" airport with the aim of preserving the accessibility of the Croatian capital from abroad.
AT2	Improve business operations and reliability of the Dubrovnik Airport to preserve accessibility to Southern Dalmatia.
AT3	Improve the availability of airports, particularly by public transport.
AT4	Improve the security standard at airports and in air transport.
AT5	Comply with the requirements for entry into the Schengen area where applicable.
Maritime transport	
MT1	Encourage development and raise the competitiveness of Rijeka port as the main Croatian seaport.
MT2	Reduce the impact of maritime transport on the environment (fleet development, measures to prevent and control pollution from marine facilities, environmental protection).
MT3	Increase the distribution of freight transport on over-Adriatic and coastal routes in favour of maritime transport.
MT 4	Increase the reliability of maritime traffic (public transport and supply chains) in toughening weather conditions.
MT 5	Improve the efficiency and economy of the maritime transport system.
MT 6	Improve maritime transport security.
MT 7	Improve the integration of ports into the local transport system (passenger and freight).
River transport	
RIT1	Increase the competitiveness of ports in Vukovar and Osijek as main river ports for freight traffic.
RIT 2	To cooperate with BiH in the development of the Slavonski Brod cargo port.
RIT 3	Focus on the potential of navigating inland waterways in the segment of tourism and public transport.

RIT 4	Adapt the buoyance conditions to transport needs and maintain the required level of navigation.
RIT 5	Improve operational and organizational conditions in river transport (economic viability).

Based on analysis of present conditions and with the aim of achieving defined general and specific objectives, a set of measures has been established in each sector of transport. Measures suggest interventions that are related to improving the infrastructure of different transport systems, but also with operational and organizational aspects. Also, the Strategy sets out measures for all transport sectors that are to a large extent related to improving safety and environmental protection.

All measures defined by the Strategy are listed and described in Chapter 7. Impact of the Strategy on the environment. Measures are within the Study, aiming at a better approach to assess the impact of the Strategy on the environment, divided into four categories: general measures (15), development measures (38), management/organization (58) and spatially located measures (48).

2 Relationship between the Strategy and other appropriate strategies, plans and programes

Strategy, plan, program	The main goals of the document	Relationship with Strategy
The Transport Development Strategy of the Republic of Croatia for the period 2014-2030 (OG 131/14)	The Ministry of the Sea, Transport and Infrastructure in 2014 developed the Transport Development Strategy of the Republic of Croatia for the period 2014-2030. Since joining the European Union on 1 July 2013, determining the development of transport infrastructure in the Republic of Croatia, primarily in accordance with the framework of the European Union's transport policy is of crucial importance. On the basis of the revision and improvement of the Transport Development Strategy of the Republic of Croatia from 1999, long-term development and future investments in the transport sector have been defined to meet the real needs of the new transport infrastructure and enable efficient and realistic planning and definition of priorities, aiming at having user functional and available transport infrastructure and services. During the preparation of the Transport Development Strategy of the Republic of Croatia for the period 2014-2030, the transport model of the Republic of Croatia was still not defined. The transport model was defined by the middle of 2015, when the second phase of the Strategy was developed, i.e. the development of the Transport Strategy of the Republic of Croatia for the period 2017-2030 began, having developed transport model of the existing transport system of the Republic of Croatia.	The Strategy is a complement to the Transport Development Strategy of the Republic of Croatia for the period 2014-2030, and has been completed after defining the final transport model.
National Road Safety Program of the Republic of Croatia 2011-2020 (OG 59/11)	In July 2010, the European Commission adopted the 4. Road Transport Safety Action Program for the period from 2011 to 2020, which should be a framework for the national strategies of all European Union countries. The goal of the National Program is to drastically reduce death and serious injury in transport, reduce the high costs of traffic accidents, improve health and quality of life, and secure and sustainable mobility. Road transport safety is closely related to energy, environment, employment,	The Strategy is in line with the objectives of the National Security Program in the section on improving the road system, both in terms of environmental protection and traffic safety. One of the general measures of the Strategy "Improving the security of the transport system" aims to reduce road transport fatalities.

Strategy, plan, program	The main goals of the document	Relationship with Strategy
	education, youth, public health, justice, insurance.	
National Aviation Safety Program (OG 141/2015)	The National Air Transport Safety Program is a document describing regulatory requirements and activities undertaken by entities to maintain and improve air transport safety and is developed in accordance with the standards of the International Civil Aviation Organization and the European Aviation Safety Agency Program. The main objectives of the Program are the establishment of aviation safety standards at the highest possible level and regional cooperation and cooperation with international organizations in order to raise the level of security and exchange of data on safety.	One of the main goals of the Strategy is also to develop the highest standards of air transport safety at the international, regional and national level in order to effectively reduce air traffic hazards, reduce the likelihood of accidents and limit the negative consequences of such accidents.
National Action Plan to encourage production and use of biofuels in transport for the period 2011 - 2020	In order to harmonize Croatian legislation with the acquis communautaire, in the preparation of this National Action Plan, consideration is given to the objectives and regulations defined by the European Union's strategic documents on the promotion of production and use of biofuels. Regarding the changes in the structure of energy sources used in transport, in line with EU policy, the legislative and regulatory framework shall encourage the placing of biofuels on the market, and promotional campaigns shall stimulate their use. Due to the beneficial effects, the use of the already ignored compressed natural gas shall be encouraged. Its place of use is the truck corridors (so-called blue motorways), city bus traffic, as well as personal vehicles.	The Strategy promotes energy efficiency in the transport sector, especially in road transport (measures to introduce alternative fuels), contributing to the goals of the National Action Plan.

Strategy, plan, program	The main goals of the document	Relationship with Strategy
The Strategy of Maritime Development and Integral Maritime Policy of the Republic of Croatia for the period 2014-2020 (OG 93/14)	The strategy represents the basis for defining the direction of maritime development as one of the most important areas of the economy of the Republic of Croatia, with the mission of increasing gross domestic product, defining development on the principles of sustainability, culture promotion, and the promotion of the safety and the protection of the marine environment. One of the strategic goals is the safe and environmentally sustainable maritime transport, maritime infrastructure and the maritime space of the Republic of Croatia. In this context, the Strategy pays attention to protecting the environment, preserving and enabling the recovery of marine and coastal environmental systems and protecting biodiversity and sustainable use of the sea and the coastal area.	The development of maritime transport defined in the relevant Strategy is in line with the Marine Development Strategy, given that the implementation of measures relating to maritime transport does not exert significant effects on the marine environment, i.e. undermining the strategic objective of the Maritime Development Strategy.
Water Management Strategy (OG 91/08)	The Water Management Strategy is the umbrella document on the basis of which European standards for water management in the Republic of Croatia are implemented. The main objective of the Strategy is to achieve and preserve good water status, prevent water pollution, prevent changes in the hydro morphological characteristics of waters under such risks and sanitization of water status where it is disrupted. The strategy prescribes protection measures for scattered and point sources of water contamination (roads, ports, ...).	The realization of the Strategy represents a potential risk for water bodies, but during the strategic assessment, the water protection measures are prescribed and therefore, in compliance with the measures stipulated by the Water Management Strategy, no explicit conflicts of the Water Strategy with the objectives of water protection are expected.
Strategy for the Development of River Transports in the Republic of Croatia (2008-2018) (OG 65/08)	In accordance with the European Agreement on the International Carriage of Dangerous Goods by Inland Waterways, a preventive measure against potential pollution risk from ships includes the obligation of separate storage, processing and disposal of hazardous and non-hazardous waste in ports and the acceptance of waste resulting from the exploitation of vessels. Croatian river ports need to be modernized qualitatively and technologically to meet the	In accordance with the relevant Strategy, in order to raise the level of safety on the waterways, it is necessary to establish clear procedures for measures to be taken in the event of an incident, along with the introduction of river information systems and the timely availability of accurate information on the movement of vessels, as well as to upgrade the existing navigation marking and tracking systems of inland waterways. For

	existing and expected transport demand. In addition to the modernization of the basic port infrastructure, security and surveillance systems in the port area should be improved. Ports must be connected to main road and railway corridors in order to achieve better integration with economic hinterland and to create preconditions for the development of intermodal traffic.	security reasons, it is necessary to modernize ports and equip them with modern security systems. With regard to the action of the Strategy in the direction of improving the conditions of the port area, conflicts with the objectives of the Development Strategy of River Transport in the Republic of Croatia are not expected.
Croatia's Tourism Development Strategy by 2020 (OG 55/13)	The Tourism Development Strategy of the Republic of Croatia by 2020 has set the main objective of tourism development in increasing tourism attractiveness and competitiveness, which should result in country entering the list of the leading 20 tourist destinations in the world according to the competitiveness criteria. Strategic goals of tourism development are oriented towards achieving the main goal and they include improving the structure and quality of accommodation, new employment, investments and increasing tourism supply.	The Strategy contributes to improvements in the tourism sector in a way that ensures better tourist connectivity, mobility and accessibility of tourist products to all aspects of transport.
Nautical Tourism Development Strategy of the Republic of Croatia for the Period 2009 - 2019	The greatest threat to the long-term development of nautical tourism is the uncontrolled use of naturally shaped area and natural goods. Therefore, the responsible management of natural resources and goodwill, i.e. protection of nature and environment for the purpose of their conservation, contained in the principle of sustainable development, represents an imperative for the creators of economic development and the planning of the use of space at all levels. With all the positive economic effects, tourism also has negative ones. The negative impact of tourism is reflected, above all, in the use of natural space for capacity building and the short seasonal concentration of a large number of tourists in a given area. The negative impacts of tourism on space and the environment can be reduced to the smallest possible extent by managing its development, which implies planning a rational and controlled, limited and targeted use of space for capacity building and the application of all environmental protection measures. By implementing regulations, the nautical tourism ports undertake the obligation to implement the receiving systems for the collection of waste materials from the vessels (faeces, oils, communal waste), thereby	The objectives of the Strategy are in line with the Strategy for the Development of Nautical Tourism in the area of improving safety and environmental protection in ports.

	contributing to the preservation of the environment. When designing the construction of nautical ports, it is necessary to valorize and apply more criteria, and certainly one of the most important criteria is selecting a location.	
The European Union Strategy for the Danube Region	The Danube region covers the fifth of the territory of the European Union and its well-being is inseparably linked to the Union as a whole. Many problems in the region have no borders (flood, transport and energy connectivity, environmental protection and security challenges) and require a unique approach. Due to the geographical and political characteristics of the region, migration, climate change and security have a particularly strong impact on this area. Projects proposed in the priority area to which the Republic of Croatia belongs include: removal of ship wrecks and other remnants from river basin, faster interurban railway links, multimodal investment to foster green mobility solutions.	The Strategy is not in conflict with the objectives of the Danube Strategy. In the priority area for the Republic of Croatia, the environmental development objectives are in line with the Croatian Road Transport Strategy.
Energy development Strategy of the Republic of Croatia (OG 130/09)	The fast-growing sectors in the Republic of Croatia include energy-intensive activities such as power engineering, oil refining and mineral products (cement, lime, glass). These Sectors shall be included in the emission trading system and burdened with the price of carbon dioxide. In addition, due to increased mobility and high price non-elasticity, there is also a significant increase in road traffic emissions. Emissions from this sector shall be limited by the development of sustainable transportation, technological development and the use of neutral fuels for carbon dioxide emissions. The transport sector participates in total direct energy consumption with about 30%. The growth rate is exceptionally high (over 5% per year over the past five years). The largest share of energy consumption in the sector has road traffic with almost 90%. Such a share is also expected in the future, due to the increase in the number of cars, the increased prevalence of the car's distance and the reduced number of passengers per car. Therefore, the focus of the energy efficiency policy in the transport sector is precisely on road transport.	The objective of the Strategy is to increase the energy efficiency of the transport sector, with particular emphasis on road traffic, i.e. the use of alternative fuels and encouraging the use of electric vehicles. In this context, these two strategies have harmonized goals.

Strategy and Action Plan for the Protection of Biological and Landscape Diversity of the Republic of Croatia (OG 143/08)	According to the Strategy, the greatest threat to wild species in Croatia is the destruction and loss of habitats, partly as a result of transforming natural habitats into construction or agricultural land or the construction of roads and other transport routes, which often leads to fragmentation of habitats. Also, great danger represents the ballast water as the main cause of invasive foreign (allochthones) species water entry point, especially in marine ecosystems. Strategic goals for transport have been: • reduce the impact of transport infrastructure on wild species and natural habitats • prevent the introduction of foreign invasive species into the nature of the Republic of Croatia and continue to address the problems of existing invasive species. A new Strategy and Action Plan for the Protection of Nature of the Republic of Croatia is under preparation (draft).	The Strategy could potentially undermine biodiversity conservation goals, as it contributes to building new transport areas. On the other hand, during the strategic assessment, potential conflicts of the Strategy for the conservation of wild species and habitats are recorded, but adequate mitigation measures are prescribed for the development of transport.
The Rural Development Program of the Republic of Croatia for the period 2014-2020	Program goals: 1. encourage the competitiveness of agriculture 2. ensure sustainable management of natural resources and climate change 3. to achieve balanced territorial development of rural areas, including the creation and preservation of jobs. According to the Program, poorly populated rural areas have remained at a lower level of communal and transport infrastructure development compared to urban areas. The poor linkage of underdeveloped rural areas with local and regional centers, inadequate quality and the build-up of existing communal and transport infrastructure still does not provide the necessary conditions for sustainable development of rural areas and quality of life in this area.	The Transport Development Strategy contributes to better conditions for rural development, primarily by encouraging better transport links of rural areas with local and regional centers.

Sava River Basin Management Plan	The Sava River Basin Management Plan was developed in line with the requirements of the EU Water Framework Directive, which establishes a legal framework for the protection and improvement of the status of all waters and protected areas, including water-dependent ecosystems, prevention of deterioration of their condition while ensuring long-term, sustainable use of water resources. The Sava River Basin Management Plan establishes several principles of integral water management, including the integration of water protection into river basin development activities.	The upgrading of the Sava River Basin is one of the measures of the Strategy, which is in line with the objectives defined in the Sava River Basin Management Plan.
Emergency Sea Pollution Plan (OG 92/08)	The Emergency Sea Pollution Intervention Plan is a document of sustainable development and environmental protection that sets out the procedures and measures for predicting, preventing, limiting, responding to the sudden sea pollution and the extraordinary natural events at sea in order to protect the marine environment. The intervention plan is in line with the international agreements on the protection of the marine environment, the Republic of Croatia being a party in these international agreements. The intervention plan is applied to the marine areas, the sea bottom and the submarine waters of the Republic of Croatia, which include maritime welfare, internal sea water, territorial sea and protected ecological fishing zone. All coastal counties have adopted intervention plans for sudden pollution of the sea.	Intervention plans ensure the protection of the marine environment in ports, which is also one of the goals of the Strategy in the area related to maritime transport. During the strategic assessment, additional measures are stipulated for the provision of port equipment devices for the pollution prevention.
Waste Management Plan of the Republic of Croatia for the Period 2017-2022 (OG 3/17)	The Waste Disposal Act (OG 94/13) lays down the following specific categories of waste: biowaste, waste textile and footwear, waste packaging, waste tires, waste oils, waste batteries and accumulators, waste vehicles, asbestos waste, electrical and electronic waste (hereinafter referred to as: EE) devices and equipment, waste ships, marine waste, building waste, waste sludge from wastewater treatment plants, waste from titanium dioxide production, waste polychlorinated biphenyls and polychlorinated terphenyls.	The realization of the Strategy can lead to the generation of a larger amount of waste, which is particularly significant in terms of marine waste that is difficult to control. The security measures defined in the Strategy also work in the direction of better waste management from specific transport sectors (e.g. ports).

Water Management Plan 2016-2021 OG (66/16)	The Water Management Plan analyzed, among other things, dotted and scattered sources of water pollution, whose coverage was extended in relation to the first water management plan. Evidence of sources and estimates of pollutant emissions has been made for all known types of pointy and scattered sources.	The Strategy defines the objectives of environmental protection, i.e. it goes in the direction of improving the traffic system in a way that, among other things, it mostly reduces pollution of the environment (including waters) caused by roads and ports. Along with the goals of the Strategy, during strategic assessment additional measures to protect water from pollution have been defined, and it is concluded that the Strategy shall not be in conflict with the measures defined by the Water Management Plan.
Air Protection Plan for the Protection of Air, Ozone Layer and Climate Change Mitigation in the Republic of Croatia for the Period 2013 to 2017 (OG 139/13)	The purpose of the Plan is to define and develop objectives and measures by priority sectors, deadlines and implementing measures, with the main objective of protecting and improving the air quality in the Republic of Croatia, particularly in areas where air quality is not of the first category, ozone layer protection and mitigation of climate change. This Plan, among other things, provides for measures to reduce total emissions from transport.	The relevant Strategy defines measures related to the application of more environmentally friendly fuels and investment in the renewal of the railway fleet, as well as maritime transport. Improved transport systems planned by the Strategy lead to the reduction of harmful emissions to the air and to the reduction of fuel consumption. The relevant Strategy is consistent with the objectives of the Air Protection Plan, i.e. measures related to the reduction of emissions from transport.
Strategy for Spatial Planning for the Republic of Croatia (1997) and amendments of the Strategy (OG 76/13)	Within general objectives of achieving a higher level of security and development of the country, increasing the quality of life of the population and increasing the value of the Croatian area and its inclusion in the European development systems, the main spatial development objectives are highlighted, with an emphasis on strengthening the spatial-development structures of the state through a balanced and realistic polycentric development, the establishment of strong bases and the focus of development based on defined and potential traffic routes, city networks and improvement of infrastructure equipment as a condition for quality development. When it comes to the transport network, the priority of the Strategy is its modernization, reconstruction and improvement of existing capacities and traffic systems. Particularly emphasized is: • good internal connectivity and connectivity within the European transport system	The general and specific objectives of the Development Strategy take into account the starting points for defining the goals and objectives for spatial development in Croatia, in which it is estimated that the degree of development of Croatia does not correspond to objective developmental opportunities and that the economic and traffic dynamics are insufficient, thereby disrupting the proper flow of traffic within the country and its connection with other countries. Furthermore, the current development processes show great regional differences which can be further enhanced by the strengthening of the main traffic-development corridors as well as the intensified interest in building on attractive areas. Also, the general objectives of the Strategy, as well as its specific sectoral objectives take into the special interests of Croatia: to take advantage of a favorable geographical and strategic

	• construction of highways of high rank, new railway tracks on the main directions • activation and modernization of the sea and river ports	position, to encourage development programs with technologies that improve area and do not pollute the environment, and develop large infrastructural projects to enable functional integration of Croatian territory, independence and security, as well as the possibility of joining the European network.
Spatial Planning Program for the Republic of Croatia (1999.) and amendments of the Programe (OG 84/13)	The Program is the Implementation Document of the Spatial Planning Strategy which determines the activities and measures for implementing the Strategy. Objectives of the Spatial Planning Program of the Republic of Croatia (1999 and 2013): • strengthen the spatial developmental structure of the country • increase the value and quality of area and the environment • rational use and protection of national goods • recognize the common features and particularities of the area • develop infrastructure systems • ensure the effectiveness of spatial planning systems • direct spatial-development priorities. When it comes to development programs for transport sectors, the Program covers the aspects of the Integrated Traffic System, all components of the action and the planning of new routes based on economic parameters and other relevant indicators of justification and realities of performance, rational use and protection of area as well as: • accelerated road traffic development • internal consolidation of railway transport • connection to the European transport system • organization of ports and existing docks for fast shipping lines • regulation of maritime transport space • river port network projection • alignment of interest in the airspace	The objectives of the development of transport systems in the present Strategy are in accordance with the sustainable and economically justified development of the Croatian transport system as stipulated by this Program, especially when it comes to the application of new technologies, the introduction of integrated transport and environmental sustainability.

	• modernization of existing capacity and airport security equipment • etc.	

3 Existing environmental status and possible environmental development without the Strategy implementation

3.1 Environmental change drivers

In the context of this document, the main driver of all changes in the environment is transport. Transport plays an important role in all segments of society's development. Transport connectivity is an important precondition for raising standards of living and for a regionally balanced development of the Republic of Croatia. Nowadays, transport provides a faster and easier link between people and education, the access to business opportunities, the exchange of goods and services, and is an important segment of the development of all business sectors.

At the same time, the faster and more efficient movement of people and goods requires the technological development of transport facilities and the increase in their number and the construction of additional transport infrastructure. In this way, the transport has a negative impact on nature and the environment. Due to the intensification of traffic, there is a growing release of pollutants into the environment (airborne, soil and water), which is most significant in the case of road traffic, which is recognized as one of the main sources of greenhouse gas emissions in Croatia. Also, transport is responsible for a large part of the noise pollution, as well as for the discharge of exhaust gases and dust particles, and is the main source of pollution in the cities. The construction of transport infrastructure irreversibly changes the landscape and natural value of space, while having a negative impact on habitats, flora and fauna, and thus landscape diversity. In addition, the transport represents a potential hazard for all environmental elements in the case of uncontrolled release of hazardous substances into the environment.

Since the transport system in Croatia is divided into six mutually different sectors, this section shall cover each sector, addressing the most significant impacts on the environment and human health. In addition, transport shall be discussed as a whole as well, potentially identifying negative cumulative impacts.

3.1.1 Traffic as a whole

According to the Environmental Report in the Republic of Croatia (Environmental Protection Agency, 2015), the key issue to be considered when considering the impact of the transport on the environment is:

Is Croatia's quality transport connection possible, while at the same time implementing environmental protection and conservation measures?

The answer can be reduced to 3 key points in the Report:

- the greatest development of the transport infrastructure is recorded in the road transport sector, thus achieving a better linkage of parts of Croatia, while in other transport sectors there is no significant progress.
- environmental protection and conservation measures are carried out while planning and constructing the transport infrastructure, in accordance with regulations in the field of environmental protection, spatial planning and construction works.
- the level of transport activities that are the source of environmental and nature pollution have been increased and the measures taken to reduce negative impacts do not fully deliver the desired results.

Comparing the last two reporting periods, from 2005 to 2008 (Environmental Protection Agency, 2012) with the period 2008 - 2012 (Environment Protection Agency, 2015), the road transport sector remained the most important source of pressures on environment. However, by adopting the Regulation on Strategic Environmental Impact Assessment and amendments to the relevant legislative and by-laws concerning the protection of nature and the environment, the level of environmental impact assessment in the context of traffic development increased in the last reporting period.

The specific features of Croatian transport are big differences in the volume of transport during the tourist season and when the tourist season is over. Comparing the models developed within the National Transport Model of the Republic of Croatia (Transport Strategy of the Republic of Croatia 2017-2030) it can be concluded that total transport demand at the state level during the tourist season is 20% higher than the transport demand out of this season. Since the educational institutions are closed for work during the tourist season and that more than 92% of the total accommodation capacity is located in In the Adriatic region, transport demand in the Adriatic region during the main tourist season is 3.1 times higher than in the offseason. The transport demand during the tourist season represents roughly twice the transport demand on the major tourist routes, especially on the motorways leading to the Adriatic coast and the main roads in the Adriatic region (Figure 3.1).

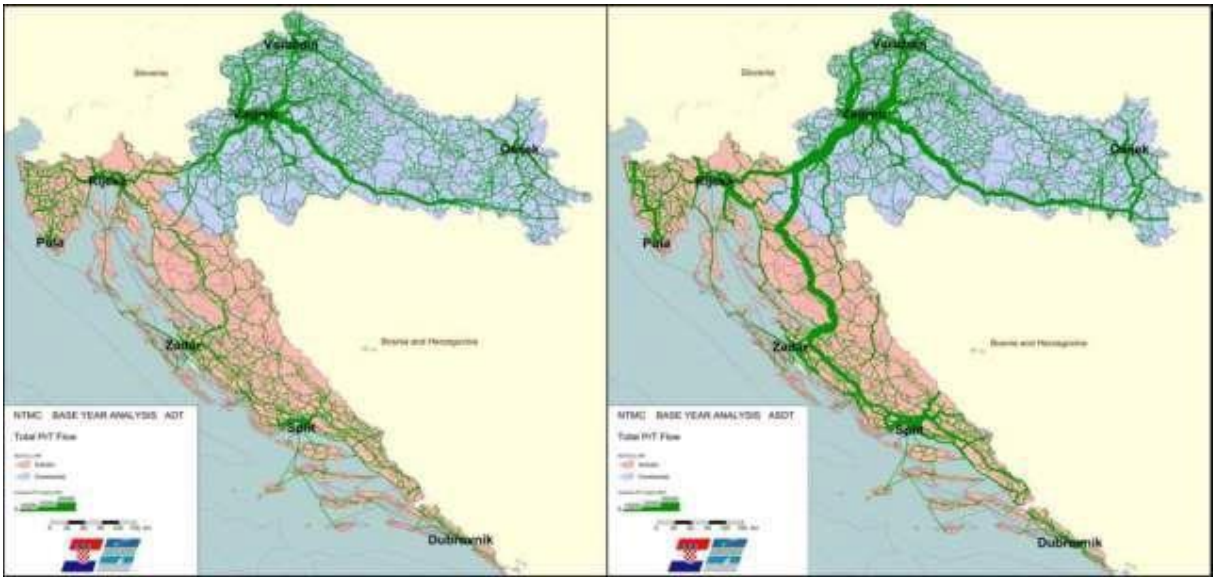


Figure 3.1 Average road traffic over the year (left) and in the season (right) - the thickness of the green line represents the density of traffic (Source: Transport Development Strategy of the Republic of Croatia 2017-2030)

Energy consumption in transport is an important factor in assessing the impact of the traffic on the environment. The table and the picture below (Table 3.1, Figure 3.2) shows that road traffic represents the largest energy consumer (about 90%), followed by air traffic and maritime and railway (Energy in Croatia in 2014).

In 2014, railway transport, road traffic, public transport and other transport generated a reduction in energy consumption. In other types of transport, the energy consumption is increased. The increase in energy consumption in air transport was 0.2% and in the maritime and river transport 7.8%. In railway transport, energy consumption decreased by 7.2% and in road traffic by 1.3%. Reduction of consumption in public and other transport was 0.6% and 0.4% respectively (Table 3.1) (Energy in Croatia in 2014).

Table 3.1 Energy consumption of certain types of transport in Croatia from 2009 to 2014 (Source: Energy in Croatia in 2014)

	2009	2010	2011	2012	2013	2014	2014/12	2009-14
	PJ*						%	
Railway traffic	1.84	1.84	1.75	1.65	1.54	1.43	-7.2	-4.9
Road traffic	80.03	77.13	75.59	74.3	75.17	74.17	-1.3	-1.5
Air traffic	4.38	4.65	4.92	5.07	5.55	5.56	0.2	4.9
Maritime and river traffic	2.07	1.65	1.65	1.58	1.79	1.93	7.8	-1.3

	2009	2010	2011	2012	2013	2014	2014/12	2009-14
	PJ*						%	
Public transport	1.43	1.45	1,41	1.35	1.36	1.35	-0.6	-1.1
Other transport	0.09	0.08	0.07	0.07	0.09	0.09	-0.4	-0.7
Total transport	89.84	86.8	85.39	84.02	85.49	84.53	-1.1	-1.2

* PJ = Penta Joules = 1015 Joules

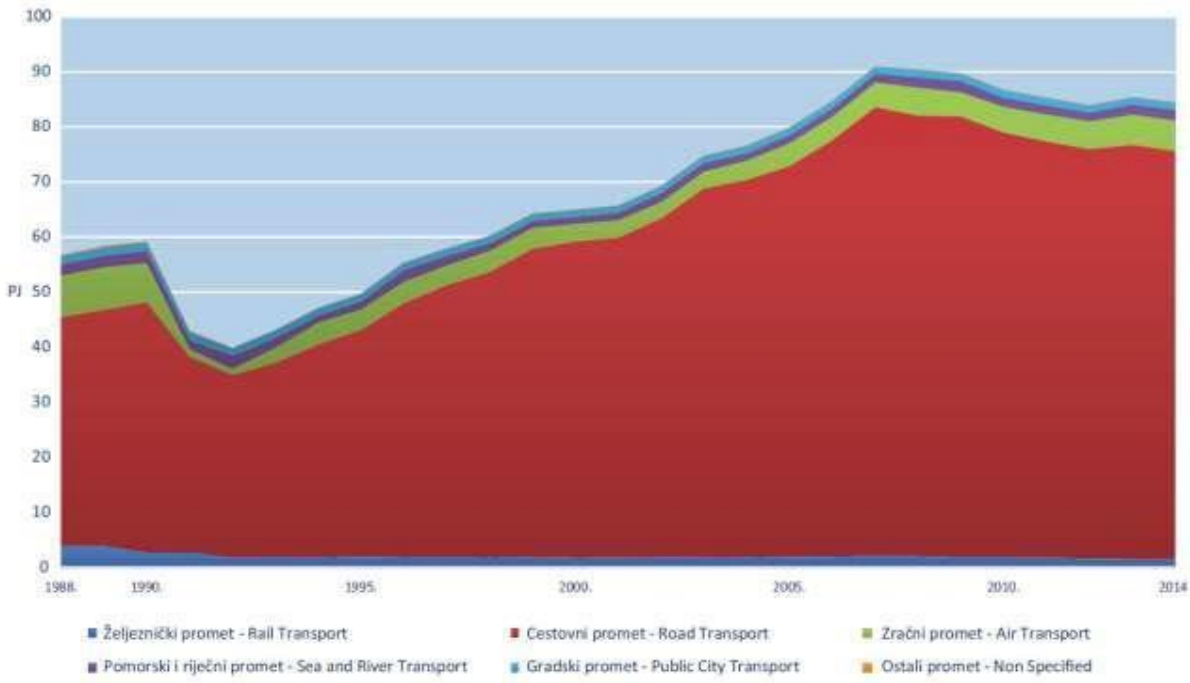


Figure 3.2 Energy consumption in Croatia by type of traffic from 1988 to 2014 (Source: Energy in Croatia in 2014)

From the point of view of energy consumption in transport to the sources of energy, the most used are diesel and motor gasoline, which make up about 90% of the energy source. Then there is the jet fuel, while the consumption of liquefied gas and liquid biofuels has increased recently (Table 3.2, Figure 3.3) (Energy in Croatia in 2014).

In the period from 2009 to 2014, gas, liquefied gas and electricity consumption decreased, while other fuels recorded a rise in consumption (Table 3.2). During this period, total energy consumption in transport decreased by 1.2%. The highest growth in consumption is recorded by natural gas and liquid biofuels with 23.2% and 33.5%, while the increase in fuel consumption by 5.1% (Energy in Croatia in 2014) has been recorded as a result of the intensification of air transport.

Table 3.2 Direct energy consumption in Croatia by energy source from 2009 to 2014 (Source: Energy in Croatia in 2014)

	2009	2010	2011	2012	2013	2014	2014/13	2009-14
	PJ*						%	
Liquid biofuels	0.3	0.11	0.14	1.51	1.33	1.25	-6.3	33.5
Released gas	3.26	2.75	2.62	2.57	2.64	2.83	7.3	-2.8

	2009	2010	2011	2012	2013	2014	2014/13	2009-14
	PJ*						%	
Natural gas	0.05	0.09	0.03	0.03	0.06	0.13	108.9	23.2
Motor gasoline	30.17	28.41	27.76	25.8	25.2	23.26	-7.7	-5.1
Jet fuel	4.26	4.54	4.81	4.98	5.44	5.46	0.2	5.1
Diesel fuel	50.67	49.68	48.87	48	49.72	50.59	1.7	0
Running oils	0.02	0.08	0.07	0.08	0.08	0.02	-80	0
Electricity	1.12	1.12	1.09	1.04	1.01	0.99	-1.8	-2.5
Total	89.84	86.8	85.39	84.02	85.49	84.53	-1.1	-1.2

* PJ = Penta Joules = 1015 Joules

Figure 3.3 Energy consumption in transport by energy sources from 1988 to 2014 (Source: Energy in Croatia in 2014)

3.1.1.1 Assesment of the current state in Republic of Croatia by type of alternative fuels and traffic types

3.1.1.1.1 Electrical energy

According to data from the National Policy Framework for the Establishment of Infrastructure and Development of Alternative Fuel Market in Traffic in the year 2016, 856 vehicles were used for the use of electricity from external sources, of which 299 passenger cars, 55 trucks, 250 mopeds, 183 motorcycles, 3 buses, 66 tractors and non-road mobile machinery, and just over 126 publicly available fillers were available.

Electricity or high-voltage land connections exist on inland waterways, in inland ports of Vukovar and Sisak, and in seaports in Rijeka, Split and Dubrovnik. Existing electricity supply in seaports does not have enough power to supply ships on cruise journeys.

In all Croatian international airports there is electricity supply of aircraft at rest.

3.1.1.1.2 Hydrogen

There is no hydrogen infrastructure in the Republic of Croatia, but four hydrogen vehicles have been registered, of which 4 personal cars (which are used by hydrogen in alternative to classical fuels).

3.1.1.1.3 Natural gas

3.1.1.1.3.1 Liquefied natural gas

There is no LNG infrastructure in the Republic of Croatia. Also, there is no registered vehicle or vessel using this energy.

3.1.1.1.3.2 Compressed natural gas

In the year 2016, 208 personal vehicles, 84 trucks, 10 mopeds, 6 motorcycles, 108 buses and 11 SPP-powered tractors were registered in the Republic of Croatia.

There are currently 2 publicly available fillers for the SPP (Zagreb and Rijeka) currently in the Republic of Croatia.

3.1.1.1.4 Liquefied petroleum gas

In the year 2016, a total of 57,911 LPG-registered vehicles were registered in the Republic of Croatia, of which 56,914 personal vehicles, 875 freight cars, 8 mopeds and motorcycles, 16 buses and 98 tractors and non-road mobile machinery.

The total number of registered workshops for installation and servicing of gas installations in vehicles in the Republic of Croatia in 2014 amounted to 153 and the number of UNP filling stations was 334.

3.1.1.1.5 Biofuels

There are 3 biofuel production plants in the Republic of Croatia, of which 2 plants are using oil made from oilseeds and 1 plant is using waste edible oil for material. Biofuels are mostly used mixed into motor gasoline or diesel fuel up to 5% and 7% respectively, and such fuel does not have to be specifically labeled at retail outlets (gas stations), therefore the number of public batches is not available. Mixtures with 5-10% biofuel mixing in gasoline or over 7% in diesel fuel must be specifically labeled at sales outlets and in Croatia such blends are mainly used by transport companies either in passenger or cargo transport through biofuels producers / dealers.

3.1.2 Road traffic

As a general rule in Europe, the motorization rate has increased considerably due to the greater purchasing power of the family and the lifestyle changes of the population (i.e. the tendency of relocation to suburban areas of larger cities), which is linked to greater needs for daily migration of the population. The last global economic crisis has led to a slight slowdown in the growth of the motorization rate, but the numbers of recent years have again shown an upward trend (Figure 3.4) (Transport Development Strategy of the Republic of Croatia 2017-2030).

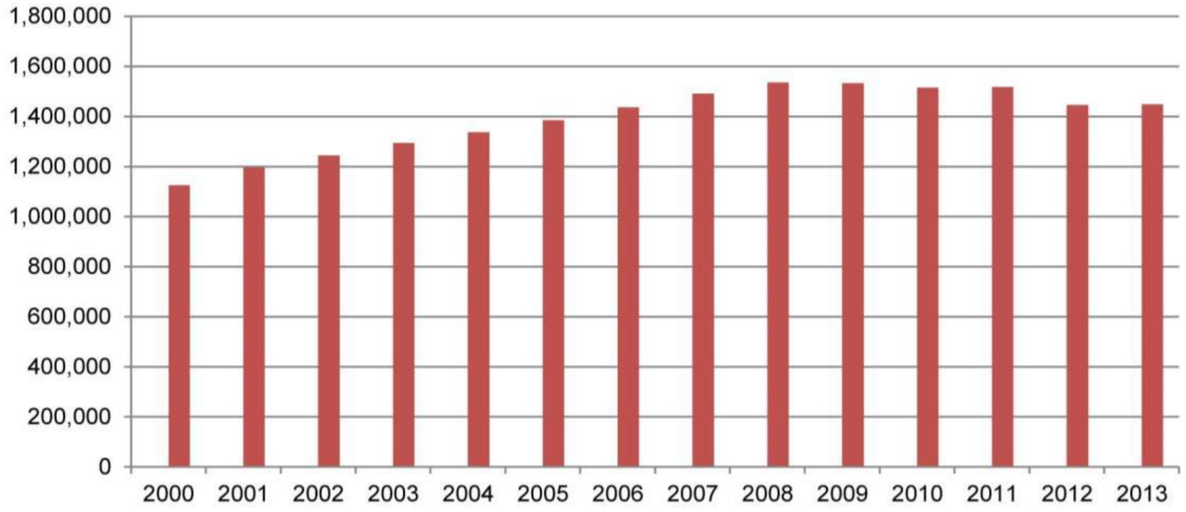


Figure 3.4 Number of registered passenger cars per year (Source: Transport Development Strategy of the Republic of Croatia 2017-2030)

When we discuss the number of motorized vehicles per 1000 inhabitants, Croatia is below the European average with 347 vehicles per 1000 inhabitants (2014). The European average on the same year was 498 vehicles per 1000 inhabitants (www.acea.be).

In the context of environmental impacts, important figures, besides the number of vehicles, are the average age of the vehicle. According to the data of the Croatian Vehicle Center since 2007, the average age of passenger cars is constantly increasing (Table 3.3).

Table 3.3 Average age of cars per year (Source: Croatian Vehicle Center)

Year	The average age of a car
2007	9.83
2008	9.89
2009	10.32
2010	10.47
2011	10.87
2012	11.38
2013	11.80
2014	12.14
2015	12.52
2016	12.76

Considering traffic infrastructure data, the road infrastructure largely predates other sectors. From the table below one can notice the constant development of road infrastructure (Table 3.4). In 2012, there is a noticeable decrease in road infrastructure, which is attributed to the adoption of the Decision on the Classification of Public Roads and the Decision on Roads in the Large Cities Area that Stop Being Classified into Public Roads (OG 44/12). The adoption of the mentioned decisions resulted in the recategorization of state, county and local roads in the urban areas into the city roads.

Table 3.4 Network length of the road infrastructure by categories and years (Source: Transport and Communications in 2015)

Category / year	2011	2012*	2013	2014	2015	2016*
Motorways and semi-motorways	1307	1307	1342	1372	1392	1416.5
State roads	6843	6581	6711	6723	6758	6858.9
County roads	10967	9809	9720	9628	9640	9703.4
Local roads	10346	9046	9094	9137	8998	8979.7
Total	29410	26690	26814	26778	26706	26958.5

* Decision on the categorization of roads in the areas of cities

** Data for 2016 taken from the web site of the Ministry of the Sea, Transport and Infrastructure

The motorways in Croatia built in the last ten years meet high standards of environmental protection. Particular attention has been devoted to the protection of wildlife by building an animal crossing (green bridges), whose position is determined on the basis of observation of natural migratory paths. Newer construction roads are under controlled and closed drainage systems with built-in cleaners and separators of grease and oils and lagoons for rainwater, and noise-protected barriers have been set up in settlements. The road sections that do not meet high environmental standards are section of the A1 motorway between Zagreb and Karlovac, which lacks the sewage drainage system and the section of the A3 Zagreb - Lipovac motorway, which also lacks drainage system with cleaners, as well as animal crossing for wildlife.

3.1.3 Railway transport

In general, the railway infrastructure in the Republic of Croatia is dilapidated and does not meet the modern technical and safety standards. The fact is that in the next five to eight years, only 45.6% of the total length of the railroad can be adequately maintained, while the remaining 54.4% requires urgent investment projects (the Transport Development Strategy of the Republic of Croatia 2017-2030). Due to the existing railroad condition, only on the 18.0% of the total length of the railroad the maximum permitted train speed equal to the projected speed is allowed.

According to the data of the Central Bureau of Statistics (Transport and Communications in 2015), the length of the service of the railroad in Croatia over the years decreases. The exception is the two-track railroad, whose length from 2011 to 2015 remained unchanged (Table 3.5). In addition, the number of railway stations decreases, suggesting a lack of investment in railway infrastructure at the level of whole Croatia.

Table 3.5 Length of railway tracks and number of railway stations by years (Source: Transport and Communications in 2015)

Length of railway tracks, km						Railway stations and other official sites
				electrified		
year	total	Single-track railway line	Double-track railway line	km	Percentage of the total	
2011	2722	2468	254	984	36.1	597
2012	2722	2468	254	984	36.1	598
2013	2722	2468	254	985	36.2	572
2014	2604	2350	254	970	37.3	554

2015	2604	2350	254	970	37.3	554

The condition of the railway infrastructure is also mapped to the railway fleet. The Croatian Railways fleet is older than 30 years. The railway fleet for passenger transport is largely characterized by obsolete and inefficient technology, and according to estimates, 70% of locomotives (in total, in 2015, Croatia had 263 locomotives, Transport and Communications in 2015) shall reach the end of its working life in the period of the next 10 years.

The characteristics of the old railway fleet are such that they cannot meet the needs and criteria of modern cargo and passenger traffic. The main problem is the lack of interoperability between the railway fleet and railway infrastructure and the inaccessibility of this type of transport to people with reduced mobility.

The exception to the general negative image of railway transport in Croatia is the railway transport in Zagreb's urban area, where the railway transport system has been successfully revived by active inclusion in the public transport system in general.

Looking at the development perspective, the Rijeka - Zagreb connection has considerable potential for the development of railway freight transport, which is linked to planned investments in the terminal of Rijeka. Currently, the railroad between Zagreb and Rijeka is along the entire railway section mainly in the freight transport function and the interurban transport of passengers between Zagreb and Rijeka and Zagreb and Split is very limited. This railway section has a limited role in transporting passengers and serves to transport daily commuters (travel to work and from work) between Zagreb and Karlovac and in the vicinity of Rijeka.

According to the Strategy of Development of the Port of Rijeka, by 2017, port capacity increase from the existing around 10 million tons of dry cargo to about 20 million tons is anticipated. Together with the planned current load, port capacity should reach 45 million tons. Larger investment in port development planned by 2030 would have to increase capacity to more than 30 million tons of dry cargo, or a total of over 55 million tons of freight. Such development of the port of Rijeka should also follow the development of railway transport in the hinterland.

In the context of the current situation of railway transport in Croatia, railway transport represents a potential risk to human health and the environment. According to the table below (Table 3.6), the growth of transport of dangerous goods in the last few years has been recorded, especially on the Rijeka - Zagreb route, which is not monitored by the adequate modernization of the railway infrastructure, leading to an increased risk of environmental accidents.

An additional reason for concern is the way of drainage along the Zagreb - Rijeka corridor, which is an open type with existing open pits with no cleaners, which means that in the event of an accident the harmful substances can directly reach the water protection areas. In general terms, the drainage system of the railways has not been restored and today it is on many sections out of function.

Table 3.6 Railway hazardous goods transport by years and categories in thousands of tons and total tons mileage (Source: Transport and Communications in 2015)

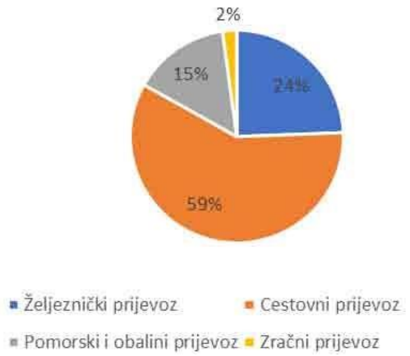
	Class of hazardous goods	2011	2012	2013	2014	2015
	Total tons in thousands	1569	1482	1636	1625	1667
1.	Explosive substances	0	-	-	-	-
2.	Gases under pressure, running and without pressure	171	170	150	144	134
3.	Flammable liquids	582	517	613	675	725
4.1.	Flammable solids	163	130	107	68	128
4.2.	Self-inflammable substances	24	31	49	86	53

4.3.	Substances that come into contact with water produce flammable gases	55	41	51	37	12
5.1.	Oxidizing substances	498	494	539	532	545
5.2.	Organic peroxides	-	-	-	-	-
6.1.	Toxic substances	5	10	19	7	8
6.2.	Infectious substances	-	-	-	-	-
7	Radioactive materials	-	-	-	-	-
8	Corrosive substances	59	82	69	39	29
9	Various hazardous substances	12	6	39	37	32
	Total tons, mil *	443	393	420	423	469

* Ton kilometer is a unit of measurement that expresses the transport of one ton of goods at a distance of one kilometer within the territory of the Republic of Croatia

3.1.4 Air transport

By comparing the number of passengers transported by type of transport, then the air transport in Croatia occupies the last place with only 2% of passengers carried, however, considering the passenger mileage as a unit expressing one-way passenger traffic at a distance of one kilometer, then air transport occupies second place with a total of 22 % of travel mileage (Figure 3.5). This data suggests that air transport favours long-distance travel, while its importance within the territory of the Republic of Croatia is not greatly significant.



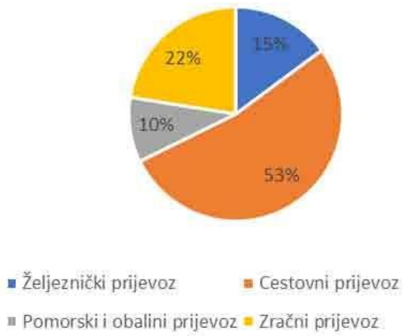


Figure 3.5 Share of transported passengers by passenger number (Left) compared to transported passengers´ share per passenger-km (Right) by category of transportation in 2015 (Adapted to: Transport and Telecommunications in 2015)

There are 9 airports in the territory of Croatia (Zagreb, Dubrovnik, Split, Zadar, Pula, Rijeka and Osijek, Mali Lošinj and Brač). Nearly 85% of the total passenger traffic in the airports takes place in the three largest ports: Zagreb Airport (36%), Split Airport (25%) and Dubrovnik Airport (24%).

Analysis of the monthly distribution of the number of passengers transferred from the Transport Strategy of the Republic of Croatia 2017-2030 points to significant connections between air travel and tourism. As can be seen from the graph below, the demand in all Croatian airports increases considerably in the period from May to September (Figure 3.6).

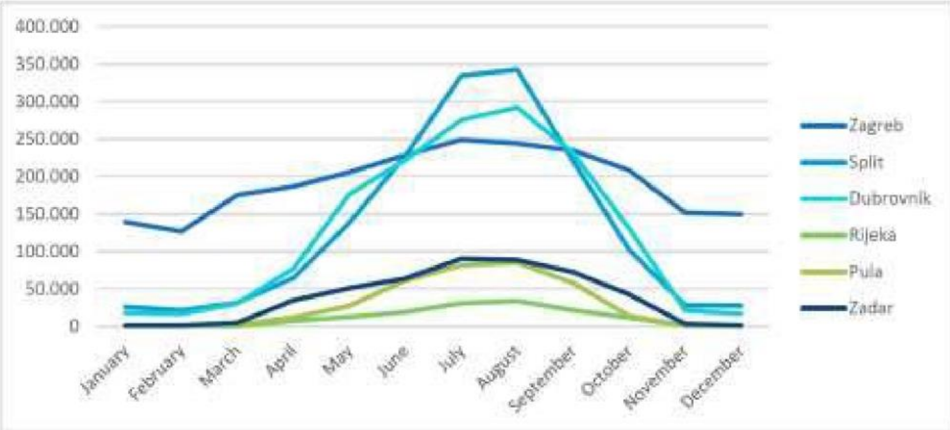


Figure 3.6 The annual number of passengers in Croatian airports in 2013 (Source: Transport Development Strategy of the Republic of Croatia 2017-2030)

The Zagreb airport has the most even distribution of passengers through the whole year (Figure 3.6), which points to its relevance not only in tourist season, but through the whole year. It is the largest Croatian airport and the major starting, that is, destination point of the air transport in Croatia and towards Croatia (Figure 3.7).

Figure 3.7 Connections between the Zagreb airport and other world destination (Source: Transport Development Strategy of the Republic of Croatia 2017-2030)

Croatia is a member of the European Aviation Safety Agency (EASA) and as its member is obliged to meet security standards in line with European requests. Until today neither Croatian airport meets the European security standards and is in a period of adjustment until December 31, 2017.

3.1.5 River traffic

Inland waterways of the Republic of Croatia are located on 5 Croatian rivers (Figure 3.8) with the total length of 804.1 km (Ministry of the Sea, Transport and Infrastructure) and four river ports: Vukovar, Osijek, Slavonski Brod and Sisak.

The most important inland waterways in Croatia are Danube and Sava. The most important ports are Port of Vukovar on Danube and Port Slavonski Brod on Sava, which are classified as the basic ports of TransEuropean Transport Network (TEN-T). The inland ports, Sisak on Sava and Osijek on Drava, are of less importance and are the part of the TNT-T network's wider circle.

Figure 3.8 The network of inland waterways of the Republic of Croatia (Source: The Ministry of the Sea, Transport and Infrastructure)

All the ports are well connected with other forms of transport, the international rail and road networks (Transport Development Strategy of the Republic of Croatia 2017-2030).

The inland waterways in the Republic of Croatia are intended for the passenger and goods transport, but the passenger transport is negligible by comparison with the freight transport. According to the data of the Croatian Bureau of Statistics (Transport and Communications in 2015) from 2011 to 2015 there is a slight increase of the freight transport (Figure 3.9), which is related to the increase of transit traffic. The internal goods transport has almost halved in the same period, from 91.000 tons in 2011 to 51.000 tons in 2015.

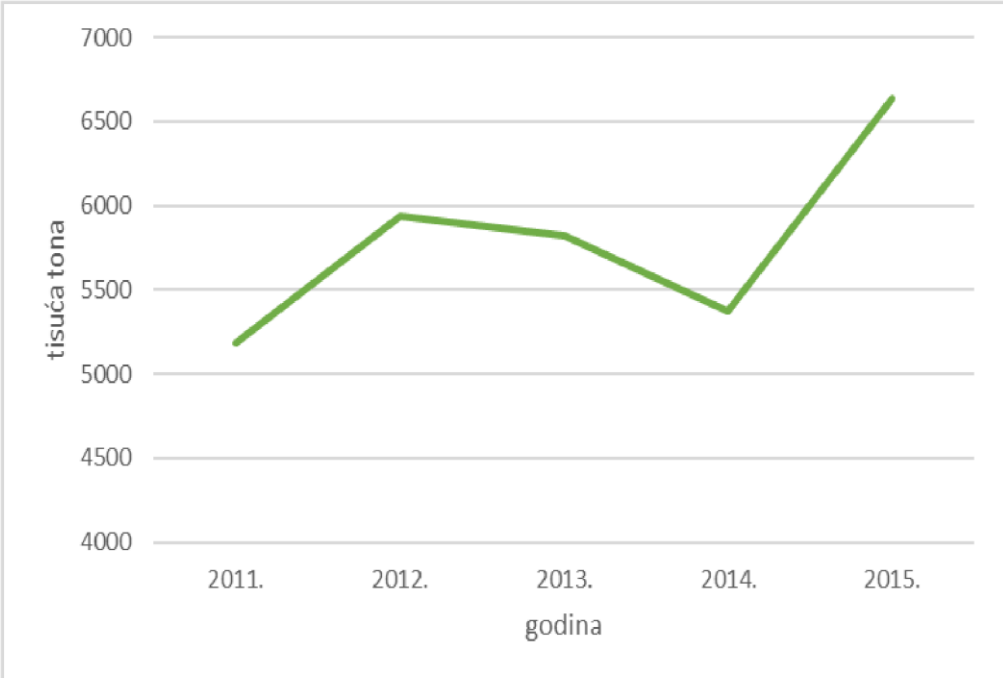


Figure 3.9 Trend of the goods transport on inland waterways from 2011 to 2015 (Source: Transport and Communications in 2015)

Freight transport is mostly related to production, that is agricultural activities from the wider gravitational area of the ports. Official numbers indicate that the Port of Vukovar is the largest according to the handled freight quantity (about 64% in the total transhipped freight). 393.860 tons of freight was transhipped in 2015 in the Vukovar Port, mostly bulk cargo, fertilizers and cereals (Transport and Communications in 2015). The Osijek Port is second in terms of the handled freight quantity with the share of approximately 24% in the total transhipped freight, of which the bulk cargo represents 60% and agricultural products (wheat, sunflower, rapeseed) represent 10%. The ports of Slavonski Brod and Sisak are the smallest ports and jointly contribute in the total transhipped freight with 12%. Dangerous goods (crude oil) is transported with ships from the Port of Slavonski Brod to the Port of Sisak, primarily for the supply of the Sisak's refinery (Transport Development Strategy of the Republic of Croatia 2017-2030).

The passenger transport is the most relevant in the Port of Vukovar and the Port of Sisak. Both ports record the increasing numbers of passengers. In the Port of Vukovarit is because of the Danube river cruises and in the Port of Sisak it is due to the local passenger transport. According to the official statistics for 2013 the Port of Vukovar had 29.215 passengers, which is almost 90% of the total passenger number in all internal Croatian ports. In the same year the Port of Sisak had 2.607 passengers and the Port Osijek 1136 passengers (Transport Development Strategy of the Republic of Croatia 2017.-2030.).

3.1.6 Maritime traffic

The Republic of Croatia is connected with world seas through the Adriatic Sea. Croatian ports are integrated into a comprehensive network of European transport corridors and that puts the Croatian maritime transport in the important position in the development of the European, as well as the world trade. Also, the maritime transport is equally important for the balanced development of the country. Croatia has 47 inhabited islands which population is in the process of depopulation for few decades already (Statistical Yearbook of the Republic of Croatia 2016). In this context, the development of the island's major coastal line service that takes place on a total of 56 public lines of national importance, and which in 2015 transported 12.5 million passengers and 2.99 million vehicles is very important. Another characteristic of the Croatian maritime transport is the increase of vessel transport due to the nautical and cruising tourism development. On the graphic presentation in continuation one can see the dynamics of vessel, passenger and goods transport in seaports from 2011 to 2015 (Figure 3.10).

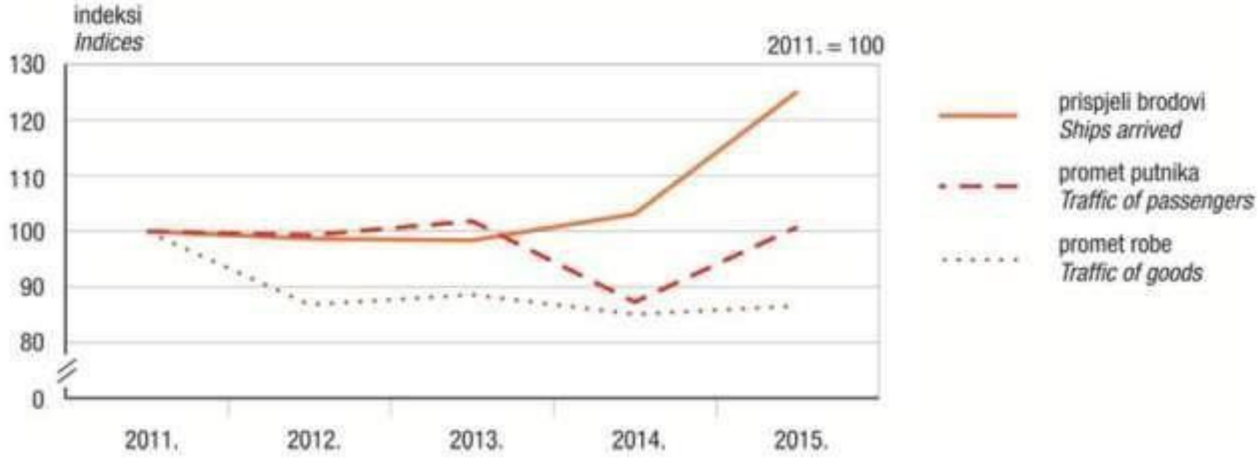


Figure 3.10 The vessel, passenger and goods transport in seaports from 2011 to 2015 (Source: Transport and Communications in 2015)

Croatia has 6 ports of special (international) economic interests for the Republic of Croatia (Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik), 68 ports opened for public transport of county significance and 333 ports of local significance (Source: Ministry of the Sea, Transport and Infrastructure).

The six ports of special (international) economic interests are conveniently positioned and facilitate maritime transport between Central and Eastern Europe and Southern Asia, Australia and Oceania (via the Suez Canal). They enable a shortening of voyages by 5 to 8 days, or by a minimum of 2.000 km compared to north European ports. If we look at the goods transport trends (Figure 3.10) and the share which the Adriatic Sea has presently on the European Union freight transport market (about 3% of total freight) we can see a potential for the freight transport increase in all Adriatic ports, but with large initial investments.

The Ports of Rijeka and Ploče and lately Split have the highest market potential for transshipment of cargo. The further development of Ports of Rijeka and Ploče depends partially on the development of their connections to the railways, so an important project for cargo maritime sector is the development and reconstruction of railway section from Rijeka to Hungary while further railway development in Bosnia and Herzegovina is of crucial importance for the development of the Port Ploče (Figure 3.11). Ports Zadar, Šibenik and Dubrovnik have limited role in the international maritime freight transport (Transport Development Strategy of the Republic of Croatia 2017-2030).

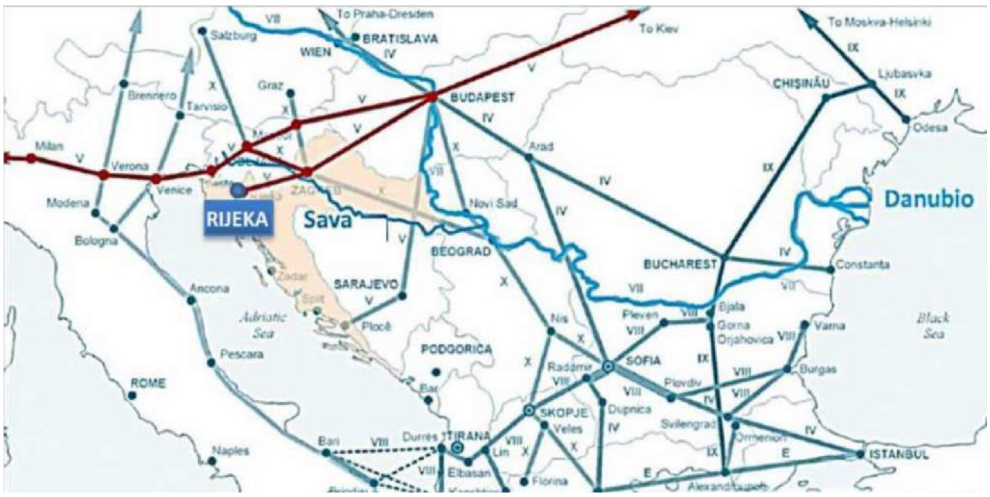


Figure 3.11 Position and connection of the Ports of Rijeka and Ploče (Source: Transport Development Strategy of the Republic of Croatia 2017-2030).

Line maritime transport carries out between islands (73 island ports, i.e. piers) and the coast (22 ports in the coastal region) in accordance with defined sailing times as a regulated service. According to the Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 in the public transportation system there are 56 state lines (27 ferries, 16 fast shipping lines and 13 classic shipping lines) maintained by 13 shipping companies with the fleet of 77 ships in total of which 17 are passenger ships, 17 fast passenger ships and 42 are ferries.

The largest shipping company is Jadrolinija from Rijeka, owned by the state. In the total passenger transport Jadrolinija participates with the share of 84.9% and in the total vehicle transport with the share of 86.4%. The Jadrolinija's fleet consists of 51 ship (9 catamarans, 37 ferries, 4 classic ships and 1 hydro-bus). 28 ships from its fleet is older than 25 years and the average fleet age is 33.15 years. Thus the Jadrolinija's fleet for the line coastal transport may be characterized as old and of law capacity (Transport Development Strategy of the Republic of Croatia 2017-2030).

The maritime transport is the kind of transport with the largest quantities of transported dangerous goods in the Republic of Croatia. The flammable liquids transport (mostly of oil and petroleum products) takes a lead in the dangerous goods transport and the main transport port for the dangerous goods is the Port Rijeka. According to the table in continuation one can see a slight increase of the transported dangerous goods in the period from 2011 to 2015 (Table 3.7), but one can expect further increase due to planned investments in the Port Rijeka.

Table 3.7 Hazardous goods transport in seaports from 2011 to 2015 in thousands of tons (Source: Transport and Communications in 2015)

Class of Hazardous Goods		2011	2012	2013	2014	2015
	Total	**7321**	**7066**	**7062**	**6180**	**7611**
1.	Explosives	0	3	4	13	5
2.	Gases	117	60	68	66	50
3.	Flammable liquids	7192	6955	6925	6073	7529
4.1.	Flammable solids, self-reactive substances and desensitized explosives	2	0	1	0	1
4.2.	Substances liable to spontaneous combustion	0	0	3	0	0
4.3.	Substances which, in contact with water, emit flammable gases	0	0	0	1	0
5.1.	Oxidizing substances	1	6	23	8	9
5.2.	Organic peroxides	0	4	-	-	-
6.1.	Toxic substances	0	11	0	-	0
6.2.	Infectious substances	-	-	-	-	-
7.	Radioactive material	-	-	-	-	-
8.	Corrosives	3	11	28	8	7
9.	Miscellaneous dangerous goods	6	14	10	9	8

The Mediterranean Sea is the second largest market for cruising tourism after the Caribbean. 207 cruisers with the capacity of 249.000 passengers, i.e. 5.7 millions passengers yearly, have sailed the Mediterranean in 2012. In the period from 2002 to 2012 the European market has increased for 162% and it is estimated that by 2020 the cruising tourism shall reach 10 millions passengers yearly (Carić and Mackelworth, 2014). Equal trends are recorded in the

Adriatic Sea (Table 3.8). With the development of Italian ports (Trieste and Venice), as well as the Dubrovnik Port in Croatia, the Adriatic Sea becomes increasingly popular destination (Figure 3.12). In 2012 Venice was the third and Dubrovnik the seventh of the cities mostly visited by cruisers. Beside Dubrovnik which accepts about 80% of cruiser tourists, the ports of Zadar and Split are increasingly becoming the part of cruiser routes.

Table 3.8 Passengers from cruiser in Croatia (Source: Carić and Mackelworth, 2014)

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Thousands of passangers	226	421	440	511	598	694	936	989	1094	1141	1155
% change	-	86.3	4.7	16.2	16.9	16.1	34.9	5.6	10.6	4.3	1.2

On the other hand, Dubrovnik, as the most developed port for cruiser reception in Croatia lags behind many European ports in solving the problems of cruisers waste disposal, which with the further development of this kind of tourism can lead to significant environmental impact.

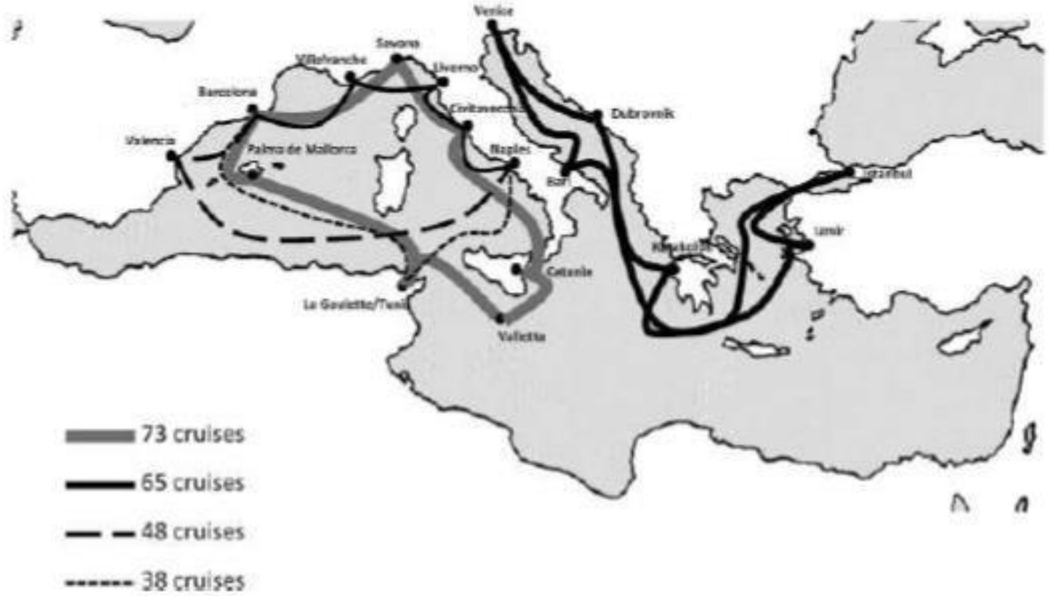


Figure 3.12 The most frequent cruiser routes in the Mediterranean Sea in 2010 (Source: Carić and Mackelworth, 2014)

3.1.7 Public urban transport

Transport in cities is the main source of air pollution and greenhouse gas emissions in the cities. One of the most effective ways of decreasing that burden is the development of public transport and the transport with zero greenhouse gases emissions (bicycles, e-vehicles).

The public transport is the transport for the public. The characteristic of publicity means that it is equally available to all users on the market which are ready to accept the publicly declared conditions of transport (price or tariff, timetable, etc.) and that it is not possible to exclude neither user from the possibility of its use. It is performed by companies or physical persons registered for the provision of transport service.

The public transport, in the full sense of the word, is carried out on the areas of large cities. In Croatia that are: Zagreb, Rijeka, Osijek, Split and their agglomerations (Figure 3.13), as well as Varaždin, Karlovac, Zadar and Pula. The public transport by trams is carried out exclusively in Zagreb and Osijek, and by railway in Zagreb[3] and Split.

[3] On the 1 July 2011 ZET abolished the co-financing of the joint HŽ-ZET ticket for public transport, which resulted with the transport decrease by 60% in 2012 in comparison with 2010 (Croatian Environment Agency, 2015)

There is no public transport to meet daily migration needs in the internal navigation, while the public maritime transport is oriented on the connections of islands with the mainland.

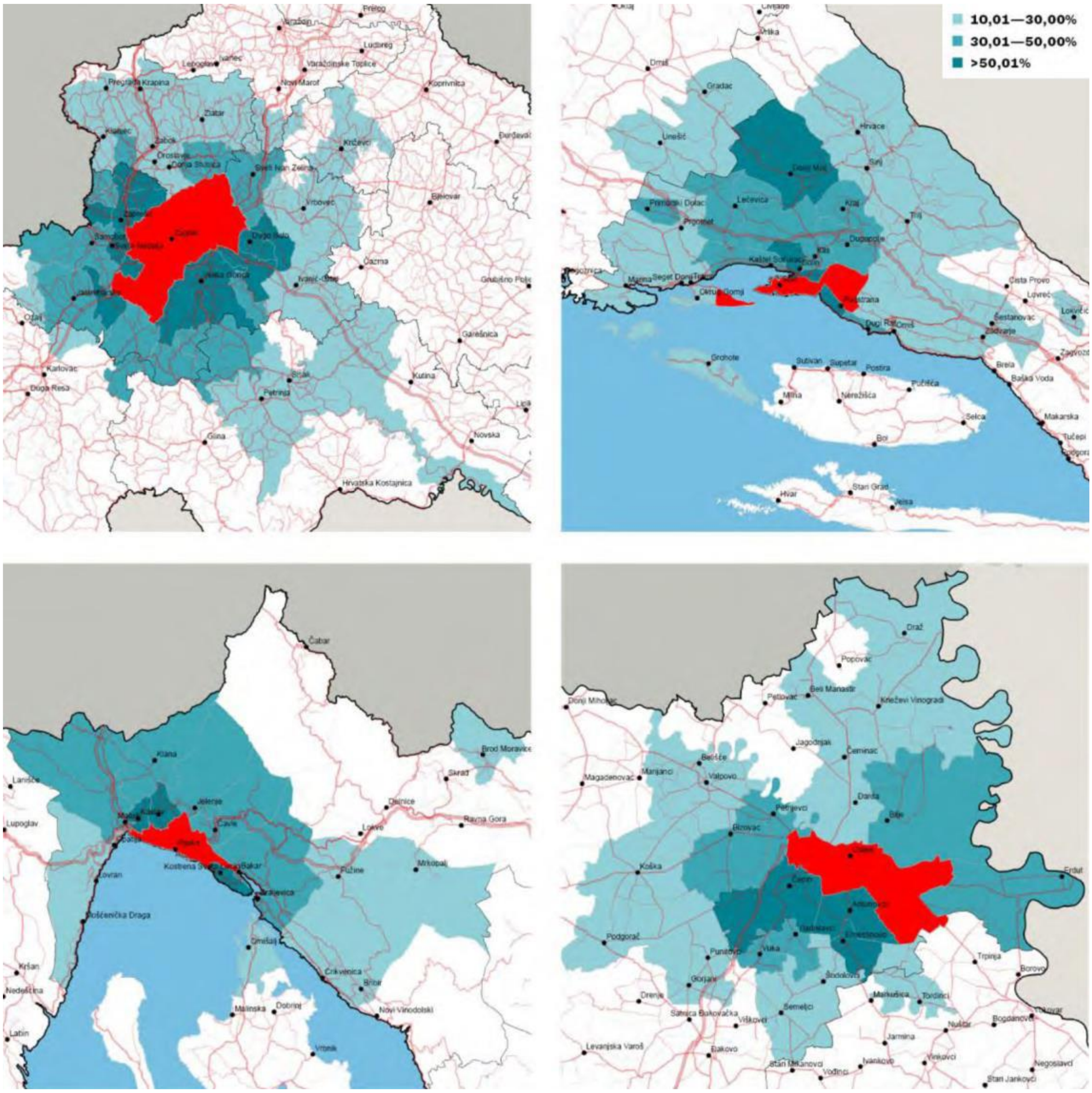


Figure 3.13 The percentage of daily passengers in Zagreb, Split, Rijeka and Osijek in relation to the total number of employed persons that gravitate towards the centres of those agglomerations (Source: Transport Development Strategy of the Republic of Croatia 2017-2030)

In recent years, public transport in the Republic of Croatia has registered an increase in the number of transported passengers (Table 3.9), which can be related to a decrease in the use of personal cars as the most common alternative to public transport. Despite the positive trend, the public transport in Croatia does not follow the world trends of intermodality and the concepts such as *Park & Ride*[4].

[4] *Park & Ride* service is the combination of car parks and public transport. It is possible to leave a vehicle in the car parks designated for that service for an unlimited time and to use the public transport service for a furhter travel afterwards.

Table 3.9 Transported passengers (in thousands) and travelled kilometres (in thousands) in urban and suburban transport (Source: Transport and Communications in 2015)

	Total		Trams		Buses	
	transported passengers	travelled km	transported passengers	travelled km	transported passengers	travelled km
2011.	364.382	86.805	173.177	16.150	191.205	70.655
2012.	363.198	84.807	174.139	14.903	189.059	69.904
2013.	371.840	83.139	177.596	14.586	194.244	68.553
2014.	388.295	83.860	191.899	15.593	196.396	68.267
2015.	398.160	83.367	199.322	14.830	198.838	68.537

At present, public transport in the Republic of Croatia is not integrated. Intermodal terminals, which enable transit from one mode of transport to another, do not exist, and there are no coordinated timetables or single tickets for different modes of transport. At the same time bus and rail carries have "parallel routes". Also, average age of the rolling stock (including the railway rolling stock) is close to the end of its service life. The situation is somewhat satisfying in the cities of Zagreb and Rijeka, while the rolling stocks of Osijek and Split are in much worse shape (Table 3.10). In addition, Osijek needs significant investments for a modernization of its tram traffic infrastructure.

Table 3.10 Average age of the public transporters' rolling stock per cities (Source: Transport Development Strategy of the Republic of Croatia 2017-2030)

City	Year of Counting	Buses	Average Age	Trams	Average Age
Split	2015	154	12.2	-	-
Rijeka	2015	172	11	-	-
Osijek	2014	38	10	26	47
Zagreb	2015	426	8	277	12

Bicycle is a very useful mode of transport on shorter distances and inside urban areas and there is a great potential for the development of that mode of transport, thereby significantly decreasing greenhouse gases emissions and enabling the use of multimodal transport systems. According to the Transport Development Strategy of the Republic of Croatia 2017-2030 the share of bicycle as a mode of transport in daily migrations on the level of whole country is 7.1% (data from 2014), while in the city of Zagreb in 2012 it amounts to 10.1% in relation to other modes of transport. Regarding the share of bicycle use in daily migrations Zagreb is in the 6th place comparing to other European cities.

Relatively large number of bicyclists in traffic calls into question the traffic safety, which is visible from the number of injured and killed bicyclists on Croatian roads from 2013 to 2015 (Table 3.11).

Table 3.11 Persons killed and injured in road traffic accidents (Source: Transport and Communications in 2015)

	total			drivers thereof			total			drivers thereof		
	2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
Number of drivers and passengers killed and injured on bicycles	23	19	34	23	19	34	1097	1185	1199	1083	1166	1177

It is alarming that up to now there is no adequate statistics on reasons of traffic accidents in which bicyclists have participated, which makes it harder to identify the reasons, as well as the prescribing and implementation of adequate measures to improve the bicycle transport safety.

Ultimately, according to the State of the Environment Report of the Republic of Croatia for the Period from 2009 to 2012 (Croatian Environment Agency, 2015) the traffic in cities was evaluated as unsatisfactory, and measures implemented so far inefficient.

3.2 Environmental loads

3.2.1 Air pollutants due to traffic

Traffic significantly contributes to the air emissions of pollutants. According to the Report on Calculation of Air Pollutants
Emissions in the Area of the Republic of Croatia (Croatian Agency for the Environment and Nature, 2016) in 2014 the traffic had contributed mostly in emissions of copper (Cu) with 80%, lead (Pb) with 59.3%, nitrogen oxides (NO_x) with 46.9% and carbon monoxide (CO) with 18.8%. The main source of emissions of pollutants into the air from transport sector in Croatia is road transport. The sources of specific pollutants are mentioned underneath. On the Figure in continuation (Figure 3.14) one can see relations of individual substances for 1990 and 2014 (Croatian Agency for the Environment and Nature, 2016).

Sulphur dioxide (SO_2) - A decrease is mostly due to the transition from fuel with high content of sulphur to low-sulphur fuels, which relates mainly to road transport.

Nitrogen oxides (NO_x) - The main source of nitrogen oxides in Croatia is traffic, with the share of 46.9% in the NO_x total emission and domination of road transport. In relation to 1990 the NO_x emission in the transport sector has decreased for 37% due to the introduction of catalysts in cars and more stringent standards for the emissions.

Ammonia (NH_3) - An increase of the ammonia emission in the transport sector is associated with a catalyst operation in road transport. In comparison with 1990 ammonia has increased 17 times.

Carbon monoxide (CO) - Road transport is the main reason for a decrease in CO emissions from 1990 (for 84% related to the transport sector) due to the introduction of catalysts into vehicles and the rolling stock renewal.

Non-methane volatile organic compounds (NMVOC) - Road transport is dominant in the NMVOC emission in the transport sector, but it also records largest decreases of the exhaust gases emissions. The road transport sector has also contributed to the NMVOC emission decrease trend due to an increased use of energy efficient vehicles and the introduction of new requests for the exhaust gases emissions.

Total suspended particles (TSP) - The transport sector contributes to a lesser degree in the total suspended particles emissions (5.9%). The dominant source of TSP emissions in the transport sector is the road transport, whereat emissions from motor fuel combustion and fugitive emissions from road, tires and breaks wearing contribute equally.

Lead (Pb) - The key source in the Pb emission in 2014 was the transport sector (59.3%) with domination of road transport. The main part of the Pb emission in 90s comes from the road transport sector due to the use of leaded gasoline. Between 1990 and 2014 the Pb emission from the transport sector had decreased significantly for 98.7% as a result of legal efforts to remove lead from gasoline. These efforts started in 1996 when the content of Pb in leaded gasoline was decreased from 0.6 g/l to 0.74 g/l, and in unleaded gasoline from 0.02 g/l to 0.013 g/l, after which in 2004 the Pb content in leaded gasoline was decreased to 0.15 g/l and in unleaded gasoline to 0.005 g/l. In 2005 leaded gasoline was completely banned.

Copper (Cu) - The dominant sector in copper emission is road transport. The Cu emissions in 2014 were 7.4 t. The transport sector (mostly tires and brakes wearing) contributes with 80.8% in the total Cu emission. The emission is decreased for 13% in relation to 1990, but the reason for that was the transport decrease due to the Croatian Independence War (1991-1995). After the period of decrease the Cu emission has a long-term period of increase, mostly due to an increase of road vehicles number and an increase in realized kilometres value in the observed period, so one can expect an increase of that element in the environment.

Zinc (Zn)- Zinc comes into the environment from transport due to fuel combustion and, although it is not the main source, transport (mostly road) contributes to the zinc pollution with 29.7%.

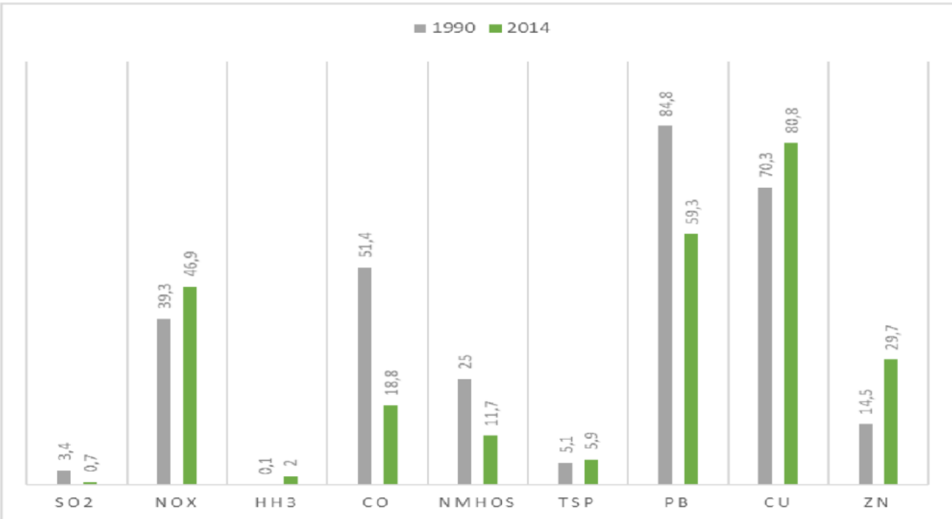


Figure 3.14 Share of the contribution of transport sector per individual pollutants (Adjusted according to: Croatian Agency for the Environment and Nature, 2016)

In the period from 2003 to 2012, a significant decrease is evident in CO and NMVOC, while other pollutants decrease mildly (Figure 3.15).

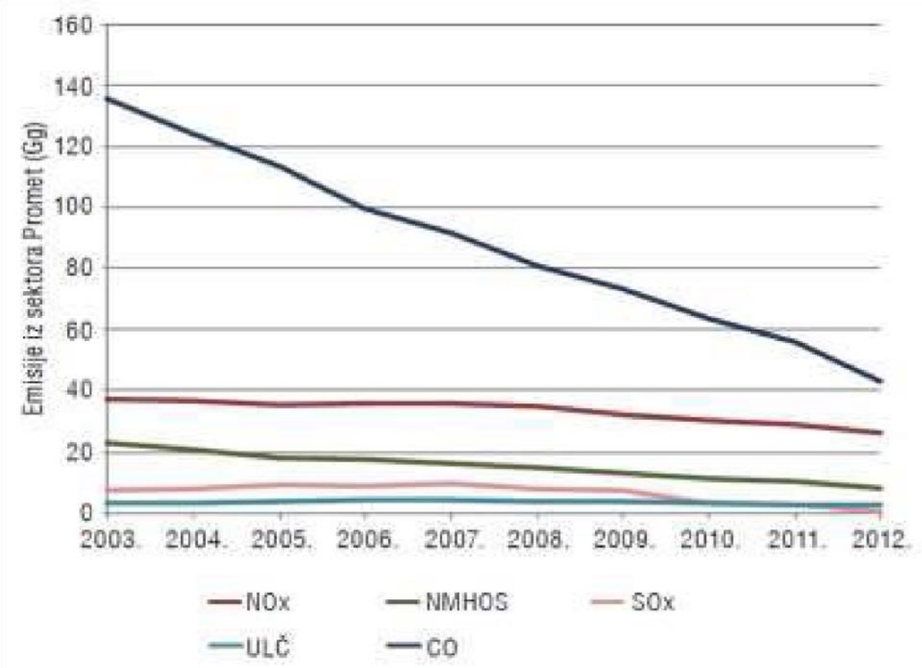


Figure 3.15 Pollutants in the air released from transport sector (Source: Croatian Environment Agency, 2015)

Ultimately, air traffic pressure contributes most to emissions of NOX, copper (Cu) and lead (Pb) and CO, TSP and NMHOS, and is therefore considered to be moderate to high.

3.2.2 Greenhouse gas emissions

Since CO_2 is the most significant anthropogenic cause of global warming, the emissions due to fuel combustion have a dominant influence on the global warming. Road transport has contributed to the CO_2 emission with 35% and non-road transport (mostly air transport) with 2%. In general, transport with the share of 37% in the greenhouse gases emissions in Croatia represents the main source of the greenhouse gases emissions. In the period from 2009 to 2014 one can see a mild positive trend of decreasing the emissions from the transport sector which have decreased for about 1% (Energy in Croatia in 2014) (Figure 3.16) which is not regarded as sufficient to meet European targets for the greenhouse gases emission decrease.

In conclusion, since road transport is the main source of greenhouse gases in the Republic of Croatia its pressure is evaluated as high, while other modes of transport represent a negligible pressure. One should single out air transport which contributes in the greenhouse gases emission with higher share in the last couple of years.

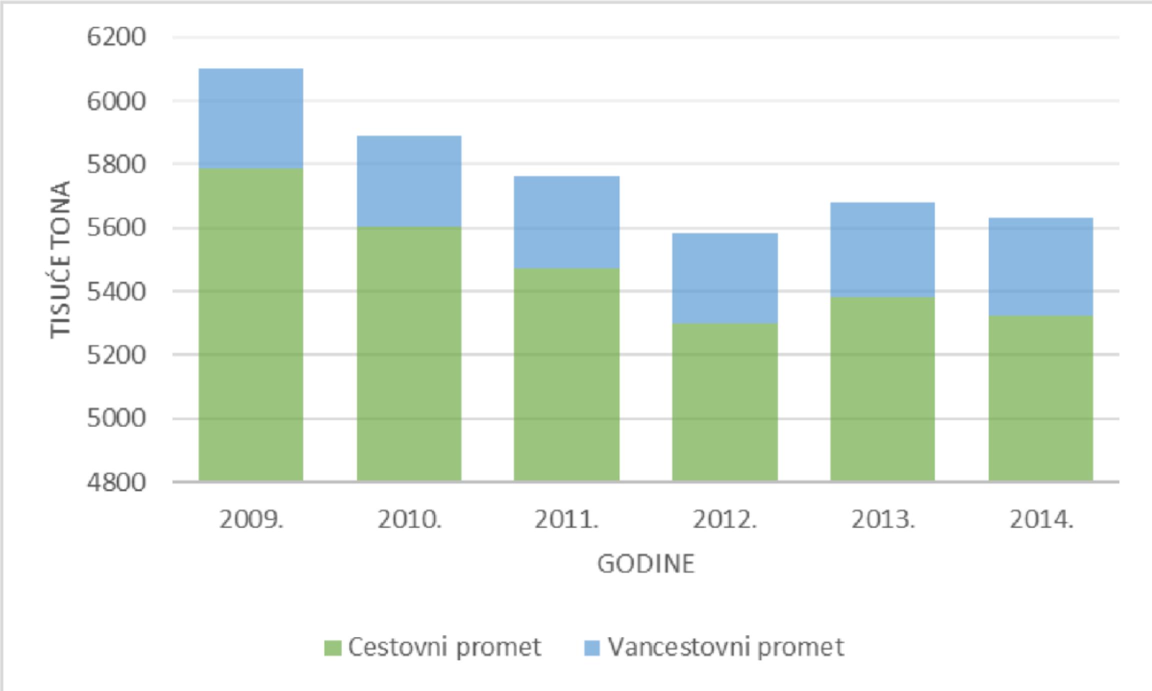


Figure 3.16 CO_2 emissions from transport sector for the period from 2009 to 2014 (Adjusted according to: Energy in Croatia in 2014)

3.2.3 Noise

Environmental noise is unwanted or for human health and the environment harmful sound in the outdoor environment caused by human activity. Transport is one of the main sources of noise on land, but in the sea, as well.

According to the Noise Protection Act (OG 30/09, 55/13, 153/13, 41/16) and the Ordinance regulating the method of preparation and the content of noise maps and action plans, as well as the method of calculation of limit values of noise indicators (OG 75/09, 60/16), on Croatian territory strategic noise maps have been prepared for the cities of Zagreb, Split, Rijeka and Osijek and the A1, A2, A3, A4, A6, A8 and A9 motorways. Railways still do not have prepared noise maps, except within the noise maps of the aforementioned cities.

Results of an analysis of the population exposure to noise in four Croatian cities (Zagreb, Split, Rijeka and Osijek) (Strategic noise maps of the cities of Zagreb, Split, Rijeka and Osijek) show that transport is the main source of noise, whereat road transport is dominant, after which comes rail and tram transport (Zagreb and Osijek). For example, in the city of Zagreb more than 40% of population is exposed to excessive levels of the road transport noise during day, evening and night, 7% to excessive levels of rail and 6% of tram transport. Such data do not depart significantly from other Croatian cities, as well as from the European average.

Barriers for noise protection are placed on all Croatian motorways on places where noise directly threatens population, but with a development of cities additional measures may be necessary. In that sense the concessionaires of Croatian Motorways have prepared strategic noise maps and in certain cases have developed few scenarios of protective measures which include measures of slowing traffic and placing walls for noise protection (Strategic noise map of Croatian Motorways Ltd. 2016).

A general quality of railway infrastructure in Croatia is rather low. Besides, rolling stock and all the railway equipment are in average older than 30 years, meaning they cause a wearing of somewhat renewed infrastructure faster than what is expected. The most prominent consequence of poor contact between railway vehicles and tracks is a high level of noise made by trains, especially in urban areas where those values are above a prescribed level. The highest levels of noise in railway transport are recorded along the corridor from Zagreb to Rijeka (Transport Development Strategy of the Republic of Croatia, 2017-2030).

Anthropogenic underwater noise is a kind of noise in the sea caused by an operation of ship engines. Maritime transport is the main source of the Adriatic underwater noise. The noise made by ships consists of the low frequencies of the broadband spectrum, which in turn consists of many tones caused by engine drive. The sound of vessels can move between 50 and 500 Hz. The noise of a distant vessel can reach frequencies from 50 to 300 Hz (Harland and others, 2005). The noise increases with an increase of the number of vessels, as well as their speed.

According to the Directive 2006/87/EC of the European Parliament and of the Council of 12 December 2006 laying down technical requirement for inland waterway vessels and repealing Council Directive 82/714/EEC (OJ L 389 30 December 2006), the noise produced by a vessel under way, and in particular the engine air intake and exhaust noises, shall be damped by using appropriate means. The noise generated by a vessel under way shall not exceed 75 dB(A) at a lateral distance of 25m from the ship's side. Apart from transhipment operations the noise generated by a stationary vessel shall not exceed 65 dB(A) at a lateral distance of 25m from the ship's side (Article 8.10 of the Directive 2006/87/EC).

A noise monitoring system in Croatia is in the phase of establishing (The set of features of good state of the environment for seas under the sovereignty of the Republic of Croatia and the set of targets in maritime environment protection and indicators connected with them, 2014).

Due to the absence of comprehensive studies and monitoring programmes currently there are not enough data according to which one could quantitatively define the current state and trends of underwater noise in the Adriatic Sea. Within the project "Consultant services in defining the system of monitoring and observing for a permanent evaluation of the Adriatic Sea state - Adriatic Monitoring Programme - Phase II (2014)" initial measurement of underwater noise had been conducted.

In conclusion, a noise pressure caused by transport is regarded as the main source of anthropogenic noise in the environment and is evaluated as high. This relates particularly to underwater noise for which there are no adequate methods of control or monitoring.

3.2.4 Emissions of waste and ballast waters

Wastewaters from traffic roads end up directly in the environment if the traffic roads don't have a closed drainage system. Waste material that ends up in the environment in such a manner are greases and oils, as well as heavy metals and other pollutants (in detail in the chapter 3.2.1).

Closed drainage systems exist on the motorways of newer construction. Sections with no such systems are the section of the A1 motorway between Zagreb and Karlovac and the section of the A3 motorway between Zagreb and Lipovac. For other roads, drainage systems are determined on the level of individual projects where the control mechanism is a procedure of environmental assessment (Environmental Protection Act) and a procedure of assessing a project acceptability for the ecological network (Nature Protection Act).

Railways in Croatia don't have closed drainage systems. In a perspective of a railway transport development it is necessary to plan suitable drainage system during a railway infrastructure construction and modernization.

Maritime transport also leads to emissions of wastewaters into the environment. Most ports release the wastewaters directly into the sea, and a part is connected to a municipal sewage or have septic tanks. Fewer ports have a wastewater treatment (fine grilles, primary treatment, bio-purifier, grease and oil separators). Pollution of coastal areas due to a release of the wastewaters of communal or industrial origin and port traffic is recorded mostly in the Rijeka Port, while increased concentrations of certain heavy metals and/or organic pollutants are recorded in the Split Port, Vranjic, the Ploče Port and the Bay of Bakar. As regards economic areas the petroleum industry is the main source that generates oily waters (oil terminals, tankers).

Except from tankers, the oily waters from ships can be generated also:

- from ships transporting general cargo (bilge waters, oily waters from ship engine rooms, ship slops)

- from ships coming for an overhaul (bilge waters, oily waters from ship engine rooms, ship slops, oily waste waters from a discharge and cleaning of tanks, oily sludge).

Solid waste is closely connected to the wastewaters from ships. On local level ports are not equipped with reception facilities for ship-generated waste in satisfying manner, while county ports are mostly in better position, i.e. they are better equipped with the reception facilities for ship-generated waste. These are mostly garbage cans and waste containers for solid waste, oily waste and waste oils, as well as garbage cans for separate waste collection. The waste collected in ports is bulk waste from fishing ships, mixed communal waste, waste oils, non-hazardous technological waste, oily solid and liquid waste, polluted packaging, plastics, paper, cans, glass.

In 2007 the Republic of Croatia has adopted the Ordinance on the management and control of water ballast (OG 55/07) which is replaced in 2012 by the Ordinance on the management and control of ballast waters (OG 128/12). Pursuant to the latter Ordinance all ships sailing into Croatian ports must implement the Plan of the ballast waters management and deliver to a competent port captaincy a ballast waters notification. Additionally, on the meeting held 30 April 2010 the Croatian Parliament has adopted the Decision on the promulgation of the Ballast Water Management Convention (BWMC) Implementation Act.

According to data of Environmental Protection Agency (2015), quantities of ballast waters in the period from 2007 to 2012 record the fall of 75% for the landed quantities and 16.6% for the brought quantities of ballast water (Figure 3.17). Through the whole observed period the Rijeka Port had reported the largest annual quantities of brought and landed ballast waters, and according to the report the Dubrovnik Port has no landed ballast waters in the whole period from the day the ballast waters are recorded.

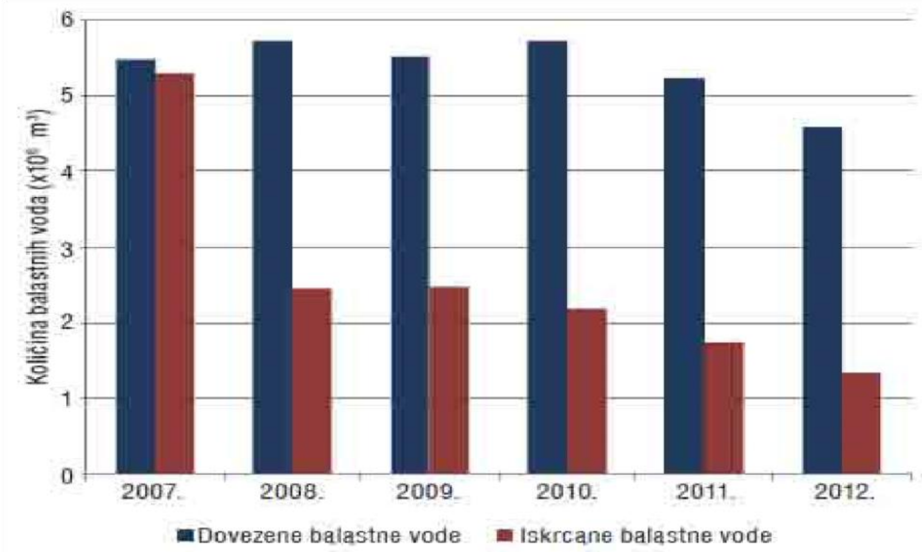


Figure 3.17 Quantities of ballast waters (Environmental Protection Agency, 2015)

The main reason for such a great fall of the landed water ballast in Croatian ports is entering into force of regulations concerning a management and control of the ship ballast waters in ships. Besides, most ships that sail in the Croatian part of the Adriatic Sea are the ships under the Croatian flag sailing from one to another Croatian port, so the main quantity of the water ballast landed in the Croatian ports comes from the Adriatic Sea.

On the other hand, the Rijeka port development strategy foresees an increase of international transport, which shall bring to an increase in the ballast waters quantity.

From everything mentioned here the pressure of wastewaters in road transport is assessed as low and moderate, in railway transport as low, and in maritime transport as moderate to high.

3.2.5 Extraordinary events (accidents)

An extraordinary event in traffic relates to an unwanted, unintended or unexpected event or a sequence of such events, having as a consequence any kind of damage. They can have consequences for the environment and nature, as well as on human health.

The number of extraordinary events in traffic related to an impact on the environment and nature in 2012 is decreased for 10.5% in relation to 2007 (Environmental Protection Agency, 2015). According to the data of the environmental protection inspection 34 extraordinary events in traffic were recorded in 2012. From the presentation in continuation (Figure 3.18), if we exclude pipelines, it is visible that the largest occurrence of the extraordinary events is related to road transport, which is expected since it is the most often kind of transport. On the other hand, motorways, as traffic roads on which the largest quantities of dangerous substances are being transported and apart from already mentioned exceptions for the older motorways, have closed drainage systems and grease and oil separators, which decreases the risk from significant environmental consequences.

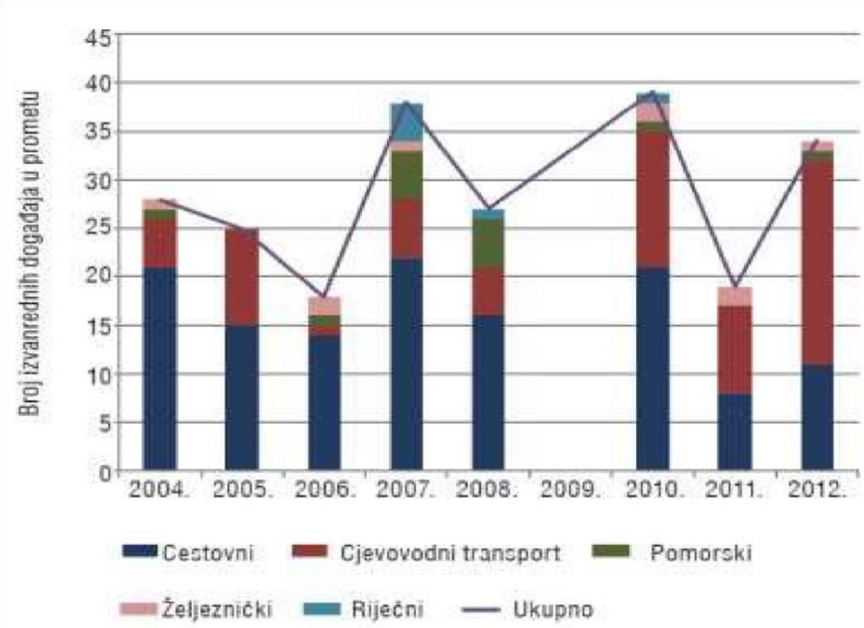


Figure 3.18 Number of extraordinary events in traffic according to a transport mode (Source: Environmental Protection Agency 2015) Note: Data for 2009 by type of transport are not available, but only the total number of extraordinary events in traffic for this year is 33

On the other hand, the most dangerous extraordinary events for the environment related to the marine transport of dangerous substances (petroleum and petroleum products), which transport on the Adriatic Sea is increasing (see the chapter 3.1.6). Although in 2008 the Parliament of the Republic of Croatia has adopted the Plan of interventions in sudden sea pollutions (OG 92/08), Croatian ports are not equipped with an adequate equipment for protection and for mitigating consequences of such events, so their recovery is of questionable efficiency. The number of the sudden sea pollutions from floating crafts in the period from 2010 to 2012 is shown in the Figure below (Figure 3.19).

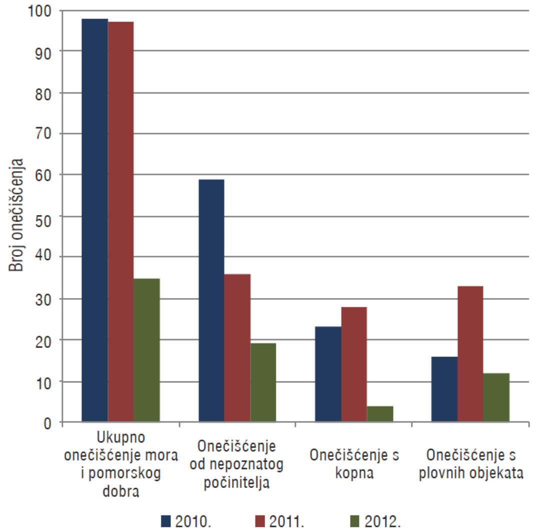


Figure 3.19 Sudden pollutions of maritime good according to the pollution source (Source: Ministry of the Sea, Transport and Infrastructure, taken from the State of the Environment Report, EPA 2015)

Immediately after the risk from extraordinary events in maritime transport comes railway transport whose infrastructure does not meet modern security standards. If to this one adds that the main railway route for transporting dangerous substances, Rijeka - Zagreb (for more details see chapter 3.1.3), passes almost totally through a karst area, and has not a closed drainage system the extraordinary events in that area can have major ecological consequences.

3.3 Description of a state of environmental components

The state of the environment in the area of the Republic of Croatia is described using indicators that were selected in accordance with the preliminary analysis of the Strategy. Pursuant to identified potential impacts of the Strategy on the environmental components the clear indicators, that is, identifiers of the state of the environment were defined that allow a focused presentation of a certain trend in the environment. Beside the most significant influences of the Strategy, data availability, that is, a possibility of quantitative and qualitative presentation of environmental elements that shall be the object of the assessment of the Strategy's environmental impact was also a criterion for a selection of the indicators.

3.3.1 Air quality and climatic features

3.3.1.1 Concentration of pollutants in air

The air quality in Croatia is being monitored on the basis of the data measured on the measuring stations of the national and local networks for the permanent monitoring of air quality.

In the Annual report on the air quality monitoring in the area of the Republic of Croatia for 2013, 2014 and 2015 one can see the air quality assessment in five zones (HR1 Continental Croatia, HR2 Industrial Zone, HR3 Lika, Gorski Kotar and Primorje, HR4 Istria and HR5 Dalmatia) and four agglomerations (Zagreb, Split, Rijeka and Osijek) from the measuring places defined with the Regulation on the definition of the list of measuring places for monitoring concentrations of certain pollutants in the air and the locations of the measuring stations in the national network for permanent monitoring of air quality (OG 22/14).

On the Figure below one can see the spatial distribution of zones and agglomerations with the measuring stations for pollution assessment, that is the measuring stations for monitoring the pollutants mentioned below (Figure 3.20).

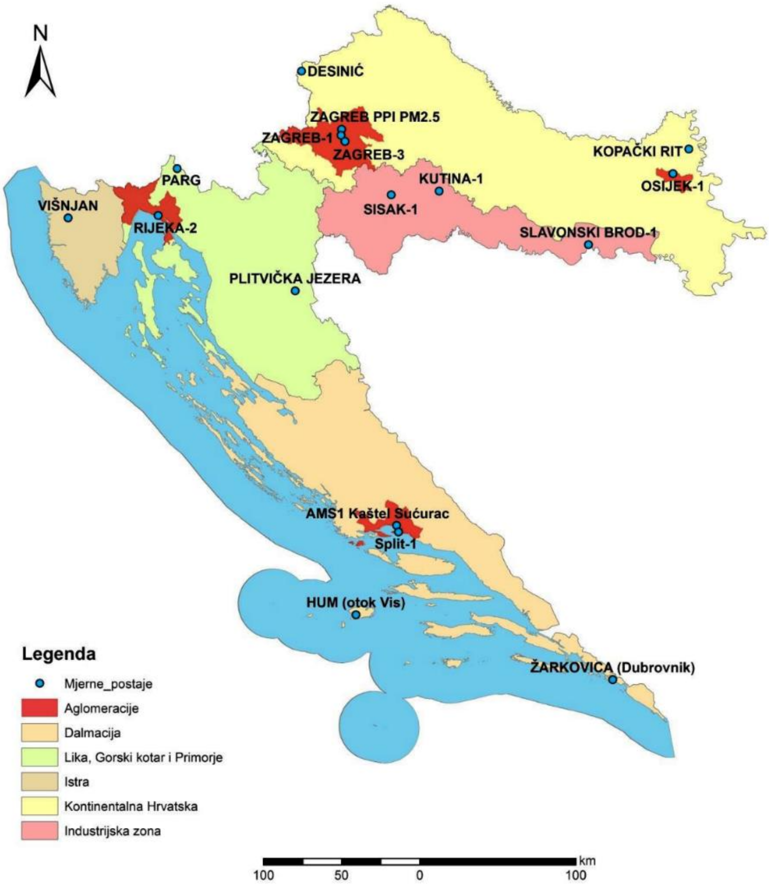


Figure 3.20 Zones and agglomerations for the purposes of air quality monitoring with the representation of measuring stations (Source: Annual Report on the Air Quality Monitoring in the Area of the Republic of Croatia for 2015)

The Annual Report on the Air Quality Monitoring in the Area of the Republic of Croatia for 2013, 2014 and 2015 encompasses data on measured concentrations of pollutants in the air, and that of sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulates (PM_{10} and $PM_{2.5}$), lead, benzene, carbon monoxide (CO), ground-level ozone (O_3) and the ground-level ozone precursor (volatile organic compounds - VOCs), arsenic, cadmium, mercury, nickel, benzoapyrene (BaP) and other polycyclic aromatic hydrocarbons (PAHs), average exposure indicators for $PM_{2.5}$(AEI) and the chemical composition of $PM_{2.5}$.

The Regulation on levels of pollutants in the air (OG 117/12) determines limit and target values concerning human health protection and the target values, as well as long-term targets for ground-level ozone.

According to the levels of pollution, given the prescribed limit values, target values and target values for ground-level ozone, the following air quality categories are defined:

- category I - clean or slightly polluted air: limit values, target values and the ground-level ozone target values are not overstepped
- category II - polluted air: limit values, target values and the ground-level ozone target values are overstepped.

According to the Annual Report on Air Quality in the Republic of Croatia for 2013, 2014 and 2015 in certain zones and agglomerations a smaller number of measuring stations was changed. On each station certain pollutants were measured and, considering their concentration, a previously mentioned air category was determined for each station. With the analysis of all measuring stations and determined air categories inside an individual zone / agglomeration a cumulative percentage of the determined air categories was calculated for 2013, 2014 and 2015.

In the table below one can see percentage shares of the determined air categories for all zones and agglomerations and those percentages that were largest in the period from 2013 to 2015 in a certain category are marked with green and red colour (Table 3.12).

Table 3.12 Air quality categories for all zones and agglomerations from 2013 to 2015 (Prepared by: IRES EKOLOGIJA d.o.o.)

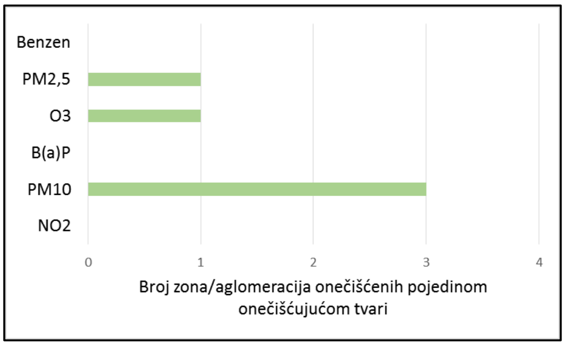
Zone / Agglomeration	**Number of stations**			**Category I (%)**			**Category II (%)**		
	2013	2014	2015	2013	2014	2015	2013	2014	2015
Agglomeration Zagreb	11	12	13	77.78	82.28	76.74	22.22	17.72	23.26
Agglomeration Osijek	1	1	1	80.00	80.00	83.33	20.00	20.00	16.67
Agglomeration Rijeka	18	19	19	88.73	94.12	89.86	11.27	5.88	10.14
Agglomeration Split	4	4	4	85.71	100.00	100.00	14.29	0.00	0.00
Continental Croatia	2	3	3	75.00	100.00	90.00	25.00	0.00	10.00
Industrial Zone	11	11	12	77.78	81.48	73.13	22.22	18.52	26.87
Lika, Gorski Kotar and Primorje	5	5	4	80.00	80.00	87.50	20.00	20.00	12.50
Istria	13	13	13	96.30	93.55	86.67	3.70	6.45	13.33
Dalmatia	5	3	4	16.67	75.00	81.82	83.33	25.00	18.18

From the previous table one can see that in the period from 2013 to 2015 the smallest number of the overstepped limit value, target value and ground-level ozone target value was recorded in the Agglomeration Split, and accordingly in it was recorded the highest percentage of the I air category. Contrary to the Agglomeration Split from 2013 to 2015 the highest number of the overstepped limit value, target value and ground-level ozone target value was recorded in the Industrial Zone, following by the Agglomerations Zagreb and Osijek.

With the analysis of the Annual Report on the Air Quality Monitoring in the Area of the Republic of Croatia for 2013, 2014 and 2015, and that of summary assessments of the zones and agglomerations pollution (discrepancy) per pollutants, graphical presentations were made in such a manner that: (1) those agglomerations and zones that were assessed as polluted in a certain year were counted, (2) pollutants which produce pollution were counted and (3) so called categories of pollution reasons were singled out. For each pollutant it was presented in how many zones and/or agglomerations it had caused the pollution, and for the pollution reasons categories their interrelation was presented.

In the following text the results of the given analysis are presented for each individual year from 2013 to 2015.

In 2013 one zone and three agglomerations were assessed as polluted and the most common pollutants were particulates PM_{10}. The most common reason of the pollution were small furnaces.



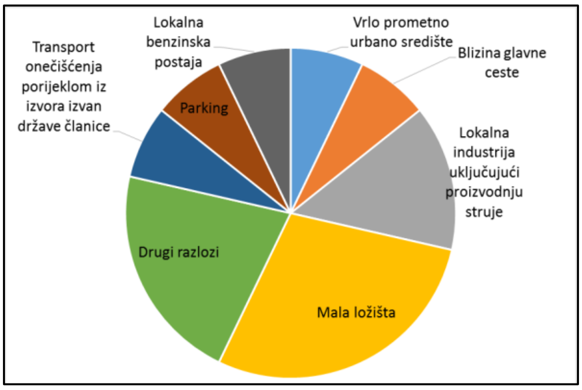
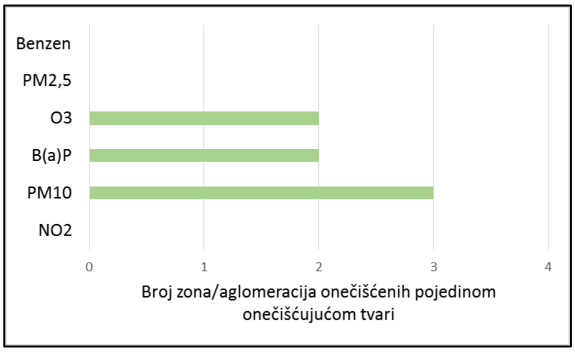


Figure 3.21 Number of zones / agglomerations polluted with an individual pollutant (left) and the relation of the overstepping reasons categories (right) for 2013 (Prepared by: IRES EKOLOGIJA d.o.o.)

In 2014 three zones and two agglomerations were assessed as polluted and the most common pollutants were the particulates PM_{10}. The most common reasons of the pollution were, in equal measure, the proximity of a main road, than small furnaces and local industry, including electricity production.



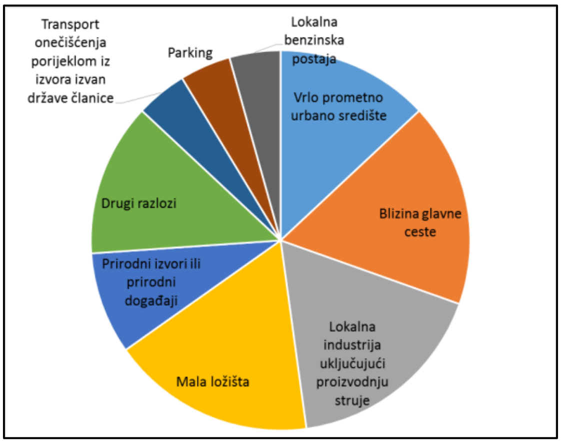
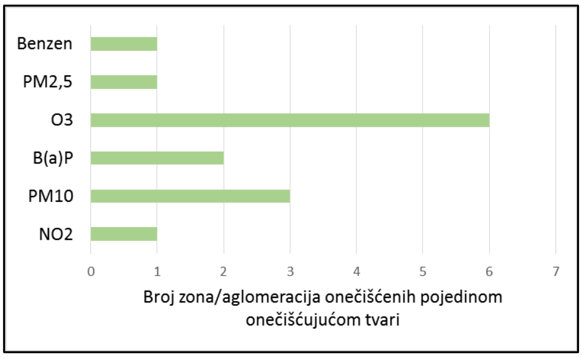


Figure 3.22 Number of zones / agglomerations polluted with an individual pollutant (left) and the relation of the overstepping reasons categories (right) for 2014 (Prepared by: IRES EKOLOGIJA d.o.o.)

In 2015 five zones and three agglomerations were assessed as polluted as the main pollutant was ozone (O_3). Besides "other reasons", the most common reasons of the pollution were natural sources or natural events and the proximity of a main road.



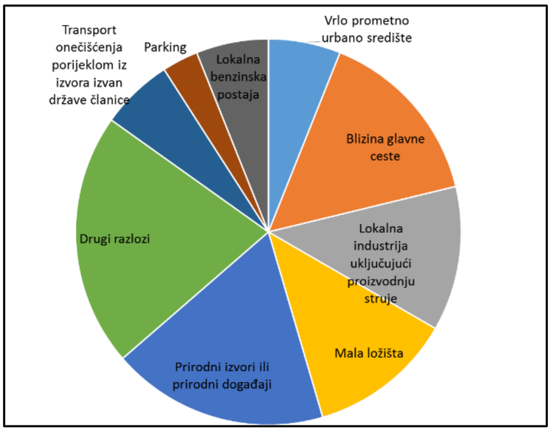


Figure 3.23 Number of zones / agglomerations polluted with an individual pollutant (left) and the relation of the overstepping reasons categories (right) for 2015 (Prepared by: IRES EKOLOGIJA d.o.o.)

Based on the previously presented analyses it is visible that the number of polluted zones in the period from 2013 to 2015 was growing proportionally, and the number of polluted agglomerations stayed the same, with smaller oscillation in 2014. In 2015 the number of zones and/or agglomerations polluted with ozone has grown and it was the cause of the pollution assessment for 6 zones and/or agglomerations, while in 2013 that number for six times smaller (Figure 3.24).

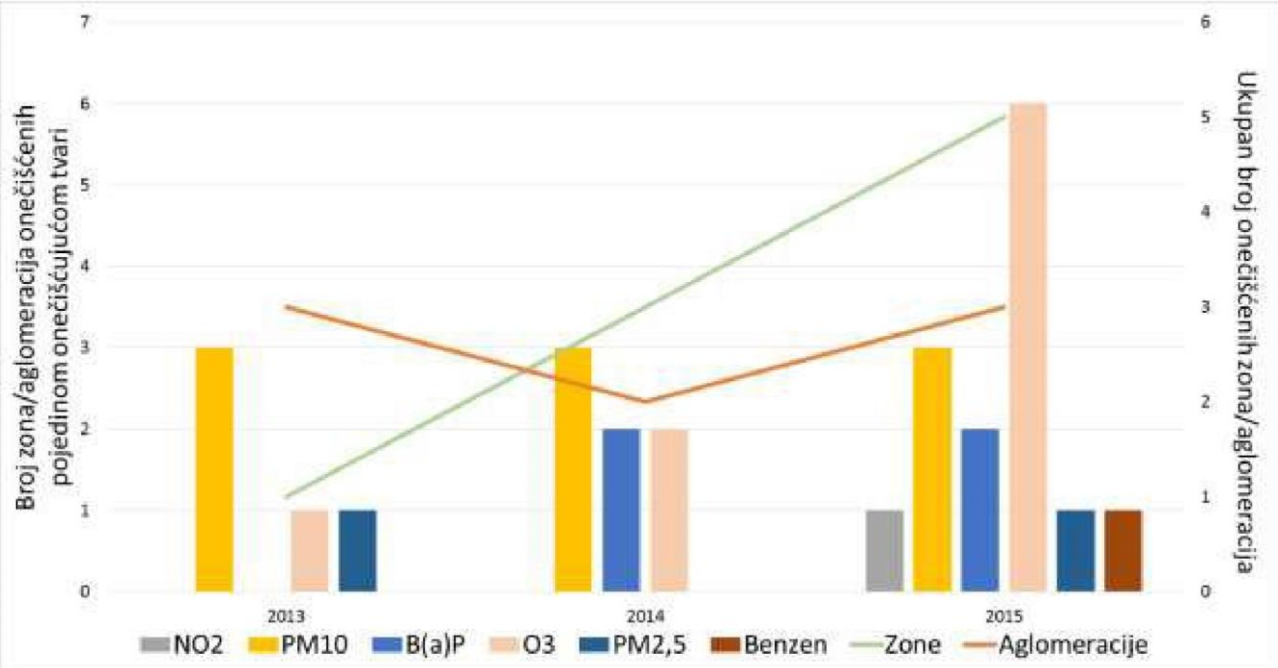


Figure 3.24 Trend of the polluted zones / agglomerations number for the period from 2013 to 2015 (Prepared by: IRES EKOLOGIJA d.o.o.)

3.3.1.2 Quantity of greenhouse gas emissions

The greenhouse gases are divided into natural and anthropogenic and can be divided on gases contributing to greenhouse effect and gases that damage the ozone layer while speeding the greenhouse effect. The gases that intensify the greenhouse effect are carbon dioxide, methane, nitrous oxide, tetrafluoromethane, hexafluoroethane, sulphur hexafluoride and hydrofluorocarbons. Beside those compounds, to the greenhouse effect contribute also water vapour (H_2O) and tropospheric ozone (O_3). But they are not included in international agreements on a decrease of the greenhouse gases emissions due to their short period of staying in the atmosphere.

According to the Report on a greenhouse gases inventory on the area of the Republic of Croatia for the period from 1990 to 2014, the Energetics sector (which includes the Transport sub-sector) contributes the most to the greenhouse gases emissions, which in 2014 were smaller for 5.5% in comparison to 2013 and smaller for 25.3% in comparison to 1990. The Energetics is the main source of the anthropogenic greenhouse gases emission, contributing about 75% to the total greenhouse gases emission on the territory of the Republic of Croatia. Observing the share in the total carbon dioxide (CO_2) emission, the energetics contributes with over 90%. The energetics contribution in the methane (CH_4) emission is much smaller (about 8%) if it is compared with the total emission of CO_2 equivalents, while the share of nitrous oxide (N_2O) is very small (about 2%) in comparison with the total emission of CO_2 equivalents. Emissions generated with the fossil fuels combustion make more than 90% of the total emission of the energetics sector.

From 1990 to 2014 the share of emissions from the transport sub-sector in the energetics sector has gradually increased, so in 2014 the largest part of the emissions was generated as a consequence of fuel combustion in transport (34.8% in 2014) (Figure 3.25).

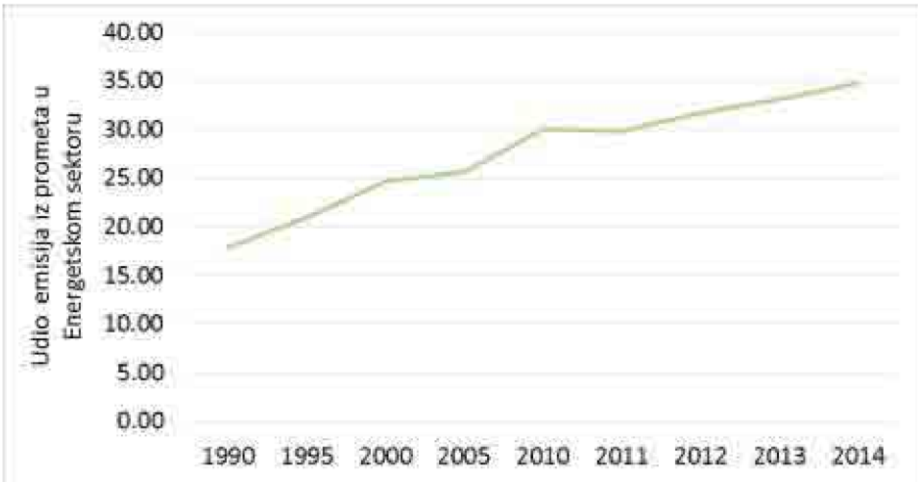


Figure 3.25 The share of emissions from transport in the Energetics sector (Prepared by: IRES EKOLOGIJA d.o.o.)

The Transport sub-sector encompasses the fuel combustion and evaporation in transport and, besides road transport, emissions from air, rail and water transport is also included, and the total emission of greenhouse gases from the said subsector is shown on the Figure in continuation (Figure 3.26).

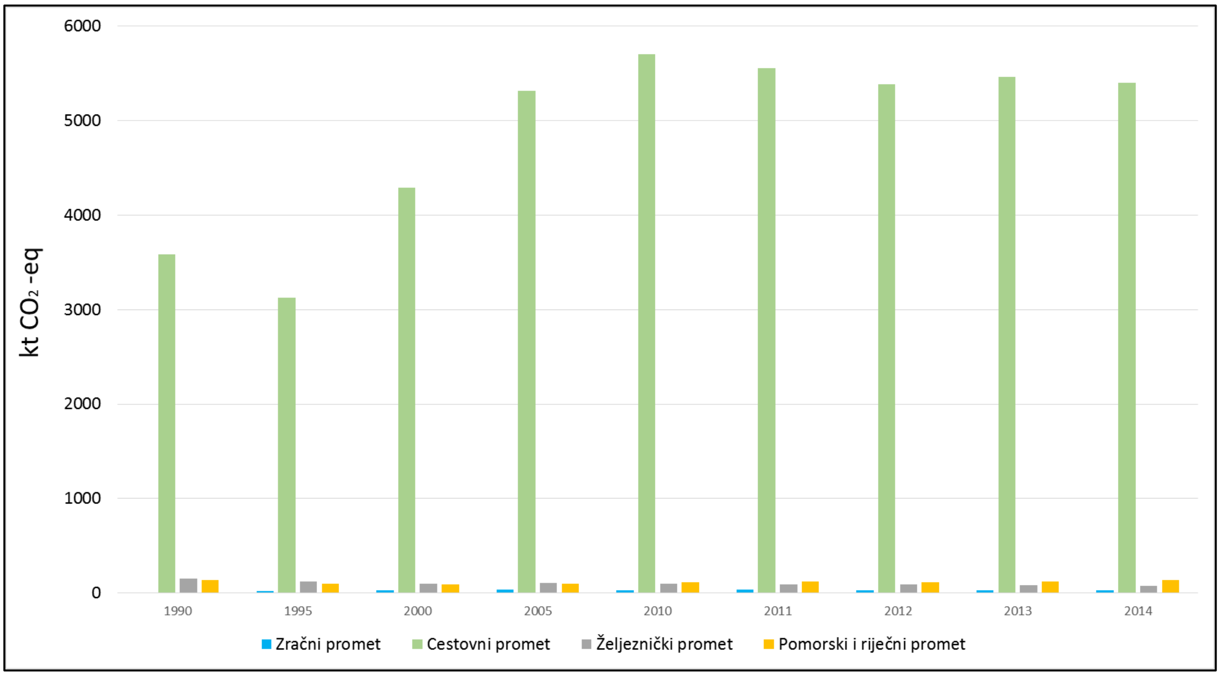


Figure 3.26 The CO_2eq emission from the Transport sub-sector (Source: Report on the inventory of greenhouse gases in the area of the Republic of Croatia for the period 1990-2014, Modified: IRES EKOLOGIJA d.o.o.)

From the above Figure it is visible that emissions from road transport are dominant and in 2014 they had contributed to the CO_2eq emission from the Transport sub-sector with 95.7%. Maritime and river transport in 2014 have contributed to the CO_2eq emission with 2.4%, railway transport with 1.3% and the domestic air transport with 0.6% in the total emissions of the Transport sub-sector. Comparing with 1990 the CO_2eq emission from the Transport sub-sector has increased for 45.4% as a result of an increase of the number of vehicles and the number of realized kilometres in road transport.

An increased concentration of greenhouse gases causes the increased absorption of heat in the atmosphere, which generates changes in the air temperature, a precipitation quantity and other climatological elements.

Climatic changes in the Republic of Croatia in the period 1961-2010 were analysed with the trends of the annual and seasonal average, average minimal and average maximal air temperatures and the temperature extremes indexes, then by the annual and seasonal precipitation quantities and the precipitation indexes, as well as the dry and rain periods.

During the last 50 years (1961-2010) the air temperature trends (average, average minimal and average maximal) show warming everywhere in the Republic of Croatia. The annual air temperatures are increasing and the changes are bigger in the continental part of the country then at the coast or in Dalmatian hinterland. The observed warming can be seen also in all indexes of temperature extremes (cold days and cold nights and a length of cold periods).

The warmest year was 2007 with the appropriate anomaly of 1.53 ˚C comparing with the average of the standard period 1961-1990. The coldest year was 2005 with the appropriate anomaly of -0.1 ˚C. For 9 out of 10 observed years in the period from 2001 to 2010 the air temperature was above the average.

During the last 50 years (1961-2010) there was an increase in the precipitation quantity in the east lowland parts and a decrease in other parts of the Republic of Croatia. Statistically significant decrease is determined in stations placed in the mountainous part of Gorski Kotar and in Istria, as well as in the South coastal area.

The climatic changes of dry and rain periods in the Republic of Croatia are presented with the annual and seasonal trends of their maximal durations. According to the trends results the most visible are the changes of the dry periods in autumn month when everywhere in the Republic of Croatia one can see a statistically significant negative trend. In other seasons the dry periods' trend for both categories is less pronounced than the autumn one.

In appendices 15.5 and 15.6 one can see a graphical deviation of the average air temperature and the precipitation quantity in the period from 2012 to 2017.

3.3.2 Geodiversity

3.3.2.1 Preservation of the features of protected geosites

On the territory of the Republic of Croatia there are two big sedimentary areas: the Pannonian Basin and the Adriatic underwater, and the elevated karst area of the Dinarides which lies between them. The oldest and the youngest deposits on land can be found in the geological structure of the Pannonian Basin. On surface the most spread are the younger, Quaternary and Neogenic deposits which surround Pannonian and peripheral hills made out of the older deposits and rocks ranging from the Precambrian to Neogene. On the other hand, in the Dinarides the most prevalent are Mesozoic and Paleogene, and less prevalent are Palaeozoic and Neogene deposits and Quaternary sediments. The border between the Pannonian Basin and the Dinarides goes along the river Kupa from Vivodina to Karlovac, than south-southeast towards Cetingrad and further along the valley of Korana to the border with Bosnia and Herzegovina (Croatian Geological Institute, 2009).

Due to its geographical position on the crossroads of the Pannonian Basin, the Dinarides and the Alps, the area of the Republic of Croatia have rich geodiversity. Approximately the half of the territory of the Republic of Croatia, mostly littoral and mountainous areas southeast from Karlovac, is a karst area. The karst of the Republic of Croatia belongs to the classical karst type and that is one of the most famous karst areas in the world. The karst is a unique relief form with specific hydrogeological and geomorphological features which occurs in the rock of high solubility in which the secondary, crevice or crevice-cavern porosity is generated. The basic characteristic of the karst is tectonic creakiness and fast loss of water in the subterranean and a lithological composition in which soluble carbonate rocks are prevalent. Also, it is characterized by a shortage of water on surface. The karst is featured by typical karstic forms in relief which can be divided on surface and subterranean:

- Surface forms (karrens, sinkholes, karst valley, karst fields, etc.)

- Subterranean forms (caves, potholes, caverns).

The geodiversity of the Republic of Croatia is visible in the large number of very valuable and significant sites, out of which some are protected on the regional, and some of the world level. The Nature Protection Act determines nine categories of protected areas. In the area of the Republic of Croatia there were established 50 protected localities of geoheritage in total, out of which 49 belongs to the natural monument category, and one in the special reserve category. The protected areas are further subdivided into 6 subcategories of protection (Table 3.13). The spatial distribution of the protected sites of geodiversity is shown on the Figure below (Figure 3.27).

Table 3.13 The number of protected localities of geodiversity according to categories and subcategories of protection (www.bioportal.hr)

Category of Protection	Subcategory of Protection	Number of protected locations
Special reserve	Palaeontological	1
Natural monument	Hydrological	2
	Geological	6
	Geologic-palaeontological	2
	Geologic-geographic	2
	Geomorphological	23
	Palaeontological	4

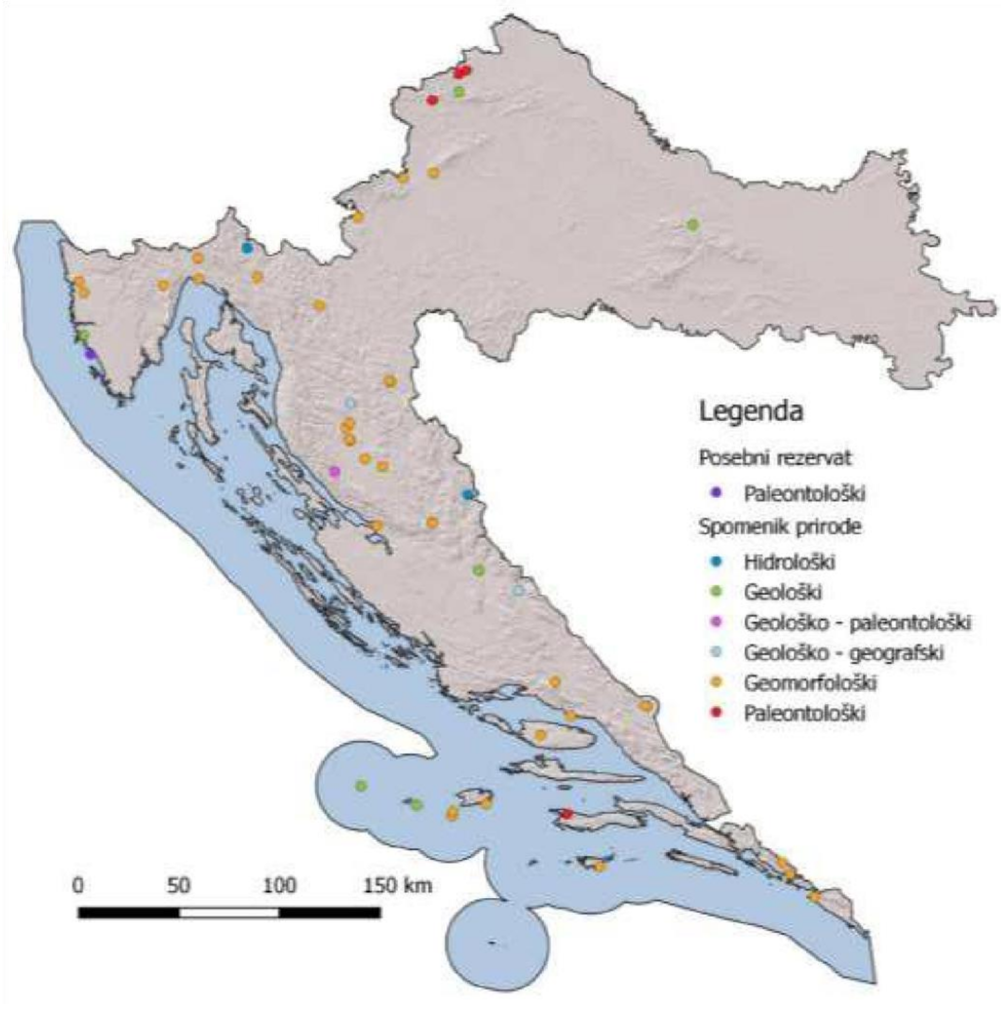


Figure 3.27 Protected locations of geodiversity on the area of the Republic of Croatia (Source: Bioportal.hr)

The largest number of the protected localities of geodiversity belongs to the subcategory of geomorphological natural monuments. All are formed in carbonate rocks, and mostly they are subterranean karstic forms, caves and potholes. Croatia is rich with caves and potholes, out of which the big part is still unexplored, and prevalent are the caves and potholes in the karstic relief in the limestone and dolomite deposits.

On the area of Croatian karst there are three potholes deeper than 1000m, as well. The deepest is the pothole system Lukina jama – Trojama with the depth of 1.431m, which is located on the 14th place of the deepest potholes in the world. Also, on the area of Croatia there are three caves, that is, pothole systems of the length above 10.000m. The longest is the pothole system Kita Gaćešina – Draženova puhaljka with 32.337m, which is at the same time the longest system on the Dinarides area. The cave in the Tounj quarry with the length of 8.639m is the 5th longest in Croatia. In it the very rare sediment, corrosive and erosive forms were found which belong into world phenomena (special kind of phreatic speleothems, facets, so called "leopard skins" and "hieroglyphs") and the very rarely ascertained simultaneous active nontectonic elevation and sinking of very close blocks inside a cave.

3.3.3 Biodiversity

3.3.3.1 Fragmentation of habitats

The most significant influence of transport infrastructure on biodiversity is visible through the fragmentation of habitats and a creation of obstacles for animals movement. The fragmentation of habitats with the transport infrastructure is seen as one of the most significant factors which influences a biodiversity decrease in Europe.

Habitats which are degraded and lost in this way are very hard and sometimes almost impossible to recover, so a preservation of large unbroken areas and a decrease of spatial fragmentation is the key criteria of sustainable development. On the national level, according to the data of the Report on the state of nature in the Republic of Croatia from 2015, the fragmentation of habitats with the transport infrastructure partly has a negative influence. A fragmentation of large forest complexes with a construction of the transport infrastructure has an effect on the state of forests in Croatia and represents one of the major causes of endangerment of this habitats.

According to the Analysis of the state of nature in the Republic of Croatia for the period 2008-2012 the fragmentation of areas of the Republic of Croatia with the transport infrastructure is shown with the use of adjusted indicators of the fragmentation with infrastructure. Singled areas are larger than 100 km^2 and they are not cut with motorways, national roads, county roads, railway tracks and urban areas larger than 93 ha. The average surface of certain non-fragmented areas is 240 km^2, and their share in the total surface of the land part of the Republic of Croatia is 58%, which is significantly less fragmentation with roads comparing with countries of the western part of Europe. The average of the non-fragmented areas per counties is 48%. The largest share of the non-fragmented areas larger than 100 km^2 has the Lika-Senj County with 85.59% and the smallest the Međimurje County with 8.03%, which shows a bigger fragmentation of the northeast counties with smaller surface.

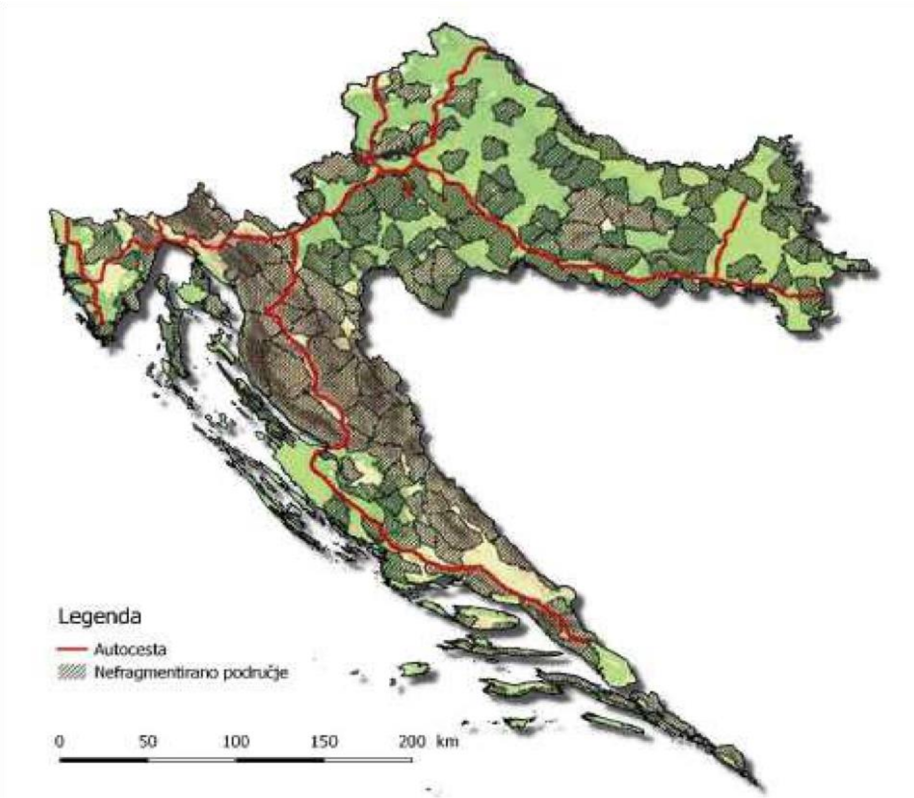


Figure 3.28 Areas larger than km^2 which are not fragmented with transport infrastructure (Source: Analysis of the state of nature in the Republic of Croatia for the period of 2008-2012, 2014)

In 2012 in the total transport infrastructure the road infrastructure prevails with the share of 46%. Newly built motorways connect the inside of Croatia with the north and south coastal belt and passing through Gorski Kotar, Lika and Dalmatia they cut through habitats of big zvijeri and numerous other animals. By comparing the data from 1980 and 2012 (Figure 3.29, Figure 3.30) one can see the fragmentation of areas with the passage of new motorways which is especially visible on the area of Lika, where with the construction of the A1 motorway it is cut into east and west part. In the uttermost north area of the once connected whole of north Velebit and Kapela and in the south area of south Velebit and the Dinara slopes they are today divided into two parts. In the east part of Croatia with the construction of the A3 motorway full profile the significant landscape Spačva, as the largest complex of European oak, is cut into two parts.

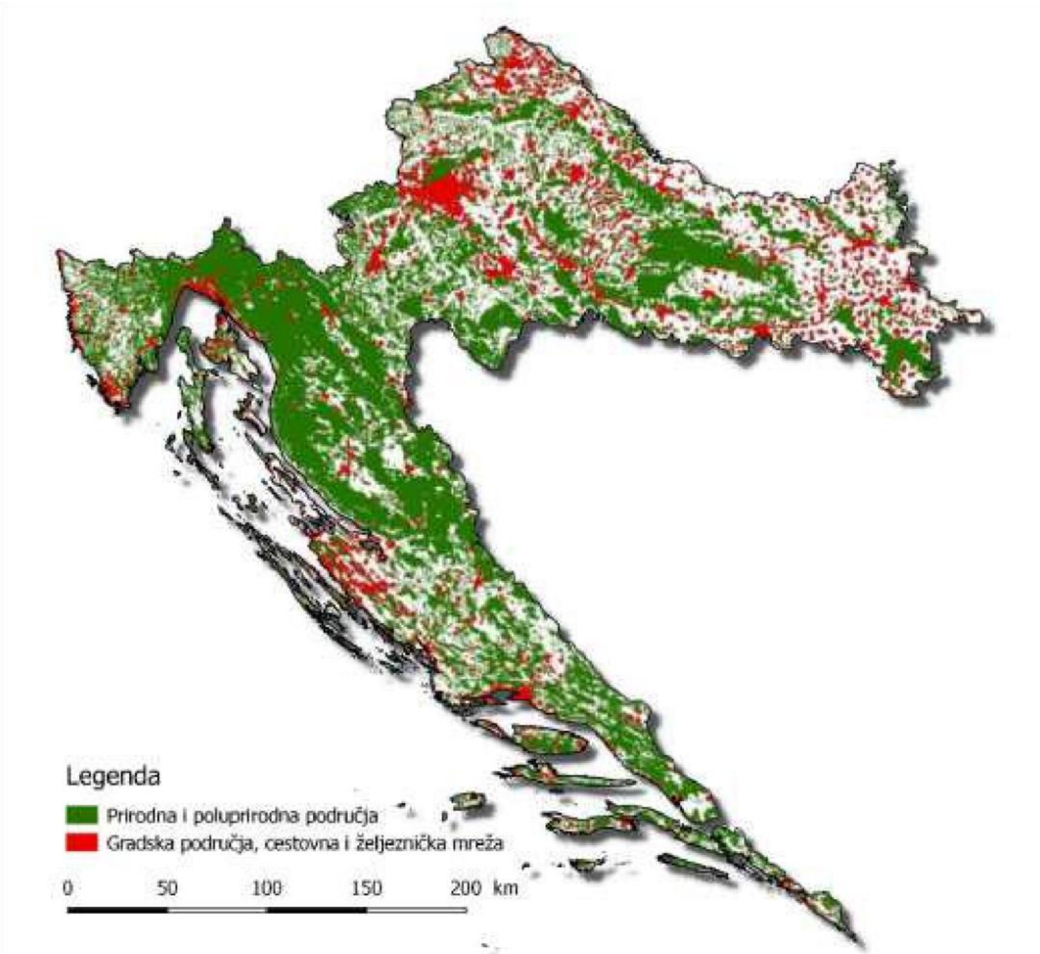


Figure 3.29 Fragmentation of habitats with transport infrastructure in 1980 (Source: Nature Protection Indicators, 2014)

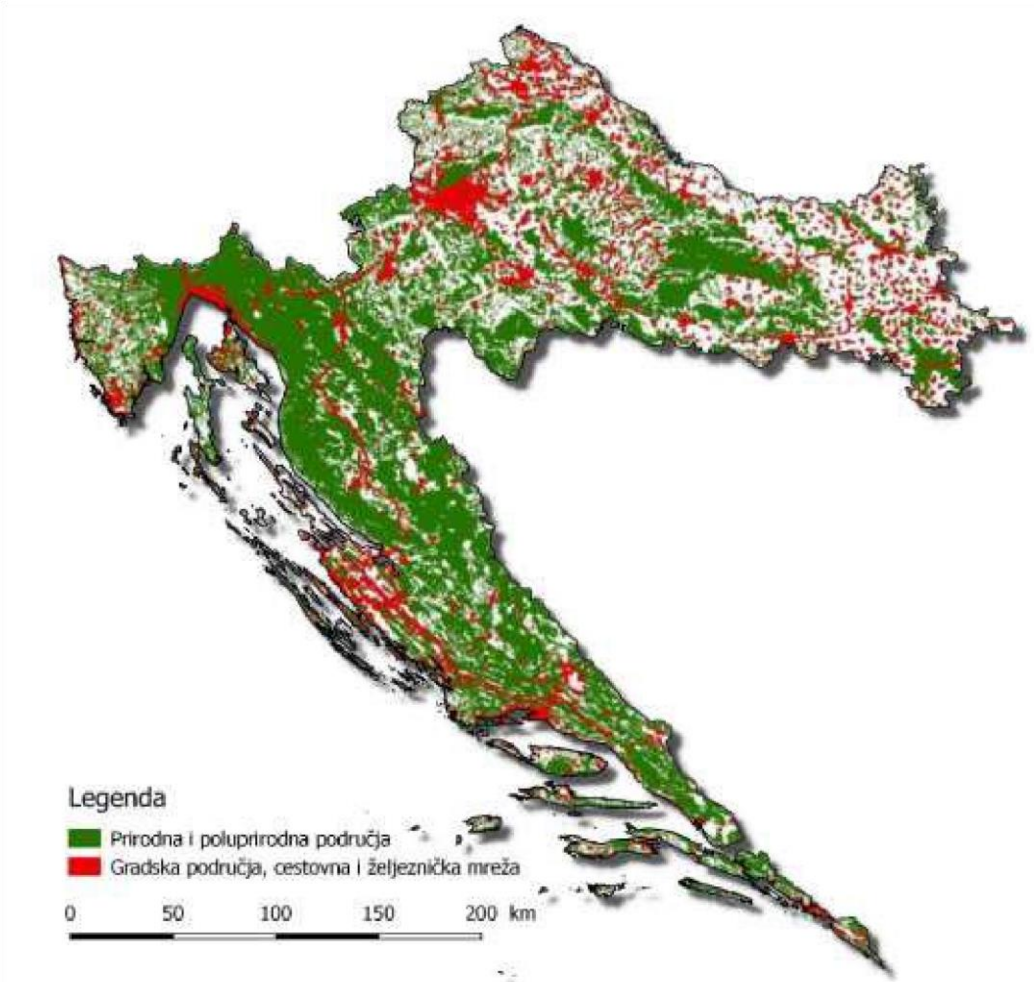


Figure 3.30 Fragmentation of habitats due to transport infrastructure in 2012 (Source: Nature Protection Indicators, 2014)

The fragmentation is caused by the infrastructure itself, as well as transport. Traffic roads enclosed due to traffic safety constitute a completely impervious obstacle to many migrating species. Fences influence mostly large mammals, since usual fence for animal protection can not stop smaller animals. Fences against noise increase obstacle effect and if they are placed along larger sections of a traffic road they create a total and impervious obstacle for most species. Even if it is not enclosed, a linear transport infrastructure can constitute an impervious obstacle due to a high traffic density. A railway activity and effects are similar to those caused by a road. Rail transport is different from the road, since time intervals between trains are much larger, but a train passage lasts much longer. A strength of the railway influence depends greatly on traffic density. Rail transport characteristics do not represent a problem for those species that can cross over tracks between trains passages. According to available data, railways with traffic larger than 300 trains daily are taken as an absolute obstacle for wild species. A construction of waterways and of an air transport infrastructure can lead to the fragmentation of habitats as well, which can result in an interruption of migratory routes of fish and other animals.

Although there is no general data on a volume of a road transport which has an absolute, that is partial effect of an obstacle, according to available data a sample correlation between a traffic road permeability for wild species and traffic density was made which can be seen in the table in continuation (Table 3.14).

Table 3.14 Relation between traffic density and permeability for mammals (Source: Iuell et al., 2003)

Traffic density	Permeability
to 1.000 vehicles/daily	Permeable for most of wild species.
1.000 to 4.000 vehicles/daily	Permeable for some species, but more sensitive species avoid it.

Traffic density	Permeability
4.000 to 10.000 vehicles/daily	Strong obstacle, noise and movement shall repel many individuals. A large number of those individuals that shall try to cross a road shall be killed.
> 10.000 vehicles/daily	Unpermeable for most of the species.

Fragmentation and obstacle effects can influence on a separation of different habitats necessary for species, but also of the habitats of the same quality and intent, and prevent in such a manner local migrations or migrations on larger distances and disrupt the flow of genes which in the long term can result with a decrease of a number of individuals and a disruption of a favourable state of populations (Iuell et al., 2003).

A fragmentation influence and an obstacle effect depend greatly on species present in habitats. The species in Croatia which are especially sensitive to the fragmentation are rare species with small local populations and large territories (large carnivores) and species with daily and seasonal local migrations (amphibians).

Regarding the populations of large carnivores, a transport and other infrastructure can act as an element of the fragmentation of habitats, as the source of a direct mortality (as it is described in the 3.3.3.2 chapter), but also as a kind of limitation for pray populations.

With the network of the Karlovac - Rijeka and Bosiljevo - Ravče (Ploče) motorways the habitat of large carnivores is conditionally divided into four parts. Although those traffic roads have an influence on a habitat quality and possibilities of animal movement, due to the large number and length of the objects on the motorway is is deemed that an enough permeability has been ensured. Therefore the motorway Bosiljevo - Rijeka has almost 25% of its total length with possible crossing, including one green bridge (Dedin). The motorway Bosiljevo - Šestanovac has half as many objects (12.5%) suitable for the wild species crossing, but on key places five green bridges were constructed which ensure the motorway permeability along with all other objects.

Other public traffic roads of national, county or local importance have also a significant influence on the fragmentation of large carnivore habitats.

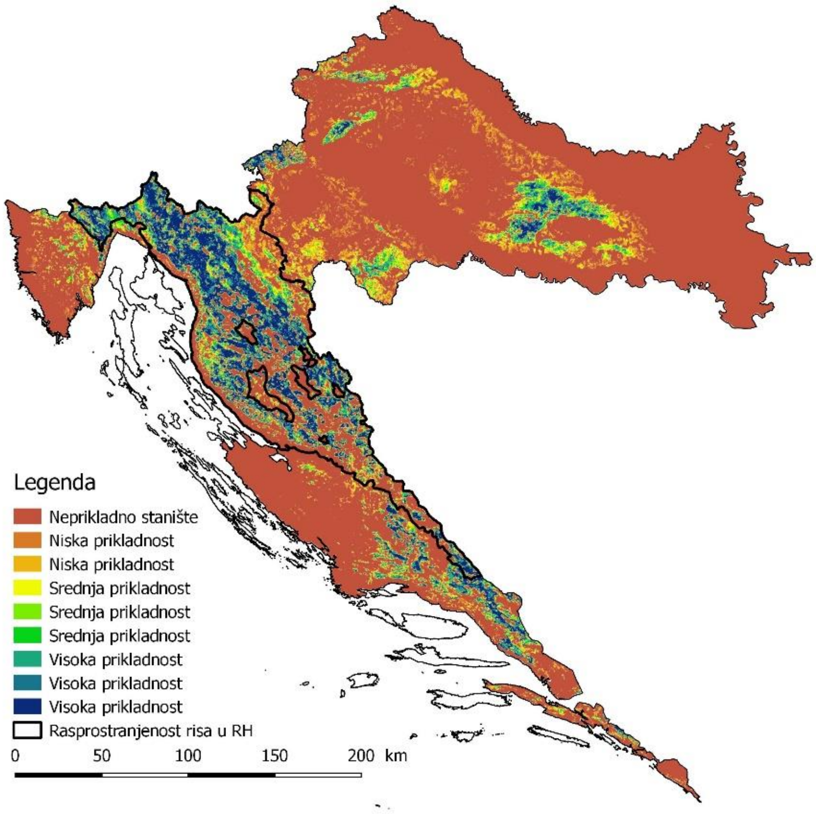


Figure 3.31 Arrangement of the (significance) classes of lynx habitats in land area and its distribution (Prepared by: IRES EKOLOGIJA d.o.o., Source: CAEN)

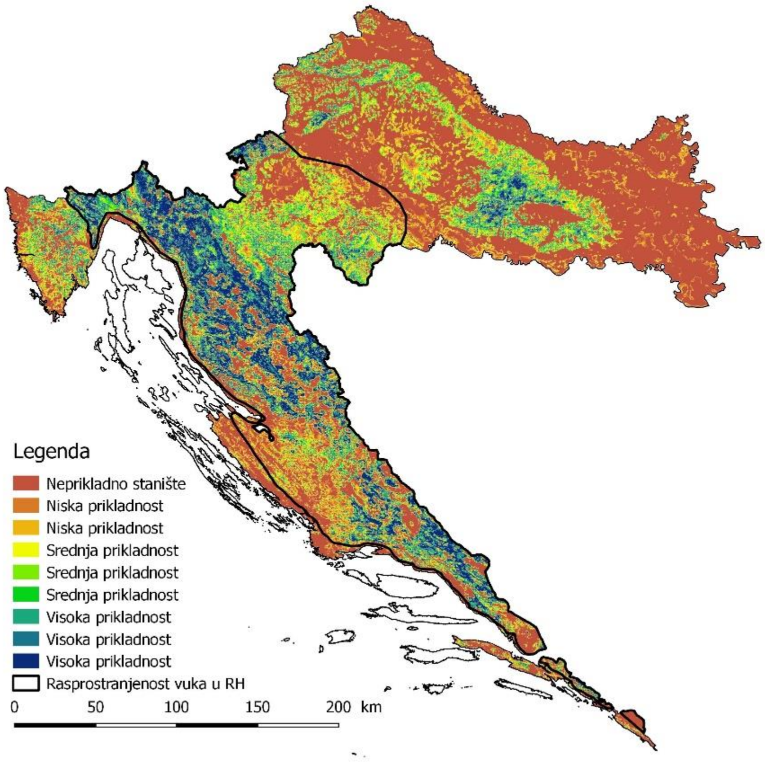


Figure 3.32 Arrangement of the (significance) classes of wolf habitats in land area and its distribution (Prepared by: IRES EKOLOGIJA d.o.o., Source: CAEN)

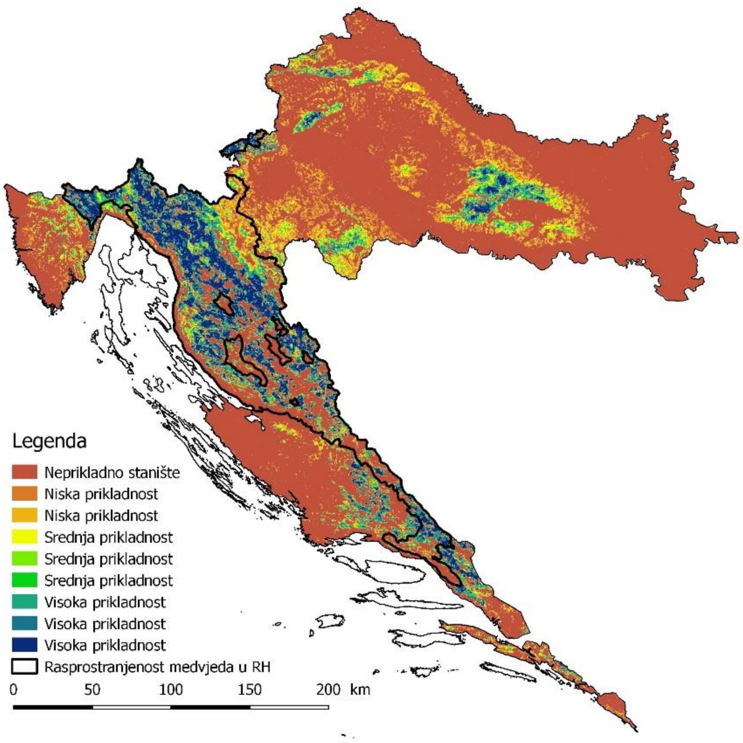


Figure 3.33 Arrangement of the (significance) classes of bear habitats in land area and its distribution (Prepared by: IRES EKOLOGIJA d.o.o., Source: CAEN)

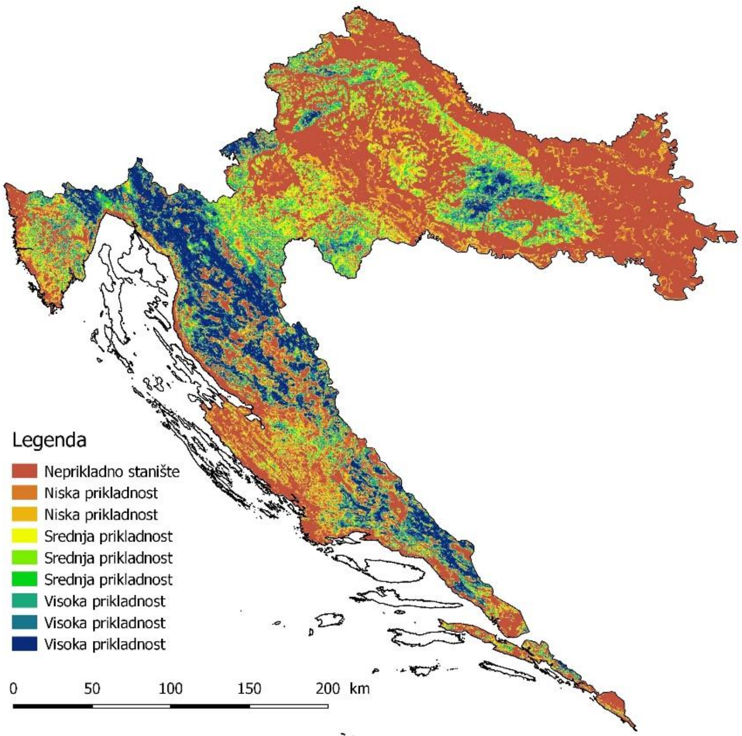


Figure 3.34 Arrangement of the cumulative (significance) classes of large carnivore habitats in the land area of the Republic of Croatia (Prepared by: IRES EKOLOGIJA d.o.o., Source: CAEN)

The influence of constructed motorways in Croatia is successfully neutralized with the construction of crossings for large land mammals. The functionality of those crossings and the permeability of the motorways for large carnivores is established with a monitoring of their use, whereby it was confirmed that it is possible to built an infrastructure and preserve the large carnivores habitats integrity (Expert manual for assessing an influence of a project on large carnivores individually and within planning documents, 2016).

However, the obstacle effect generated by traffic roads does not influence only the mentioned groups, but also other terrestrial mammals, bats (dense traffic repels them), birds, reptiles, as well as invertebrates. Results of a study conducted in Sweden had shown that even some species of butterflies (*Aphantopus hyperantus*) did not cross a road.

The significance of an increase in the fragmentation of an area depends upon the features of a traffic road itself, which on the strategic level are not completely defines (e.g. a supporting infrastructure). However, on the strategic level the kinds and categories of traffic roads were defined, as well as their potential spatial placement which is also important for a determination of the mentioned indicator shift (railways mostly have a smaller fragmentation effect from roads, a road of lesser importance with an expected low density of traffic results with smaller fragmentation effect, as well as planning of roads in areas which already are under a high anthropogenic influence). A preservation of habitat integrity and a decrease of an existing fragmentation is one of key criteria of sustainable development.

3.3.3.2 Favourable population status

Besides the previously described fragmentation of habitats, transport which is closely related with a transport infrastructure is the cause of a large number of fatalities of wild species, which reflects directly on the status of their populations in nature, especially of those species which migratory routes were cut off. Mostly invertebrates are being killed in the road, and according to available data the transport infrastructure (road and rail), as the cause of a threat for the species from the Red lists and Red books, threatens mostly the following groups: snails, butterflies, amphibians and reptiles (Figure 3.35). However, due to a hampered monitoring, the data on animals killed on traffic roads relate mostly to large mammals and birds, and that mostly to birds of prey and owls.

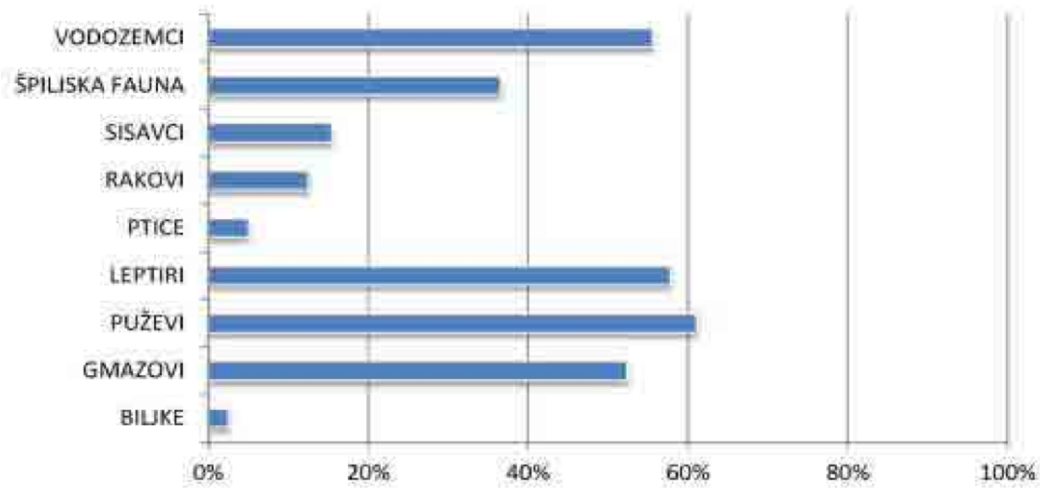


Figure 3.35 A share of evaluated species per groups on which roads and tracks have an influence (Source: Analysis of the state of nature in the Republic of Croatia for the period of 2008-2012)

The largest number of recorded onrushes on wild animals is registered on the county and local roads on the area of the City of Zagreb and Zagreb County, the land part of the Primorje-Gorski Kotar County and the Istria County and on the A2 and A3 motorways (400 per year in average).

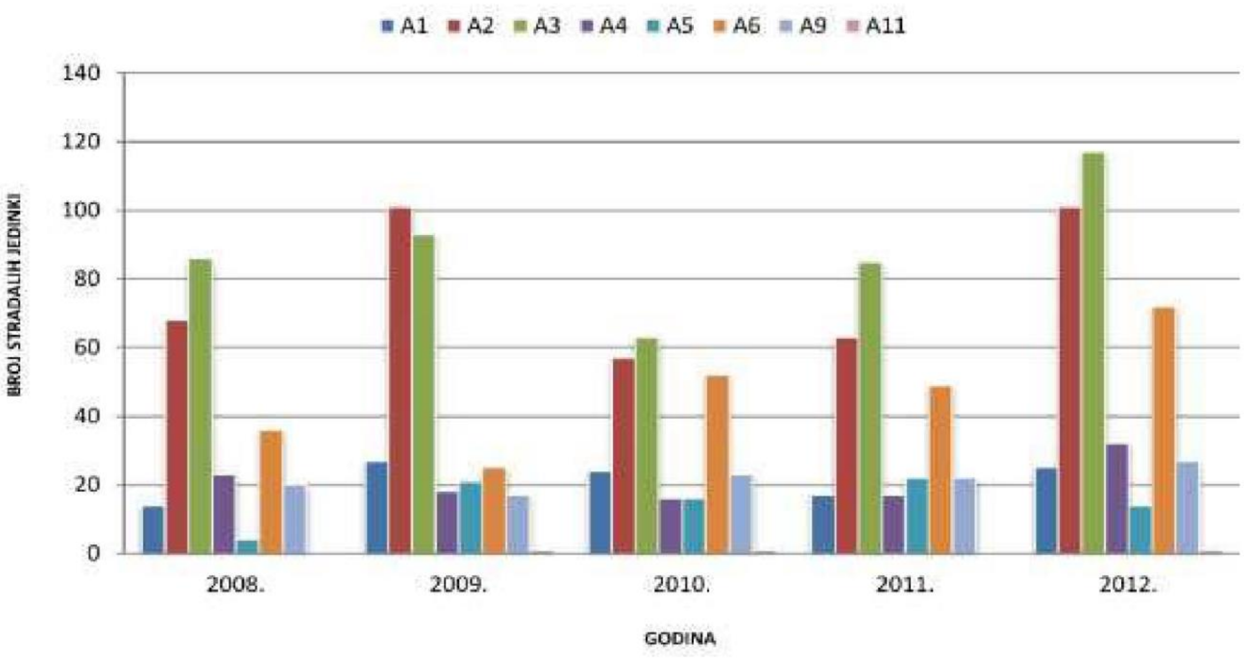


Figure 3.36 The number of killed animals on motorways per years in the period of 2008-2012 (Source: Analysis of the state of nature in the Republic of Croatia for the period of 2008-2012)

Out of the total known wolf mortality, wolf fatalities by transport amount to 27% and that is the second most common cause of the wolf mortality in Croatia. Also, the most fatalities were registered on local, that is, national roads (Figure 3.37). The data on the wolf (*Canis lupus*) fatalities show that each year almost 9 individuals is killed by road transport, and the largest number of fatalities was registered in the period from 2010 to 2011 (13 individuals). Problems connected with traffic roads are various, from speeding to a badly placed support structure (e.g. inadequate wire-fence along a motorway which allows the passage of animals below or above the fence).

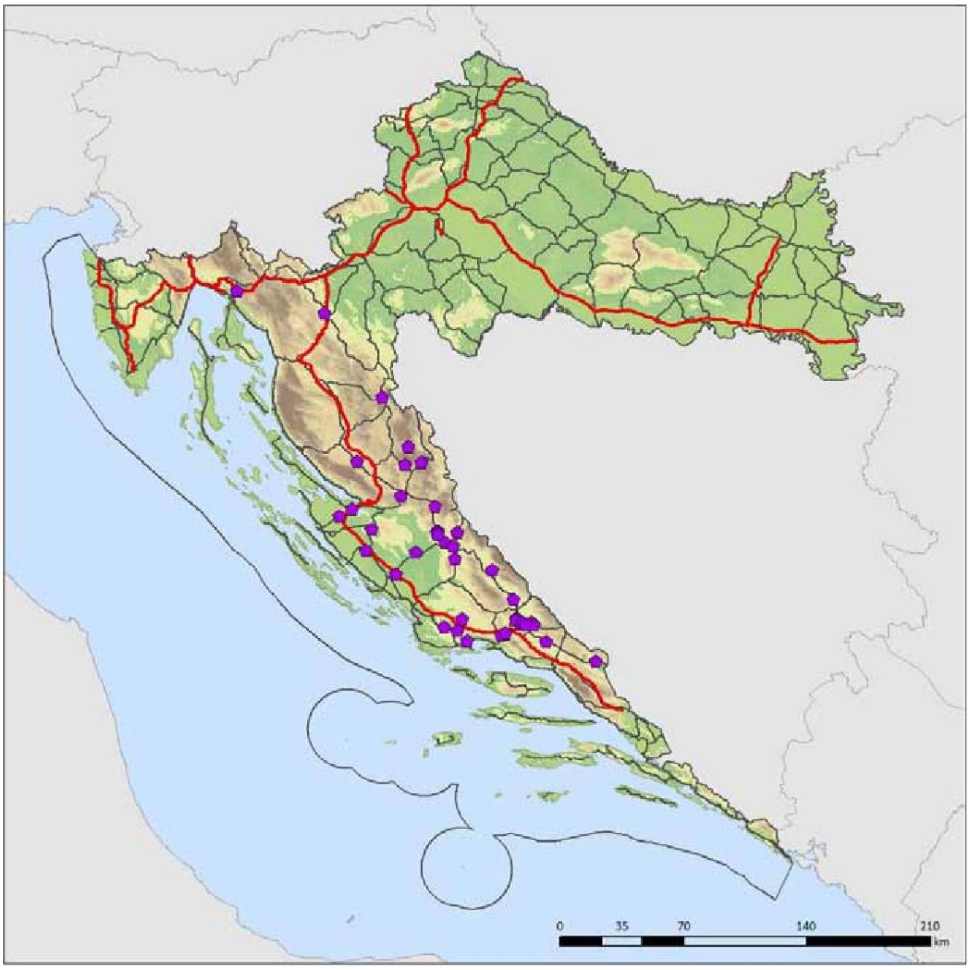


Figure 3.37 Locations of the wolf individuals fatalities induced by road transport in the period 2008-2012 (Source: Analysis of the state of nature in the Republic of Croatia for the period of 2008-2012)

Out of the total known bear (*Ursus arctos*) mortality, the fatalities induced by road and rail transport amount to 16% and are the 2nd most common cause of the bear mortality in Croatia. Mostly they are killed on the railroads (70% of the total fatalities in traffic). In the Figure below (Figure 3.38) one can see locations of bear fatalities in traffic, blue dots mark the places of collision of a bear with a train, while red dots mark the places of collision with vehicles on roads.

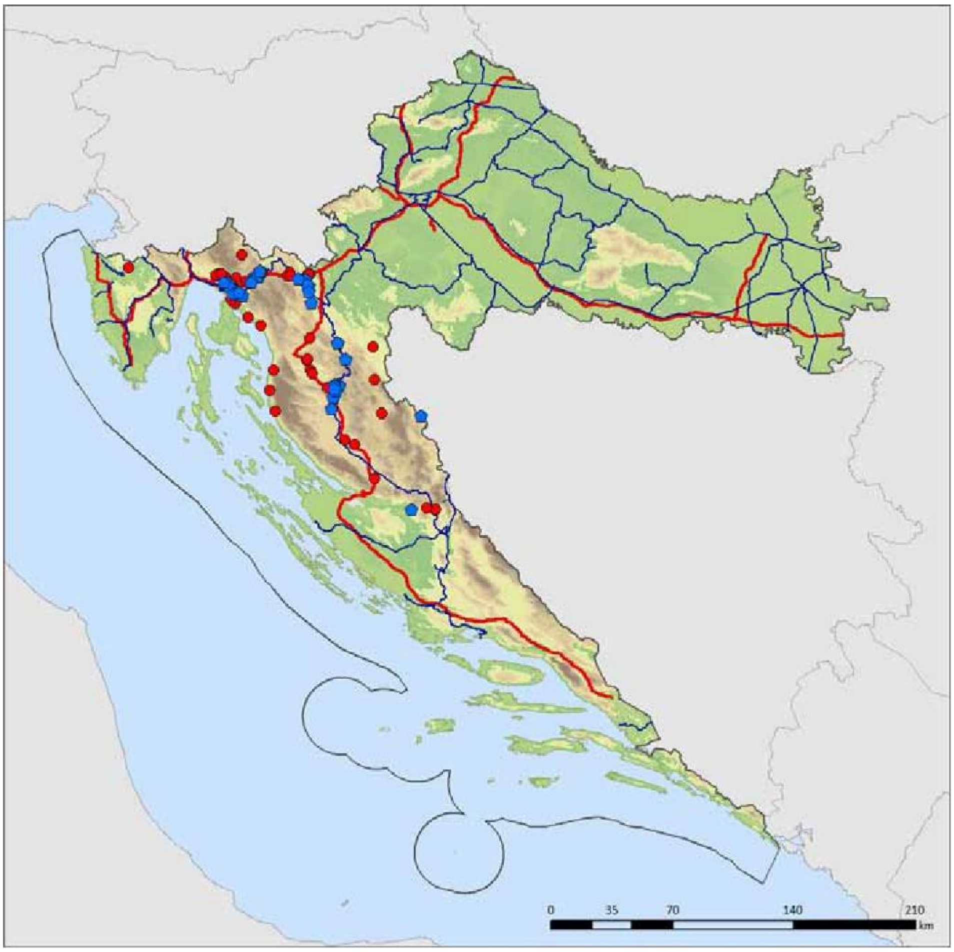


Figure 3.38 Locations of the bear individuals fatalities induced by road and rail transport in the period 2008-2012 (Source: Analysis of the state of nature in the Republic of Croatia for the period of 2008-2012)

According to the latest estimated, the lynx population in Croatia ranges between 40 and 60 individuals, while the Dinaric population which encompasses individuals in Slovenia, Croatia and Bosnia and Herzegovina is larger and number approximately 130 individuals. However, considering the habitat capacity the population is small and endangered and last years it is in a slight decrease. It is assumed that a probable high percentage of its mortality caused with human activity has a part in the decrease of the lynx population. Registered causes of the mortality are primarily related with culling (76.21%), transport (8.37%) and traps and poisoning (9.69%) (Plan of the lynx management in the Republic of Croatia for the period from 2010 to 2015, 2010).

Besides large mammals, other terrestrial mammals, as well as bats are killed on roads. A susceptibility of bats to influences and an intensity of those influences are varying depending upon a species. Although there are no more specific data on bats fatalities in the area of Croatia it is known that a mortality rate depends upon the traffic speed and density. A dense traffic shall repel bats more, and the more speedy a vehicle gets the harder is it for a bat to avoid it. So, the order of decreasing possibilities of the bat fatalities is: individual fast driving > fast and dense traffic > individual slow driving > slow and dense traffic (Expert guidelines - transport infrastructure, 2015).

Regarding the bird fauna, two groups are under a high risk of fatalities: the species which are not usually sensitive to disturbance and which reproduce near roads and along watercourses and the species that target roads, sometimes from great distances (vultures). The species of birds with exceptionally high risk of traffic fatality are for example owls, red kite, black kite, white-tailed eagle, lesser spotted eagle, falcon, kestrel, common buzzard, nightjar. Due to the absence of a more precise system of recording and reporting of the fatalities of all kinds of birds (especially small songbirds) the available data mostly relate to larger species. In the period 2008-2012 the killing of 49 bird individuals was registered, out of which the most numerous were the species *Buteo buteo* (common buzzard) and *Bubo bubo* (Eurasian eagle-owl).

For the traffic fatalities of amphibians and reptiles there are no available statistical data on the level of counties or Croatia, but it is known that roads cause a large number of killings of individuals of those groups which is shown in the Figure 3.35, where it is visible that over 50% of endangered species is endangered with traffic and supporting transport infrastructure. By crossing roads the individuals are not only in danger of being run by vehicles, which mostly depends upon a traffic density, but they get hurt also due to a pressure and wind generated by moving vehicles, which depends upon a movement speed.

According to the Red book of amphibians and reptiles of Croatia (Jelić and others, 2012), out of the total number of the endangered species and subspecies of amphibians and reptiles in the Republic of Croatia, 16 of them is under the influence of direct danger from road and rail transport. In the Figure below one can see the geographical representation of 22 species with 6 subspecies of the endangered herpetofauna (Figure 3.39).

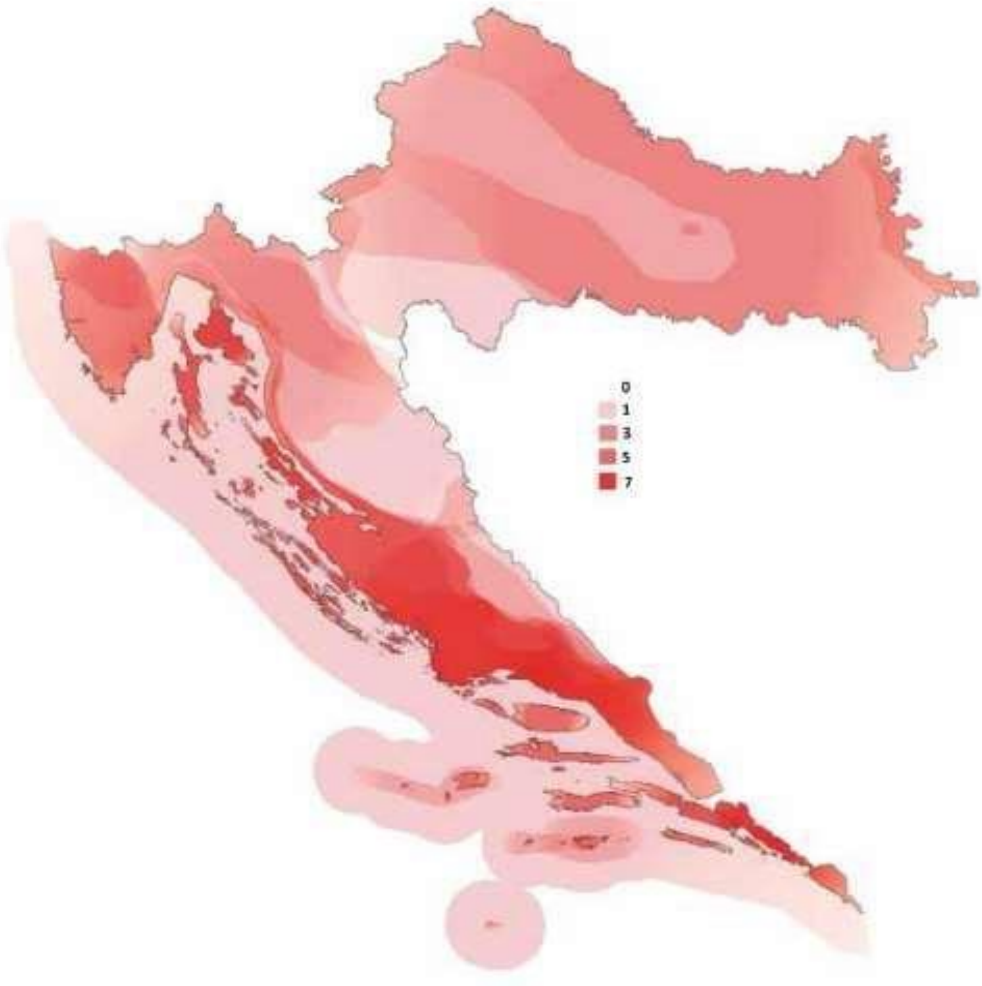


Figure 3.39 Geographical representation of endangered families and important areas for amphibians and reptiles in Croatia, with a presented sum of species and subspecies on a certain area (Source: Red book of amphibians and reptiles of Croatia, 2012)

In the text above the fatalities of individuals on railway tracks and roads are described, but the important share in the fatalities of individuals in transport relates also to the air transport, which is considering the size of Croatia and a number of inhabitants in the range of the more developed European countries. The fatalities of the air transport are mostly the individuals of wild species in airports themselves and their proximity, since the most collisions of wild species' individuals with aeroplanes occur at low altitudes up to 60m during landings and take-offs, and a smaller number of collisions on a path of aeroplane flight. According to the available data, the number of animal fatalities in the air transport is increasing, which can be in a correlation with the improved system of reporting, so in 2008 the number of reported cases was about 50 and 2012 it has increased on over 100 (Figure 3.40, Figure 3.41).

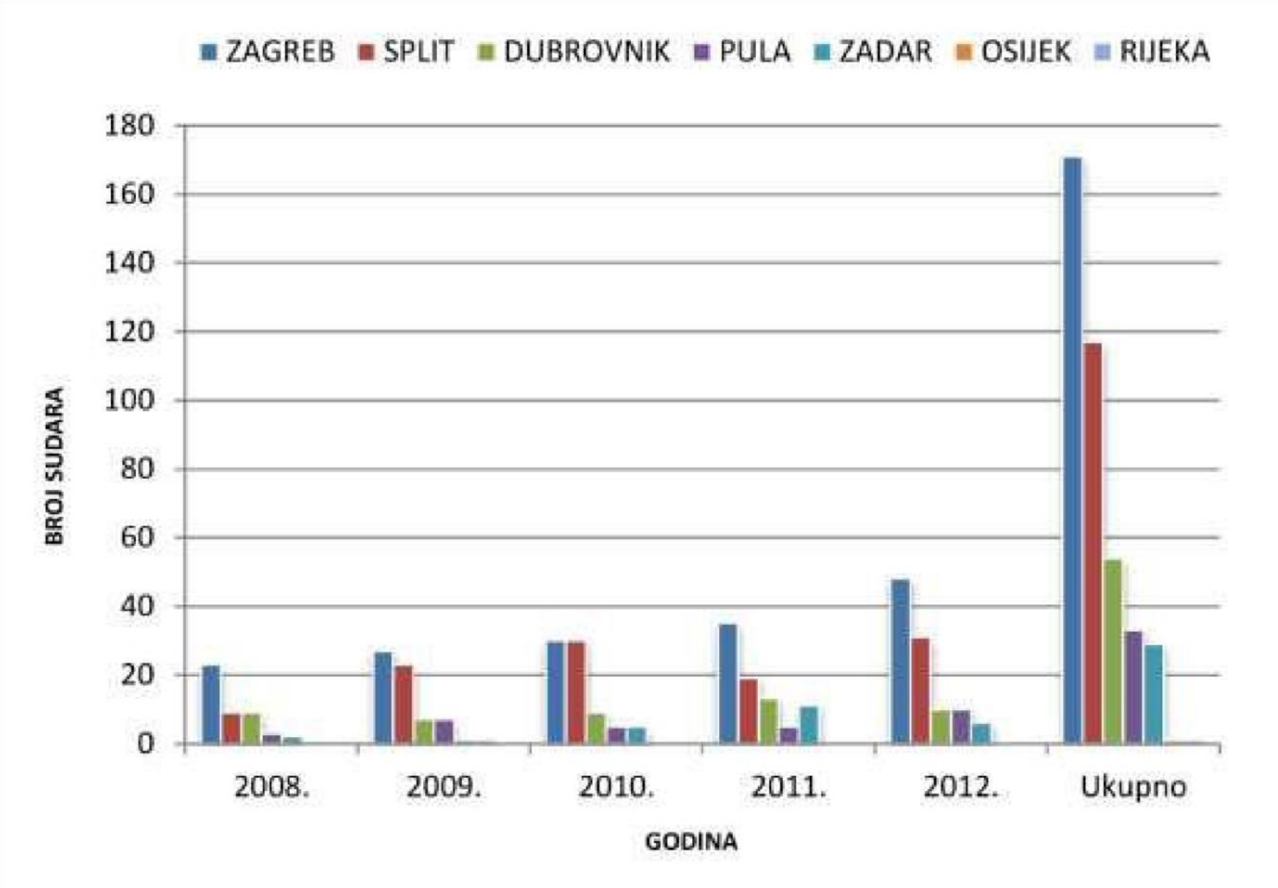


Figure 3.40 The number of collisions of airplanes with animals per airports in the period 2008-2012. It includes also avoided collisions with no direct contact of an aeroplane with an animal (Source: Analysis of the state of nature in the Republic of Croatia for the period of 2008-2012)

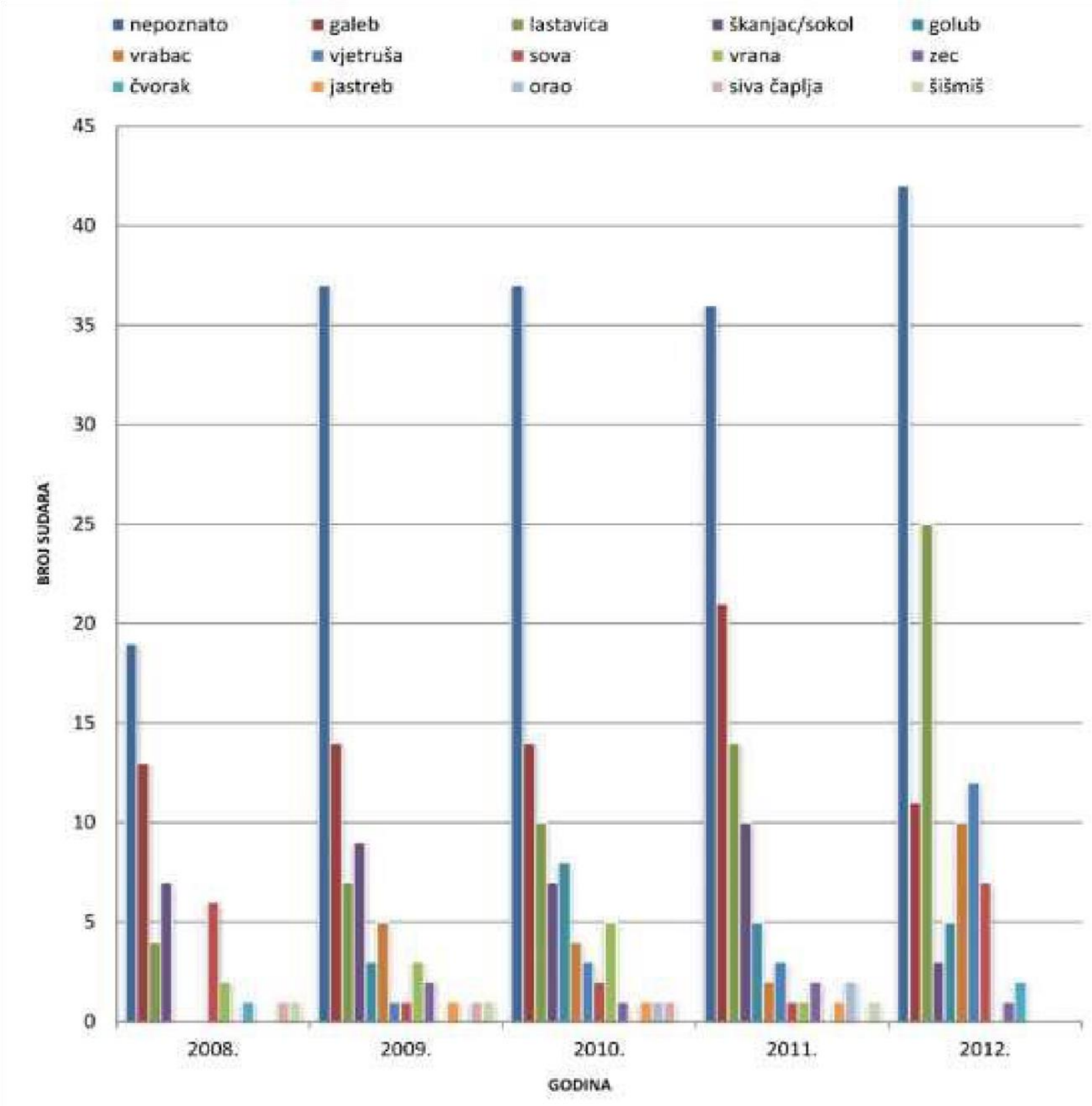


Figure 3.41 The number of collisions per families / groups per years (more than 2 individuals in total in the period 2008-2012)(Source: Analysis of the state of nature in the Republic of Croatia for the period of 2008-2012)

The airports Rijeka and Mali Lošinj are located inside the areas of preservation important for birds (APB) of the ecological network, and all other, with the exception of Dubrovnik, are in the proximity of such areas.

The status of wild species populations depends greatly upon the quality of habitats and human activities which reflect upon animal conditions in them. The transport infrastructure development generates an increase of danger from the fatalities of the wild species individuals caused by the traffic, which ultimately brings to a decrease of a population number and that depends upon more parameters within the planning of roads and their construction. This decrease is more visible at more isolated and fewer populations and can lead to endangering the species survival itself.

3.3.3.3 Occurrence of invasive species

Although, according to the data of the Report on the state of nature in the Republic of Croatia for the period from 2008 to 2012, the invasive species generate lesser negative influence on the national level, they are more present in the environment and a further growth of their frequency and number is expected and with that a more significant pressure on the biodiversity of Croatia, as well. A large number of invasive species is registered amongst freshwater fish (about 19% of the total number of species) and vascular plants (11.9%). In the area of Croatia 25 invasive species of freshwater fish and more than 600 foreign plant species and subspecies have been recorded and it is assumed that the real number is even larger and amounts to about 1.500 species. Ways of entry are different and depend upon individual groups and species.

The fragmentation of habitats generated with transport infrastructure plays an important role in the process of the invasive species spreading, since with the development of roads and railway new corridors suitable for inhabitation gets open (*Ambrosia artemisiifolia* L., *Solidago Canadensis* L.) However, river and maritime traffic are much more intensely important for the entry of the invasive species (plant and animal). The river traffic has generated the spreading of the Pontic-Caspian species of gobies in the Danube basin and the spreading of the bivalve called zebra mussel (*Dreissena polymorpha*), which is classified amongst the 100 most invasive species in the world.

Amongst others, with the maritime transport foreign invasive species are introduced into the Adriatic Sea through ballast waters and ship biofouling, to which also points the fact that the largest number of such species has been recorded in the proximity of major ports. According to the data of the Handbook for Marine Protection and Identification of Adriatic Marine Species, during 2008 in the Croatian territorial sea almost 2.5 tons of ballast waters were released, and mostly in the area of the Rijeka and Pula ports, out of which 86% of released waters was of Adriatic origin, while 11% comes from the Mediterranean Sea, and 3% from the rest of the world. The monitoring of the released quantities of ballast waters exists in Croatia, but there is no program for the monitoring the physical, chemical and biological composition of ballast waters. However, for the larger number of fish species it is known that they tolerate well a transport through ballast waters, and one of the fish species for which it is ascertained that it came into the Adriatic Sea through ballast waters is the fish called dwarf flathead (*Elates ransonnetti*), which individual was caught at the entrance into the Split cement factory's cargo port itself (Dulčić and others, 2012). Besides their role in the mentioned spreading of fish, the ships are also the vectors of entry and spreading of the flora and fauna’s invasive species as are algae which can cause serious changes in marine ecosystems.

It is estimated that the invasive species endanger mostly amphibians, freshwater fish, algae, reptiles, saltwater fish and odonata (Figure 3.42).

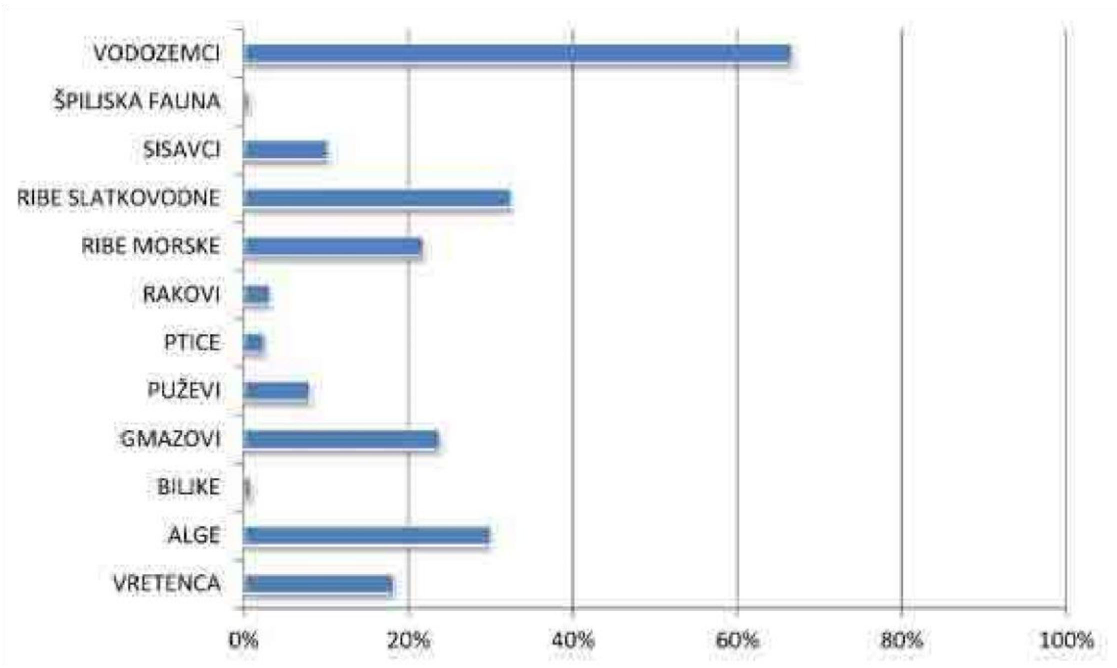


Figure 3.42 The share of the estimated species per groups which are endangered with the presence of invasive species (Source: Analysis of the state of nature in the Republic of Croatia for the period from 2008 to 2012)

Invasive species are present in Croatia already for many years, but only lately the negative influences which they have on biodiversity have been pointed out. The invasive species have a direct negative effect on the fauna and flora of Croatia, but also an indirect effect through the change of habitats' conditions. A transport improvement with the development of transport infrastructure generates increased risks of the entry and spreading of new invasive species of plants and animals on the area of Croatia, as well as of the further spreading of the already present species. The fragmentation of natural habitats with transport corridors generates suitable habitats for the invasive species' settlement, but much bigger problem is the development of river and marine traffic since additional ways are opened through which, besides the spreading, the entry of the invasive species from more distant parts of the world is enabled.

3.3.3.4 Stress

With the development of transport infrastructure, besides material changes, also new immaterial factors are being introduced into the environment, which have a negative effect on the environment and that on a bigger area than it was the case with the material factors, which is especially pronounced in undisturbed natural habitats. The immaterial factors that follow the development of transport infrastructure include an increase of noise and vibration and the light flash phenomena, and all mentioned increase the stress of the present fauna.

According to the available data related to roads for which the greatest number of studies was conducted, to the stress generated by the transport activity the most sensitive are birds, so in the table below (Table 3.15) one can see the indicative review of the distancing of the birds from different habitats from the roads. In the study conducted in the Netherlands a decrease of birds populations in a proximity of motorways for 60% has been noticed. The recorded distancing from the roads was greatest amongst the birds of open habitats and somewhat lesser amongst the species that inhabit forest habitats (Forman and Alexander, 1998).

Table 3.15 Distances from roads on which an influence of noise on birds populations has been recorded (Source: Forman and Alexander, 1998)

Road*	Open habitats species	Forest habitats species
10.000 vehicles / day	365m	305m
50.000 vehicles / day	930m	810m

*vehicles movement speed 120 km/h

A decrease of the population of the open habitats birds has been noticed already at the transport density of 5.000 vehicles daily when the vehicles movement was slower than 120 km/h and at higher speeds the population decreases even at the transport density of 3.000 vehicles daily. Although it depends upon a species, in average the forest species of birds are more sensitive that the birds of open spaces, however, due to the character of noise spreading through the environment, an influence on forest habitats is limited on somewhat smaller areas. The forest species shall distance themselves from locations on which noise level is 42dB, while the birds of open habitats shall react to the noise intensity of 48 dB (Forman and Alexander, 1998).

Considering populations of large mammals, a decreased movement on the distance of 100 to 200m from a road has been recorded (with the exception of forest paths which large mammals use as movement corridors, especially in the period of no human activity, i.e. at night).

The previously described stress is caused by land roads, but an increase of stress for wild species, which is mostly related with noise, is generated by other transport forms, as well. An air transport noise has a smaller area of influence, since it is closely related to the area of an airport and its surrounding.

In the marine environment, except for noise generated by natural phenomena, the largest source of noise is marine transport (Rako and others, 2012). According to the data from the Handbook for Marine Protection and Identification of Adriatic Marine Species, in the territorial sea in 2015, 220 459 recreation vessels and 327 782 transport ships were recorded so, although there are no relevant data on the noise pollution of the Adriatic Sea, one can conclude that this kind of pollution is present in the Adriatic Sea and that it surly reflects on an increase of stress in marine organisms. Although there are no comprehensive studies, according to a study conducted in the North Adriatic it was determined that noise influences on the populations of common bottlenose dolphins (*Tursiops truncatus*), and the intensity of that influence is in the correlation with a tourist season and an increased transport quantity (Rako and others, 2013). The dolphin populations which are endangered with this type of stress spend less time in feeding activities and resting, which has a direct influence on their health. Studies conducted in the Miramare Reserve in the Gulf of Trieste point to an influence of noise on fish populations. The Miramare Reserve in Italy is characterized with a high quantity of human activities, and is at the same time an important nursery of the Mediterranean fish species (Codarin and others, 2009).

Despite the fact that in Croatia a small number of studies have been conducted which relate to the increase of stress and the changes of behaviour at individuals of wild species generated with transport, considering world studies one can conclude that the stress is present in the area of Croatia as well and that by further development of transport infrastructure in undisturbed parts of nature this kind of stress shall increase, too.

3.3.3.5 Preservation of features of protected areas

A protected area is a geographically clearly defined area intended for nature protection and governed for the purposes of a long-term protection of nature and the supporting services of an ecological system. According to the Protected Areas Register of the Ministry of Environment and Energy in the Republic of Croatia there are 409 protected areas in different categories (Table 3.16). The protected areas today encompass 8.56% of the total surface area of Croatia, that is, 12.24% of its land territory and 1.94% of its territorial sea. The largest part of the protected area is covered by nature parks (4.56% of the total state territory).

Table 3.16 Categories of protected areas (Source: http://www.dzzp.hr/)

Category	Purpose	Number of protected areas	Surface (km^2)	% of the surface area of Croatia
Strict reserve	Protection of original nature, monitoring of the nature state and education	2	24.25	0.03
National park	Protection of original natural values, scientific, cultural, educational and recreational	8	966.65	1.10
Special reserve	Protection for its uniqueness, rarity or representativeness, and is of a special scientific importance	77	398.30	0.45
Nature park	Protection of biologic and landscape diversity, educational, cultural-historical, touristrecreational purpose	11	4020.90	4.56
Regional park	Protection of landscape diversity, sustainable development and tourism	2	1020.12	1.16
Natural monument	Ecological, scientific, aesthetic or educational	81	1.18	0.001
Significant landscape	Protection of a landscape value and biological diversity or a cultural-historical value or a landscape with conserved unique features, rest and recreation	83	1077.77	1.22
Forest park	Protection of a natural or planted forest of a larger landscape value, rest and recreation	26	30.23	0.03
Monument of park architecture	Protection of a natural or planted forest of a larger landscape value, rest and recreation	119	7.78	0.01

Protected areas in RH in total	Protection of an artificially formed space, that is, a tree that has an aesthetic, stylistic, art, cultural-historical, ecological or scientific value	409	7547.18	8.56

The figure below (Figure 3.43) presents the distribution of protected areas.

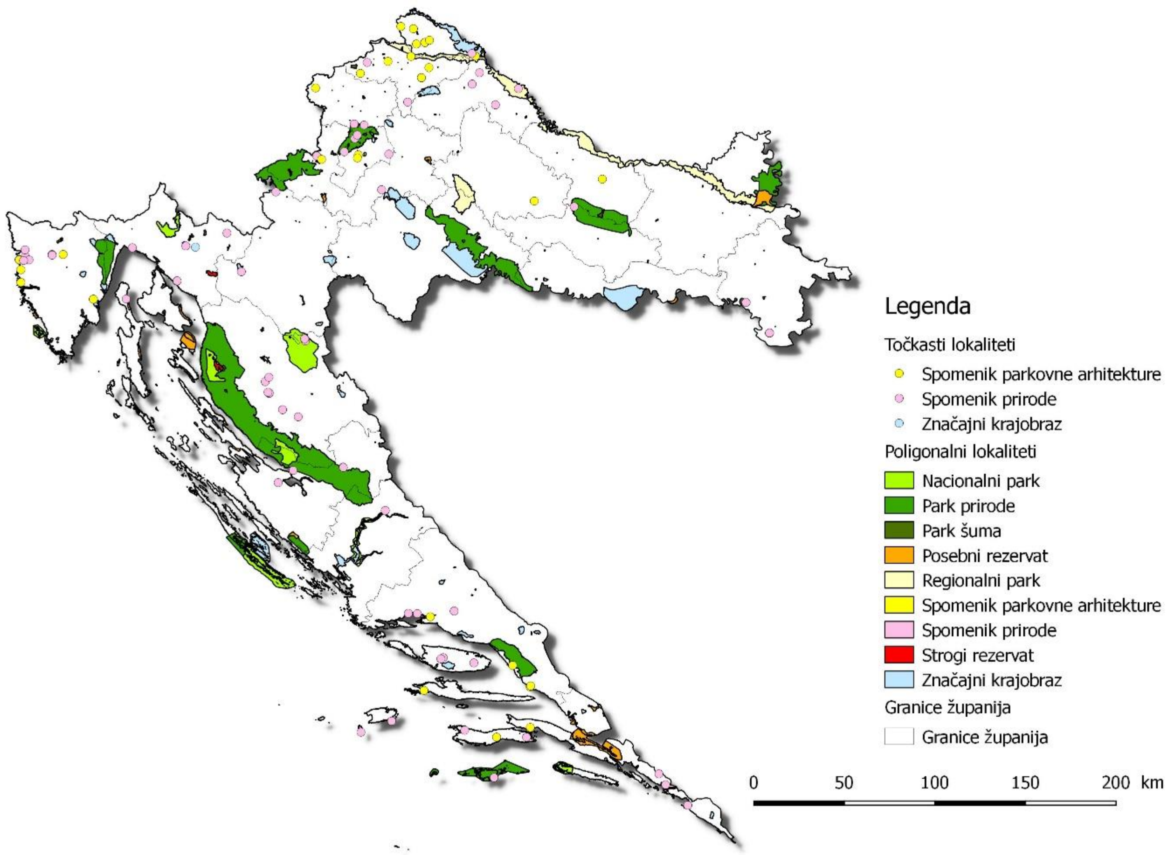


Figure 3.43 Protected areas in the Republic of Croatia (Prepared by: IRES EKOLOGIJA d.o.o.)

Each protected area is characterized by its features and values due to which an area was suggested for protection and finally protected. The features and values differ amongst individual areas and their purpose is also different, so they are categorized to be easier for management (Table 3.16). If with certain anthropogenic projects or natural phenomena the characteristics of some area get lost, than that area also loses its value, which consequently brings to the abolishment of protection. As an example one can take areas of the natural monument category which often protect an individual tree, which due to its age or outer influences is destroyed after which the protection is abolished since the features of such an area gets lost completely.

Mostly present in protected areas are anthropogenic pressures which may be generated also as a consequence of the development of transport infrastructure. In 2007 the Croatian Environment Agency (current Croatian Agency for the Environment and Nature) has drawn a document by which the pressures for the protected areas that have the largest surface areas have been analysed, and that are nature parks and national parks. Guided by that document, in the table below (Table 3.17) is given an indicative overview of the existing pressures of transport infrastructure in the national parks and nature parks, that is, the surface of roads in certain areas is presented. Taken into consideration were the surface areas of motorways, fast and state roads which were, besides small modifications, taken over from the previously mentioned document of the Croatian Environment Agency (the modifications were done pursuant to the available data of newer date), and the land surface of protected areas. Considering that the national parks Paklenica and Northern Velebit are located inside the surface area of the Nature Park Velebit, those three localities are taken as one in the analysis.

Table 3.17 Representation of motorways, fast and state roads inside protected areas (Source: Pressures on protected areas, 2007)

Protected area	Surface of a land part of protected areas (ha)	Surface of roads (ha)	Share of roads in a protected area (%)
National parks			
Brijuni Islands	752.46	0.00	0.00
Kornati Islands	5 004.83	0.00	0.00
Krka	11 063.68	1.62	0.01
Mljet	2 850.03	7.24	0.25
Plitvice Lakes	29 630.77	33.21	0.11
Risnjak	6 344.46	1.27	0.02
Nature parks			
Biokovo	19 330.54	13.37	0.07
Kopački Rit	23 127.41	0.00	0.00
Lastovo Islands	5 139.34	9.50	0.18
Lonjsko Polje	51 173.29	20.77	0.04
Medvednica	17 936.20	3.93	0.02
Papuk	34 306.81	11.52	0.03
Telašćica	2 531.14	3.85	0.15
Učka	16 051.33	9.50	0.06
Velebit	203 551.12	175.49	0.09
Vransko Lake	5 748.99	1.80	0.03
Žumberak – Samobor Hills	34 235.98	20.27	0.06

In conclusion to the aforementioned, the transport pressure is evident in protected areas. Out of the total number of the analysed areas only 3 areas are not under a direct influence of motorways, fast and state roads, while the largest surface area covered with roads is in the Nature Park Velebit and the most negative status is recorded in the National Park Mljet. Taking into consideration that in the analyses the total transport infrastructure was not used, neither all the protected areas, the real status of the transport pressure on the protected areas is surely more negative. With a construction of new transport infrastructure further disturbance of these areas features is possible, which would have a negative influence on their preservation.

3.3.3.6 Endangerment of habitats

The Republic of Croatia is characterized with large diversity of habitats, and thanks to the richness of geomorphological forms, above and below the soil, a three-dimensional distribution of habitats is enabled, which helps to their richness. Many habitat types are specific for this part of the Mediterranean, e.g. underground karstic habitats, the plant groups of rock and talus cones and certain marine habitats, like karst marine lakes.

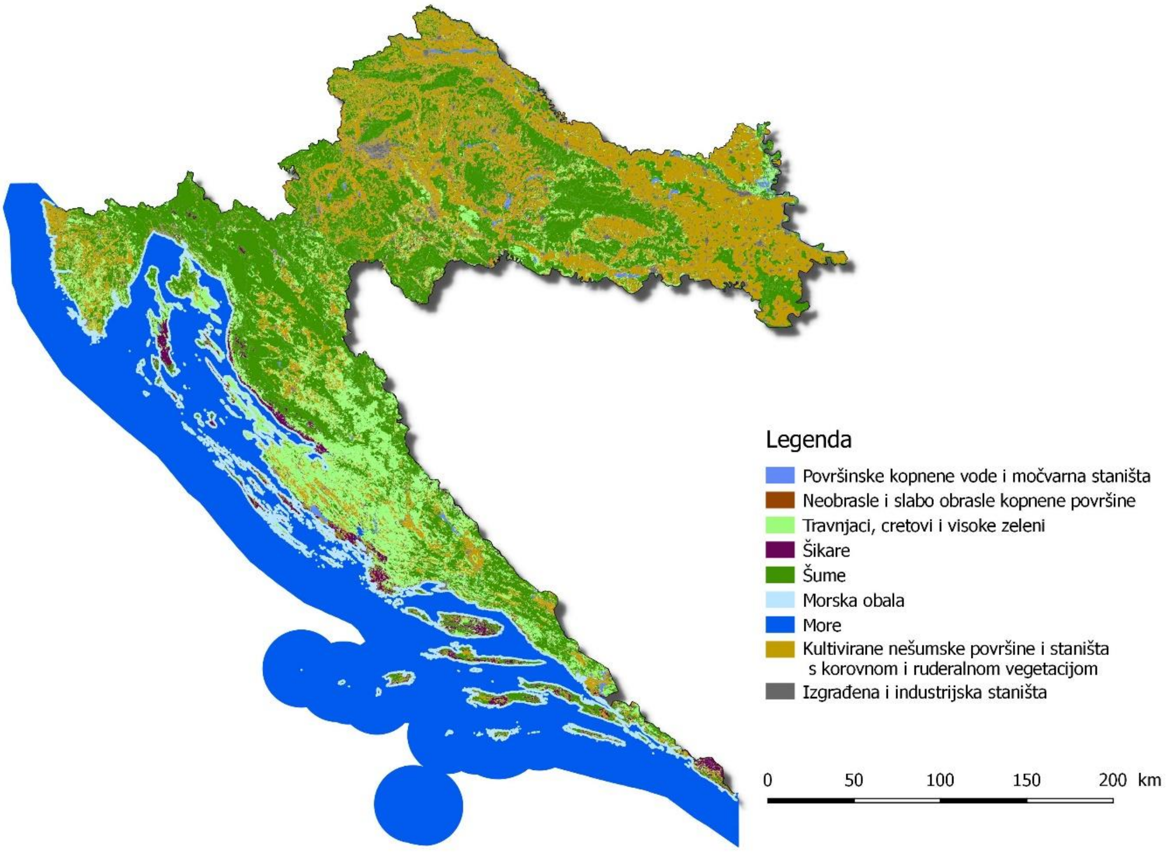


Figure 3.44 Habitats in the Republic of Croatia (dotted habitat types are not shown, and mosaic habitats are grouped according to the first mentioned habitat type)(Prepared by: IRES EKOLOGIJA d.o.o.)

In the land part of Croatia the most prevalent are different types of forest habitats (43.5%), followed by cultivated and ruderal surfaces (30%) and different types of grassland habitats (18%). The least surface area is taken by land waters, only 1%, and glabrous, naked surfaces with only 0.1% of share in the surface area of the Republic of Croatia.

The status of endangerment of habitats is not estimated in detail, but causes of their endangerment are known. The habitats are primarily endangered with anthropogenic activity; however, natural vegetative successions can also generate changes in a habitat.

Amongst the most endangered types of habitats are river gravels, sands and silts, the most prevalent in large lowland rivers (Drava and Mura and some parts of the river Sava). Endangered are the types of habitats and waterways with tufa-forming communities and travertine barriers, which are characteristic for Croatian karstic rivers. They are endangered by succession, a change in water regime, that is, by the periodic shortage of water and eutrophication.

Grasslands are endangered primarily with the abandonment of traditional activities such as pasture and haying and are threatened with a progressive vegetative succession. Additionally, certain types of grasslands, like large wet karstic grasslands, are endangered by waterways regulation or their conversion into plough-fields.

Forests in Croatia are mostly endangered due to the pollution of air, soil and water, to a change of water regime and roads building.

Sand habitats are under the pressure of tourism, construction and uncontrolled waste disposal. Their specialised flora and fauna has almost gone in most of the localities. Muddy coasts are not suitable places for beaches, so they are filled with construction material so as to get an area for further construction. Amongst the most endangered habitats included are also the rare habitats like shallows in the northern Dalmatia, the habitats of bushy dry lakes and dry lakes with the tall types of *Juncaceae* recorded on a few smaller localities, the mixed habitats of the Neretva Delta, as well as sand and gravel coasts. Shallows are rare on the Croatian coast, and are best preserved in the area of the Neretva Delta and in the northern Dalmatia, where there sea bays with shallows bordering with the dry lakes of glassworts and the wet grassland vegetation.

Sea caves are endangered with pollution and waste deposits, with the filling of coast, and anchialine caves are especially endangered by the pollution through water filtered through the karst, by the filling of coast and waste disposal. Similar to the anchialine caves, the submarine karst springs known as vruljas are endangered with pollution that comes into them in fresh water filtered through the karst and by filling and construction along the coast. Meadows of Neptune grass are present and grow in areas where the pressure of human activities is large. A natural recovery of the damaged Neptune grass settlements lasts a few decades, which makes that species especially sensitive and endangered. The Neptune grass is endangered by anchoring, fishing with towed gear, pollution and shading, the spreading of invasive species, as are green algae *Caulerpa taxifolia* and *Caulerpa racemose*. The survival of coralligenous communities is endangered by pollution, than by overfishing that changes the populations' structure. The anchoring can also damage coralligenous organisms, as well as the use of various towing and net fishing gears. The invasive green algae *Caulerpa racemosa* is recorded in the Adriatic Coralligena.

The underground habitats are especially sensitive and endangered by outer influences. From the major reasons of endangerment one can single out road construction, invasive urbanization, the pollution of water with large waste and the waste waters from industry and households, intensive agricultural production with a use of chemical fertilizers and pesticides, changes in the regime of underground waters or of their quality and large hydrotechnical projects (Analysis of the state of nature in the Republic of Croatia for the period from 2008 to 2012).

Regarding the described reasons of the habitats endangerment in Croatia one can conclude that the most of the endangered and rare habitats are sensitive to the development of transport and transport infrastructure through direct or indirect influences. In conclusion, with the further development of traffic one can expect an increase of their endangerment, which depends mostly upon transport types, the spatial distribution of roads and waterways and the manner of their construction.

3.3.3.7 Presence of pollutants in habitats

With the development of new transport infrastructure comes an increase of transport in areas where there was none before or not in such a measure, and the transport, that is, vehicles generate different byproducts that pollute water, soil and air and finally the habitats present, as well.

Considering that an increase of pollutants in a habitat is a consequence of the pollution of other environmental components (water, sea, soil and air) the current state of indicators which describe pollution is explained within the components on which the pollution has a direct influence.

3.3.4 Landscape features

For the purposes of the Strategy of spatial arrangement of the Republic of Croatia (Bralić, 1995) the landscape regionalization of Croatia was defined considering natural features and the presence of man in a certain area. Based on the aforementioned, 16 basic landscape units were separated:

1. Lowland areas of Northern Croatia
2. Pannonian highlands
3. Bilogora and Moslavina area
4. Northwest Croatia
5. Žumberak and Samobor Hills
6. Kordun plateau
7. Gorski Kotar
8. Lika
9. Peak Velebit strip
10. Kvarner-Velebit area

11. Istria
12. North Dalmatian plateau
13. Zadar-Šibenik archipelago
14. Dalmatian Hinterland
15. Coastal area of the central and southern Dalmatia
16. Lower Neretva

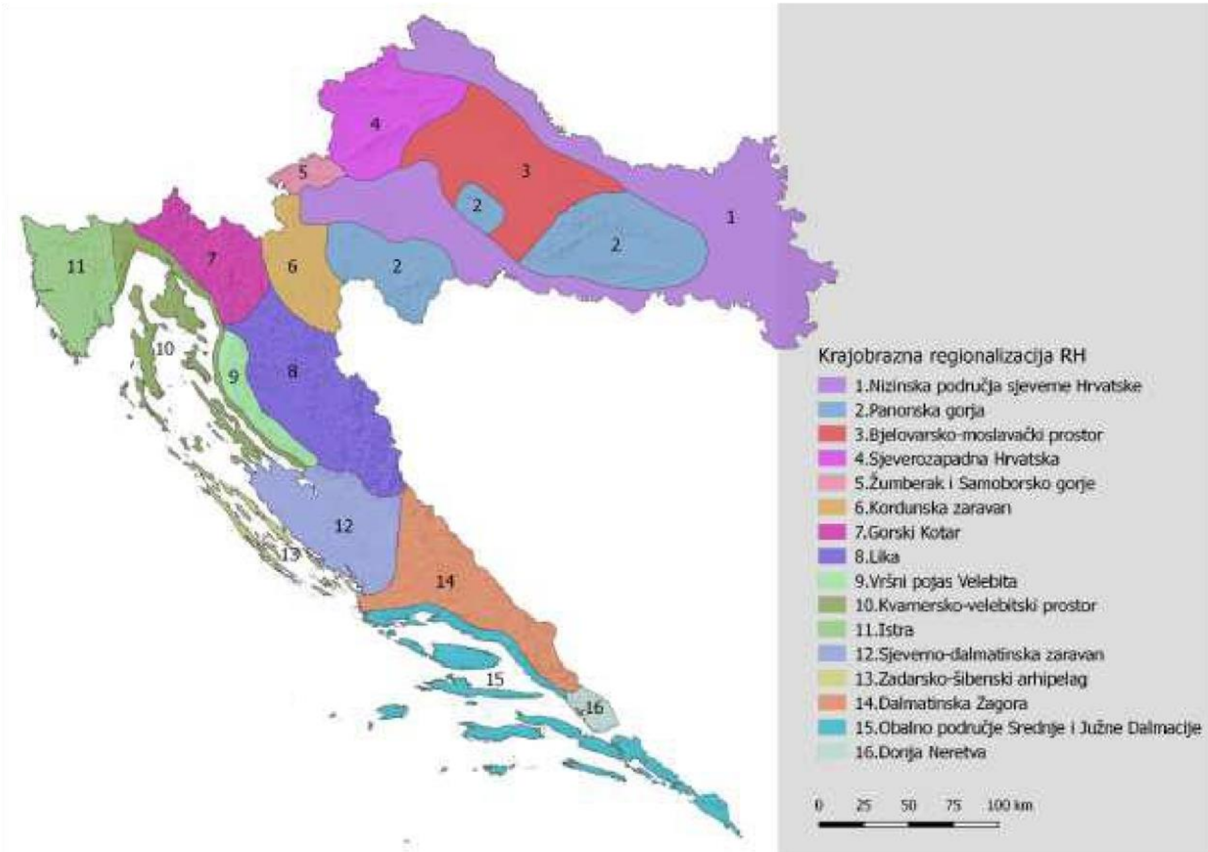


Figure 3.45 Landscape regionalization of the Republic of Croatia according to Bralić (1995) from the Strategy of the spatial arrangement of the Republic of Croatia (Modified: IRES EKOLOGIJA d.o.o.)

Landscape features

The indicator shows the influence of the measures anticipated with the Strategy on the character of the Croatian landscapes. The character of landscapes is a basic principle for recognizing a landscape which is defined with a specific combination of geology, relief, soil, vegetation, manner of land use, sample of fields and settlements. The changes shall have an effect on natural, cultural and visual-experiential qualities of a landscape. The changes shall be seen due to the increase of prevalence of anthropogenic elements and the change of an area perception and identity.

1. Lowland areas of Northern Croatia

Natural features of the landscape are a broad spectre of areas which cross border parts along the border with neighbouring countries, and are comprised of the Mura, Drava, Danube and Sava rivers with their tributaries, river branches, oxbow lakes and lakes. The area is characterized by plains and alluvial plateaus within which in some parts swampy vegetation and grasslands have developed. The natural surface coverage is made of deciduous and mixed forest on higher altitudes, and without larger compact units due to the anthropogenic influence of the surrounding.

Anthropogenic (and cultural) features of the landscape are characterized by an agrarian use of land through the melioration of agricultural areas which make a dominant geometric sample of parcelling. The parcelling size and sample differ from the north part of the Republic of Croatia towards the east. Water surfaces (lakes, ponds, rivers) make a significant landscape pattern that, along with roads, settlements and other infrastructural elements dictate the direction and pattern of cultural landscapes. Urban landscape is visible through the division of open green areas inside cities as are Varaždin, Čakovec, Osijek, Vukovar, Slavonski Brod and Sisak, out of which certain parts are of special historical importance.

Visual-experiential features of the landscape are seen in a relatively flat terrain which is not dictated by relief segmentation, but by its vertical surface which enables a spatial organization. An important element in space are river courses which link the area naturalness to themselves. Considering that there aren't many forest areas, as an important element of the landscape one can single out mixed forests which are visually valuable and interesting due to colour and texture variations through the year.

2. Pannonian highlands

Natural features of the landscape are seen in an indented terrain of the highlands which stand out inside the flat surface of the Pannonian Basin. This landscape area is placed in three separated zones inside the lowland Croatia, and is comprised of the Banovina highlands (Petrova Gora and Zrinska Gora), Moslavačka Gora and Slavonian highlands (Papuk, Psunj, Krndija and Dilj). From the west of the region towards the east the mountain peaks get gradually elevated and in the area of Banovina the average altitude is about 350m a.s.l., while Slavonian highlands mutually vary from 600 to over 900m a.s.l. The karstic relief of Slavonian highlands gives a special value and geomorphological diversity which is atypical for this region.

Anthropogenic (and cultural) features of the landscape make a combination of fragmented and consolidated parcels which distribution depends on natural features. So in the area of Banovina and Moslavačka Gora prevalent are small fragmented parcels with small areas of arable land, while the urban centres of Glina and Kutina were developed along the alluvial plains of the homonymic rivers, with agricultural areas that are related to suburban settlements. On the area of the Slavonian highlands' plateau, in the so called Požega Valley, there is a cultural landscape comprised of large areas of arable land of regular shape that follow water canals and are related to the settlements in near proximity. The water canals are followed by groups of trees that create a visual and physical barrier inside the plain. From larger settlements one can single out Požega, to which smaller settlements are linked that are linearly developed along transport infrastructure.

The visual-experiential features of the landscape are emphasized in a vertical segmentation of the highlands inside the surface of the plain which creates an accent in the space with its volume and naturalness. The cultural landscape of the Požega Valley is specific for its position and recognisability, where against the dark volume of the highlands dominate the light surfaces of arable land of different cultures, between which linear elements of water intertwine.

3. Bilogora and Moslavina area

The natural features of the landscape are determined by a rich Lonja-Ilova Basin (120 to 160m a.s.l.) surrounded with the slopes of the neighbouring highlands (Bilogora, Moslavačka Gora). The relief characteristics have influenced the creation of swamps and ponds, out of which some are converted for economic purposes (fish farms). The area is characterized by the river Česma, which basin is fan-shaped and is comprised of numerous courses which spring out in the area of Bilogora and Moslavačka Gora. Natural vegetation is characterized in individual forest stands of deciduous forest.

Anthropogenic (and cultural) features of the landscape are comprised of cities (Bjelovar, Križevci, Koprivnica) with their infrastructure elements and open spaces. Villages are connected with central settlements by road infrastructure along which they develop linearly, so there are no large interruptions (distances) between the neighbouring settlements. Mosaics of cultural surfaces occupy the larger part of the area between which irregular forms of lakes, ponds and other water surfaces are intertwined. Agricultural areas of mixed purpose follow the basic physiognomy of the area and make the largest share of the anthropogenic landscape.

Visual-experiential features of the landscape are comprised by organic forms of water surface against the relatively flat, narrow and elongated agricultural areas which makes a specific spatial pattern. A cultural value is made by visible anthropogenic structures (sacral and secular architecture) inside urban areas, while in rural areas objects of oil fields, wood industry and agriculture single out.

4. Northwesten Croatia

Natural features of the landscape are made by a relief indented area in which high areas of highlands, lower areas of hills and lowland areas of river alluvial plains alternate. The high areas of highlands are covered with forest, mostly with beech and fir where the highest peaks reah over 1000m a.s.l. The mixed forest in the lower areas of hills covers small fragmented areas under anthropogenic influence.

Anthropogenic (and cultural) features of the landscape are defined in cities which are linearly developed along alluvial plains of rivers (Krapina, Sava, Lonja) and their tributaries. The phases of city development are clearly visible in architecture, and mostly in forming of open spaces, so the most important city of this area is Zagreb. Besides Zagreb, smaller cities are also important (Krapina, Lepoglava, Ivanec) which make urban centres on the hilly-mountainous area of Zagorje. Foots of the highlands are relatively densely populated since the terrain allows a possibility for economic activity. The cultural landscape is comprised of agricultural areas in the form of fragmented and segmented mosaic surfaces of plough-fields, vineyards and orchards, as well as pastures, meadows and gardens on the hills.

Visual-experiential features of the landscape can be seen in the domination of higher vegetation. Characteristic are the width open views from mountain peaks on river valleys and other water surfaces and on lower surrounding hilly areas. A vertical segmentation of the hilly area have influenced its ambient value, along with narrow and closed views. In the space one can see visually exposed routes of rail, road, river and power line infrastructure.

5. Žumberak and Samobor Hills

Natural features of the landscape are seen in the rich segmented relief with expressed peaks and dominant brook hollows, which descent from higher areas into the hill's foots. The natural vegetation coverage is comprised from deciduous forest and the area covered with meadows with overrun land. The area is also characterized by a representation of karstic forms as are caves and potholes.

Anthropogenic (and cultural) features of the landscape can be seen in small dispersed rural settlements with no larger areas of arable land. Smaller areas of arable land (meadows, plough-fields and pastures) alternate inside forest areas and the areas of settlements which are located even up to 800m a.s.l. Those areas, along with vineyards on foothills of Plješivica and Japetić, make an important areal pattern of the cultural landscape. The wooden traditional architecture of settlements with a church/chapel and ruins of old towns make a recognizable Figure of this area, while from the cities of urban character here lies Samobor.

Visual-experiential features of the landscape can be seen in the woodiness of the area and the recognizable relief forms on which higher altitudes hamlets with small mosaic fields are dispersed. The area of highlands present a visual background from larger distances.

6. Kordun plateau

Natural features of the landscape are created by a wide limestone plateau which in the north is closed by the river Kupa, in the east by the line Petrova Gora – Žumberak and in the west by Gorski Kotar-Lika mountains. Although the area is rich with numerous geomorphological forms they are not visible enough in space due to dense natural vegetation composed mostly of mixed forest and surfaces under succession.

Anthropogenic (and cultural) features of the landscape are created by the cities of Karlovac and Ozalj which are located near the border of the landscape region itself. Smaller cities as Slunj and Duga Resa to which surrounding settlements and hamlets are connected are also important. The cultural landscape is composed of small agricultural parcels along rivers (Mrežnica, Kupa, Korana and Dobra) which creates a striking element in the space.

Visual-experiential features of the landscape are composed of the rivers Kupa, Dobra, Korana and Mrežnica, as well as of canyons which represent a specific natural-anthropogenic system.

7. Gorski Kotar

Natural features of the landscape are composed of the forest-hilly area of a plateau which elevates abruptly and steeply above the Kvarner with mountain peaks that reaches up to 1500m a.s.l. A high degree of naturalness is visible in protected areas and through natural phenomena. In the area a vegetation of mixed forest is prevalent, amongst which an accent in the space is created by coniferous forests in combination with grey rocky karstic peaks.

Anthropogenic (and cultural) features of the landscape are composed of cities (Ogulin, Delnice) alongside which important infrastructural elements pass. Also, smaller urban units and their gravitating settlements (Ravna Gora, Skrad, Mrkopalj) are important since the cultural landscape of agricultural areas is connected to them. There are no many areas of arable land, so meadows and pastures make an impressive element in the landscape. Pastures on the rocky ground dominate at high altitudes and they are mostly neglected.

Visual-experiential features of the landscape are composed of lakes as surface elements within the dark volumes of forests. The area's naturalness is seen through a dark, closed and forested ambient against small and dispersed cultural units (pastures and areas of arable land). Closed views are prevalent, while panoramic views characteristic for higher altitudes open in places.

8. Lika

Natural features of the landscape are seen in mountain ranges which clearly define this area inside which a mountain plateau has settled. In the south the border is determined by the Velebit mountain, in the west by Velika Kapela, in the north by Mala Kapela and in the east by Lička Plješivica. The plateau is segmented with smaller mountain ranges inside which karst fields have settled: Gacko Polje, Ličko Polje and Krbava. Natural vegetation coverage is created from deciduous, coniferous and mixed forest in combination with natural grasslands and overrun land. Considering that it is a karstic area one can recognize numerous forms of karst sinkholes, sinkholes, sinter pools and potholes up to hydrogeological features in forms of springs, water swallows and pools.

Anthropogenic (and cultural) features of the landscape are created by larger settlements (Otočac, Gospić, Gračac) on the border parts of fertile fields along rivers (Lika, Gacka, Krbava) and other water surfaces. Regarding that the area is of rural character the only larger urban centre is Gospić while other settlements are of compacted type with an open central square connected to a cultural landscape in near surrounding. In lowland parts present are agricultural areas of different purposes while higher altitudes are related to pastures and livestock activity.

Visual-experiential features of the landscape are created by the dominant geometrical patterns of the meliorated fields of different purpose closed with mountainous slopes where regularity and flatness is expressed in relation to a dynamic forest surrounding. A contrast in space is created by carriers of lighter tones out of which roads, rocky grounds and agricultural areas are stand out against the dark tones of high vegetation which is prevalent in this area.

9. Peak Velebit strip

Spatially defined measures of the Strategy are not within the mentioned landscape region, so it shall not be described in the Study.

10. Kvarner-Velebit area

Natural features of the landscape are created by the expressed peaks of the mountains of Učka and Velebit from the landside and large Kvarner islands of Cres, Krk, Rab and Pag.

Anthropogenic (and cultural) features of the landscape are created by the coastal cities like Rijeka, Opatija, Senj and Karlobag, as well as larger island centres lake Cres, Rab, Pag and Krk with their zones for different use and purpose. The largest anthropogenic influence due to its function and spatial location has the city of Rijeka as the largest urban centre, while the island cities have preserved their rural character and a central settlement structure. Cultural landscapes are created by agricultural and livestock surfaces with drywall structures which differ considering their type, size, location and natural conditions of an area. On the area of Littoral Croatia Andlar (2012) records and describes exceptional cultural landscapes amongst which 24 of them (Cres olive groves, Učka pastures etc.) are within the Kvarner-Velebit landscape region.

Visual-experiential features of the landscape are created by dominant lines of the mountain ranges of Učka and Velebit. Vertical segmentation of the space is visible through an agitated terrain and peaks from which panoramic views on open sea and neighbouring countries are visible. A micro-ambient value of the space is created by the cultural landscape with specific patterns, construction technique and a manner of land use.

11. Istria

Natural features of the landscape are visible in the coastal line which in the west becomes more shallow and indented, and in the east steeper. Considering vegetation coverage and the type of soil, three units which mutually differ in colour and texture are clearly divided in the landscape. The west coast manifests in the red soil and from that it got its name Red Istria. Grey clay soil is characteristic for the middle part, that is the Grey Istria, while the White Istria has got its name due to its rocky foundation which encompasses the eastern part.

Anthropogenic (and cultural) features of the landscape are created by cities and settlements with the related rural and urban landscape. From the cities on the coast the more important are Pula, Rovinj, Poreč and Umag which have the characteristics of urban centres, while the cities in the inside like Pazin, Buzet and Žminj are of rural character. Andlar (2012) says that the Grey Istria is made by the grouped smaller settlements and the cultural flysch terraces of mixed purposes (olive growing, viticulture), while the Red Istria is characterized by the radial open/closed system of irregular fields, forests and meadows on the karstic plateau which surrounds the centrally grouped settlements on natural hills/mounds.

Visual-experiential features of the Istria landscape stand out through the closed and protected units with specific geographical and geomorphological characteristics. This area is not perceived as a whole in that sense, which is expressed in different landscape elements of the land and the coastal parts of Istria.

12. North Dalmatian plateau

Natural features of the landscape of this region are composed of smaller relief forms (closed sinkholes of different sizes), than dry valleys and ravines, tectonic depressions and large canyon forms (Krka, Čikola, Zrmanja). Natural vegetation coverage is composed of small scattered areas of deciduous forest with surfaces under succession. Natural grasslands take the largest part of the surfaces of this region in combination with bushy vegetation. An important natural element is composed the water surfaces of the Lake Vrana, Lake Prokljan and Visovačko Lake and the Karin Sea.

Anthropogenic (and cultural) features of the landscape are created by specific rural units with dispersed hamlets located along edges of sinkholes. The rural unit includes also the spaces outside the hamlets in open pastures of extensive character. Drywall construction is closely related to areas of arable land in the function of fences or in the function of stables for livestock farming. Larger settlements of urban character are located along the sea coast out of which stands out Zadar and Šibenik as cultural and historical centres with numerous open green surfaces within the city. In their background the mosaics of arable land are located which continually follow larger settlements and transport infrastructure out of which the area of Ravni Kotari is the most significant.

Visual-experiential features of the landscape of this region are created by the unique and recognizable plateau with traditional features of an enclosure system. Important elements of the area identity are views on river canyons, the sea and lthe akes.

13. Zadar-Šibenik archipelago

Spatially defined measures of the Strategy are not within the mentioned landscape region, so it shall not be described in the Study.

14. Dalmatian Hinterland

Natural features of the landscape distinguish via three relief elements amongst which stand out the mountain ranges of Dinara, Svilaja, Mosor and Biokovo, then karstic depressions inside which are located Petrovo, Sinjsko and Imotsko fields and the limestone plateaus around the fields. Of other elements stand out the river Cetina with fields and the canyon, the Peruća Lake and the hydrological-morphological phenomena of Imotski lakes. Mountain areas are characterized by naked rocks with smaller share of natural vegetation.

Anthropogenic (and cultural) features of the landscape are manifested through the rural type of settlements which differ in their function, structure and shape, as well as in their spatial placement. The cultural landscape of the hinterland fields is adjusted to the direction and shape of relief and to canals and roads. Former livestock presence is visible in drywall construction and the manner of land use.

Visual-experiential features of the landscape are defined by wide panoramic views from the mountain peaks of Svilaja, Mosor and Dinara and contrasts of light and dark elements of infrastructural objects, scattered settlements and the arable land mosaics. The karstic fields areas are visually more visible in tone and structure in relation to mountain massifs which lack vegetation.

15. Coastal area of central and southern Dalmatia

Natural features of the landscape are composed of the land coastal belt which which the vertical segmentation of the mountain peaks of Mosor, Biokovo, Snježnica alternates with areas of larger islands as are Hvar, Korčula, Brač and the Pelješac peninsula. The area is also characteristic for its numerous smaller islands which, parallel to each other, stretch along the Dinaric direction Northwest-Southeast.

Anthropogenic (and cultural) features of the landscape are composed of the urban areas of cities on coast of which the most prominent are Split and Dubrovnik. The architectural value of this landscape is one of the most significant for Croatia and Dalmatia due to is long history and preservation. Andlar (2012) mentions that exceptional cultural landscapes (pastures, olive groves, sinkholes, fields) of this region which are represented on the islands of Brač, Hvar, Korčula and Mljet are composed of the system of intensive drywall and terraced olive groves and vineyards distant from the settlements.

Visual-experiential features of the landscape of this region are composed of the views on open sea and neighbouring islands which get on the experiential value with the elevation to higher altitudes. Prevalent are the narrow views inside the streets of old city centres and settlements. An interesting micro-ambient value of a historical character is composed of the cities of Dubrovnik, Stari Grad, Ston, Konavle and others within cultural landscapes which makes a visual-experiential attraction from the sea side.

16. Lower Neretva

Natural features of the landscape are comprised of the Neretva Delta. The north and northeast part of the Delta is enclosed with the slopes of Dinaric mountains, the south part is enclosed with the so called Podgradina-Slivanja hills, while in the west the Delta is under the constant influence of the sea.

Anthropogenic (and cultural) features of the landscape are composed of the numerous melioration areas within 12 river branches. Besides the cultural landscape of a large karst field and a river valley of mixed purpose are located cities, that is, larger settlement and important transport routes. Of the more important cities in this area stand out

Metković and Opuzen as the cities on the river coast, while the city of Ploče is the largest city on the sea coast. Andlar (2012) mentions that only in some parts, within the cultivated part of the Neretva Valley a traditional manner of land cultivation survives which means the transfer of the soil from swamps to cultivated parcels. The parcelling pattern is characterised for the alteration of water canals and irregular square agricultural parcels.

Visual-experiential features of the landscape are composed of surfaces of agricultural land, with a different parcelling pattern, depending upon a land use. In the area natural karst and swampy vegetation alternate. The parcelling visibility is the best from the rocky karstic mounds, while within them there is a vegetation obscureness depending upon a cultivation culture.

3.3.5 Soil

3.3.5.1 Quantity of pollutants in the soil

The Ordinance on the protection of agricultural land from pollution (OG 9/14) defines the pollutants, the sources of pollution and the maximally allowed quantities of the pollutants in the soil, but only for agricultural land, which operationally is not an obstacle to its implementation on other lands. As the system of soil protection is not normatively established as a unique act, but is defined in relation to a manner of land use, the establishment of a single system of the soil status monitoring, i.e. of the systematic monitoring of soil state, is somewhat difficult. Limit values of pollutants in the soil are not prescribed for the land used for other purposes (e.g. forest land, settlements, parks and playgrounds, industrial zones), which hinders the definition and systematic monitoring of polluted and potentially polluted locations, as well as the eventual changes in the soil state.

The most significant sources of the soil pollution are of anthropogenic origin. The anthropogenic sources of pollution are: industrial production and services, industrial waste, city waste, oil industry, mining, power plants, warehouses, military activity, transport, transport effluents, agricultural activity, incident situations and other.

A polluted location is a place on which a presence of pollutants is confirmed in a concentration that presents a danger for human health and the environment elements (soil, underground and surface waters and air). The most critical locations polluted with waste in the area of the Republic of Croatia generated with a long-term unsuitable production (technological) waste management are the so-called black spots. The Waste Management Plan 2007-2015 determines 13 black spots, with the total surface area of around 710 000 m^2. From the mentioned 13 locations, 4 were cleaned up by the end of 2012, 6 were in the process of recovery, while for 3 locations the recovery was in preparation. In the table below an overview of black spots in the area of the Republic of Croatia is given according to the data of the State of the Environment Report 2009-2012 (Table 3.18).

Table 3.18 The status of the black spots recovery in the area of the Republic of Croatia (Source: State of the Environment Report 2009-2012, Modified: IRES EKOLOGIJA d.o.o.)

Serial number	Black spot	Recovery status
1.	Pools of the Glinica factory - Obrovac	Recovery in progress
2.	Salonit JSC factory	Recovery in progress
3.	Lemić hill - near Karlovac	Recovery in progress
4.	Slag landfill - Kaštela Gulf	Recovery in progress
5.	Coke plant - Bakar	Recovery finished
6.	Slag landfill - TPP Plomin I	Recovery finished
7.	Phosphogypsum landfill - Petrokemija Kutina	Recovery in preparation
8.	Oily sludges - Botovo	Recovery in preparation

Serial number	Black spot	Recovery status
9.	Sovjak near Rijeka	Recovery in progress
10.	Electrodes and feroalloys factory - Šibenik	Recovery in progress
11.	Borovo factory - Vukovar	Recovery finished
12.	Salbunara beach - Biševo island	Recovery finished
13.	DIV Ltd. (TVIK screw factory) - Knin	Recovery in preparation

The Waste Management Plan 2017.-2022. identifies six black spots in the area of the Republic of Croatia which are still not cleaned up. They are the following spots:

- Pools of the Glinica factory - Obrovac
- A beach across the Salonit JSC factory - Kosica
- Slag landfill - Kaštela Gulf
- Oily sludges - Botovo
- Sovjak pit near Rijeka
- DIV Ltd. (TVIK screw factory) - Knin.

From this list it is visible that the number of unrecovered black spots between two plans decreased from nine to six. The black spots which were removed from the list are: Lemić hill, Petrokemija Kutina and the Electrodes and feroalloys factory (TEF Šibenik). The Lemić hill locality was removed from the list of black spots since the recovery process was finished in November 2016, after two and a half years of works. The TEF Šibenik locality recovery is also finished, the works have been concluded in 2015 and this black spot was removed from the list. The recovery of the phosphogypsum landfill of the Petrokemija Kutina is planned within the whole project of recovery and closure of the landfill with the owner's means, however this locality was removed from the black spots list. On the Figure below the locations of all black spots in the Republic of Croatia (recovered or not) are presented, including the already mentioned phosphogypsum landfill of the Petrokemija Kutina (Figure 3.46).

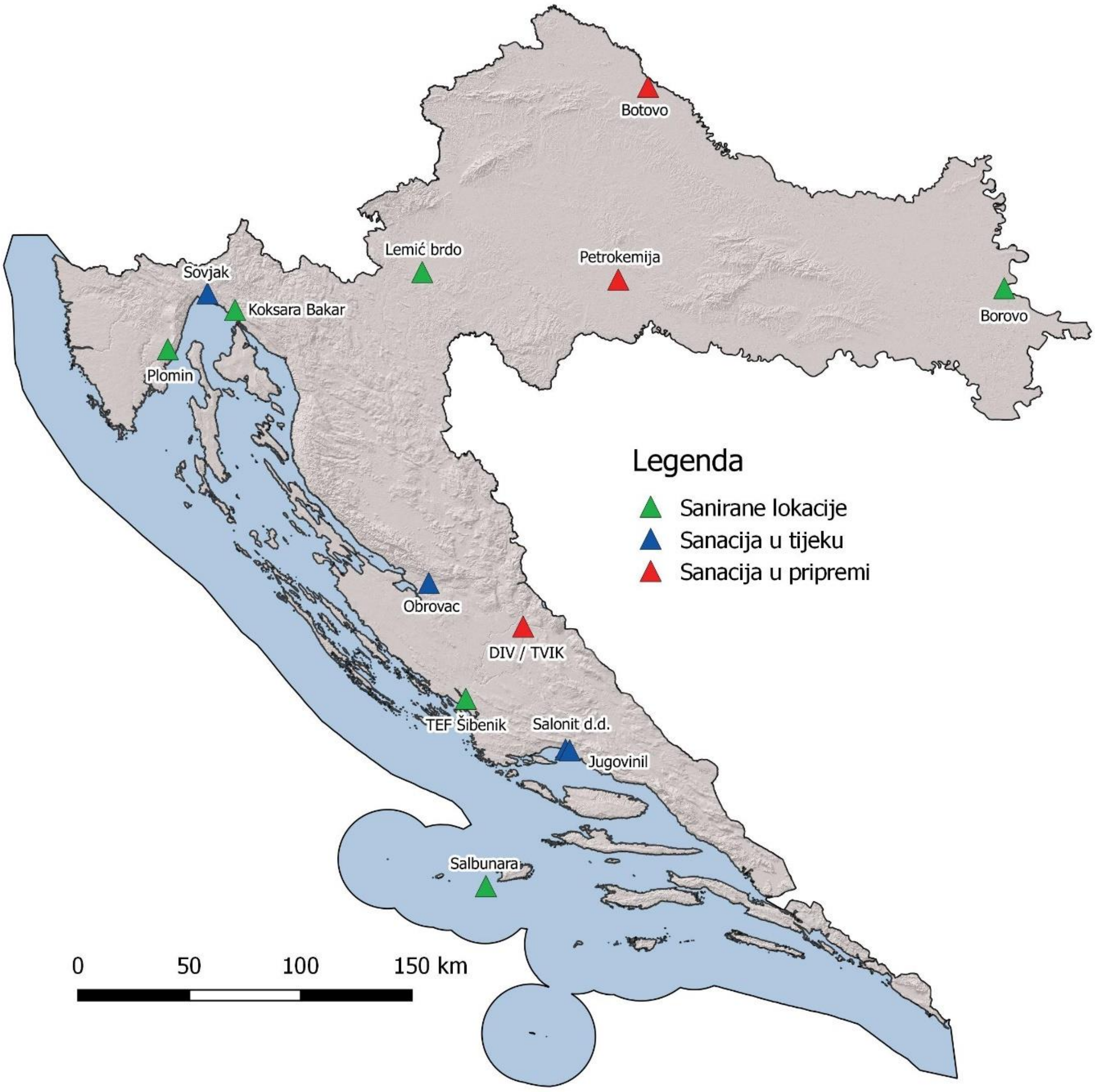


Figure 3.46 Black spots in the area of the Republic of Croatia (Source: State of the Environment Report 2009-2012, Modified: IRES EKOLOGIJA d.o.o.)

The recovery, financing or co-financing is in the competence of the Environmental Protection and Energy Efficiency Fund. Locations owned or used by active legal subjects are subjected to the "polluter pays" principle, so the owner or user of a location bears the costs generated with the environmental pollution. Pursuant to the aforementioned, out of the six black spots that are still unrecovered, two are subjected to the "polluter pays" principle, and that are the localities of the laundry and disinfection station in Botovo and the ex screw factory TVIK in Knin.

Locations polluted with heavy metals mostly contain As (arsenic), Cd (cadmium), Cr (chromium), Cu (copper), Hg (mercury), Ni (nickel), Pb (lead) and Zn (zinc). Their maximally allowed concentrations (except for arsenic) in agricultural land are defined with the Ordinance on the protection of agricultural land against pollution. Increased concentrations of these metals endanger agricultural production, the environment and human health.

Table 3.19 Comparative table of major statistical parameters for individual regions, Croatia and Europe (Source: State of the Environment Report 2009-2012)

		Elements (mg/kg)							
		As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Littoral Croatia	Min	2.5	0.2	18	7	0.005	10	10	23
	Med	18	1.1	121.2	35.5	0.08	74.6	47.7	108
	Mx	105	9.5	443.9	429	1.414	261	177	341
Mountainous Croatia	Min	2.5	0.2	22	6.4	0.01	11	14	33
	Med	15	0.6	85.9	24.6	0.105	52.8	39	104
	Mix	74	15.5	212	85	1.195	289	136	638
Central Croatia	Min	1.8	0.2	28	3	0.005	12	14	28
	Med	8.4	0.2	74	19	0.05	33	27	73
	Max	59	9.4	524	248	4.535	427	217	477
Posavina	Min	0.5	0.2	37	4	0.005	9.2	15.6	42
	Med	9	0.2	77.75	19.6	0.04	34.95	25.4	74
	Max	53	11	502	171.6	0.850	215	145.3	269
Podravina	Min	0.5	0.2	37	5.3	0.005	11	15	34
	Med	10	0.2	75	21	0.035	31.2	25.3	74
	Max	92	7.1	209	239.1	0.640	195	699	1432
Croatia	Min	0.5	0.2	18	3	0.005	9.2	10	23
	Med	12	0.4	88.2	25.4	0.06	47.5	33	88
	Max	105	15.5	524	429	4.535	427	699	1432
Europe	Min	0.32	<0.01	<3	0.81	0.005	<2	5.3	<3
	Med	7.03	0.145	60	13	0.037	18	22.6	52
	Max	282	14.1	6230	256	1.35	2690	970	2900

According to the data presented in the table above (Table 3.19) the higher average concentrations of arsenic (from 2.5 to 105 mg/kg, with the median of 18 mg/kg) are recorded in the soils of littoral Croatia, in the area of North Dalmatia (Obrovac - Evernik up to Drniš plateau) and are probably related to the phenomena of bauxite mineralization.

Maximal concentrations of cadmium (15.5 mg/kg) are recorded in the soils of mountain Croatia in the wider surrounding of Udbine, which is probably a consequence of former military activity of that area. In Posavina and Podravina high concentrations of cadmium are registered in the narrow belt on flood sediments of the rivers Sava, Drava, part of Mura and Danube as the consequence of upstream mining and industrial activities in the last two centuries.

The highest concentrations of chromium are recorded in the central Croatia in the area of Trgovska and Zrinska Gora and in the eastern part of Medvednica (Donje Orešje) and is directly connected with ultramafic rocks in the foundation. The soils of the littoral Croatia contain in average the most chromium (median is 121 mg/kg) with maximums in the area of Ravni Kotari (Benkovac) and Obrovac, which points to the chromium acquisition from bauxite deposits.

Littoral Croatia records the highest concentrations of copper in soil, which are twice higher than in other Croatian regions. The span of concentrations varies from 7 to 429 mg/kg and the median is 35.5 mg/kg. The copper is decidedly of anthropogenic origin and is mostly located in the areas with intensive agricultural activity, especially viticulture. The areas of Bakar and the Vinodol basin, Drniš plateau, Neretva mouth and Konavle, as well as the islands of Cres, Pag, Vis, Korčula and Mljet stand out with concentrations that are regularly over 50 mg/kg, and often even higher than 85 mg/kg.

The highest concentration of mercury in soil (4.5 mg/kg) was recorded in the central Croatia. Anomalous concentrations are registered on the highest parts of Ivanščica and Kalnik and they point to geogenic origin. The largest part of Gorski Kotar contains over 0.2 mg/kg of mercury, out of which almost half represents the values over 0.5 mg/kg. This acquisition is characteristic for Gorski Kotar and is connected with mineralization in the rocks of Palaeozoic complex (cinnabar), especially in the furthest Northwest part where maximums reach 1.2 mg/kg.

The area of littoral Croatia and the border with mountain Croatia are mostly burdened with the geogenic nickel in soil. The span of the concentrations is from 10 to 261 mg/kg, with the high median of 74.6 mg/kg. The maximal concentrations of nickel in soil are recorded in the central Croatia, in the east part of Medvednica (Donje Orešje) and on the Zrinska Gora in Banovina. They are the consequence of geological foundation consisting of ultramafic and basic igneous rocks.

The highest concentrations of lead were measured in Podravina, in the valleys of Drava and Mura and are the consequence of the upstream anthropogenic influence of mining and industrial activities. Littoral Croatia is the region which is the most spatially burdened with lead in soil, with the concentrations of mostly between 46 and 60 mg/kg, while the median for the whole region is 48.7 mg/kg. The highest concentrations are measured in the sub-Velebit area, the Dalmatian hinterland and on the central Dalmatian islands of Brač and Hvar. Furthermore, high concentrations of lead are recorded in the mountain Croatia, in the mountain areas of Gorski Kotar (Risnjak) and Lika (Velebit). The cause of these anomalies in the littoral and mountain Croatia is connected to the composition of red soil and atmospheric pollution.

The highest concentrations of zinc are measured in Podravina, in the soils above the alluvial sediments of the rivers Drava, Mura and Danube, and especially in the Drava valley, and are the consequence of the upstream long-term mining and industrial activities. Littoral and mountain Croatia register the highest medians (108 and 104 mg/kg) which are twice as much as the European average (52 mg/kg). The higher concentrations are characteristic also for the sub-Velebit littoral and the whole central and south Dalmatia (State of the Environment Report in the Republic of Croatia, 2014).

3.3.5.2 Soil erosion

The damage of soil due to erosion is considered as the leading degradation process in Europe. According to the EEA estimates 105 million ha, that is 16% of the European surface area is affected with the soil erosion by water and 42 million ha are affected with the soil erosion by wind.

Many factors influence the soil erosion by water as are the climate, a manner of land use, a land coverage, a soil texture, an angle and a land upkeep. A real risk of the soil erosion by water is represented by a real or actual risk of erosion within which estimate one takes into consideration the coverage and the manner of land use. The map of the real risk of erosion is shown on the Figure below (Figure 3.47).

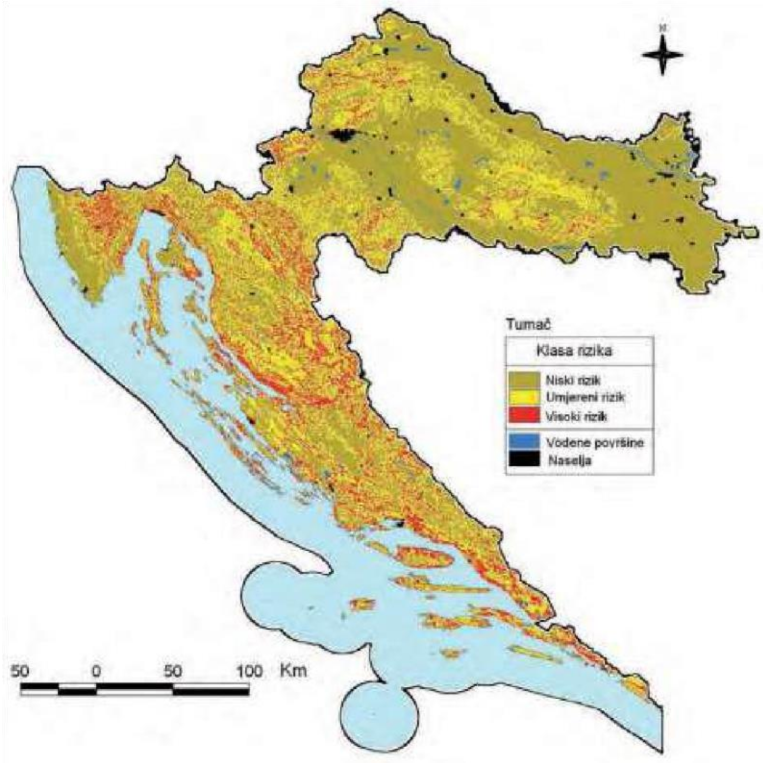


Figure 3.47 The real risk of a soil erosion by water (Source: State of the Environment Report in the Republic of Croatia, 2014)

Pursuant to the given map the agricultural land in Croatia is the most sensitive to erosion, so 23.2% of the agricultural land has a high risk and 23.1% a moderate risk of the soil erosion by water. Forest land is sensitive to the soil erosion by water mostly in the karstic area, so the moderate rick encompasses 44.8% of the forest land.

Unlike the water erosion where an eroded material follows certain paths, a material taken by wind gets spread into the environment. Dust emission, as a consequence of the wind erosion, is the largest source of aerosol which has a direct or indirect influence on the atmosphere balance and with that on the global climatic changes and on the environment, human health and economic activities in general. On the soil erosion by wind sensitive are the agricultural areas exposed to the winds of high speed and of a soil base coverage with loosely connected particles which can be lifted up and transported, as well as the areas insufficiently protected with cultures or plant remains. The erosion and deposition processes take place on wide areas, so they are difficult to identify.

3.3.6 Waters

In the Republic of Croatia, the status of water resources is assessed according to the water bodies, which represent basic units for the analysis of features and water quality management.

3.3.6.1 Surface waters

The analysis of surface water features comprises running waters with basin surface larger than 10 km^2 and standing waters with the surface area larger than 0,5 km^2. Around 20% of the total length of all registered running waters and around 98% of the total surface of all registered standing waters in the Republic of Croatia exceed the indicated size. The other 80% of length of the registered running waters and 2% of the surface of the registered standing waters comprise extremely small water bodies which are not categorized nor assessed in accordance with the provisions of the Water Framework Directive, but rather, when necessary, according to the standards applicable to a larger water body that has surface contact with, or in case there's no surface contact, applicable to the closest or the most appropriate larger water body.

Surface waters in the Republic of Croatia are divided into two basins: Danube river basin and Adriatic basin.

The Danube river basin has many surface waters and a branchy network of running waters, particularly in its Pannonian region. The biggest rivers in this basin are Danube, Sava, Drava, Kupa and Mura, all having very large basins (more than 10 000 km^2). There are only few natural lakes in this area. The basin is divided into two sub-basins – Sava river sub-basin and Drava and Danube river sub-basin.

Continental surface water is scarce in the Adriatic basin, but there is a significant number of ground waters running through karst system. Most of the rainwater penetrates into deeper layers all the way to watertight layers of groundwater and karst springs. Watercourses are present in the areas of mild karst with alluvial drift and shallow underground circulation. There is basically no surface water on the islands, except occasional torrent or rare, usually low-capacity springs.

Ecological and chemical status of surface water

The status of a surface water body is determined by the poorer of its ecological status/potential and its chemical status.

Ecological status of a surface water body is determined based on individual assessments of relevant biological and basic physico-chemical, chemical and hydromorphological elements supporting the biological elements. Depending on the individual assessments of the relevant quality elements, bodies of surface water are classified into five classes of ecological status: high, good, moderate, poor and bad. Regulation on water quality standard (OG 73/13) regulates the key role of biological elements of the quality in the classification of ecological status. Apart from biological standards, all basic physico-chemical, chemical and hydromorphological requirements must be met in order to classify a water body as a body with high ecological status.

The assessment of ecological status as defined by the Regulation is possible only for water bodies with pre-assessed biological status. These are water bodies which were subjected to the monitoring of biological elements of quality and upstream water bodies to which it was possible to extrapolate the results of biological testing (water bodies of the same type et equally assessed by physico-chemical, chemical and hydromorphological quality elements). Other water bodies were assessed only according to the supporting quality elements, in such way that all supporting elements (basic and specific physico-chemical and hydromorphological) are equally important but applicable is the one supporting element with the lowest assessment. In the figure below, an ecological status of water bodies of rivers and lakes (more intensive color represents water bodies with full assessment including biological indicators) (Figure 3.48).

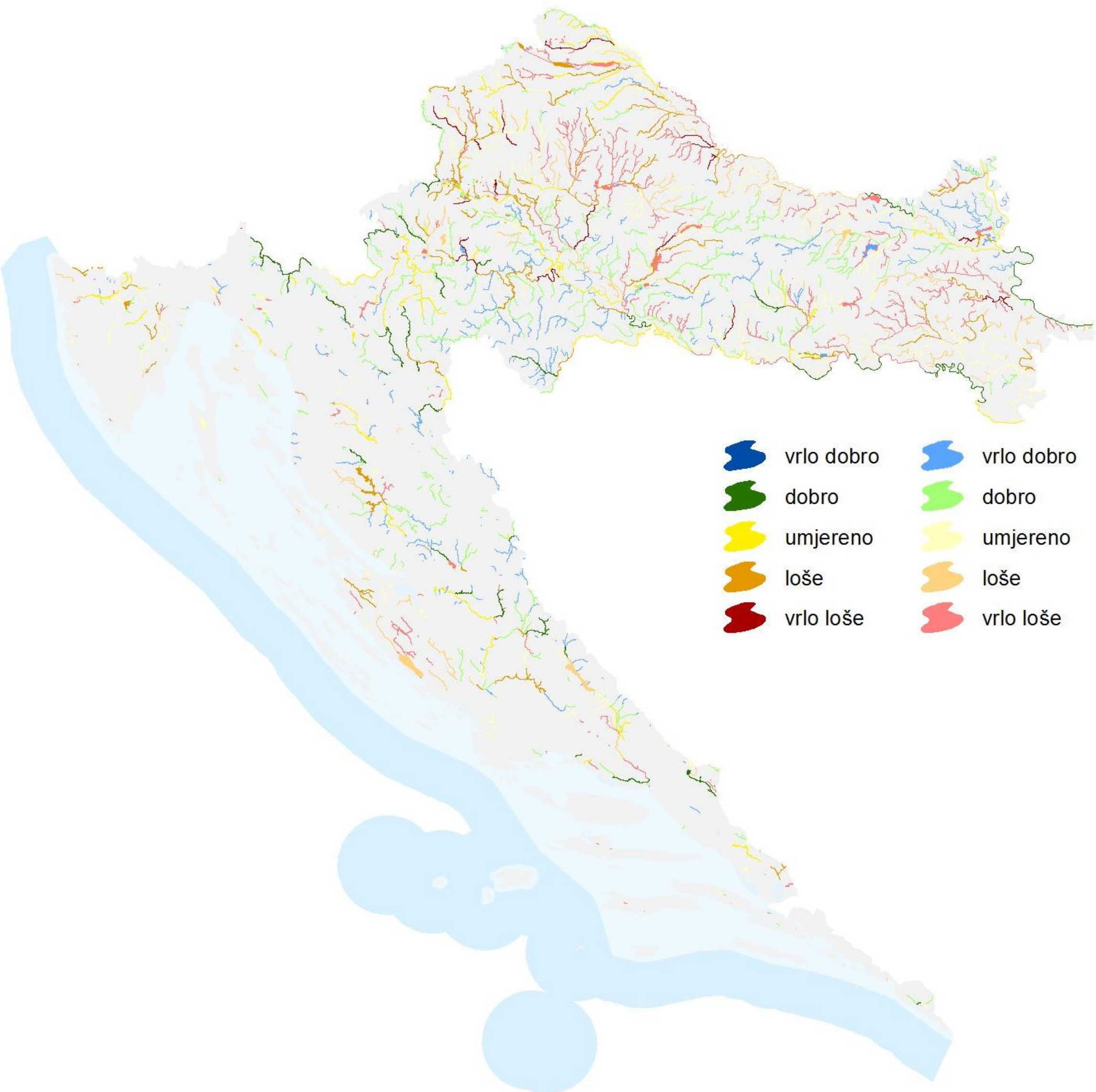
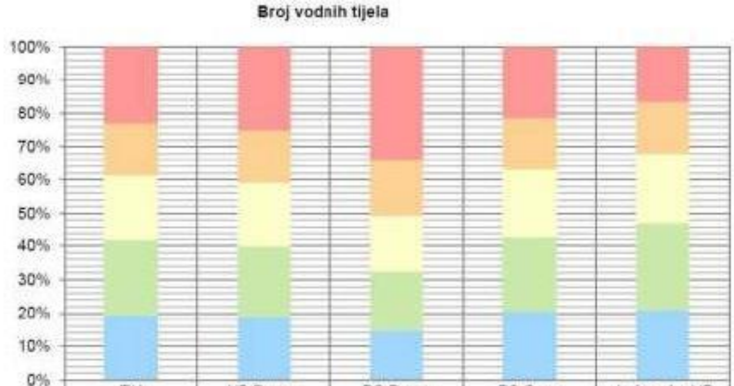


Figure 3.48 Ecological status of water bodies of rivers and lakes (Source: River Basin Management Plan 2016-2021)

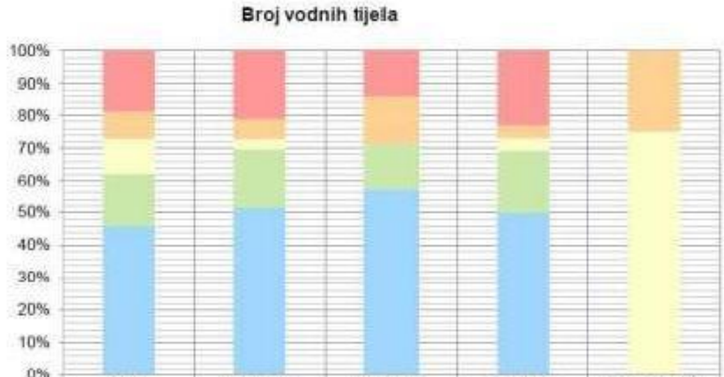
There are 1484 rivers on the territory of the Republic of Croatia. The ecological status of the water bodies varies significantly with all five classes of ecological status represented. All five classes of ecological status of rivers are approximately equally represented on the total territory of the Republic of Croatia. The majority of water bodies are assessed as having bad ecological status, counting 343 water bodies in this class. On the other hand, if we compare water bodies of moderate and good status with those of poor and bad status, the majority of water bodies have moderate or good ecological status. The distribution of classes also varies depending on the basin or sub-basin. The water bodies with best assessment are those of Adriatic basin, where nearly 47% of water bodies are assessed as having good or moderate ecological status, while the water bodies with worst assessments were those of Drava and Danube basin, with over 50% of water bodies with poor or bad ecological status. Distribution of rivers according to their ecological status is shown in the figure below (Figure 3.49).



	RH	VP Dunav	PS Drava	PS Sava	Jadransko VP
vrlo loše	343	283	110	173	60
loše	233	178	53	125	55
umjereno	290	216	54	162	74
dobro	330	236	57	179	94
vrlo dobro	288	213	47	166	75
broj vodnih tijela	1.484	1.126	321	805	358

Figure 3.49 Distribution of bodies of rivers according to their ecological status (Source: River Basin Management Plan 2016-2021)

Lakes in the Republic of Croatia have significantly better ecological status than rivers. The biggest part of them, 17 to be exact, is assessed as having good ecological status. This is approximately 46% of lakes in the Republic of Croatia. Still, the second most frequent class is that of bad ecological status with 7 lakes. The ecological status varies significantly between basins. In Danube basin, in which there is almost 90% of all lakes in the Republic of Croatia, the distribution of ecological statuses of bodies of lake corresponds to distribution of statutes on the whole territory of the Republic of Croatia. On the other hand, all lakes in Adriatic basin are assessed as having moderate or poor ecological status. The distribution of ecological status of bodies of lakes is shown in figure below. (Figure 3.50)



	RH	VP Dunav	PS Drava	PS Sava	Jadransko VP
vrlo loše	7	7	1	6	0
loše	3	2	1	1	1
umjereno	4	1	0	1	3
dobro	6	6	1	5	0
vrlo dobro	17	17	4	13	0
broj vodnih tijela	37	33	7	26	4

Figure 3.50 Distribution of bodies of lakes according to their ecological status (Source: River Basin Management Plan 2016-2021)

Chemical status of surface water bodies shows the presence of priority substances in the surface water, sediment and biota. Depending on the concentration rate of certain priority substances, surface water is classified into two classes of chemical status: good chemical status and good chemical status not achieved. Surface water body has a good chemical status if the average and maximum annual concentration of each priority substance does not exceed the established quality standards.

Nevertheless, the assessment of chemical status of rivers is based on the results of priority substances monitoring in rivers in water column. The indicators of the chemical status of sediment and biota are not assessed due to low number of measuring stations and inability to extrapolate the results. The chemical status of rivers and lakes in the Republic of Croatia is shown in the figure below. (Figure 3.51)

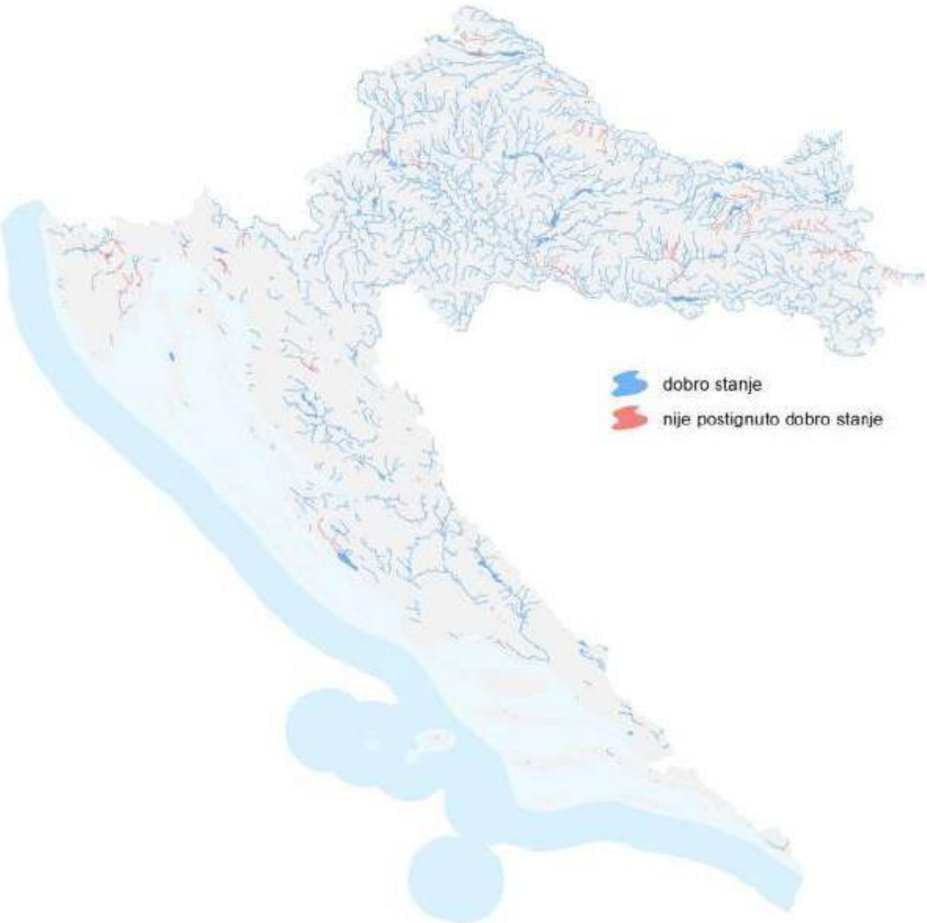
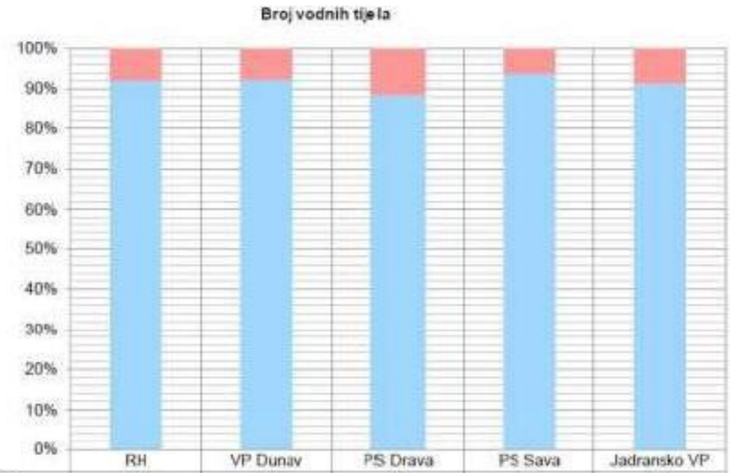


Figure 3.51 Chemical status of bodies of rivers and lakes (Source: River Basin Management Plan 2016-2021).

Around 8% of river bodies do not comply with the established environmental quality standards. In terms of length, it is slightly more than 9% of length of all rivers whose surface exceeds 10km^2. The most common pollutions are those caused by metal and metal compounds: mercury was found in 97 water bodies, while lead (37 water bodies) and nickel (29 water bodies) are less common. Pesticide active ingredients were endosulfan found in 8 water bodies, and in some cases, chlorphenvinphos, chlorpyrifos, pentachlorobenzene and hexaxhlorobenzene. From hydrocarbons group, the compounds found were polycyclic aromatic hydrocarbons: most common is fluoranthene (61 water bodies) and less common volatile halogenated hydrocarbons. Distribution of river bodies according to their chemical status is shown in figure below. (Figure 3.52)



	RH	VP Dunav	PS Drava	PS Sava	Jadransko VP
nije dobro	118	87	37	50	31
dobro	1.366	1.039	284	755	327
broj vodnih tijela	1.484	1.126	321	805	358

Figure 3.52 Distribution of river bodiesaccording to their chemical status (Source: River Basin Management Plan 2016-2021)

The assessment of chemical status of lakes is based on the results of priority substances monitoring in lakes during the period 2010-2012. As in the case of rivers, the assessment of the lakes that were not monitored was conducted by the numeric evaluation of impact of the known load, based on the intensity data and spatial arrangement of point sources and dispersive sources of pollution.

None of the lakes were assessed as having concentration of priority substances higher than allowed, which indicates that all lakes have good chemical status.

3.3.6.2 Coastal and transitional waters

Ecological and chemical status of coastal and transitional waters

The typology of water is a main criterion in defining coastal and transitional water. On the territory of the Republic of Croatia, 26 coastal waters bodies and 26 transitional waters bodies have been defined.

Coastal waters comprise surface waters on the landward side of the line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters. The inner limit is a line of low water along the cost. By applying the said criteria for determining the limit of coastal waters, offshore islands Vis and Biševo are excluded from the area of coastal waters. Since it is necessary to protect all islands, the coastal area within 1 nautical mile from the islands of Vis and Biševo is considered as coastal water.

Transitional waters are present in the areas of contact of coastal water and land, where the sea substantially influences the dynamics of water movement and chemical and ecological features of freshwater. These water bodies are found in the vicinity of river mouths which are partly saline as a result of their proximity to the coastal waters, but which are significantly influenced by freshwater flows. Bigger rivers influenced by the sea are Dragonja, Raša and Mirna in Istria, Rječina in the Kvarner region and Zrmanja, Krka, Jadro, Cetina, Lower Neretva and Ombla in Dalmatia.

For the purpose of the chemical status assessment, a priority substances monitoring has been conducted in all transitional and coastal waters bodies. The chemical status of coastal (Figure 3.53) and transitional waters (Figure 3.53) is shown in the figures below.

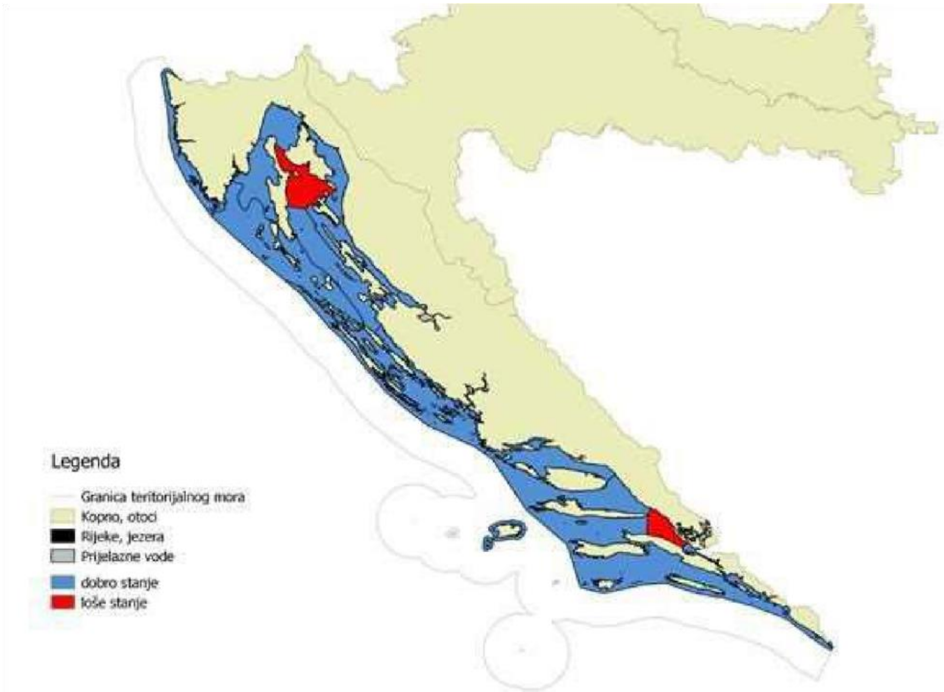


Figure 3.53 Spatial distribution of chemical status by groups of bodies of coastal waters (Source: River Basin Management Plan 2016-2021)

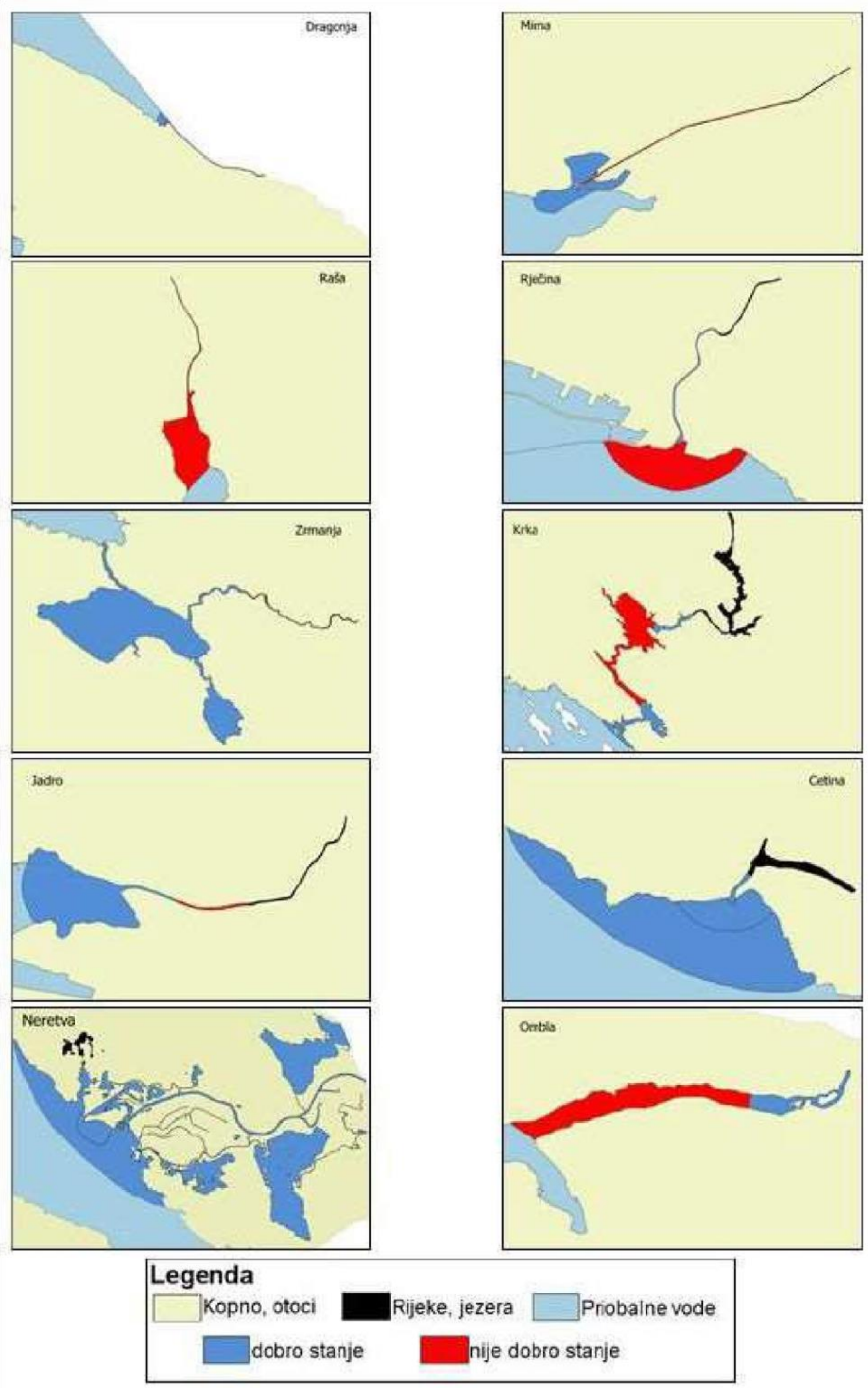


Figure 3.54 Spatial distribution of chemical status by groups of bodies of transitional waters (Source: River Basin Management Plan 20162021).

The results imply good chemical status in 68% of groups of transitional water bodies and in 84.6% of groups of coastal water bodies. Good chemical status has not been achieved in 7 groups of bodies of transitional water: rivers Ombla, Jadro, Krka, Rječina, Raša and Mirna. The reason for not achieving good chemical status is the concentration of pesticides from the group of chlorinated carbohydrates that exceeds threshold limit value. Good chemical status has not been achieved in 4 bodies of coastal waters: Neretva canal outside the port of Ploče, port of Split, Bay of Bakar and northern part of Kvarnerić (a part of Kvarner region). The reason for not achieving good chemical status in these water bodies is the presence of tributyltin which exceeds threshold limit value. The distribution of chemical status of transitional and coastal water bodies is shown in figure below. (Figure 3.55)

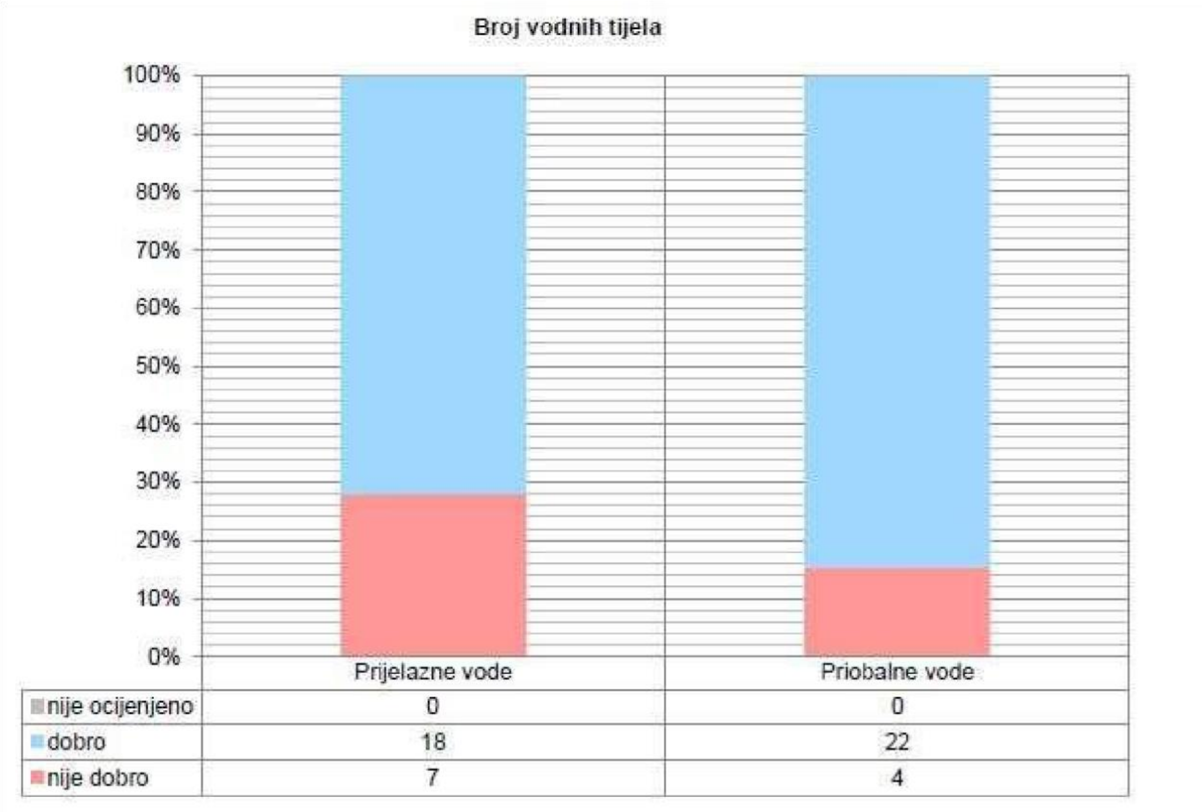


Figure 3.55 Chemical status of transitional and coastal water (Source: River Basin Management Plan 2016-2021)

For the purpose of elaboration of the River Basin Management Plan, an analysis of certain quality elements has been conducted for each transitional and coastal water body. According to the results of the analysis, the ecological status of the bodies has also been determined. Figures below show ecological status of coastal (Figure 3.56) and transitional wate bodies (Figure 3.57).

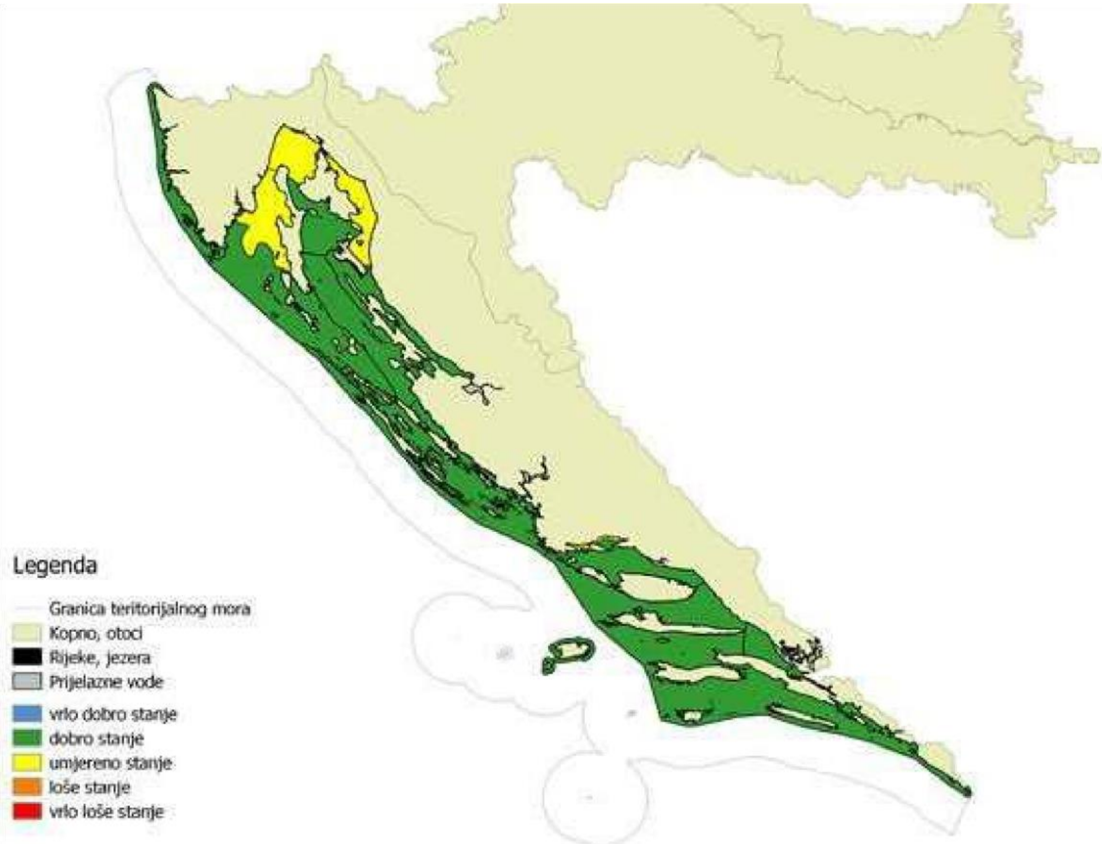


Figure 3.56 Spatial distribution of ecological status of groups of bodies of coastal water (Source: River Basin Management Plan 2016-2021)

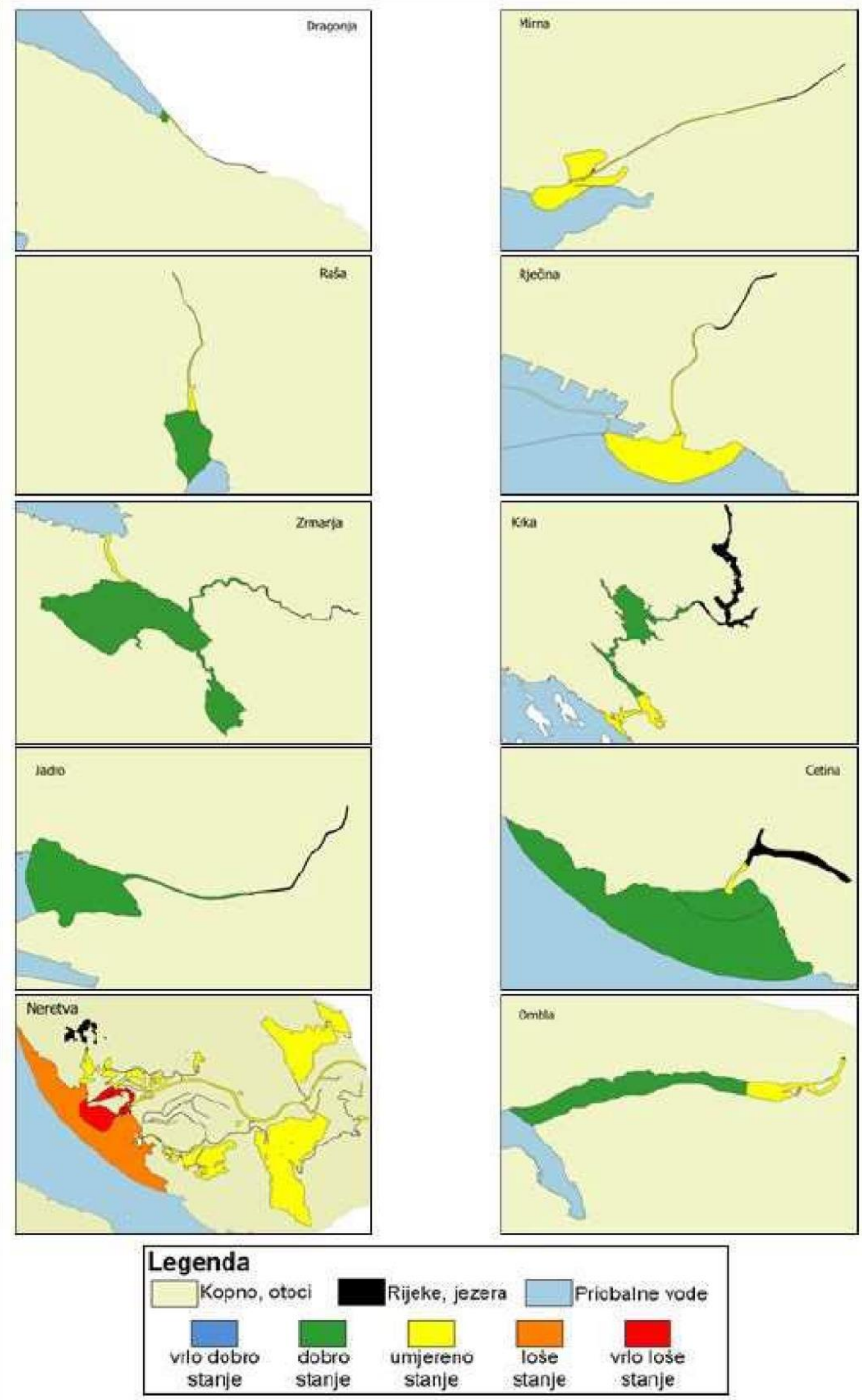
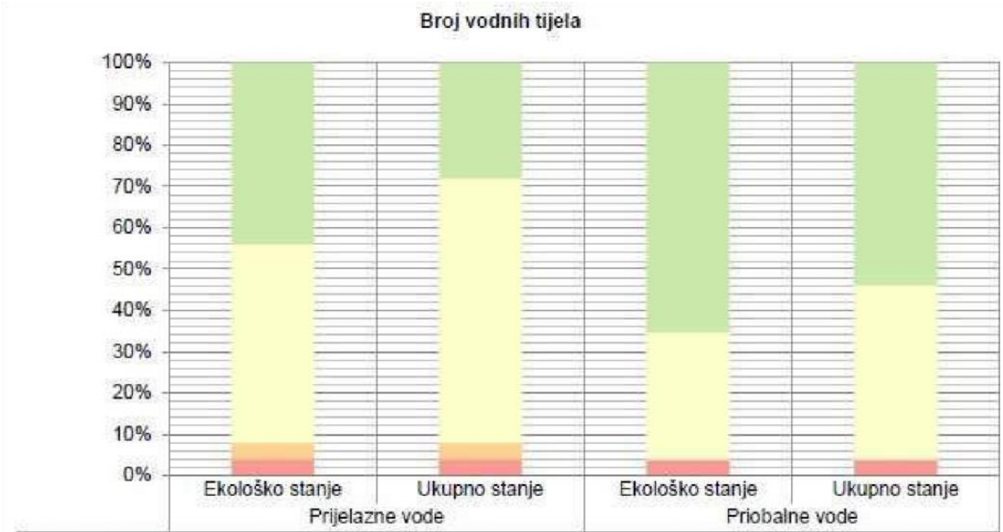


Figure 3.57 Spatial distribution of ecological status by groups of bodies of transitional water (Source: River Basin Management Plan 2016-2021)

Very good ecological status has not been found in any of the water body groups. Good ecological status has been found in 44% of the transitional water bodies and in 65.4% of the coastal water bodies. Moderate ecological status has been found in 48% of the transitional water bodies and 30.8% of coastal water bodies. Poor ecological status has been found in 4% of the transitional water bodies while no area in coastal water has been assessed as having bad ecological status. Bad ecological status has been assessed in 1 of both water body types, i.e. 4% of the transitional water bodies and 3.9% of the coastal water bodies. The distribution of ecological and overall status of transitional and coastal water is shown in figure below. (Figure 3.58)



	Prijelazne vode – Ekološko stanje	Prijelazne vode – Ukupno stanje	Priobalne vode – Ekološko stanje	Priobalne vode – Ukupno stanje
nije ocijenjeno	0	0	0	0
vrlo dobro	0	0	0	0
dobro	11	7	17	14
umjereno	12	16	8	11
loše	1	1	0	0
vrlo loše	1	1	1	1

Figure 3.58 Ecological and overall status of transitional and coastal waters (Source: River Basin Management Plan 2016-2021)

Overall status of transitional water bodies has been assessed as 28% good, 64% moderate and 4% as poor or bad. Overall status of coastal water is somewhat better, i.e. it has been assessed as good in 53.9% cases, 42.3% as moderate and 3.9% as bad.

3.3.6.3 Groundwater

According to the Water Framework Directive and Croatian Water Act, groundwater means all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

By applying the criteria set out in the Water Framework Directive, there are 461 groundwater bodies (hereinafter referred to as GWB) on the territory of the Republic of Croatia. The selected GWB comprise 55 867km^2 of the land territory of the Republic of Croatia, including 11 big islands which use groundwater for the public water supply. The rest of the islands do not include selected GWB. Due to impossible management of such great number of GWB, many of which have extremely small surface, GWB were divided into groups.

Due to significant differences in hydro-geological features of the Pannonian region of the Republic of Croatia and its Adriatic region, groundwater is divided into two basins, Danube River Basin and Adriatic Sea Basin. Therefore, GWB status is also described separately for each basin.

GWB status is assessed based on the groundwater quantity and quality, which may be good or poor. Good status is based on meeting the requirements set out in the Water Framework Directive and the Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration. In order to achieve the satisfying result that meets the requirements, a classification is carried out. The poorest result of all tests is taken into consideration for overall assessment of the groundwater body.

3.3.6.3.1 Chemical status of groundwater

The groundwater assessment in the Republic of Croatia is conducted in several phases. First phase consists of an analysis whose purpose is to determine whether classification of GWB should be conducted. The analysis aims to determine whether any of the listed parameters exceeds threshold value (hereinafter referred to as TV) at any point of monitoring. If none of the relevant locations within GWB exceed TV, GWB is assessed as having good condition. In case this requirement is not met, classification tests are conducted.

Chemical analysis data from the National groundwater monitoring and monitoring of raw water at drinking water wells in the period 200-2013 and partly in 2014.

For the purpose of elaborating the River Basin Management Plan, the chemical status assessment has been conducted on all bodies of groundwater in the Pannonian region of Croatia, distributed in groups excluding the group of groundwater bodies of Zagreb, where the assessment of water bodies has been conducted on basic water bodies for multiple reasons: significant heterogeneity of hydro-geological features (lithologic composition of sediments, hydrogeological parameters), variable conditions of recharge of aquifers, numerous point and diffuse sources of pollution and extremely variable vulnerability of aquifers in different areas of the group of water bodies, ranging from very low to very high. GWB chemical status in the Pannonian part of the Republic of Croatia is shown in table on the right. (Table 3.20)

Table 3.20 Chemical status of groundwater body in the Pannonian part of Croatia (Source: River Basin Management Plan 2016-2021)

GWB code	Name of GWB	Total status assessment
CDGI_18	Međimurje	good
CDGI_19	Area of Varaždin	poor
CDGI_20	Bednja River Basin	good
CDGI_21	Legrad - Slatina	good
CDGI_22	Novo Virje	good
CDGI_23	Eastern Slavonia – Drava River Basin and Danube River Basin	good
CSGI_24	Sutla River Basin and Krapina River Basin	good
CSGN_25	Basin Lonja – Ilova - Pakra	good
CSGN_26	Orljava River Basin	good
CSGI_27	Zagreb	good
CSGI_28	Lekenik Lužani	good
CSGI_29	Eastern Slavonia – Sava River Basin	good
CSGI_30	Žumberak – Samoborsko gorje	good
CSGI_31	Kupa	good
CSGI_32	Una	good

In the Pannonian region of Croatia, only the area of Varaždin of all groups of GWB is assessed as having poor chemical status. The reason for such a poor result is an average value of nitrate in GWB, which in considerable number of quarters exceeds threshold values of the“General quality assessment”. Spatial distribution of GWB chemical status in the Pannonian region of the Republic of Croatia is shown in the figure below (Figure 3.59).

Figure 3.59 Spatial distribution of chemical status of groundwater bodies in Pannonian Croatia (Source: River Basin Management Plan 2016-2021).

In the group of groundwater of Zagreb, only the basic groundwater body has been assessed with a high level of reliability as having poor chemical status. This basic body has poor chemical status due to average value of sum of trichloroethylene and tetrachloroethylene in GWB, which in considerable number of quarters in 2012 and 2013 exceeds threshold value of the “General quality assessment”. Since this basic body covers 2.6% of the total surface of the whole group of bodies and the pollution neither spreads nor endangers good chemical status of the rest of the body and surface water connected to groundwater, the group body of Zagreb has been assessed as having good status.

In the karst area for selected GWB conceptual models were elaborated in order to describe conditions of the groundwater flow. Basic analysis of the quality of groundwater has been conducted on 16 selected GWB. Based on these results, two more GWB were isolated which were considered as separate GWBs in further analysis. These two bodies of groundwater are South Istria (wider area of Pula) and Bokanjac-Poličnik (region of Ravni Kotari).

The assessment of the general chemical status of groundwater has been conducted on 18 GWB in total. The testing has shown with high reliability that 6 GWB has good quality status of groundwater. Classification tests have been conducted for other GWB. According to the results of classification tests, only two GWB have been assessed as having poor chemical status. GWB Southern Istria (JKGN-03) has nitrate concentration above threshold value on a large number of monitoring points. Another GWB with poor chemical status is GWB Bokanjac-Poličnik (JKGN-09), with intrusion of saltwater. Chemical status of GWB in the karst region of the Republic of Croatia is shown in the table on the right (Table 3.21). Spatial distribution of GWB chemical status in the karst region of the Republic of Croatia is shown in the figure below (Figure 3.60).

Table 3.21 Chemical status of groundwater bodies in the karst region (Source: River Basin Management Plan 2016-2021)

GWB code	Name of the GWB	Total status assessment
JKGI-01	Northern Istria	good
JKGI-02	Central Istria	good
JKGI-03	Southern Istria	poor
JKGI-04	Bay of Rijeka	good
JKGI-05	Rijeka – Bakar	good
JKGI-06	Lika – Gacka	good
JKGI-07	Zrmanja	good
JKGI-08	Ravni kotari	good
JKGI-09	Bokanjac - Poličnik	poor
JKGI-10	Krka	good
JKGI-11	Cetina	good
JKGI-12	Neretva	good
JOGN-13	Adriatic islands	good
CSGI-14	Kupa	good
CSGN-15	Dobra	good
CSGN-16	Mrežnica	good
CSGN-17	Korana	good
CSGN-18	Una	good

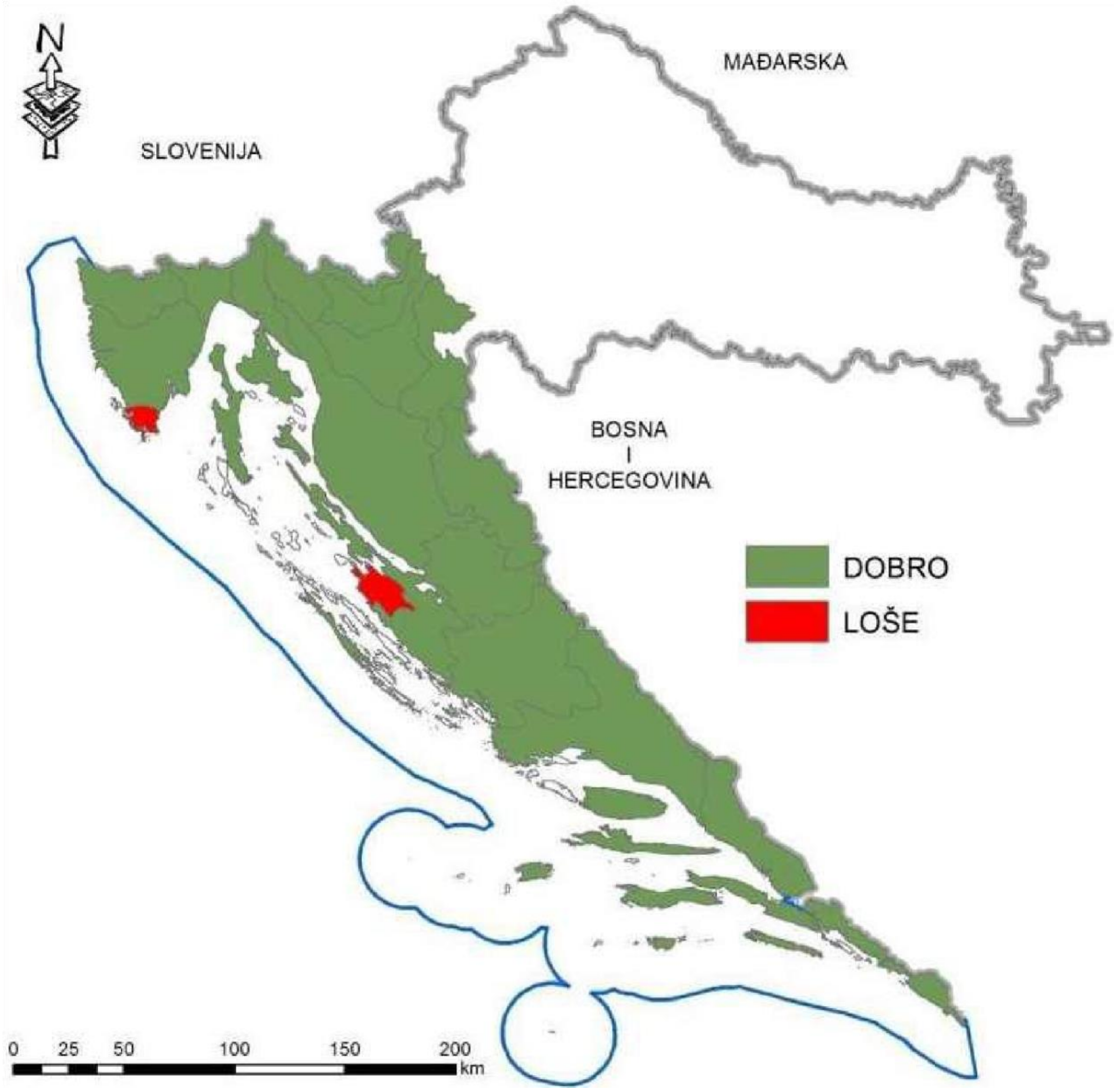


Figure 3.60 Spatial distribution of groundwater chemical status in the karst area of the Republic of Croatia (Source: River Basin Management Plan 2016-2021).

3.3.6.3.2 Quantity status of groundwater

Precipitation and flow data from the database of Meteorological and Hydrological Institute of Croatia and data on the abstraction of groundwater used for public water supply and other purposes taken from the database of Hrvatske vode (institution for water management in Croatia) have been used for the assessment of the quantity status of groundwater. Relevant classification tests have been conducted in order to assess the quantity status of groundwater.

The quantity status of all GWB in the Pannonian region of Croatia has been assessed on individual groundwater bodies. All GWB have been assessed with high level of reliability as having good quantity status, except for the bodies of groundwater of Zagreb, which has been assessed as having good quantity status, but with low level of reliability. Renewable resources and abstracted quantity of groundwater in the Pannonian region of the Republic of Croatia are shown in table below. The data shown in the table indicates that there is significantly less abstracted groundwater than the renewable resources of groundwater in all GWB.

Table 3.22 Renewable resources and abstracted quantity of groundwater in the Pannonian region (Source: River Basin Management Plan 2016-2021)

GWB code	GWB name	Renewable resources (m^3/year)	Abstracted quantity (m^3/year)	Abstracted quantity as percentage of renewable resources (%)
CDGI_18	Međimurje	$1,13*10^8$	$6,39*10^6$	5,65
CDGI_19	Area of Varaždin	$8,80*10^7$	$1,06*10^7$	12,05
CDGI_20	Bednja River Basin	$5,20*10^6$	$2,13*10^6$	4,10
CDGI_21	Legrad - Slatina	$3,62*10^8$	$8,83*10^6$	2,45
CDGI_22	Novo Virje	$1,80*10^7$	0	0
CDGI_23	Eastern Slavonia – Drava River Basin and Danube River Basin	$4,21*10^8$	$2,23*10^7$	5,30
CSGI_24	Sutla and Krapina River Basin	$8,20*10^7$	$7,44*10^6$	9,07
CSGN_25	Lonja – Ilova – Pakra River Basin	$2,19*10^8$	$3,48*10^6$	1,59
CSGN_26	Orljava River Basin	$1,34*10^8$	$3,83*10^6$	2,86
CSGI_27	Zagreb	$2,73*10^8$	$1,33*10^8$	48,72
CSGI_28	Lekenik – Lužani	$3,66*10^8$	$3,51*10^6$	1,00
CSGI_29	Eastern Slavonia – Sava River Basin	$3,79*10^8$	$1,60*10^7$	4,22
CSGI_30	Žumberak –Samobor Hills	$1,39*10^8$	$3,77*10^6$	2,71
CSGI_31	Kupa	$2,87*10^8$	$1,19*10^7$	4,15
CSGI_32	Una	$5,40*10^7$	$3,42*10^5$	0,63

The assessment of the groundwater quantity status in the karst area of the Republic of Croatia is conducted based on the analysis of climatic conditions monitoring data, groundwater leakage and respective surface water and data on the usage of groundwater for each GWB. The chemical status of GWB in the karst area of the Republic of Croatia is shown in the table below (Table 3.23).

Table 3.23 Quantity of GWB in the karst area of Croatia (Source: River Basin Management Plan 2016-2021)

Code	GWB	Total water utilization (m^3/year)	Renewable resources of groundwater (m^3/year)	% of used water	Status assessment	Reliability assessment
JKGI-01	Northern Istria	18,3*106	4,41*108	4.16	good	low
JKGN-02	Inner Istria	4,98*106	7,71*108	0.65	good	low
JKGN-03	Southern Istria	1,3*106	3,15*107	4.08	good	low
JKGI-04	Bay of Rijeka	1,17*106	5,81*108	0.20	good	low
JKGI-05	Rijeka – Bakar	24,16*106	9,73*108	2.48	good	low
JKGN-06	Lika – Gacka	8,99*106	3,87*109	0.23	good	low
JKGN-07	Zrmanja	19,3*106	1,68*109	1.15	good	low
JKGN-08	Ravni Kotari	3,63*106	2,99*108	1.21	good	low
JKGN-09	Bokanjac – Poličnik	10,06*106	7,24*107	13.88	poor	low
JKGI-10	Krka	20,47*106	1,24*109	1.65	good	low
JKGI-11	Cetina	55,63*106	1,83*109	3.05	good	low
JKGI-12	Neretva	13,18*106	1,30*109	1.01	good	low

Code	GWB	Total water utilization (m^3/year)	Renewable resources of groundwater (m^3/year)	% of used water	Status assessment	Reliability assessment
JOGN-13	Adriatic Islands	3,22*106	1,22*108	0.26	good	low
CSGI-14	Kupa	1,61*106	1,43*108	0.11	good	low
CSGI-15	Dobra	1,10*106	7,58*108	0.15	good	low
CSGI-16	Mrežnica	3,70*106	1,32*109	0.28	good	low
CSGI-17	Korana	0,38*106	8,70*108	0.04	good	low
CSGI-18	Una	1,17*106	1,59*108	0.07	good	low

Only GWB Bokanjac – Poličnik has been assessed as having poor status, as a consequence of the overuse of renewable resources of groundwater during long periods of summer drought at Bokanjac intake. The same results would probably be the same for GWB Southern Istria, where some of the previously abandoned wells of Vodovod Pula have been reactivated during the extreme drought in 2012 which caused an excessive concentration of chloride in the water.

3.3.6.4 Water intended for human consumption

There are 16 protected areas of surface water in the Republic of Croatia and 320 protected areas of groundwater from which the water is being abstracted or are designated for the abstraction of water intended for human consumption. No additional quality standards are prescribed for this type of protected areas; therefore, they are assessed according to the criteria generally applicable to surface water and groundwater. It is partly connected to the fact that for groundwater, which make the majority of the protected areas of water intended for human consumption, high standards are prescribed for a number of key quality indicators, equal to those of quality standards for the water intended for human consumption.

A special protection of drinkable water is achieved by defining the zone of sanitary protection of water sources used for the public water supply. The zones of sanitary protection are determined in accordance with the Directives for the determination sanitary protection zones (OG 66/11, 47/13), the provisions of which do not refer to the water sources for industrial use of water and sources that are out of use. Figure below shows the zones of sanitary protection of water sources on the territory of the Republic of Croatia (Figure 3.61).

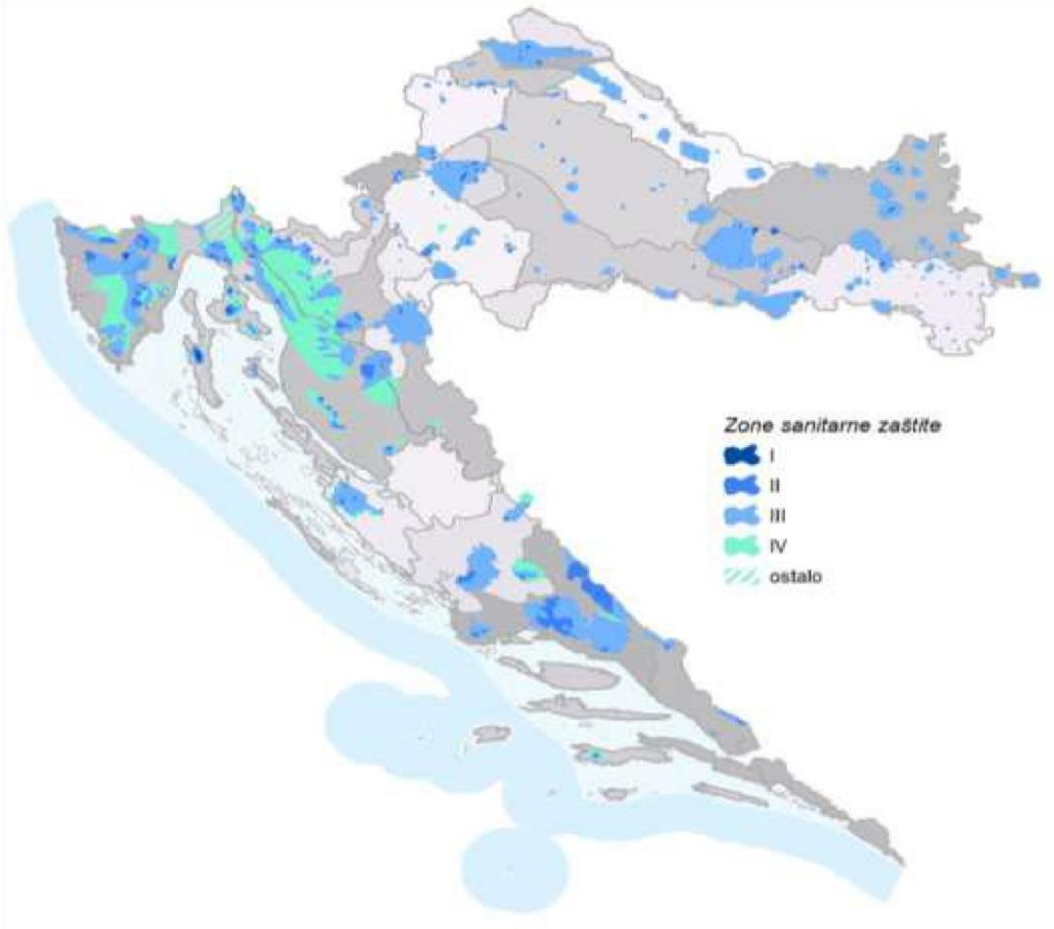


Figure 3.61 Zones of sanitary protection of water sources intended for human consumption (Source: River Basin Management Plan 20162021)

3.3.6.5 Flood danger and flood risk

Floods are rare natural phenomena that cannot be avoided; however, the risk of flooding may be decreased to an acceptable level by taking preventive construction or other measures. As set out in the River Basin Management Plan 2016-2021, flood management is conducted through a concept of flood risk management.

Flood risk is a combination of probability of flooding and its potential harmful damage to people's health, cultural heritage or economic activities. For the purpose of risk assessment, a preliminary flood risk assessment has been undertaken during elaboration of Flood Risk Management Plan, Food Hazard Maps and Flood Risk Maps have been elaborated retrospectively.

Flood hazard maps and Flood risk maps are elaborated for low, medium and high probability of flooding. Flood hazard maps are produced on a scale of 1:25,000 for all areas affected by flood or having potential significant flood risk, i.e. for all the areas that have been identified during preliminary assessment stage as the areas with potential significant flood risk. Flood hazard map covering low, medium and high probability of occurrence of flooding events is shown in figure below (Figure 3.62).

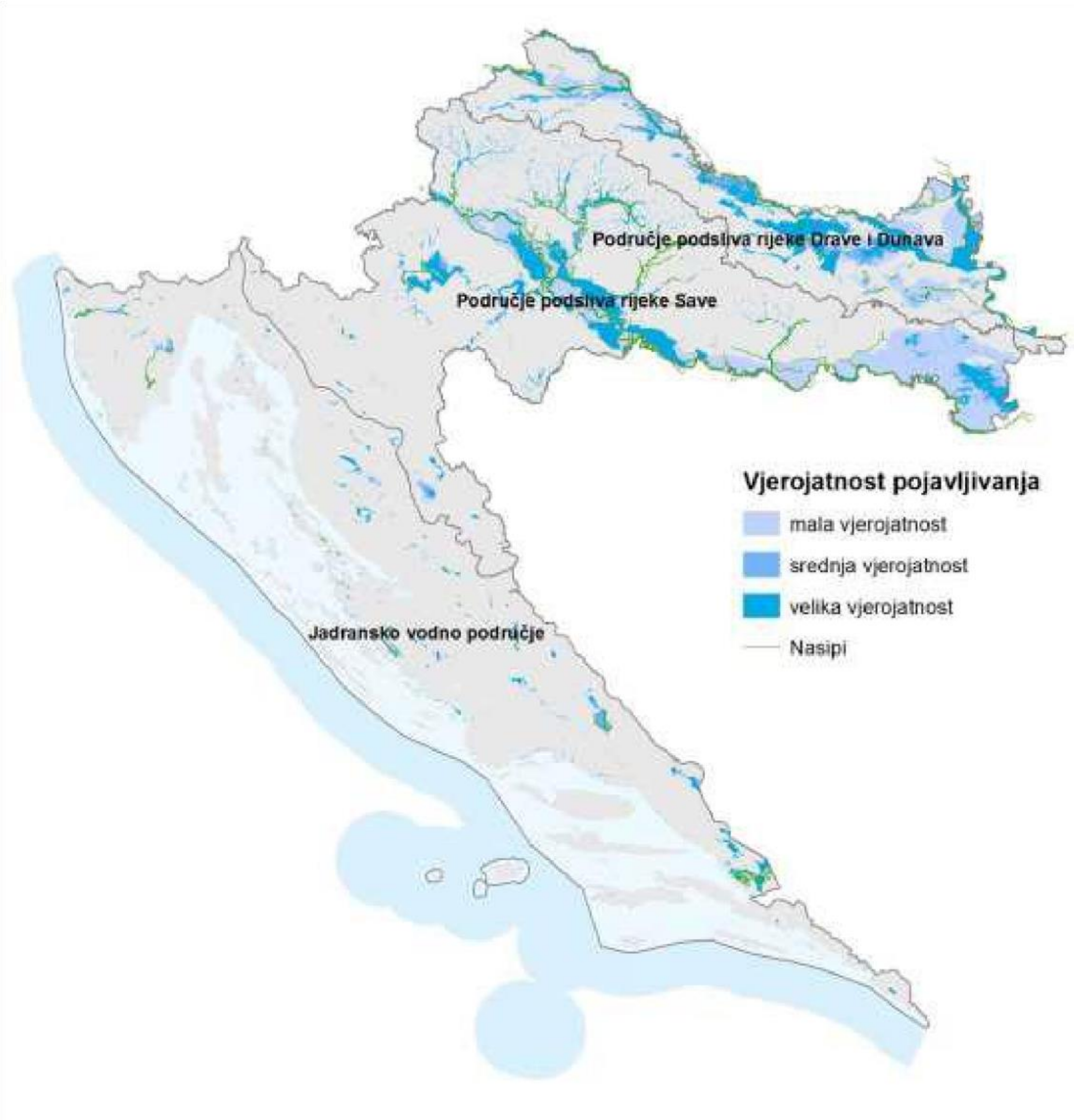


Figure 3.62 Flood Hazard Map with low, medium and high probability of occurrence of flooding event (Source: River Basin Management Plan 2016-2021)

Flood lines defined on the Flood Hazard and Flood Risk Maps show that potential significant flood risk is present on 6.2 % of the land territory of the Republic of Croatia in case of high probability of occurrence of flooding events, on around 8.1% of the territory for medium probability of flooding and on 17.1 % of the territory for low probability of flooding events. As for the river basins, Danube River Basin is at considerably larger danger of flooding than the Adriatic basin. Taking into account floods with low probability of occurrence, one fourth of the Danube River Basin is at flood hazard, while only 3.9 % of the Adriatic Basin faces the same hazard. The surfaces of flooded areas for three scenarios of probability of occurrence of flooding event are shown in table below (Table 3.24).

Table 3.24 Surface of flooded areas for three scenarios according to elaborated Flood Hazard Maps (Source: River Basin Management Plan 2016-2021).

		Low probability	Medium probability	High probability	Land and islands total
Adriaic Basin	km^2	829	534	286	21.445
	%	3.9%	2.5%	1.3%	100.0%
Danube River Basin	km^2	8.818	4.049	3.218	35.117
	%	25.1%	11.5%	9.2%	100.0%

Sava River Sub-basin	km²	5.341	2.209	1.820	26.764
	%	20.0%	8.3%	6.8%	100.0%
Drava and Danube River Sub-basin	km²	3.477	1.840	1.398	9.363
	%	37.2%	19.7%	14.9%	100.0%
Republic of Croatia	km²	9.646	4.583	3.503	56.562
	%	17.1%	8.1%	6.2%	100.0%

Flood Risk Maps show potential harmful damage in the areas for which flood hazard maps have been preliminarily elaborated for the analyzed scenarios (low, medium and high probability of flooding event) taking the following into account:

- indicative number of inhabitants potentially affected by flooding
- type of potentially affected economic activities in the area
- industrial facilities and equipment that may cause accidental pollution in case of flood and potentially affect protected areas and
- other information

Flood Risk Maps are produced at 1:25.000 scale and are publicly available on a website. According to the available data, Flood Risk Maps contain the following data:

- Number of potentially affected inhabitants by village, displayed in three categories (0-100, 101-1000 and 1001-100000)
- Facilities with considerable number of vulnerable people, such as hospitals, schools, pre-school facilities, retirement homes
- Economic activities and land cover within the area affected by flood grouped by categories (populated areas, entrepreneurial zones, sports and recreational facilities, intensive agriculture, other agricultural activities, forests and low vegetation, marsh zones and poor vegetation, water surfaces)
- Different infrastructures such as water intakes, airports, railway and bus stations, substation, railroads, dams, motorways, other roads (data taken from authorities and/or collected from public data sources)
- Protected areas such as national parks, protected natural valuables (areas for preservation of species and habitat types, drinking water protected areas and bathing areas) and possible significant pollutants such as industrial facilities, landfill sites and water treatment plants
- Cultural heritage and sights (areas under the protection of UNESCO).

3.3.7 Cultural and historical heritage

Representation and proximity of architectural heritage (individual structures and cultural and historical complexes, cultural landscapes), archaeological zones and sites listed in the Register of cultural goods of the Republic of Croatia and recorded physical planning documents within the scope of the Strategy

Croatia is a Mediterranean and Central European country by its geographical and cultural definition. On its territory there could be found traces and remains of urban and architectural culture dating from prehistoric era, Illyrian hill forts (6th/5th century B.C.) and first Greek cities in the Adriatic (4th century B.C.), Roman camps and cities, medieval and renaissance cities, cities dating from the Baroque period or 19th century, and even modern cities of 20th century. The architectural heritage of Croatia is more than just cultural goods of high value and of national importance and those inscribed on the UNESCO's list of cultural heritage, it also consist of modest examples of historical buildings, urban and rural settlements, archaeological localities and landscapes formed by man. This is a materialized history that determines the identity of the territory and in this way the cultural heritage of Croatia contributes to European cultural diversity. Over 2500 years of urban culture and architectural tradition of Croatia mark the autochthony born from this climate, topographic features of the territory, skills and creation of constructors and social and economic circumstances.

Rich and various cultural heritage of Croatia is categorized according to the basic division of heritage into tangible (movable and immovable) and intangible heritage. The most numerous type of immovable cultural heritage, which is in great measure exposed to the influence of changing purpose and way of use, is an architectural heritage (individual structures and complexes, cultural and historical settlements, historic parts of settlements, historic remains of civil engineering, industrial facilities with equipment and similar facilities), cultural landscapes (designed: gardens and parks; organically developed landscapes and associative cultural landscapes: memorials, historic events localities) and archaeological zones and sites, including submarine zones and sites.

Archaeological sites are often being discovered during construction work or during recreational diving in case of submarine sites, while the level of perseverance varies from intact remains to the heavily damaged ones. Nevertheless, the importance of archaeological sites is of greatest importance to Croatian and world culture and science. Many of them are inscribed on the World Heritage list or have been recognized by European projects as localities that have strongly affected the history of civilization during Prehistory and Antiquity, while lately even the Medieval and New Age localities are being found.

A cultural landscape is a type of immovable cultural heritage having historically characteristic features that witness human presence in the area, and they represent a piece made both by a man and nature that illustrates the development of the community and its territory through the course of history. In the Republic of Croatia many characteristic types of cultural landscapes can be found which make an integral element of its spatial identity. On this rather small territory of various geomorphologic and microclimate features, diverse cultural landscapes have been created through the history that can be comparable to the Mediterranean and Central European regions of Europe. Being a life environment they are subject to changes, frequently deteriorated by the social and technological development, urbanization and other forms of construction, but also due to abandonment or inappropriate use. In many areas of Croatia there are historical cultural landscapes that have preserved traditional spatial relations, historical patterns and way of use (rural landscapes of Lonja field, Žumberak, central Istria, karst fields of Dinaric Alps, Gorski kotar, Neretva valley, some parts of coastal Croatia, off-shore islands etc.) Only one area of the cultural landscape has so far been preventively protected in Croatia: Žumberak – Samoborsko gorje – Plješivičko prigorje.

Other types of heritage, such as movable heritage (museum collections, gallery collections, library collections and other collections in public or private institutions, church inventory, archives, pieces of art, applied arts, design arts, ethnographic objects, old and rare books, money, objects in use) and intangible cultural heritage (various forms of spiritual creation, languages, dialects, oral literature, folklore creations and other traditional folk valuables, traditional arts and crafts) are less exposed to physical influence of development and application of modern technology.

The number of cultural goods listed in the Register of Cultural Goods of the Republic of Croatia is not constant due to their variable features.

On April 4, 2017 a total number of permanently and preventively protected immovable and movable cultural goods was 9376, 6231 of which are individual immovable cultural goods and groups of cultural goods (including historical areas and continental and submarine archaeological localities), and 2387 individual movable goods (including museum, archive, library and private collections). There are 159 protected intangible cultural goods. The total number of archaeological cultural goods is 965, 873 of which are archaeological sites and 92 archaeological zones.

Moreover, Conservation departments record at least three times more archaeological localities and at least three times more potential indicative toponymes. This is only a rough indicator of richness of Croatia's archeological heritage.

A map showing their representation has been elaborated according to the number of cultural goods in each county. The data set forth indicates the sensitivity of the county's territory to planned changes.

Table 3.25 Intangible cultural goods listed in the Register of cultural goods of the Republic of Croatia by county (permanently and preventively protected, status in 04/2017)

County	Individual structures	Cultural-historical areas	Archaeological heritage	Cultural landscape
Bjelovar-Bilogora	175	8	15	0
Brod-Posavina	111	4	49	0
Dubrovnik-Neretva	453	22	129	1
City of Zagreb	589	35	8	1
Istria	212	58	85	2
Karlovac	235	13	2	0
Koprivnica-Križevci	127	5	12	0
Krapina-Zagorje	195	13	23	0
Lika-Senj	192	14	33	0
Međimurje	54	3	7	0
Osijek-Baranja	301	19	139	0
Požega-Slavonia	114	5	60	0
Primorje-Gorski Kotar	278	97	51	1
Sisak-Moslavina	229	23	32	0
Split-Dalmacija	864	112	185	4
Šibenik-Knin	257	18	65	1
Varaždin	177	5	36	1
Virovitica-Podravina	56	2	41	1
Vukovar-Srijem	143	5	79	0
Zadar	183	19	72	0
Zagreb	283	22	9	1

Beside cultural goods protected by the Decision on protection and Decision on preventive protection of cultural goods, numerous examples of cultural heritage, mostly of local value, are recorded in documents of physical planning (physical planning of the county and physical planning of the city/municipality). The said cultural heritage is protected by implementing provisions of physical planning documentation on county, city and municipality level. Within the scope of the lower levels of physical planning documentation (Urban plans and Detailed plans), more detailed protection measures have been set out.

The analysis of the data available in physical planning documents of the counties has shown that the number of recorded goods is multiply higher than the one listed in the Register of cultural goods, especially in the categories of cultural-historical areas – rural settlements and archaeological localities. It should be mentioned that, apart in Spatial planning documentation, a great number of archaeological sites is recorded and recognized during the elaboration of the study on environmental impact and through archaeological research conducted prior to large infrastructure projects: construction of traffic, energetic and communal infrastructure and other construction projects. Archaeological site recording is being conducted regularly by museums, archaeological institutions and Conservatory Departments.

3.3.8 Agriculture

3.3.8.1 Land of level P1 and level P2 value

Pursuant to Article 20 of the Agricultural Land Act (OG 39/15, 48/15), a study has shown that the land of P1 and P2 value which represents a valuable land resources should be protected from conversion and should be solely and exclusively used for agricultural production which is not always possible to achieve. Other types of land, categorized as P3 (other arable land), N1 (temporary inappropriate land) and N2 (permanently inappropriate land) are not included in this study since P1 (particularly valuable arable land) and P2 (valuable arable land) are considered having the greatest value from the economic aspect of agriculture.

Considering the fact that distribution and surface area data of certain land categories are not available in Croatia, that is, considering the fact that different methods of land evaluation have been used in elaboration of each county's physical plans and that these data are not comparable, for the purpose of this Study a data from digital soil map of the Republic of Croatia have been used.

Land of P1 and P2 value on the territory of the Republic of Croatia are shown in table (Table 3.26) and figure (Figure 3.63) below.

Table 3.26 Land of P1 and P2 value in the Republic of Croatia (Source: Digital Soil Map of the Republic of Croatia)

Land value	Surface (ha)	Share in total surface of Croatia (%)
Particularly valuable arable land (P1)	266 715	4.71
Valuable arable land (P2)	805 513	14.23

Particularly valuable arable land (P1) and valuable arable land (P2) are dominant in the Pannonian region of Croatia and Istria, while there are only few in the region of Dinaric Alps. The fact that in the region of the Dinaric Alps the number of particularly valuable arable land is extremely low and the number of valuable arable land is low indicates the need for maximum protection of these lands in accordance with the regulatory requirements from all kinds of deterioration, especially during conversion of the land.

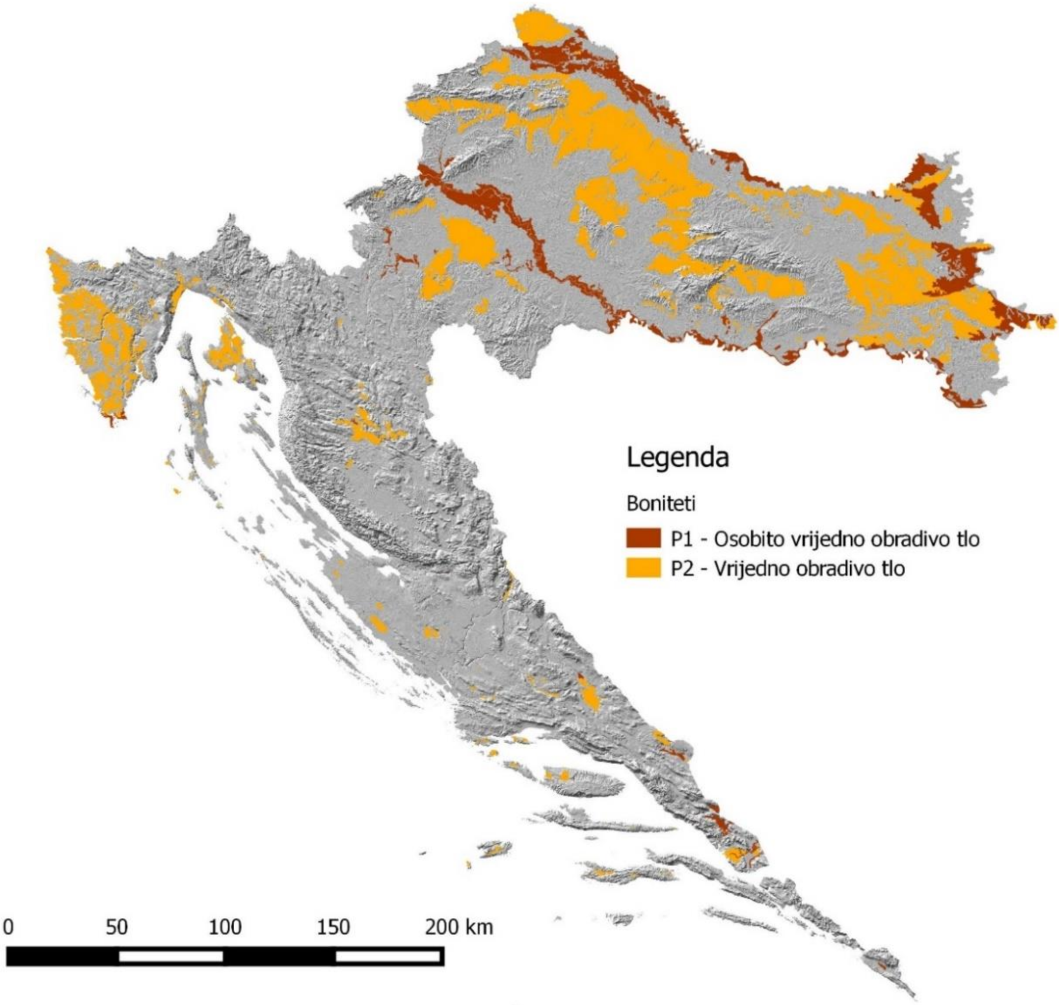


Figure 3.63 Land of P1 and P2 value in the Republic of Croatia (Source: Digital Soil Map of the Republic of Croatia)

3.3.8.2 Agricultural land areas

An overview of all agricultural lands in Croatia is shown in the figure (Figure 3.64) and table (Table 3.27) below. A share of agricultural lands is shown according to the data extracted from CORINE Land Cover database (hereinafter referred to as CLC). CLC is a digital database containing data on status and changes of land cover in the Republic of Croatia and its purpose. The database is updated every six years, and the most recent data date from 2012.

Most frequent agricultural land categories in the Republic of Croatia are: agricultural areas, land principally occupied by agriculture, with significant areas of natural vegetation, and non-irrigated arable land.

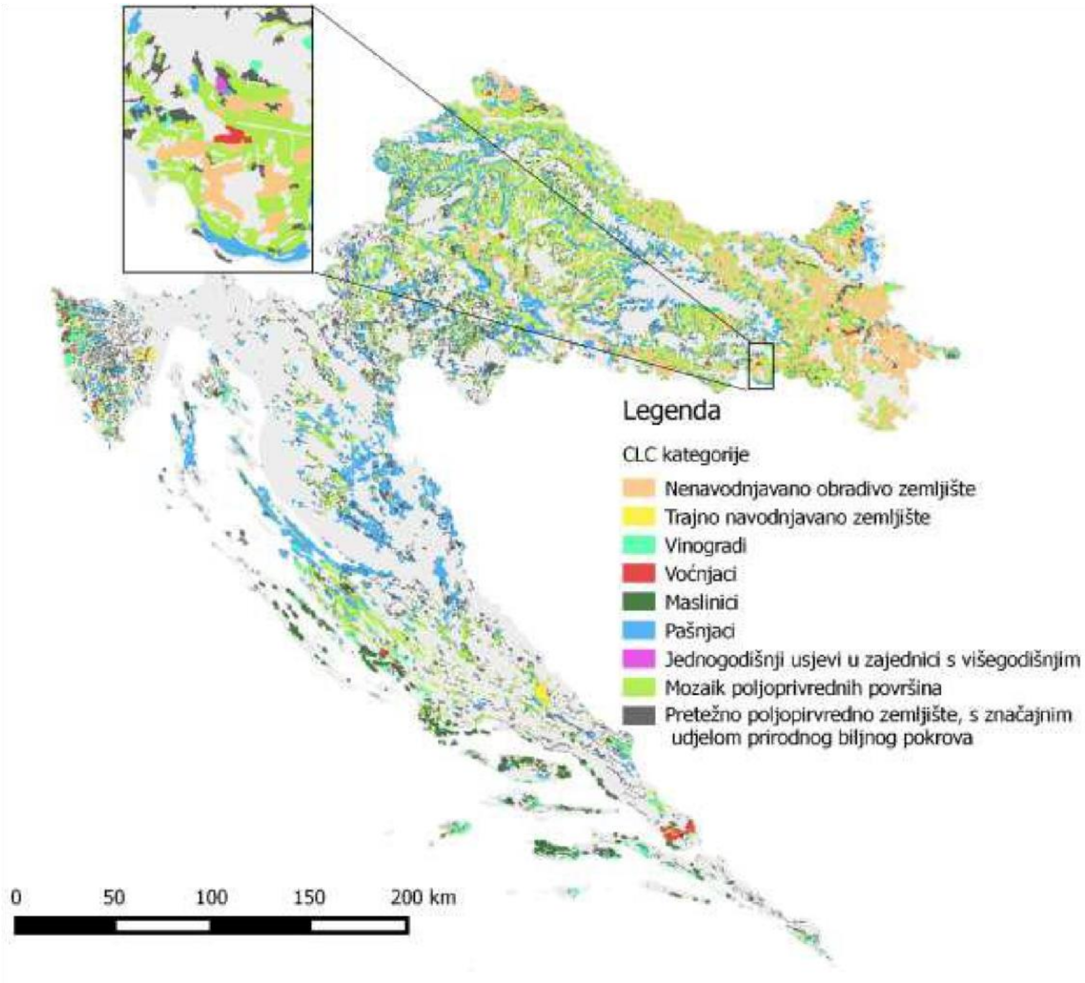


Figure 3.64 Agricultural area in Croatia (Source: CLC database)

Table 3.27 Agricultural area in Croatia (Source: CLC database)

Agricultural area	Surface (ha)	Share in Croatia (%)
Non-irrigated arable land	3850,63	6,80
Permanently irrigated land	105,11	0,18
Vineyards	279,33	0,49
Fruit trees and berry plantations	79,71	0,14
Olive groves	221,35	0,39
Pastures	2839,25	0,50
Annual crops associated with permanent crops	0,78	0,00
Agriculture areas	10059,57	17,77
Land principally occupied by agriculture, with significant areas of natural vegetation	5421,73	9,58
Total	**22857,46**	**35,78**

3.3.9 Forestry

Forest surface

According to the Forest Management plan of the Republic of Croatia, a total forest and forest land surface is 2 759 039.05 ha, which is roughly 48% of the total country's land territory. 90% of the total forest and forest land area is covered by forest vegetation, bare productive land covers 7% of the total forest land, bare non-productive land covers 1% of the area, while infertile forest land covers 1% of the forest area. 76% of the forest area is state-owned, while the other 24% is the property of the private forest owners. 97% of State forests are managed by the state forest company Hrvatske šume d.o.o, while the remainder is used by the state administration bodies and legal persons. Private forests are managed by their owners with the help of the Advisory Service.

Deciduous forests cover 84% and evergreen forest cover 16% of the forest area. The forest vegetation of the Croatia is divided into continental and Mediterranean part. The continental part is subdivided into 5 zones: lowland, hilly forests, mountainous forest, high-mountainous and subalpine forests.

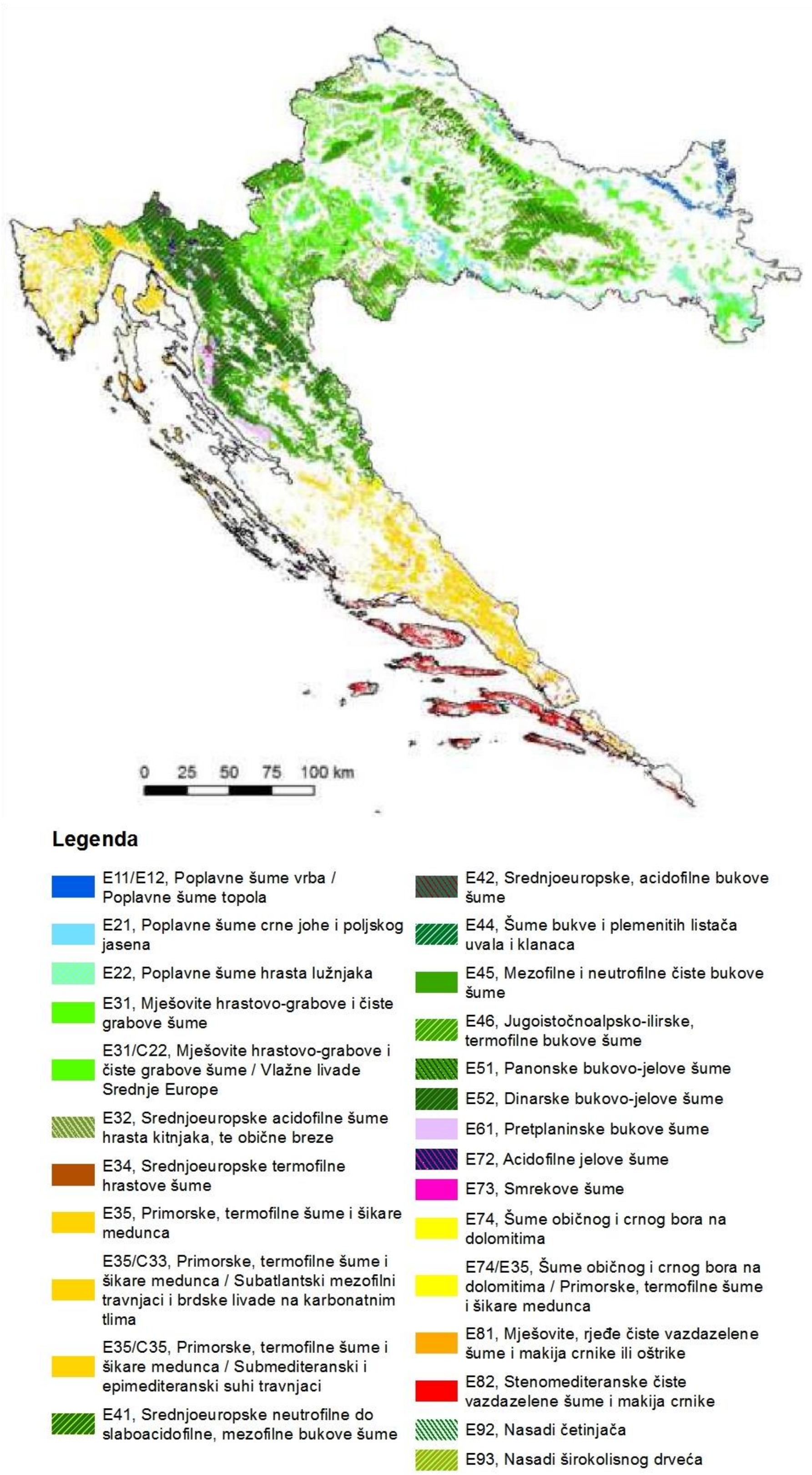
The **lowland zone** comprises the area north of the city of Karlovac, particularly the area between Sava and Drava rivers. The altitude of this zone ranges 80-150 m, but characteristics of this vegetation zone can be found on higher altitudes (300-600 m) on the plateau of Lika. The most important tree species are pedunculate oak (*Quercus robur*), narrow-leaved ash (*Fraxinus angustifolia*), black alder (*Alnus glutinosa*), common hornbeam (*Carpinus betulus*), silverleaf poplar and black poplar (*Populus alba* and *Populus nigra*) and various species of willow (*Salix spp*.). The key environmental factor is water, especially flood water in willow and poplar forests, groundwater (in pedunculate oak forests) and combination of flood water and groundwater (in narrow-leaved ash and black alder forests). The most frequent forest types of this area are pedunculate oak flooded forest and broom (*Genisto elatae-Quercetum roboris*), black alder forests (*Carici elongatae-Alnetum glutinosae* in the region of Podravina and *Frangulo-Alnetum glutinosae* in the region of Posavina) and narrow-leaved ash forests (*Leucoio Fraxinetum* and *Pruno-Fraxinetum*). In higher and drained areas out of reach of flood water, bur still rather influenced by high groundwater, pedunculate oak forests and common hornbeam forests have developed (*Carpino betuli-Quercetum roboris*). The white willow forests with bedstraw (*Galio-Salicetum albae*) are common in the region around Danube and the lower stream of the river Drava. The **zone of hilly forests** is found at the altitude of 150-500 m. This zone comprises hills and lower parts of the Pannonian highlands (Medvednica, Ivanščica, Kalnik and highlands of Slavonia), areas south of Karlovac towards Severin na Kupi and towards Josipdol, border of plateau of Lika and a part of Istria. The most common tree species are sessile oak (*Quercus petraea*). Other common tree species are common hornbeam (*Carpinus belutus*), sweet chestnut (*Castanea sativa*), silver birch (*Betula pendula*), Turkey oak (*Quercus cerris*), downy oak (*Quercus pubescens*), field maple (*Acer campestre*), wild cherry (*Prunus avium*), common beech (*Fagus sylvatica*). The forest communities belonging to this zone are sessile oak forests and common hornbeam (*Epimedio-Carpinetum betuli*), sessile oak forest and sweet chestnut forests (*Querco-Castanetum sativae*) and thermophile forests of hop hornbeam and downy oak forests (*Ostryo-Quercetum pubescentis*). Mountainous forest can be found in the areas of 350 m of altitude and higher in the Pannonian region or above 600m in Dinaric Alps, while the upper altitude limit is between 700-900 m. Apart from beech tree, the most common tree species are sessile oak (*Quercus petraea*), common hornbeam (*Carpinus betulus*), wych elm (*Ulmus glabra*), maple trees (*Acer platanoides* and *A. pseudoplatanus*) and common ash (*Fraxinus excelsior*). The forest communities also common in this zone are beech forests with deadnettle (*Lamio-orvalae Fagetum*), beech forests of the coastal region (*Seslerio-Fagetum*), yew and linden forests (*Tilio-Taxetum*) and black pine forests (*Pinus nigra ssp. illirica*).

Mountainous forest zones in Dinaric Alps and Pannonian mountains is present at the altitudes 600 (800)-1100 m, while the can also be found in the lower parts of the northern slopes of Papuk and Medvednica. Virgin forests i.e. the forests that haven't been affected by human activities may also be found in this zone such as Čorkova uvala near Plitvice Lakes, Devčića tavani and Nadžak Bilo in northern Velebit. There are beech trees (*Fagus sylvatica*) and silver fir (*Albies alba*) but also maple trees (*Acer platanoides* and *A. pseudoplatanus*), common ash (Fraxinus excelsior), wych elm (Ulmu glabra). The most common forest communities found here are fir-beech forests (*Abieti-Fagetum*) and fir-spruce-beech forests (*BlechnoAbietetum*). High-mountainous zone covers the area at the altitude 1100-1700 m and includes forest communities in the Dinaric Alps. The most common forest communities here are pre-alpine beech forests (*Homogyno sylvestris-Fagetum*), mountain pine forests (*Lonicero borbasiane-Pinetum mugi*) and common spruce forests.

Unlike the Mediterranean region, the continental part is characterized by lower temperatures and a sufficient level of rainfalls during summer months so there are no periods of summer drought. The Mediterranean region consists of thermophilic evergreen and deciduous forests of the Adriatic region and can be divided into two zones: Mediterranean-littoral and Mediterranean-mountainous.

The **Mediterranean-littoral zone** includes most of the islands, narrow littoral zone and Central and South Dalmatia. The area is characterized by the evergreen forests of evergreen oak (*Quercus ilex*) and the forests of Aleppo pine and black pine (*Pinus halepensis* and *Pinus nigra dalmatica*) frequent in steno-Mediterranean and European-Mediterranean zone. In the littoral zone there are forests of downy oak (*Quercus pubescens*) that are a part of sub-Mediterranean zone. Due to longterm human activities in the area, the forest vegetation covers only small areas and does not have any significant share in the total forest vegetation. The most common vegetation species are maquis (short and dense shrublands), garrigue (widely spaced bush), karst terrain and karst pastures and small fragmented arable land. **Mediterranean-mountain zone** includes vegetation growing in the higher areas of the Mediterranean region and is directly connected to the sub-Mediterranean vegetation zone. This vegetation is found on the islands mostly above 400 m (hemimediterranean vegetation zone), while in the continental part the vegetation is present above 300 m (epimediterranean zone) in northern Adriatic part, or above 600 m in south Adriatic part. The most common species here is the hop hornbeam (*Ostrya carpinifolia*). The evergreen oak (*Quercus ilex*) is also present. The most common species of the continental part are oriental hornbeam (*Carpuni orientalis*), downy oak (*Quercus pubescens*), Dalmatian black pine (*Pinus nigra dalmatica*), and silver fir on Biokovo (*Abies alba*). Hemimediterranean vegetation zone of evergreen/deciduous forests is common in the highest parts of Adriatic islands Hvar, Brač, Korčula, Mljet and peninsula Pelješac. This type of forest community has a rather small area, but a great value due to their biodiversity. Epimediterranean zone of thermophilic deciduous or evergreen forests are present in the highest zones of the Mediterranean vegetation in Croatia, most common in northern Istria and southern slopes of Dinaric Alps.

Spatial distribution of the forest vegetation of Croatia is shown in the figure bellow (Figure 3.65). It is observed that the biggest forest complex are present in western Dinaric Alps (Gorski kotar, Velebit), dominated by beech and fir forests (around 200 000 ha) in Sava valley with floodplains Spačva and Lonjsko polje with forests of pedunculate oak, common hornbeam and narrow-leaved ash (around 200 000 ha). The Mediterranean is dominated by forest communities of maquis (Eumediterranean) or shrubland (submediterranean), while only the smaller area is covered by well-preserved forests of evergreen oak and black pine.



Map legend:

E11/E12 Flooded willow forests / Flooded poplar forests

E21 Flooded black alder and narrow-leaved ash forests

E22 Flooded forests of pedunculate oak

E42 Central-European acidophilus beech forests

E44 Beech forests and forest of broadleaves in valleys and cloughs

E45 Mezophiles and neutrophiles beech forests

E31 Mixed oak-hornbeam forests and hornbeam forests	E46 Southeast-Alpine-Illyric thermophilic beech forests
E31/C22 Mixed oak-hornbeam forests and hornbeam forests / wet meadows of Central Europe	E51 Pannonian beech-fir forests
E32 Central-European acidophilus forests of sessile oak and silver birch	E52 Dinaric Alps beech-fir forests
E34 Central-European acidophilus oak forests	E61 Pre-mountainous beech forests
E35 Littoral, thermophilic forests and downy oak in shrublands	E72 Acidophilus fir forests
E35/C33 Littoral, thermophilic forest and shrublands of downy oak / Sub-Atlantic mezophiles meadows and mountain meadows on carbonate soil	E73 Spruce forests
E35/C35 Littoral, thermophilic forests and shrublands of downy oak / Sub-Mediterranean and epimediterranean dry meadows	E74 Forests of common and black pine on dolomite soil
E41 Central-European neutrophile to fairy acidophilus, mezophiles beech forests	E74/E35 Forests of common and black pine on dolomite soils / Littoral, thermophile forests and shrublands of downy oak
	E81 Mixed, evergreen forests and maquis of evergreen oak or kermes oak
	E82 Stenomediterranean evergreen forests, maquis and evergreen oak
	E92 Conifers
	E93 Broad-leaved trees

Figure 3.65 Habitat Map of the forest vegetation in Croatia (Author: IRES EKOLOGIJA d.o.o.)

Stability of the forest ecosystem

The forests in Croatia are managed by the principles of the sustainable management with the aim to establish a permanent balance between total biomass production and general benefit from forests by sustaining permanent productivity of all forest benefits. Sustainable management means that forest and forest lands are being used but at the same time their biodiversity, productivity, ability to regenerate, vitality and potential are preserved and they fulfill present and future economic, environmental and social function on a local and global level without doing any harm to other ecosystems. This means that deforestation never exceeds forestation. A part of increment is accumulated in wood stocks so the forest cover is always present, while silviculture helps to preserve the natural structure of forests. Surface share of natural forests in total forest surface is very high, to be exact 95% of our forests is regenerated in a natural way and deforestation is forbidden by Croatian forest Act (OG 140/05, 82/06, 129/08, 80/10, 124/10, 25/12, 68/12 and 148/13). Moreover, the whole forest area managed by Hrvatske šume d.o.o. is managed as prescribed by Forest Stewardship Council certificate, which confirms that the forest are managed in accordance with strict environmental, social and economic standards. The monitoring of forests through ICP Forest (the International Co-operative program on Assessment and Monitoring of Air Pollution Effects on Forests) and forecasts on the impact of abiotic and biotic factors are effective and timely way to preserve forests health. In Croatia, there is a general decrease of concentration of acidic substances which has a positive impact on forest condition.

From biological and environmental prospective, the condition of Croatian forests is one of the best in Europe. Apart from the previously mentioned naturality of our forests, they also have a favorable age structure and diversity (ratio of main and incident tree species). A continuous transition from shrublands (degraded stands) and coppice to seed plants, which is a result of biological regeneration of forests, conducted in accordance with forest management plans. Naturality and forests ratio of Croatian forests are shown in the figure below (Figure 3.66).

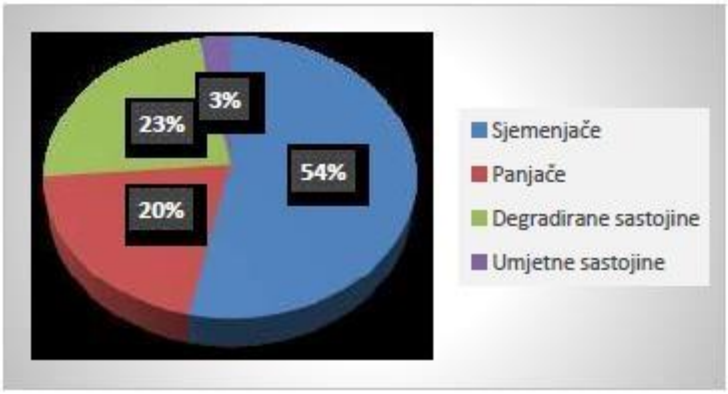


Figure 3.66 Silviculture forms by the area in Croatia, data from 2012 (Source: Draft report on environment condition in the Republic of Croatia, 2014)

It is evident that seed plants cover the biggest area of forests. These are more complex and richer ecosystems than coppice and degraded stands (shrubs, garrigue, etc.). Almost all stands have natural forms, while only 3% of forest areas are artificial (forest plantations and cultures).

Wood stock

According to Regulation on Forest Management Planning (OG79/2015), the aim of the forest management is to have a healthy stand at the time of fellable age. In this way the healthy wood stock is available at any time and the forest vitality is sustained given that forest management procedures exclude low-quality trees. The wood stock assessment is done according to tree volume per surface unit (m^3/ha). The Forest Management Plan established that the wood stock is 418.6 million m^3, while the annual increment is 10.1 million m^3. The most common tree species and their wood stock are in constant growth. The figure below shows tree species in total wood stock in the forest management area.

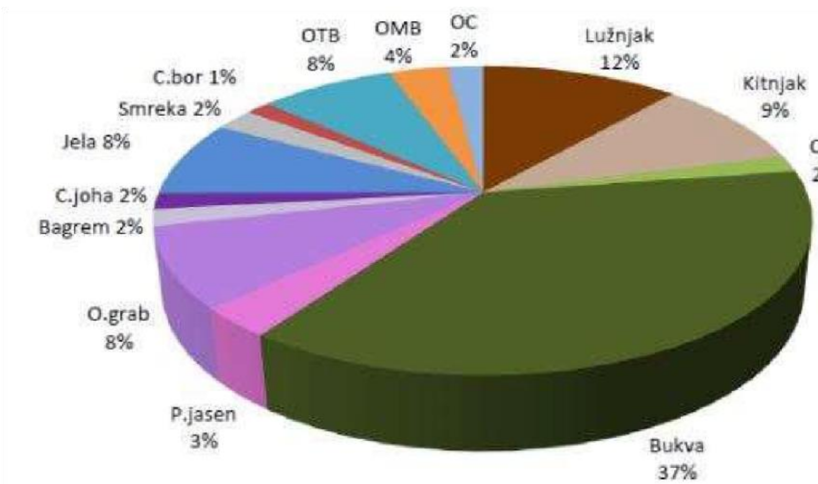


Figure 3.67 Main tree species share in total wood stock of the forest management area (Source: Basic areas, 2016-2025)

It is evident that the biggest share in the total wood stock holds common beach followed by pedunculate oak, sessile oak, common fir, common hornbeam, etc. The previous Forest Management Plan (2006-2015) indicates the 10-year wood stock in the amount of 65.6 million m^3. Therefore, 6.56 million m^3 (annual) of wood stock is cut for the purpose of economic activities. The annual wood stock was 64.36% of the annual increment, which indicates that sustainable management that does not disturb natural balance has been conducted and that increment is every year higher than the amount of felling. In addition, the felling includes damages caused by natural disasters (drying of forests, ageing, snowbreak, blowdown, fire, infrastructure works, etc.) These data show that forest resources in Croatia are managed in a sustainable way, which ensures healthy and stabile forest ecosystem and sufficient raw materials for wood industry and energetic sector. By the current Forest Management Plan, a 10-year wood stock is increased by 14.72 milion m^3 and amounts 80.37 million m^3 (around 73% of the annual increment.)

Forest functions of general benefit

Although wood is a very important raw material, the forest functions of general benefit are also gaining greater importance. These are non-market values of forests such as: forest services, forest impact, benefits, values given to man, community, environment and nature. In some areas they have become more significant than production values, sometimes reaching several times higher value. Forests highly fulfill their economic, environmental and social functions. The most significant economic functions are: protection of soil from erosion caused by water or wind, water treatment by drainage through forest soil, favorable impact on climate and agriculture, polluted air treatment, preservation of biological diversity of genofond, species, ecosystem and landscape, moderation of greenhouse gas effects by carbon sequestration, oxygen enrichment of the environment, etc. The social functions of the forests have beneficial effect on human health and quality of life considering that they are a place for relaxation and recreation. The beneficial forest functions assessment is conducted according to the Forest Management Regulation.

Apart from their economic values, managed forests have many general benefits because, at the same time, a well-managed forest fulfils its functions of general benefit since direct and mutual benefits of forests are strongly mutually related. Direct and general benefits are a result of a habitat and biocoenosis, and their values depend on the quality of tending and regeneration of forests that are keeping the ecosystem in optimal conditions making it thus eternal (Prpić et al. 2005).

Forest functions of general benefit are most apparent in the Mediterranean part of the region. The primary role of the Mediterranean forests used to be the production of wood stock, but due to long-term human activities the forest vegetation has significantly decreased over the years. Forest stands are degraded and the most common forest forms are maquis (dense and low coppices), garrigue (widely spaced bush), karst terrain and karst pastures and small fragmented arable lands. The economic value of these forest forms is lower than the value of seed forests. Nevertheless, due to their environmental and social functions, Mediterranean forests are an important element of the Croatian forest ecosystem.

3.3.10 Wild game and hunting

Hunting ground conditions

According to data indicated in the Environment Status Report of the Republic of Croatia (2005-2008), the hunting ground covers an area of 5.3 million ha. There are 1066 hunting grounds, 317 of which are state-owned hunting grounds covering an area of 1.8 million ha and 749 common hunting grounds covering an area of 3.5 million ha. Within the hunting grounds there are hunt-efficient areas, i.e. a part of the hunting ground where a certain species has all natural conditions for living, feeding and watering, reproduction and hiding. The quality of the hunt-efficient areas is assessed according to the data on fulfillment of requirements for inhabitation and reproduction of certain game species. An improvement in hunting ground management is evident in the increased number of game animals and improvement of the hunting tradition and ethics. The maximum number of certain game species has still not been reached which indicates a significant potential of further improvement in hunting and game management.

According to the Croatian Hunting Act (OG 140/05, 75/09, 153/09, 14/14, 21/16, 41/16, 67/16), the following species are considered wild game:

1. big game: red deer (*Cervus elaphus* L.), fallow deer (*Dama dama* L.), axis deer (*Axis axis* L), roe deer (*Capreolus capreolus* L.), chamois (*Rupicapra rupicapra* L.), mouflon (*Ovis aries musimon* Pall.), wild boar (*Sus scrofa* L.), brown bear (*Ursus arctos* L.)
2. small game:

a) small hairy game: badger (*Meles meles* L.), wild cat (*Felis silvestris* Schr.), marten (*Martes foina* Ehr.), fine marten (*Martes martes* L.), small weasel (*Mustela nivalis* L.), beaver (*Castor fiber* L.), rabbit (*Lepus europaeus* Pall.), wild rabbit (Oryctolangus cuniculus L.), big dormouse (Myoxus glis L.), fox (Vulpes vulpes L.), jackdal (*Canis aureus* L.), skunk (*Putorius putorius* L.), mungos (*Herpestes ishneumon* L.)

b) wild fowl: pheasant (*Phasianus sp.* L.), rocky partridge (*Alectoris graeca Meissn*), chukar partridge (*Alectoris chucar*), field partridge (*Perdix perdix;* L.), quail (*Coturnix coturnix* L.), virginian partridge (*Coturnis virginiana* L.), wood cock (*Scolopax rusticola* L.), snipe (*Gallinago gallinago* L.), ringdove (*Columba palumbus* L.), rock doves (*Columba livia* Gmelin.), Taiga bean goose (*Anser fabalis* Latham.), Greater White-fronted Goose (*Anser albifrons* Scopoli.), wild duck (*Anas platyrhynchos* L.), big-headed duck (grey duck) (*Aythya ferina* L.), tufted duck (*Aythya fuligula* L.), garganey (*Anas querquedula* L.), common teal (*Anas crecca* L.), black moorhen (*Fulica atra* L.), grey crow (*Corvus corone cornix* L.), rook (*Corvus frugilegus* L.), western jackdaw (*Coloeus monedula* L.), magpie (*Pica pica* L.), jay (*Garrulus glandarius* L.).

According to Regulation on the proclamation of protected and strictly protected wild taxa (OG 099/09) and its Annex III, the list of the protected species also contains those species considered as hunting species, including brown bear. Brown bear management in the Republic of Croatia is conducted in accordance with the Brown Bear Management Plan, established in 2005, revised in 2008. The current management plan is the Brown Bear Management Action Plan for the Republic of Croatia for the year 2017.

Considering the conditions of game habitats in Croatia, the hunting ground are divided into lowland, hilly, mountainous and Mediterranean hunting grounds.

Lowland hunting grounds are entirely or mainly established in the Pannonian region covering the area of eastern, central and northern Republic of Croatia extending from the border of the Republic of Slovenia west of Samobor, to Jastrebarsko, Karlovac, along the Kupa river to Sisak and along railway road to Sunja and Dubica all the way to the border of the Republic of Bosnia and Herzegovina. The area comprises all hunting grounds lower than 200 m of altitude with extremely continental climate. Game species found in this area are: deer, fallow deer, roe deer, wild boar, rabbit, fox, badger, beaver, skunk, sunbleak marten, fine marten, small weasel, quail, rocky partridge, pheasant, wild duck, wild goose, woodcock, and coot.

Hilly hunting grounds are entirely established in the area above 200 m of altitude or partially in the region of Dinaric Alps. The eastern border of the area matches the west border of the Pannonian region. The western border of the area is established along the border of the Republic of Slovenia near Klana heading south at the altitude of 800 m towards coastal slopes of the Velebit, passes Maslenica canal, towards east and Knin. The area also comprises the slopes of Dinara all the way to the border of the Republic of Bosnia and Herzegovina. Game species found in this area are: brown bear, deer, roe deer, wild boar, mouflon, badger, dormouse, skunk, and rabbit.

Mountainous hunting grounds are established in the region of Gorski kotar and the region of Dinaric Alps at the altitude above 800 m with severe continental climate and constant presence of big predators. Game species found in these areas are: brown bear, chamois, jackal, wild boar, rabbit, marten and fine marten. Mediterranean hunting grounds are established in the whole Adriatic region comprising Istria, Croatian Littoral with islands and Dalmatia with islands. The eastern border of the area matches western border of the region of Dinaric Alps. The Mediterranean hunting grounds are characterized by Mediterranean climate and relief. Game species found in this area are: roe deer, wild boar, fallow deer, deer, mouflon, jackal, rabbit, wild rabbit, pheasant, rocky partridge, partridge, Virginian quail, and wild pigeon.

3.3.11 Tourism

3.3.11.1 Tourism offer in Croatia

Croatia is characterized by two main features of its geographical location which are crucial for the development of tourism: the country is not only oriented towards the important communication and tourism flows but also towards the attractive neighboring area and leading emitive markets in Europe (Bešker, 2005). Croatia is located in a geographical, cultural, historical and political crossroad of Eastern and Western Europe, thus its historical, ethnic, cultural, economic, urban, administrative and other particularities attract many visitors. Moreover, Croatia abounds with natural attractions. The most important tourism development factors are the sea, indented coastline, multitude of islands, well-preserved natural beaches, protected natural areas, biodiversity, rivers, lakes and other continental waters. Along with the attractive natural resources, the richness of the Croatian cultural-historical heritage is also an important factor of tourism development in this country. Many cultural goods are protected by UNESCO, such as historical center of Dubrovnik, Diocletian Palace in Split, Cathedral of Šibenik, historical center of Trogir, the Euphrasian Basilica in Poreč, Stari Grad Plain on the island of Hvar, but also many other valuable cultural goods such as Arena in Pula, historical center of Hvar, city walls of Ston and a large number of individual buildings in well-preserved historical part of Zagreb and other cities and villages (Tourism Development Strategy of the Republic of Croatia until 2020, 2013) In addition, Croatia is the leading country in Europe by the number of intangible goods protected by UNESCO, while on global level Croatia is placed right after China and Japan.

According to the Tourism Development Strategy the key tourism products of Croatia are:

- The sun and the sea

Thanks to rich natural resources for tourism development, this tourism product dominates the tourist offer and tourism-related activities in Croatia. Its share in the total tourism product of Croatia is around 85%, with a lower share in total revenue (75-80%), due to low prices caused by huge capacities of private accommodations.

- Nautical tourism *(yachting/cruising)*

Thanks to its geo-traffic location and one of the most indented coastlines in the world, moderate climate and winds, Croatia is one of the most popular nautical destinations in the world. This fact is evident in the constant growth of nautical tourism (especially in the prolongation of the nautical season), but also in the continuous creation of the corresponding value chain. Cruising tourism records an increased number of mega cruiser arrivals in the last decade, as well as the growing demand for cruises on national cruisers.

- Business tourism

There's a relatively constant demand in Croatia by individual and group business guests, changing only its qualitative features depending on current trends. The research among hoteliers has shown that business guests make 10-15% of the total of hotel guests.

- Cultural tourism

A great number of cultural-historical sites and events in Croatia make it a destination for "cultural travels". Cultural tourism includes: urban tourism, heritage tourism, event tourism, creative tourism and religious tourism.

In the last few years, tourism products described in the text below are more and more developed and they contribute to differentiation of the tourism offer of Croatia

- Health tourism

Thermal springs, proximity of the emitive markets, price competitiveness and good reputation of health services in general are the reason why Croatia is suitable for development of health tourism. The health tourism products especially relevant for Croatia are namely: wellness tourism, health tourism and medical tourism.

- Bicycle tourism

Croatia has a rather well-developed network of local and regional cycling paths, some of which are a part of international cycling routes. This product is presented in the tourism offer of Croatia as an additional vacation activity.

- Gastronomy and oenology

Gastro-oenological tourism offer has been for many years an integral part of the tourist promotion of Croatia. This complex product consumed by almost all tourists even though only a small number of international tourists travel exclusively for gastro-oenological reasons, so demand growth is mostly generated by the local population. Gastronomy and oenology as tourism products are best developed in Istria, Dalmatia and Slavonia.

- Rural and mountain tourism

Rural tourism in Croatia is characterized by a very slow development. The only exception is Istria and Osijek-Baranja County. This product is especially attractive to the emitive market of big cities, as well as to transit tourists, so it is primarily developed near bigger cities, established tourist destinations and in the vicinity of major traffic routes. Regarding mountain tourism, there are potential mountain centers like Bjelolasica, Begovo Razdolje and Platak, and many mountain paths in Croatian mountains and hills.

- Golf tourism

Currently, there are only 4 golf courses with 18 holes, two 9-hole courses and a few training course. For this reason, Croatia is not present on the golf tourism map even though golf tourism is today, and will be in the future, one of the most important market segments of the Mediterranean tourism demand, especially in the off-season period.

- Adventure and sports tourism

This fast-growing product group is gaining more and more significance and includes: scuba diving, kayaking, canoeing, rafting, extreme sports, hunting, fishing, winter sports and trainings. The hilly and coastal part of Croatia rapidly develops a wide and diversified offer, including niche offers (speleological tourism, paragliding) and adventure sports programs. Croatia is still not using sufficiently its comparative advantages to develop of this product group.

- Eco tourism

Supported by the growing environmental awareness of clients, this tourism product demonstrates intensive development around the world. Despite the availability, attractiveness and perseverance of natural resources, eco-tourism in Croatia is still poorly developed. The ecotourism can be developed in national parks and other protected locations, as well as on family farms running business in accordance with the principles of organic agricultural production. In order to provide tourism activities in rural area, a family-run farm has to offer organic groceries and additional tourist and hospitality services.

3.3.11.2 Tourism intensity

In 2015, Croatia had 942.830 permanent beds in registered commercial accommodations mostly of which were in hotels, camps and households. A majority of permanent registered beds is in Adriatic Croatia (95.66%), while only 4.34% of the registered beds are in continental Croatia. The leading county in total number of permanent beds in Adriatic Croatia is Istria County (26.15%), followed by Split-Dalmatia County (20.67%) and Primorje-Gorski kotar County (17.89%).

In the period 2011-2015 Croatia has increased available accommodation capacities by 10.47%. The capacity is calculated according to the number of permanent beds in the registered commercial accommodation establishments. The biggest accommodation potential growth is registered in private accommodations followed by hotels and camps.

The number of beds per 1000 population is the indicator marking the pressure of accommodation capacities on the local population. It is calculated as the ratio of the total number of beds and total population per county, multiplied by 1000.

In the period 2011-2015, the pressure of beds on the local population in Croatia is in constant growth since 2013 (Table 3.28). There are great differences in pressure between counties of the Adriatic and continental Croatia, while Istria County stands out having the highest pressure of the accommodation capacities on the local population. The number of beds in Istria County is 1.19 times higher than its population in 2011. In continental Croatia, Brod-Posavina County has the lowest ratio of total population and the number of beds, although there is a light but constant growth in the period 2011-2015 (Table 3.28).

The counties in which the pressure of permanent beds on the local population is lower in 2015 comparing to 2013 are Vukovar-Srijem County, Osijek-Baranja County, Varaždin County, Virovitica-Podravina County and Bjelovar-Bilogora County.

Among the counties of the continental Croatia having a constant growth and maximum pressure of accommodation capacities on the local population, only Karlovac county stands out thanks to the extensive offer of services provided for active vacation in the nature (cyclotourism, rafting, riding, speleological tourism, fishing, hiking) and excursion tourism. A significant growth of accommodation capacities in this period is observed in the City of Zagreb and Krapina-Zagorje County.

Table 3.28 Number of beds per 1000 population, per county in Croatia in the period 2011-2015 (Source: Croatian Bureau of Statistics)

County	2011.	2012.	2013.	2014.	2015.
Adriatic Croatia	582.76	549.13	593.06	611.84	638.80
Primorje-Gorski kotar	601.14	517.86	544.58	561.73	569.53
Lika-Senj	595.95	501.78	565.04	584.15	655.94
Zadar	599.99	600.28	621.17	685.42	701.49
Šibenik-Knin	543.71	530.49	591.47	615.93	636.11
Split-Dalmatia	338.30	328.33	385.99	395.89	428.49
Istria	1122.84	1091.41	1143.17	1135.44	1185.15
Dubrovnik-Neretva	534.12	488.90	518.77	551.28	567.42
Continental Croatia	10.65	10.99	12.30	12.13	14.23
Zagreb	3.40	3.70	4.12	4.55	5.09
Krapina-Zagorje	13.18	14.29	17.57	16.07	17.83
Sisak-Moslavina	4.77	5.57	5.34	5.92	7.42
Karlovac	44.24	48.81	47.77	47.99	52.79

Varaždin	11.62	12.67	12.91	12.48	12.86
Koprivnica-Križevci	4.41	4.35	4.46	4.97	5.13
Bjelovar-Bilogora	6.50	6.30	6.64	5.95	6.25
Virovitica-Podravina	7.00	7.17	7.30	7.13	6.85
Požega-Slavonia	5.07	5.27	5.09	4.83	5.43
Brod-Posavina	3.80	4.17	4.19	4.23	4.74
Osijek-Baranja	6.84	7.05	7.52	6.87	7.19
Vukovar-Srijem	6.96	8.37	10.54	7.72	9.36
Međimurje	10.23	10.23	10.77	10.61	10.93
City of Zagreb	14.95	14.26	17.66	18.02	23.22
Republic of Croatia	199.17	188.32	203.67	209.74	220.04

The number of beds per km^2 indicates the load and spatial pressure of beds per county. It is calculated as the ratio of the total number of beds and surface in km^2. The analysis of the data per county indicates that the highest pressure of the accommodation capacities is in the counties of the Adriatic Croatia, Istria country and Primorje-Gorski kotar county, while Like-Senj county has the lowest pressure, yet still higher than most counties of the continental Croatia (Table 3.29). The City of Zagreb distinguishes itself from the other continental counties by the highest spatial pressure of accommodation capacities. In most of the counties, the spatial pressure of accommodation capacities is in constant growth since 2013.

Table 3.29 Number of beds per km2 per county in Croatia in the period 2011-2015 (Source: Croatian Bureau of Statistics)

County	2011.	2012.	2013.	2014.	2015.
Adriatic Croatia	33.81	31.38	3.89	34.97	36.51
Primorje-Gorski kot ar	49.63	42.75	44.96	46.37	47.02
Lika-Senj	5.67	4.77	5.38	5.56	6.24
Zadar	27.98	27.99	28.97	31.96	32.71
Šibenik-Knin	19.93	19.44	21.68	22.58	23.32
Split and Dalmatia	33.89	32.89	38.67	39.66	42.92
Istria	83.05	80.72	84.55	83.98	87.66
Dubrovnik-Neretva	36.76	33.65	35.70	37.94	39.05
Continental Croatia	0.96	0.99	1.11	1.09	1.28
Zagreb	0.35	0.38	0.43	0.47	0.53

Krapina-Zagorje	1.42	1.55	1.90	1.74	1.93
Sisak-Moslavina	0.18	0.22	0.21	0.23	0.29
Karlovac	1.57	1.74	1.70	1.71	1.88
Varaždin	1.62	1.77	1.80	1.74	1.79
Koprivnica-Križevci	0.29	0.29	0.29	0.33	0.34
Bjelovar-Bilogora	0.29	0.29	0.30	0.27	0.28
Virovitica-Podravin a	0.29	0.30	0.31	0.30	0.29
Požega-Slavonia	0.22	0.23	0.22	0.21	0.23
Brod-Posavina	0.30	0.33	0.33	0.33	0.37
Osijek-Baranja	0.50	0.52	0.55	0.50	0.53
Vukovar-Srijem	0.51	0.61	0.77	0.56	0.68
Međimurje	1.60	1.60	1.68	1.66	1.71
City of Zagreb	18.4 2	17.5 8	21.77	22.20	28.61
Republic of Croati a	15.0 8	14.2 6	15.42	15.88	16.66

The number of tourists per county indicates the importance and growth of the tourism sector in counties' economy and country in general. In 2015, 14 343 323 guests visited Croatia; this is 25% more than in 2011. The number of tourists in Croatia is in constant growth (Figure 3.68). In the period 2011-2015 more than 85% of the arrivals were realized in the Adriatic Croatia.

Istria County, Primorje-Gorski Kotar County and Split-Dalmatia County registered the highest number of arrivals. In continental Croatia, the number of arrivals has a lower growth rate. The City of Zagreb and Karlovac County register the highest number of arrivals, while the lowest number of arrivals is registered in Požega-Srijem County (Figure 3.69).

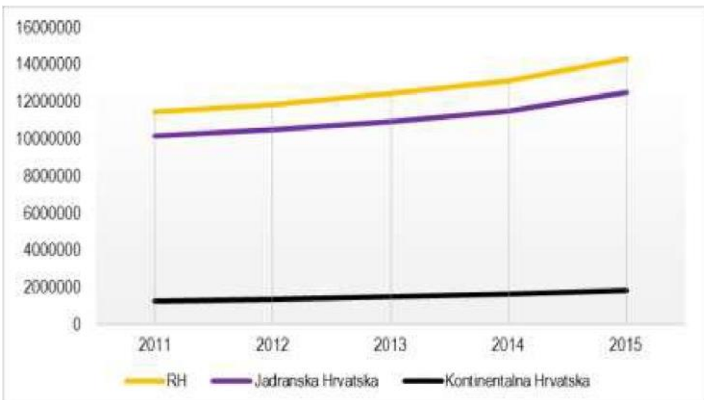


Figure 3.68 The number of overnight stays in continental and Adriatic Croatia, 2011-2015 (Source: Croatian Bureau of Statistics)

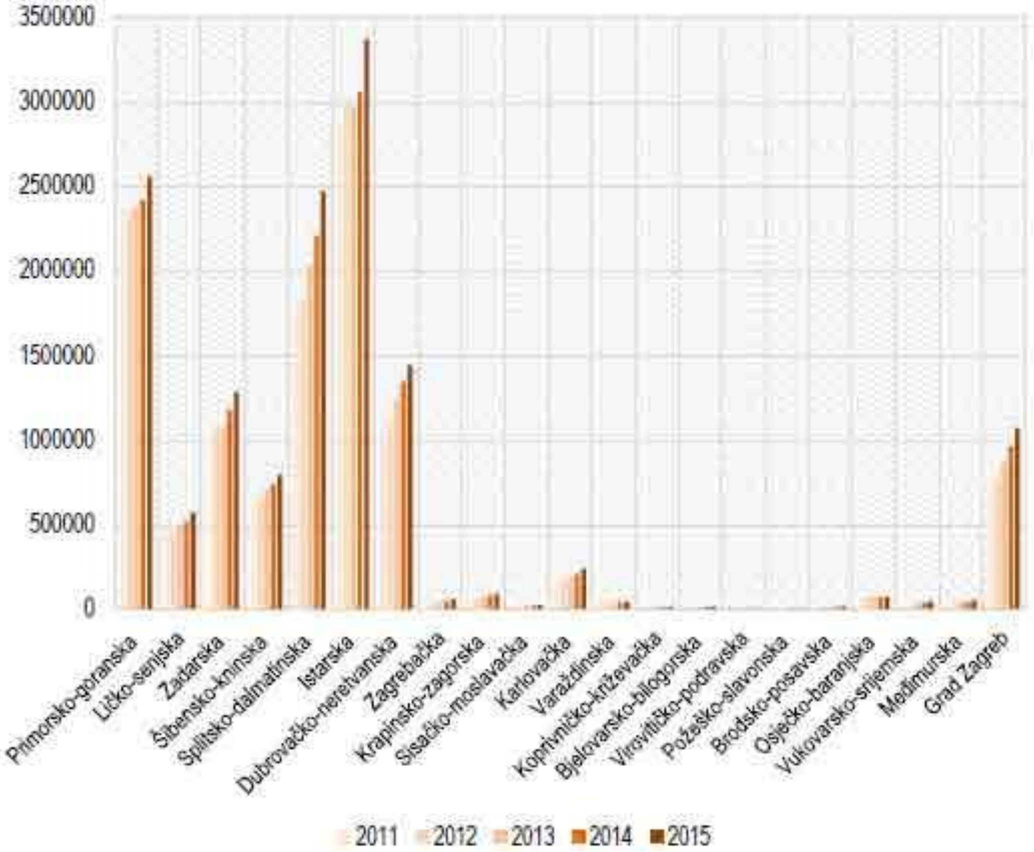


Figure 3.69 The number of overnight stays per county in Croatia, 2011-2015 (Source: Croatian Bureau of Statistics)

Ratio of the total number of tourist arrival per km^2 indicates the pressure on each county in high season. The spatial pressure of tourists in Croatia in 2015 was 253.44 tourists/km^2; in the Adriatic counties 506.33 tourists/km^2, while in the continental Croatia the pressure was 57.53 tourists/km^2. The analysis of the data per county has shown that the highest spatial pressure is registered in the City of Zagreb (1681.40 tourists/km^2) and Istria county (1197.98 tourist/km2). Follow the DubrovnikNeretva (810.28 tourists/km^2, Primorje-Gorski kotar (713.69 tourists/km^2) and Split and Dalmatia County (544.83 tourists/km^2). In continental Croatia, the City of Zagreb is followed by the Krapina-Zagorje county (77.91 tourists/km^2) and Međimurje county (77.42 tourist/km^2). The lowest spatial pressure is recorded in Virovitica-PodravinaCcounty (5.59 tourists/km^2) and Požega -Slavonia County (5.64 tourists/km^2).

Croatia also registers the growth of number of nights. Comparing 2011 and 2015, the number of overnight stays has increased by 18.64%. The highest number of overnight stay was recorded in the Adriatic Croatia (95.4%) (Figure 3.70). The highest number of nights in 2015 was recorded in Istria county, Split-Dalmatia county and Primorje-Gorski kotar county, while the lowest number was recorded in Požega-Slavonia county, Koprivnica-Križevci and Virovitica-Podravina county. The latter also register a decrease of the number of total nights.

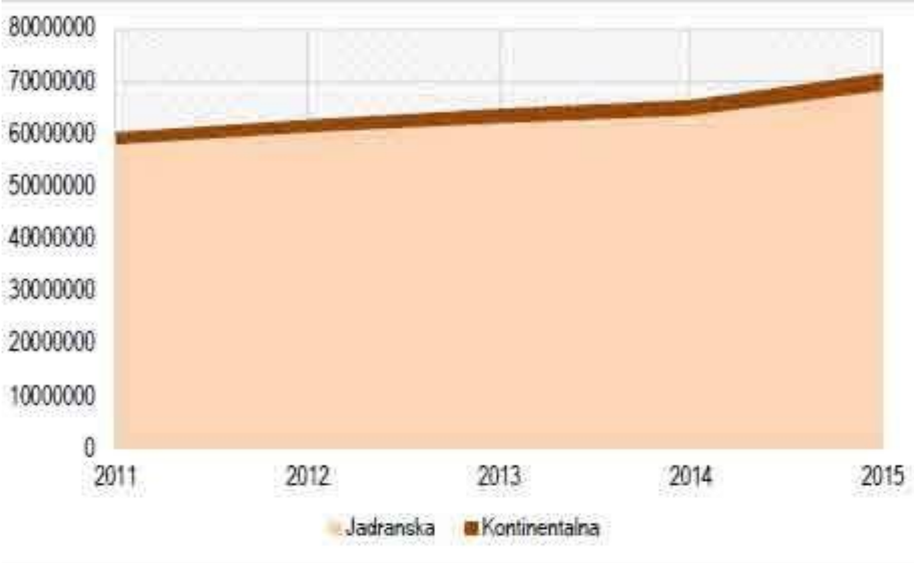


Figure 3.70 The number of overnight stays in continental and Adriatic Croatia, 2011-2015 (Source: Croatian Bureau of Statistics)

The number of nights per capita in counties reflects the density of the tourism traffic. The number of nights per capita in Croatia is 16.71, which indicates that there were 16 times more guests in Croatia in 2015 than the number of the registered population in 2011. Adriatic Croatia stands out with the number of nights per capita of 48.37. In continental Croatia the number of nights is 1.15. The highest number of overnight stays has Istria county (100.77), followed by Dubrovnik-Neretva county (50.06) and Zadar county (45.98). In continental Croatia, Karlovac county (3.07) and the City of Zagreb (2.28) have a high number of overnight stays. The lowest number of overnight stays per capita has Koprivnica-Križevci County (0.24). In February 2017, 210 000 tourists spend the night in commercial accommodation establishments, which is 10% more than in February 2016. The highest number of nights is registered in hotels - 68% of total number of nights. Regarding hotel accommodation, 4-star hotels have the highest demand growth. The hotels also register the highest level of gross occupancy rate.

Most of the guest in Croatian counties in 2015 (91.98%) were foreign guests. Foreign guest are most frequent guests both in the Adriatic (93.2%) and continental Croatia (67.22%). The share of foreign and domestic guests in continental Croatia is different in each county, while foreign guest are dominant in the total number of nights in all counties in the Adriatic Croatia (Figure 3.71).

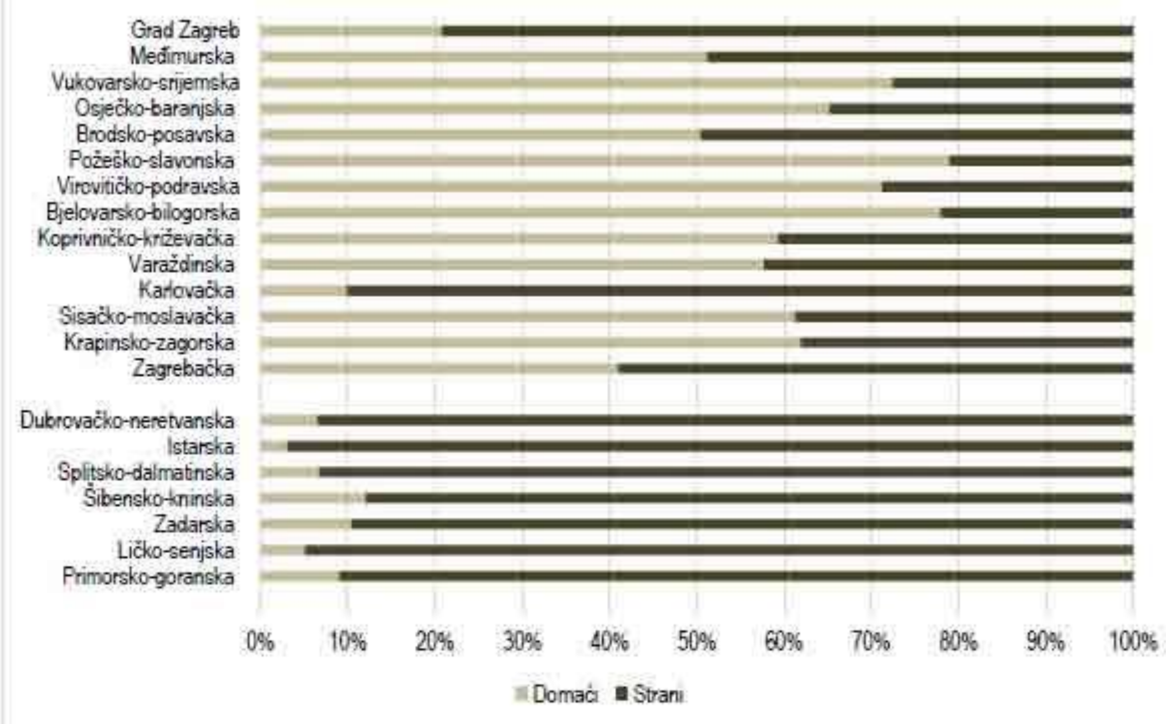


Figure 3.71 Share of domestic and foreign guests in the total number of nights per county in Croatia in 2015 (Source: Croatian Bureau of Statistics)

The specific accommodation offer in Croatia is 139 nautical ports. 71 of these ports are marinas, while the other 68 ports are categorized as anchorages, moorings or non-defined ports of nautical tourism. Most of the nautical ports are located in Zadar County, Split-Dalmatia County and Primorje-Gorski kotar County. At the end of 2016, there were 17 428 moorings in total and 4 880 berths. More than half of the total number of moorings was intended for vessels 10-15 m of length. At the end of 2016, 13 422 vessels had permanent mooring in Croatian ports, which is 0.2% more than the number of moorings in the same period in 2015. Of all permanent moorings, 50.1% were used for sailboats, 47.5% for motor yachts, and 2.4% for other types of vessels. The number of vessels in transit in 2016 in Croatian ports was 198 151, which is 8,6% more than in 2015 Comparing to year 2015, total nautical port income in 2016 was 2.1% higher, while the income from renting moorings was 3.8% higher than the previous year.

3.3.12 Social and Economic characteristics

3.3.12.1 Total (general) natural change in population of the Republic of Croatia

The main characteristics of the demographic picture of the Republic of Croatia in the last decade is constant depopulation, that is a higher number of deaths that live births, population ageing and distortion in the age structure of the population, constant growth of life expectancy at birth, negative migration balance and constant population decline since its independence.

According to 2011 Census of population, a total population of the Republic of Croatia was 4 284 889. The City of Zagreb is the county with the highest population (around 18.4% of total population), while Lika-Senj County has the lowest population in the country (1,2% of total population) (Figure 3.72).

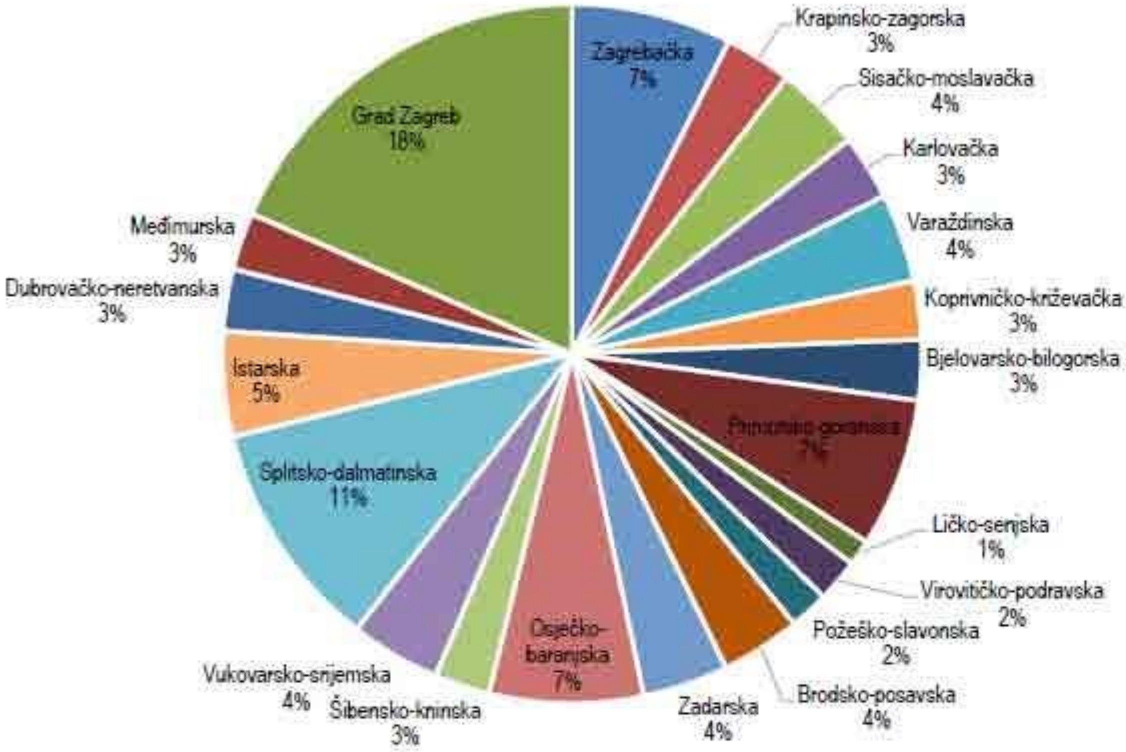


Figure 3.72 Share of the counties in the total population of the Republic of Croatia in 2011 (Source: Transport development strategy of the Republic of Croatia for the period 2017-2030 - draft)

Most of the counties mark a population decline since 1991 (rate of population change was -7.25%). In the period 1991-2011 Brod-Posavina County had a population increase of 1% and Zadar County marked a population decline of 24,6% (Appendix 15.9).

Comparing to 2001 Census of population, the population in the Republic of Croatia in 2011 has decreased by -3.44% or 152 571 persons. The analysis of the population per county indicates the population growth in only four out of 21 counties: Zadar County (+4.9%), Zagreb County (+2.6%), the City of Zagreb (+1.4%) and Istria County (+0.8%). The highest population decrease was registered in Vukovar-Srijem County (-12.3%), Brod-Posavina County (-10.3%) and Bjelovar-Bilogora County (-10%). (Appendix 15.9)

Population projections show the results of what might happen if the current demographic trends continue. The Croatian population projections for 2020 and 2030 are calculated based on the population assessment from 2013, the starting year of the projections (Demographic scenarios and migrations, 2014). A further population decrease is expected and it is highly possible that total population in Croatia by 2030 will be less than 4 million (Appendix 15.9). It is expected that by the year 2020, only the City of Zagreb (+2.5%) and Zadar County (+1.5%) will record a population growth, while Istria County, Zagreb County and Split-Dalmatia County will record population stagnation due to their more favorable age structure. In 2030, a population decrease is expected in all counties except the City of Zagreb which will still register a slight population growth (+0.6%) due to its favorable immigration rates comparing to other regional centers in Croatia. Sisak-Moslavina County, Vukovar-Srijem County and Karlovac County (Appendix 15.9) are expected to have the most unfavorable situation.

Among the four counties with macro regional centers, the Osijek-Baranja county is expected to have the most unfavorable situation with population decrease of 15% by the year 2030. If the current demographic trends continue, the region of Rijeka (Primorje-Gorski Kotar County) will have a population decrease of 8% mostly due to its very low birth rate. (Appendix 15.9)

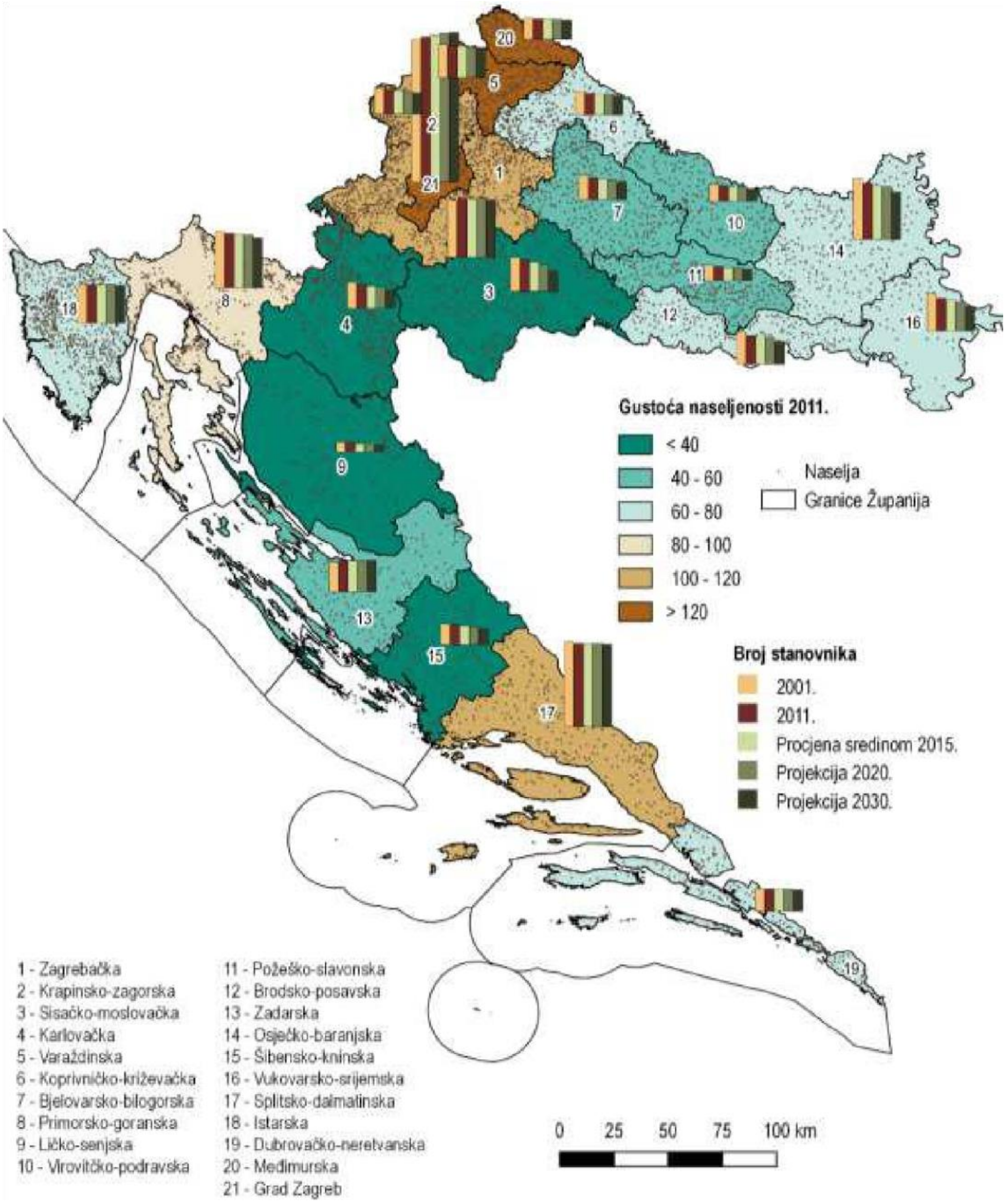


Figure 3.73 Croatian population movement in the period 2001-2011 and projections until 2030 per county (Source: Croatian Bureau of Statistics, Demographic scenarios and migrations, 2014, Prepared by: IRES EKOLOGIJA d.o.o.)

The highest population density is registered in the City of Zagreb (1232.48 people per sq km), followed by Međimurje county (156.11 people per sq km) and Varaždin county (139.42 people per sq km). Eight counties has above average population density (average density is 75.71 people per sq km.) The lowest population density is recorded in Lika-Senj county (9.51 people per sq km) and Karlovac county (35.55 people per sq km) (Figure 3.73).

Ageing Index

Ageing is a demographic process very common in Croatia for many years now, especially in the last period between the last two Census on population. Birth rate decrease, prolongation of life expectancy, emigration of young generations and depopulation in general contribute the most to an increase of elderly groups (65 or more). Ageing Index, that is the ratio of old (65+) and younger (0-14) people is one of the best ageing indicators due to its high sensitivity to differences or changes in the age structure of a population (Demographic scenarios and migrations, 2014).

According to the 2011 Census of population, the population of Croatia is extremely old with ageing index 115. Comparing to the 2001 Census of population, the share of people over the age of 65 in total population has increased by 9.4% (Ageing index in 2001 was 90.7) (Appendix 15.8).

A longer life expectancy in Croatia stems from the fact that in the period 2001-2011 the number of the oldest age groups (80+) has increased by almost 70%, from 99.507 to 168.704 people.

The ageing speed is depicted by the fact that most of the counties according to the 2001 Census of population had more young age groups than elderly age groups in the total population. Only one decade later, in 2011, only Zagreb county and Međimurje County had less old people that the young ones in the total population (Appendix 15.8). On the other hand, Primorje-Gorski Kotar County, Šibenik-Knin County, Karlovac county have 50% more elderly people than the young ones, especially Lika-Senj county with the difference of more than 80% (Demographic scenarios and migrations, 2014).

Lika-Senj County has the oldest population in the country, with more than a half of population over the age of 45 (ageing index 166). Lika-Senj is followed by the Primorje-Gorski kotar county (ageing index 155.3), Karlovac county (ageing index 149) and Šibenik-Knin County (ageing index 146.1). According to the 2011 Census of population Međimurje County, Zagreb county and Vukovar-Srijem County had the youngest population (Appendix 15.8)

The share of old population (65+) in the total population of Lika-Senj county, Karlovac county and Šibenik-Knin county is higher than 20%, and since the age structure in the said counties is not favorable it is expected that demographic ageing will continue to grow even faster. The lowest share of old age groups (65+) in total population have Međimurje County (15.6%), Zagreb County (15.9%) and Split-Dalmatia County (16.6%).

According to the 2001 Census of population, Croatia had 17% of children under the age of 15 in total population, while according to the 2011 Census, that share has decreased by 15.2% which is about one tenth. According to the 2011 Census of population, the lowest share of children under the age of 15 in total population was registered in Primorje-Gorski kotar county (12.5%), Istria county (13.4%) and Karlovac county (13.4%). It is the result of low birth rates and above-average high life expectancy in those counties. The highest share of children in total population is registered in Brod-Posavina (17.1%) et Vukovar-Srijem county (17%), which is the result of the lower life expectancy in those counties. The highest decrease of share of children in the age 0-14 is recorded in Šibenik-Knin county and Požega-Slavonia county, and the lowest one in the City of Zagreb and Zagreb county.

The ageing speed in certain counties is evident through the change of average age between the two recent Censuses of population. In fact, in all counties an average age growth has been registered in the period 2001-2011. In that period, the fastest ageing was registered in Zadar county and Šibenik-Knin county, while the City of Zagreb and Koprivnica-Križevci county have the slowest ageing speed (Demographic scenarios and migrations, 2014).

It is expected that by the year 2020 every fifth citizen (every fourth by 2030) will be 65 or older. What is certainly expected is not just the ageing of the entire population, but also ageing of the older population. By the year 2020, more than 5% of the total Croatian population will be aged 80 or more, and their share in total population by the year 2050 shall double, so every tenth citizen of Croatia could be over 80 (Demographic scenarios and migrations, 2015).

Along with the current birth and death trends that shall continue even in the future, Primorje-Gorski Kotar County, SisakMoslavina County and Karlovac County will also have the least favorable situation regarding the age structure of the population. In those three counties, along with the continuation of the current trends, there will also be a decrease in the share of children (0-14) in total population to 10%, and at the same time the share of elderly population (65+) to almost 30%. It is estimated that in 2030 there will be two and a half times more elderly population (65+) than young population in those counties. Within the indicated age group, the highest and fastest growth is expected in the population above the age of 80.

Međimurje county, Požega-Slavonia county and Brod-Posavina county are expected to have the most favorable age structure with 50-60% more elderly that young population (Demographic scenarios and migrations, 2014).

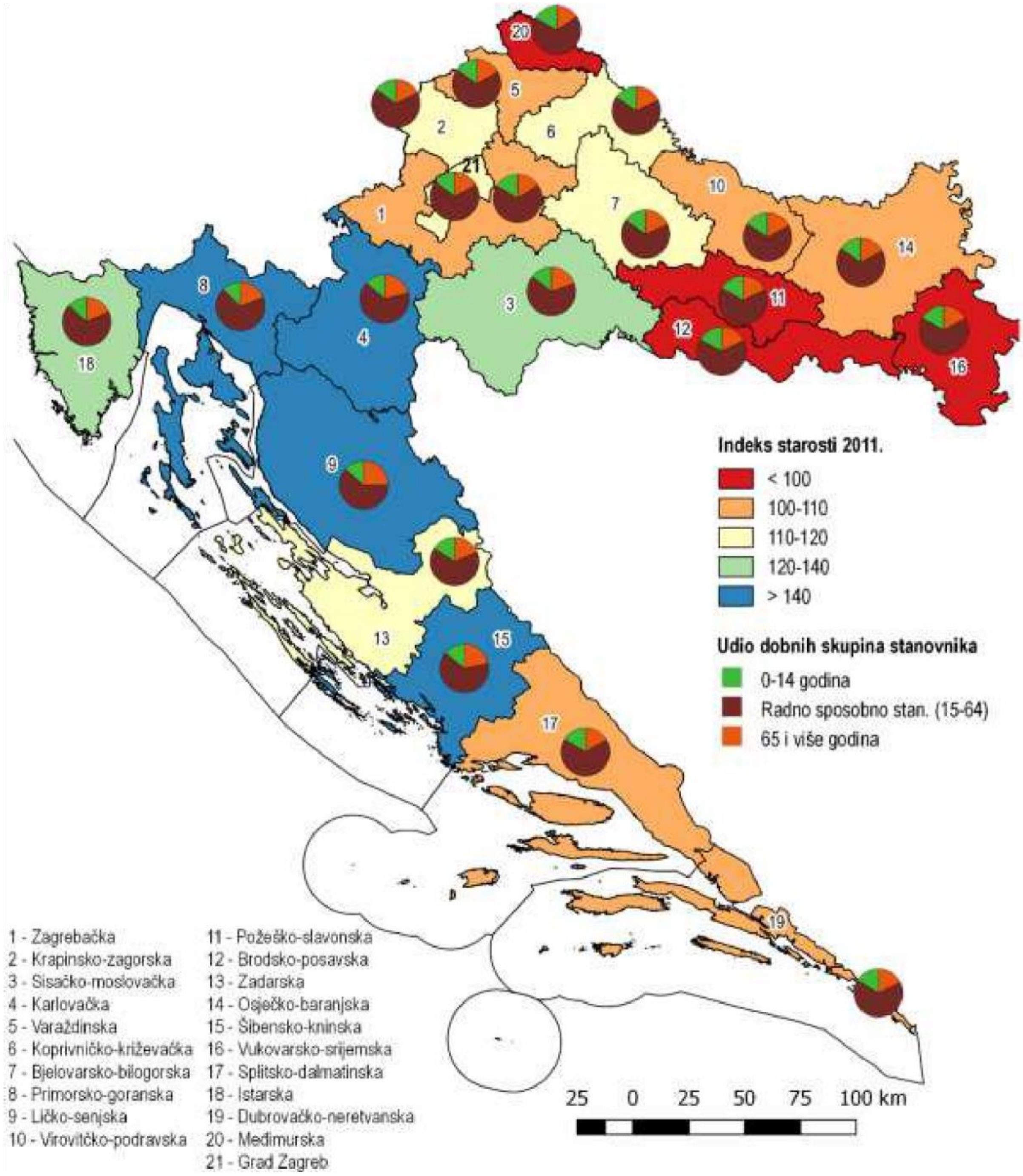


Figure 3.74 Indicators of population age per county in the Republic of Croatia in 2011 (Source: Croatian Bureau of Statistics; Made by: IRES EKOLOGIJA d.o.o.)

Type of general change in population

General change in population depicts a relation and impact of natural change in population and migration on total change in population in a certain period. Depending on whether the migration balance is positive or negative, it is determined whether a certain area has immigration (I) or emigration (E) features. The scale of types of general change in population (four in each group) is determined according to the intensity of emigration of immigration features and according the positive or negative income of natural change (Appendix 15.7) (Nejašmić, 2005).

The discussed ageing process is the result of a decreased birth in the last decade. In the period 2001-2010, a decrease of total population is registered in the Republic of Croatia, where the difference between births and deaths was -95.047, which is about 2.22% of the total population from 2011.

While the number of deaths is more or less stable, the number of births is different each year, especially in the counties with increase in population (Split-Dalmatia county and Dubrovnik-Neretva county) or stagnation (Međimurje county and Zadar county). All the other counties register high decrease in population, but Sisak-Moslavina county, Primorje-Gorski kotar county, Osijek-Baranja county and Karlovac county have very high decrease in total population.

The Republic of Croatia is characterized by E4 type of general change in population, which is extinction (E4), which means that the decrease rate of total population between the two Censuses is higher than the death rate. The migration balance is lower that natural decrease rate, which indicates that the population is in decrease due to negative natural increase and due to immigration (Appendix 15.10).

Demographic picture of Croatia is characterized mostly by depopulation and stagnation with rare exceptions of significant demographic growth caused by immigration (Figure 3.75). During the 1990s, a depopulation was accelerated by the low birth rate and induced emigration. Depopulation particularly affected the counties in which the natural increase had been negative for years. These counties also suffer from economic stagnation, unlike those with demographic growth which attract investors and contribute to the local economic development. If the current demographic trends continue, the chances to reach the demographic balance in most of these depopulation-affected counties are not great. These counties have several characteristics in common: these are all mostly rural and emigration areas with weakened reproductive potential. Decreasing birth rate and emigration in the last period between the last two Censuses have jointly accelerated depopulation in these counties.

Classification of the counties according to joint impact of natural increase and migrations on the total change in population indicates the domination of the counties with negative natural increase and migration balance. The E4 (extinction) classification of general change in population has been registered in 12 counties (Figure 3.20), among which are especially Požega-Slavonia county, Brod-Posavina county, Osijek-Baranja county, Vukovar-Srijem county and Međimurje county with a decrease rate of migration balance higher than decrease rate of natural change, which indicates the high emigration rate from these areas (Appendix 15.10).

Bjelovar-Bilogora county, Brod-Posavina county, Vukovar-Srijem county have lost more than 10% of their population, and 10 other counties have loss above-state average of their population (Appendix 15.10).

Out of 19 counties with natural decrease in population, 7 counties have succeeded to alleviate decrease with positive migration balance, while Zagreb county, Zadar county, Istria county and the City of Zagreb have succeeded to obtain positive total change in position by immigration. Dubrovnik-Neretva county and Split-Dalmatia county have achieved a positive natural increase with negative migration balance. A decrease in population has been registered in twelve counties due to negative natural change and migration balance. At the same time, none of the counties registered a positive natural increase or positive migration balance (Appendix 15.10)

The latest data for the year 2015 have shown that none of the counties have achieved a natural increase in population.

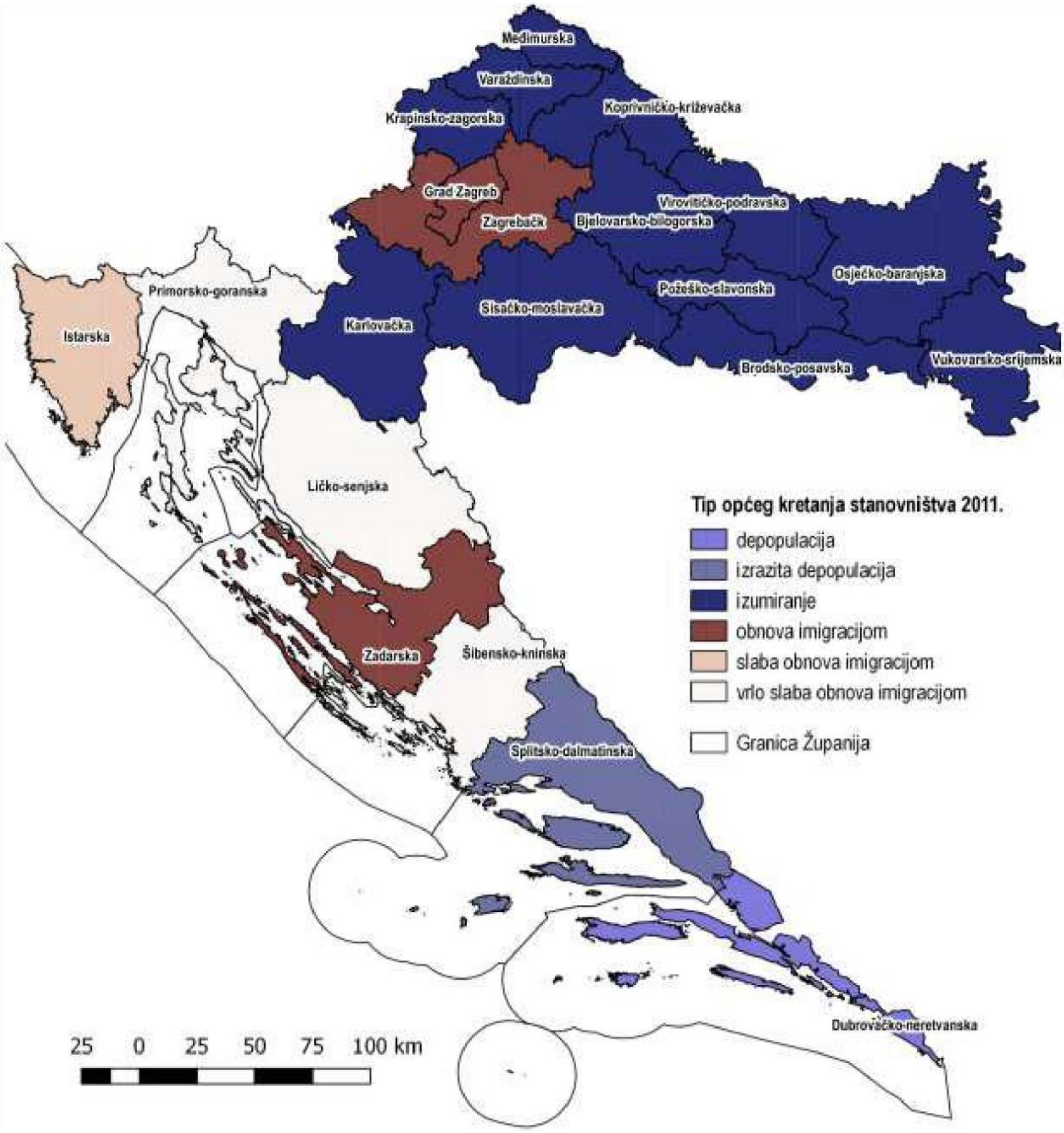


Figure 3.75 Counties according to classification of general movement of population in 2011 (Source: Croatian Bureau of Statistics; Made by: IRES EKOLOGIJA d.o.o.)

3.3.12.2 Number of employed persons and labor market

The distribution of job positions is one of the most relevant indicators of the development of a certain area because jobs positions are at the same time the most important migration factor. The migration of population within the Republic of Croatia incites a gradual modification of work distribution. The City of Zagreb, Split-Dalmatia county, Primorje-Gorski kotar county, Osijek-Baranja county, Zagreb county, Istria county and Varaždin county are demographically biggest counties and at the same time the labor centers with over 50 000 employed persons.

The counties with four biggest Croatian cities have the highest share in total number of registered unemployed persons in Croatia. Zagreb county, Sisak-Moslavina county and Vukovar-Srijem county also have a share of unemployed persons higher than 5%.

The highest shares of active population in total active population in Croatia have the City of Zagreb, Split-Dalmatia county, Primorje-Gorski kotar county, Osijek-Baranja county and Zagreb county. The same order applies for the share of workingage population (age 15-64) in total working-age population in Croatia (Appendix 15.8).

On the contrary, the highest employment rate or percent share of employed persons in working-age population is recorded in the City of Zagreb, Istria county, Varaždin county and Primorje-Gorski kotar county.

The highest percent share of active population (work force, that is, employed and unemployed persons) in working-age population is registered in the City of Zagreb. Zagreb is followed by Primorje-Gorski kotar county, Varaždin county and Split-Dalmatia county. A relative share of active population in 2015 comparing to available working contingent in 2011 for Croatia was around 49.17%. This indicates that there are significant reserves for increase of inclusion of the working force into the labor market. In fact, in extremely favorable conditions, the activity rate reaches value of 80%. According to data herein attached, only City of Zagreb provide these conditions (activity rate is 74.18%).

Table 3.30 Working-age population in 2011, employed and unemployed persons shares, active population shares, activity and employment rate in 2015 per county (Source: Croatian Bureau of Statistics, Croatian Employment Service)

County	Share of employed person (%)	Share of unemployed person (%)	Share of active population (%)	Share of working age population (%)	Activity rate 2015.	Employment rate 2015.
Republic of Croatia	100	100	100	100	49.17	39.22
Zagreb	5.56	5.53	5.55	7.50	36.44	29.10
Krapina-Zagorje	2.34	2.33	2.34	3.12	36.91	29.49
Sisak-Moslavina	2.78	6.39	3.51	3.96	43.63	27.58
Karlovac	2.49	3.35	2.66	2.94	44.61	33.24
Varaždin	4.47	2.60	4.10	4.15	48.55	42.30
Koprivnica-Križevci	2.07	2.26	2.11	2.68	38.75	30.35
Bjelovar-Bilogora	2.00	4.04	2.41	2.76	42.98	28.41
Primorje-Gorski kotar	7.47	5.43	7.06	7.07	49.07	41.44
Lika-Senj	0.93	1.21	0.98	1.09	44.24	33.22
Virovitica-Podravina	1.16	3.21	1.58	1.98	39.19	23.03
Požega-Slavonia	1.20	1.85	1.33	1.77	36.87	26.49
Brod-Posavina	2.24	4.44	2.68	3.61	36.58	24.33
Zadar	3.08	2.84	3.03	3.89	38.30	31.04
Osijek-Baranja	5.73	11.36	6.87	7.19	46.93	31.22
Šibenik-Knin	2.00	2.49	2.10	2.44	42.41	32.24
Vukovar-Srijem	2.70	5.96	3.36	4.12	40.09	25.69
Split and Dalmatia	9.27	14.01	10.23	10.61	47.39	34.26
Istria	5.28	2.33	4.68	4.97	46.32	41.65
Dubrovnik-Neretva	2.67	2.72	2.68	2.81	46.82	37.21

County	Share of employed person (%)	Share of unemployed person (%)	Share of active population (%)	Share of working age population (%)	Activity rate 2015.	Employment rate 2015.
Međimurje	2.69	1.95	2.54	2.67	46.70	39.44
City of Zagreb	31.88	13.71	28.20	18.69	74.18	66.88

In the period 2011-2013, the number of vacant job posts in Croatia and in each county varies. Since 2013, there is a growth of the number of vacant job posts in all counties in the Republic of Croatia (Figure 3.76). In total of vacant job posts in 2016, the City of Zagreb had the highest share (20.14%), followed by Split-Dalmatia county (10.66%), Primorje-Gorski kotar county (9.30%), Istria county (7.76% and Osijek-Baranja County (7.15%). The share of all the other counties is less than 5% in total number of vacant job posts in Croatia.

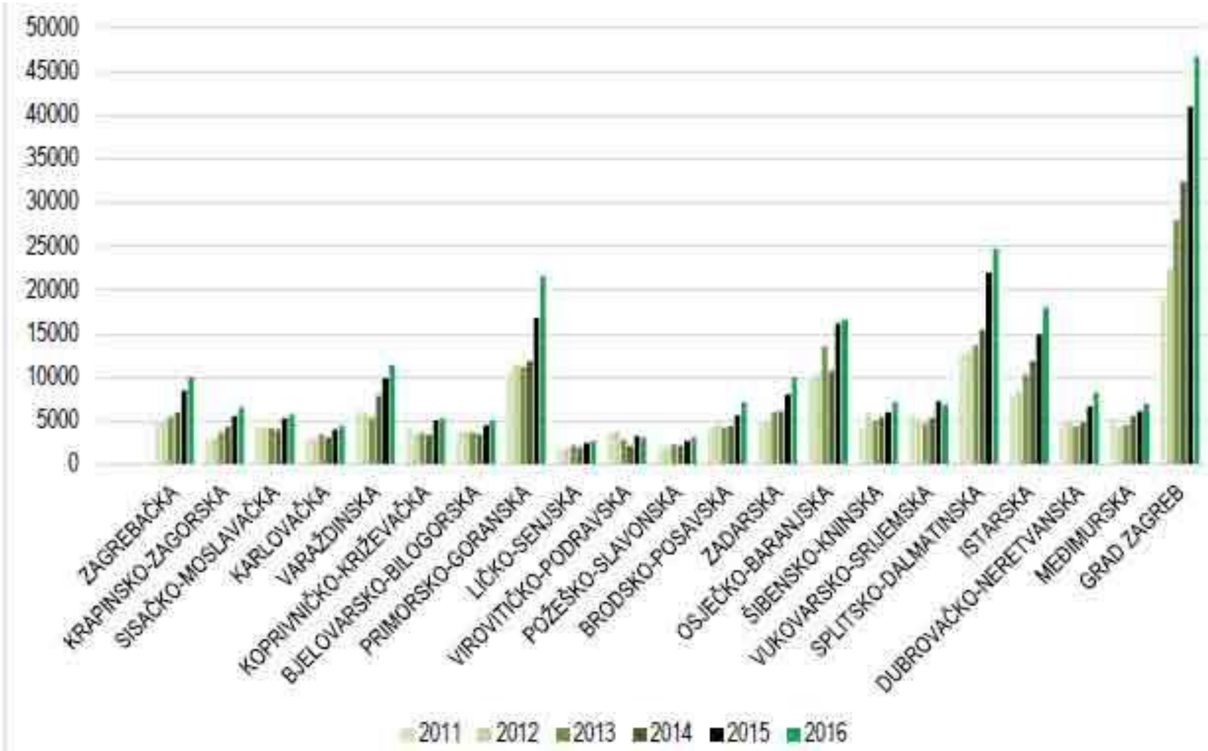


Figure 3.76 The number of vacant job posts registered at Croatian Employment Service in the period 2011-2015 (Source: Croatian Employment Service)

In accordance with the growth of the registered vacancies, all spatial units recorded a decrease of registered unemployment rate since 2013 (Figure 3.77). It should be emphasized that persons aged 25-29 have the biggest share in unemployed population. They are followed by the persons aged 50-54, 20-24 and the persons above the age of 60. Regarding the employment policy measures, a significant growth in number of users of all measures can be noticed. Before registering as unemployed, most of the registered unemployed persons were employed; the second most common status before registering as unemployed was inactivity and the last one was education. The duration of the unemployment of the registered unemployed persons was mostly up to 9 months. Most of the unemployed persons finished high-school, followed by those who finished only primary school. In the City of Zagreb most of the unemployed persons hold high-school or university degree.

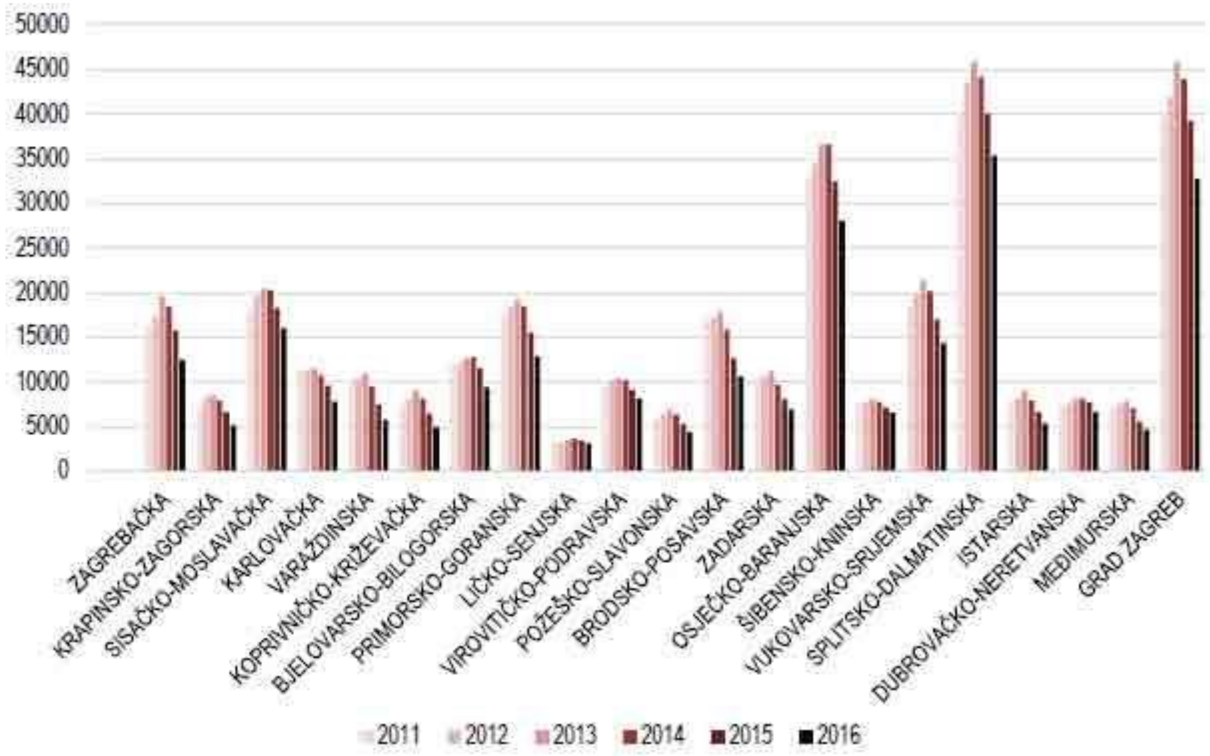


Figure 3.77 The number of registered unemployed persons per county in Croatia, 2011-2016 (Source: Croatian Employment Service)

If we compare the number of registered vacancies and the total number of registered unemployed persons per county, the result is either excess or deficiency of vacancies in the counties (Appendix 15.11). The previously mentioned job vacancies growth per county since 2013 is noticed. In the reference period, only Istria county constantly has higher number of job vacancies than the number of registered unemployed persons (more than 100%). Until 2015, none of the counties, except Istria county, had a number of registered job vacancies higher than the number of unemployed persons. In 2015 that ratio was higher than 100% in six counties, while in 2016 that number was higher in 10 counties (Appendix 15.11).

The chart below (Figure 3.78) shows the ratio of the number of registered job vacancies and the number of registered unemployed persons in the period 2011-2016. The values for 2012-2016 are shown on the ordinate while abscissa shows the data from 2011, which are the basic values used as a reference for values 2012-2016.

There are many similarities in the ratio of the number of registered job vacancies and the number of the registered unemployed persons in 2015 which is less than 100 in most of the counties. Since 2015, especially 2016, most of the countries record this ratio at almost 100% or more than 100%, which implies that the situation on the Croatian labor market is getting better.

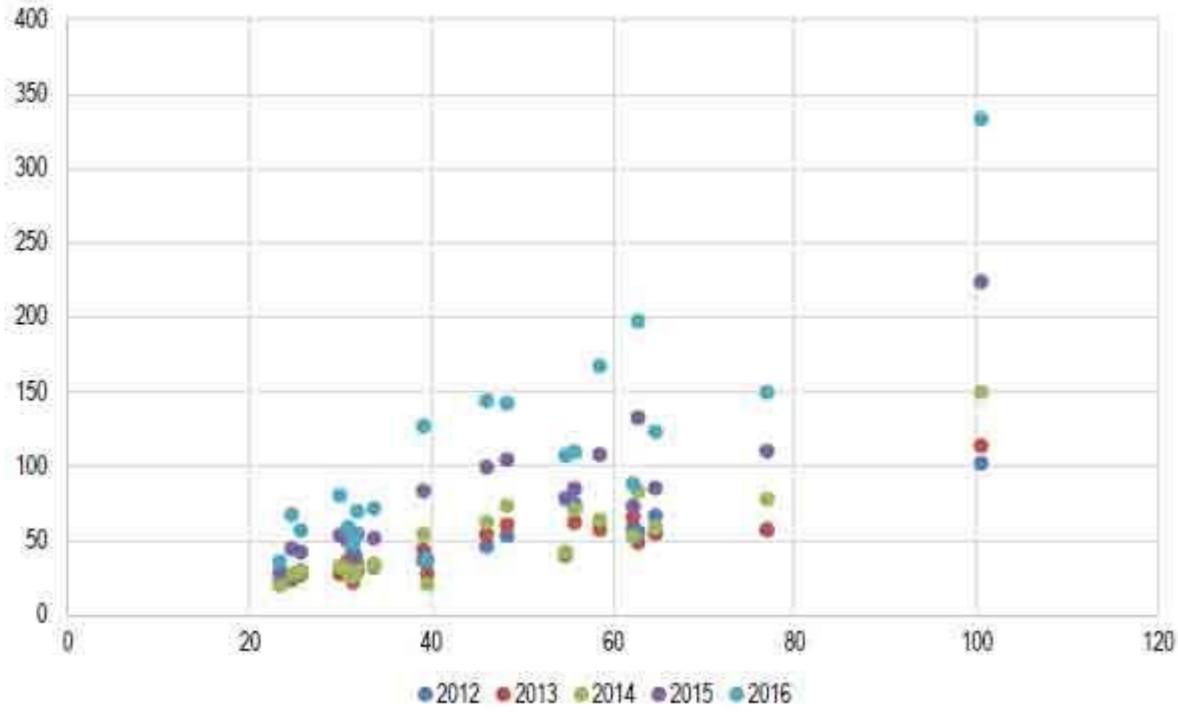


Figure 3.78 Share of registered job vacancies in total number of the registered unemployed persons (%) in the period 2012 -2016 base=share in 2011 (Source: On-line Statistics, Croatian Employment Service)

3.3.12.3 Development Index

Development Index (hereinafter referred to as: DI) is a composite indicator calculated as ponderated average of multiple social and economic indicators (unemployment rate, per capita income, budget income of local or regional self-government per capita, general population movement rate and education rate) for measurement of the level of development of local and regional self-government bodies and is based on deviation of indicator value from the state average of local and regional self-government bodies categorized in development groups.

DI was introduced for the purpose of objective measurements of development of all local and regional self-government units in the Republic of Croatia. By directly connecting the levels of the economic development incentives with the levels of development, a quality frame of development drive is obtained for all local and regional units in accordance with the development level of each unit. Croatia’s Regional Development Act (OG 147/14) states that assessment procedure is to be conducted every five years, while the last procedure of assessment and distribution of all units of local and regional self-government according to development index has been conducted at the end of 2013.

The development index of twelve counties distributed in the Development group I is by 75% lower than Croatian average. This lowest development group is also qualified as assisted area. The Development group II comprises Šibenik-Knin County, Varaždin County and Split-Dalmatia County, while the Group III comprises Zadar County, Dubrovnik-Neretva county and Zagreb county. The most developed counties are Istria County, Primorje-Gorski Kotar County and the City of Zagreb.

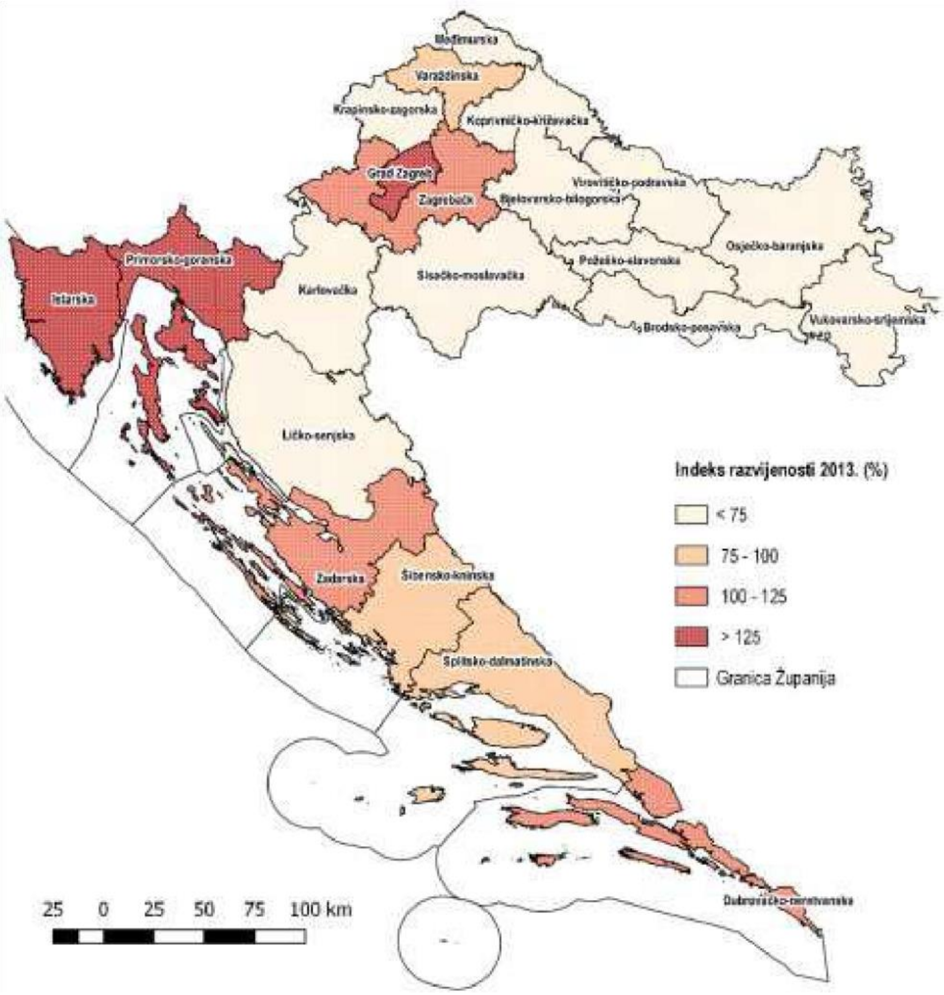


Figure 3.79 Development Index per county in 2013 in the Republic of Croatia (Source: Ministry of regional development and European Funds)

Generally speaking, the north-west Croatia has the highest regional development index, while Slavonia and other continental regions have significantly lower index. Higher index values are registered in Istria and other littoral counties thanks to tourism and tourism-related investments in development.

The lowest development index values are registered in Virovitica-Podravina county, Vukovar-Srijem county and Brod-Posavina County.

A higher level of development is registered in the counties in which there's a better and denser infrastructure for economic (transportation, energetic, communication system, public utility services) and non-economic activities (education, health care system, science, culture, social service and administration) that caused a higher concentration of job posts and better educated workforce, immigration and better economic indicators in general.

Counties with higher development index generally have higher rates of motorization. Higher motorization rates are generally registered in the areas in the proximity of capitals or big cities and indicate that the certain area has a large population traveling to work. Motorization rate in Croatia has increased due to stronger purchasing power and change in population's way of life (tendency to move into suburban areas) which is connected to stronger need for daily migration of the population. According to the draft of the Transportation Development Strategy of the Republic of Croatia for the period 2017-2030, the highest motorization rates are registered in Istria County, Primorje-Gorski kotar County, Dubrovnik-Neretva County and the City of Zagreb and Zagreb County.

Gross domestic product per capita (hereinafter referred to as: GDP) is the indicator of the economic production of a certain space unit and may be used for measurement and comparison of the level of economic activities between the counties. GDP is not an indicator of regional prosperity or regional revenue.

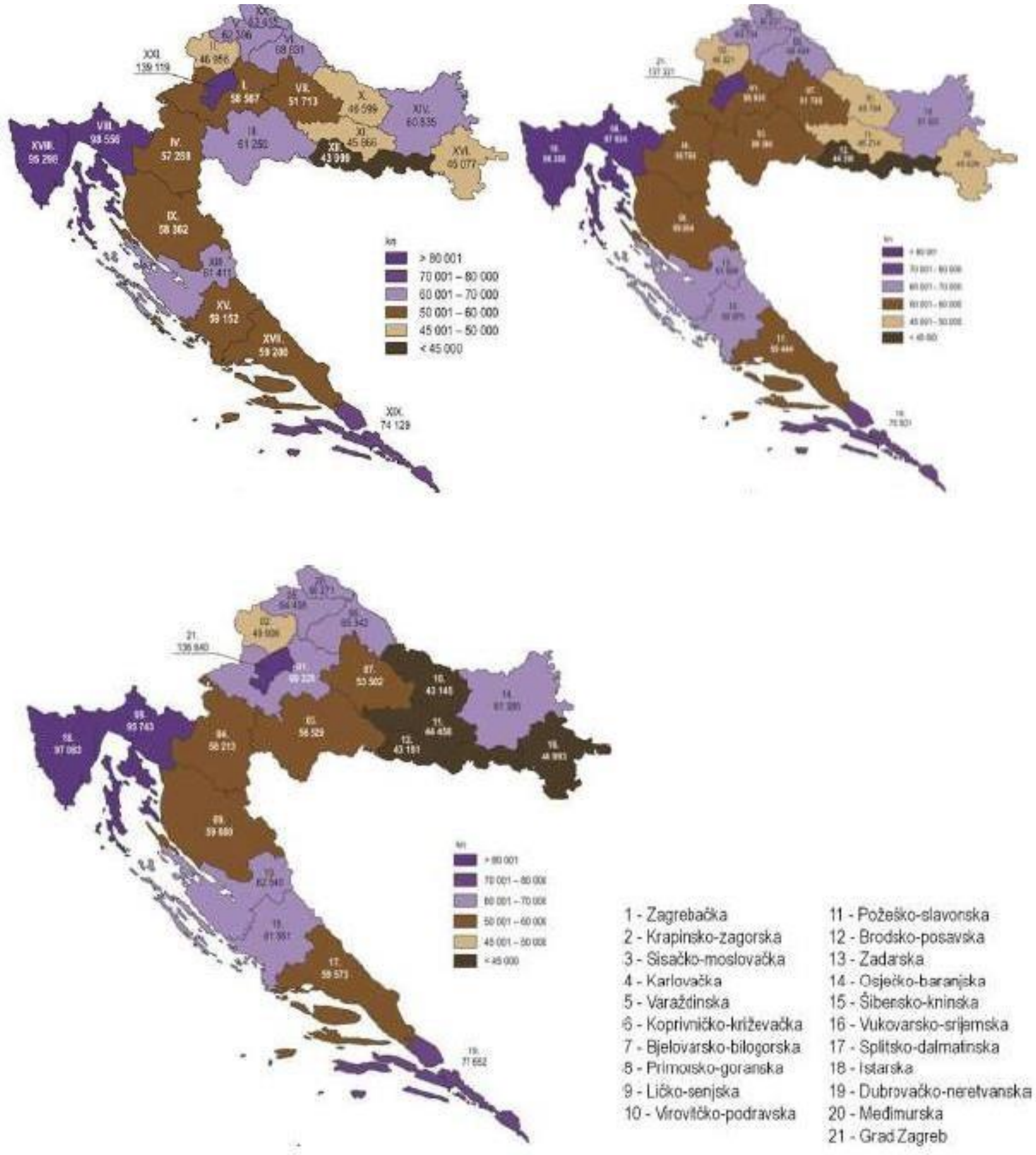


Figure 3.80 Gross domestic product per capita in 2012 (up left) 2013 (up right) until 2014 (down left), per County (Source: Croatian Bureau of Statistics)

There is a significant difference between fastest growing counties, such as counties in Dalmatia and the City of Zagreb and those poorest located in continental Croatia: Virovitica-Podravina County, Požega-Slavonia County and Sisak-Moslavina County.

GDP per capita in the Republic of Croatia in 2014 was 77 456 HRK. GPD in all counties except in the City of Zagreb, Dubrovnik-Neretva County, Primorje-Gorski kotar County and Istria County have under-average GDP per capita. The City of Zagreb has the highest GDP per capita, higher than the state average by 76.4%.

It can be noticed that in the period of three reference years, the highest GDP per capita was registered in only three counties: City of Zagreb, Istria County and Primorje-Gorski kotar County. The situation is far different with the lowest GDP values per counties (Figure 3.80). Only Požega-Slavonia County had the lowest GDB in 2012 and 2013, while in 2014 the lowest values of GDP were registered in Brod-Posavina County, Vukovar-Srijem County and Virovitica-Podravina County. It is important to emphasize that the population of municipalities/cities/counties with the lowest GDP per capita face the highest risk of poverty in the Republic of Croatia.

The statistics have shown that in 2014 GDP per capita has slightly increased by 0.06% comparing to 2012.

Data for 2014 show that continental Croatia (the City of Zagreb and 13 counties) have around 60% of share in total Croatian GDP per capita, while share of the Adriatic Croatia with seven counties is almost 40%.

The lowest BDP per capita is registered in Virovitica-Podravina County, which is by 44.3% lower than the Croatian average and more than three times lower than GDP of the City of Zagreb.

Comparing to 2012, a decrease of GDP per capita was registered in eight countries in 2014. These are mostly counties of the continental Croatia (the City of Zagreb, Koprivnica-Križevci County, Virovitica-Podravina County, Požega-Slavonia County, Brod-Posavina County, Vukovar-Srijem County and Sisak-Moslavina County) and Lika-Senj County. The highest GDP decrease per capita in the reference period was registered in Sisak-Moslavina County, while Krapina-Zagorje County had the highest GDP growth.

According to the report of the Croatian National Bank, a favorable economic situation continued at the end of 2016. A significant growth of industrial production and export of goods was realized, including retail trade turnover and business and consumer optimism.

3.3.12.4 Human health risk

In the period 2011-2014 the number of deaths decreased in the Republic of Croatia, while in 2015 that number highly increased (Figure 3.81). In 2015, the main cause of death of the Croatian population were cardiovascular diseases, followed by tumors, injuries, poisoning and other consequences of external causes. The next most common cause of death was respiratory system and digestive system diseases. In the period 2011-2013, the most common cause of death in Croatian population were digestive system diseases, while in 2014 the respiratory system diseases were primary cause of death. Since 2011, the number of deaths caused by respiratory system diseases is in constant growth, reaching 2663 persons in 2015.

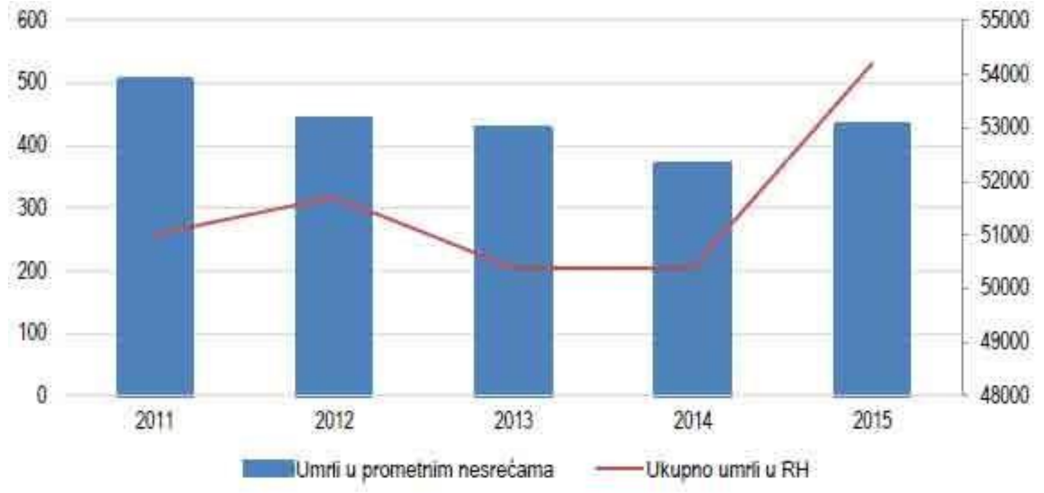


Figure 3.81 Total number of deaths and the number of killed in traffic accidents in Croatia in 2011-2015 (Source: Croatian Bureau of Statistics)

A very similar trend is observed in the number of deaths caused by traffic accidents. Up until 2014 that number has been decreasing, but in 2015 a sudden increase of deaths caused by traffic accidents was recorded. In 2015, 432 persons died in traffic accidents, that is, 62 more than the previous year (Figure 3.81). A share of deaths caused by traffic accidents in total number of deaths in 2015 was 0.8%.

Regarding traffic accidents in 2015, most people died in a mean of transport (67.6%), followed by pedestrians (17.4%) (Figure 3.82).

Regarding deaths in a mean of transport, the highest number of deaths in 2015 was in August (12.7%), while the lowest number of deaths was recorded in February (3.1%). The highest registered number of pedestrian deaths was in October. A share of pedestrians killed in traffic in that month was 14.7% of the total number of killed pedestrians in 2015, while the lowest number was registered in May (4.0%). Regarding traffic an accident in 2015, the highest rate of persons killed was registered in Split-Dalmatia County (46), followed by Osijek-Baranja County (42) and the lowest number of persons killed in traffic accidents was registered in Požega-Slavonia County (7).

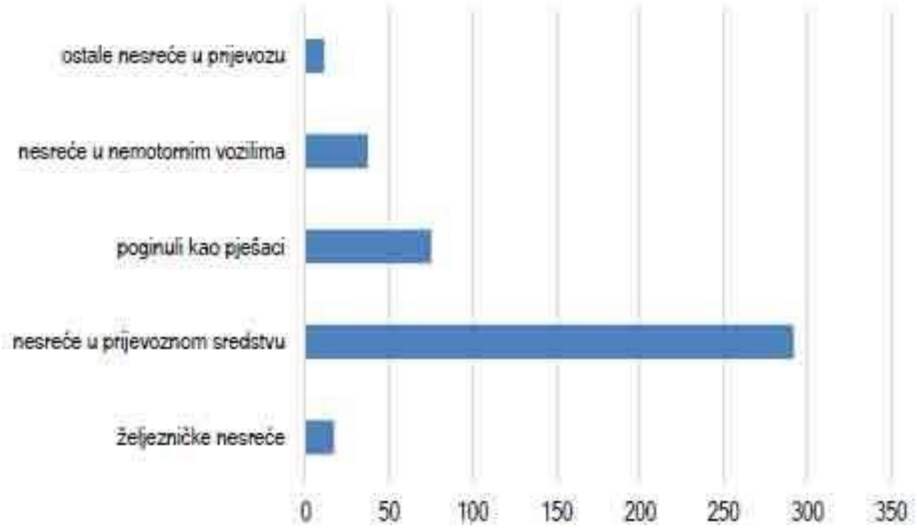


Figure 3.82 Persons killed by type of the traffic accident in Croatia in 2015. (Source: Croatian Bureau of Statistics)

Considering that the number of death is increasing in Croatia, as well as the number of deaths caused by respiratory system diseases and considering the aggravation of air quality and risk for human health, it is important to mention which pollutants and their values are being recorded in Croatia. Namely: flying particles (PM10 and PIVb), B(a)P in PM10, ozone (O3), nitrogen dioxide (NO2) and benzene.

Hydrogen sulphide (H2S) measurements record exceeded limit values affecting the quality of life. PM_{10} values are high in bigger cities and industrial centers of the continental Croatia: Zagreb, Osijek, Kutina, Sisak and Slavonski Brod, with exceeded values of household furnaces, traffic and industry, as well as high values of BaP in PM10 in Zagreb, Sisak and Slavonski Brod. High $PM_{2,5}$ values are registered in Zagreb and Slavonski Brod.

Unlike the primary pollutants which are emitted directly into the air, the tropospheric ozone (O3) is not emitted directly into the atmosphere, but is formed by complex chemical reactions and is affected by emissions of its precursors such as nitrogen oxide (NOx including NO and NO2) and non-methane volatile organic compounds (NMHOS). These reactions are induced by solar radiation. High ozone values recorded in Zagreb and Rijeka are a consequence of traffic and industrial pollution as well as in the littoral area where the intensity of the solar radiation is very high. Moreover, exceeded values of the tropospheric ozone were recorded in almost every background station on the whole territory of the Republic of Croatia, which indicates a significant regional contribution as well as the influence of the trans-frontier transportation.

High values of NO_2 are registered near traffic routes in the City of Zagreb, where the fuel combustion in traffic transport is the dominant cause of pollution with emission of NO_2. High values of benzene are registered in Sisak.

Exceeded values of H2S are registered in the industrial centers Sisak, Urinja and Slavonski Brod, which is also located near an industrial center.

The pollutants that may cause damages to human health are also found in the soil. Pollutant in the soil are heavy metals (Cd, Cr, Cu, Hg, Ni, Pb i Zn) and potentially toxic essential elements (Zn and Cu), organic pollutants (pesticides, industrial chemicals, combustion by-products and industrial processes by-products), radionuclide and pathogenic organisms. The most significant soil pollution causes are those of anthropogenic origin (waste, emissions from traffic, accidents, etc.). The Regulation on the protection of the cultivated land from contamination defines pollutants, causes of pollution and maximum allowed quantities of pollutants in soil, but these only apply to cultivated land. Threshold limit values of pollutants are not defined for land used for other purposes (forest land, settlements, parks and playgrounds, industrial zones), which prevents defining and monitoring of polluted and potentially polluted locations and potential changes in soil.

3.4 Potential environment development without the implementation of the Strategy

By joining the European Union, Croatia has assumed the responsibility to reduce the greenhouse gas emission as well as to improve environment and nature status, especially regarding water, biodiversity and air quality. National strategies, programs and plans define measures for the improvement of status of a certain activity which should ultimately result in a reduced impact on the environment.

In the context of this document, the main driver of changes in the environment is the construction and organization of traffic system. The traffic connection is an important precondition for raising life standard of the population and for regionally balanced development of the Republic of Croatia. The transportation ensures faster and easier availability, better mobility of people, access to a work place, effective trade of services and goods, which is why it represents an essential segment of the development of all economic sectors.

Should the Strategy not be implemented, the negative demographic trends would continue, that is the low birth rate would affect the total population movement, younger and working-age population would emigrate and the population would continue to age which all initiated the extinction process in many areas in Croatia. The growing trend of population ageing affects both socioeconomic needs of total population and the mobility of the population. The increasing share of elderly population in the total population shall have greater needs for public transportation, the availability of which is not adequately solved in all parts of Croatia. Should the objectives of this Strategy regarding the improvement of the public transportation system in general (GO 1 and PT1-PT5) and by transport sector (RDT2, AT3, MT6) not be implemented, meeting the social needs demanded by the elderly Croatian population may be postponed or even ignored.

Moreover, in case the Strategy's objectives GO3, GO7, GO8, GO9, GO3 and SG6 are not implemented, high differences in values of development index and GDP may continue in the counties. A diversified spatial development creates uneven conditions for the development of entrepreneurship. This leads to deepening of socioeconomic differences between the counties and population migration to the counties with better availability of job vacancies and social infrastructure which ultimately leads to higher pressure on the environment. Non-implementation of the objectives RDT6 and RDT8 shall lead to further deepening of the socioeconomic differences in Croatia in the areas that are less available because the upper limit of the maximum road capacity has been reached in the existing transportation infrastructure and in which there are no alternative means of transportation or they are not economically justified. In case the objectives regarding development of the logistic potential of main traffic crossroads (SG4, SG5), increasing competitiveness of ports (AT1, AT2, MT1, RIT1, RIT2) and increasing the efficacy of traffic systems (GO2, RT1, RT2, RT6, RT7, RDT4, RDT7, MT3, MT5, RIT4, RIT5) are not implemented, the differences in values of development index per County and uneven spatial development in Croatia will be even stronger.

Intensification of social and economic activities in most developed and most populated counties induces an increasing level of pollution emissions into air/soil and water (most significant pollutions in road traffic), noise pollution, exhaust gas pollution and dust pollution. Non-implementation of Strategy's general objectives GO4 an GO5 irreversibly changes natural values of space and has negative impact on the habitat fragmentation and flora/fauna diminution. In addition, lack of control of pollutant emissions represents a risk for human health. Moreover, excess traffic infrastructure (especially road traffic infrastructure in the littoral area) contributes to the modification of landscape visual features which has a negative impact on tourist perception and experience of the location. On the other hand, traffic is an important factor of the tourism development, so non-implementation of Strategy's objectives GO9, SG1, SG2, SG7, RDT9 and RIT3 would lead to further deepening of transportation issues in the tourism sector.

The non-implementation of Strategy's general objectives GO1, GO4, GO5 and GO6 would postpone some positive changes regarding reduction of environmental pollution, especially by using environmentally-friendly fuel, improvement of transportation system security, raising transportation system effectiveness using energy sources with low or zero carbohydrate emission, reduction of noise pollution and waste. The same applies to non-implementation of the specific objectives in the respective transportation sectors: RT3, RT4, RT5, RDT1, RDT3, RDT5, AT4, MT2 and MT4.

Should the measures defined in this Strategy not be implemented, Croatia would not fulfill internationally assumed responsibility of reduction of greenhouse gas emission so the environmental development would still be affected by the greenhouse gas emissions and pollutant caused by the transportation sector. Even though the Croatia's share in total global emissions is low, it is necessary that Croatia joins the world countries in their efforts to reduce greenhouse gas emissions and to contribute to limit global temperature growth to maximum of 2°C.

Finally, it is estimated that without the implementation of this Strategy, the environment would continue to develop in accordance with the currents trends with potential improvements in transportation sector that might help fulfill development strategies and Spatial planning documents in counties, cities or municipalities.

4 Environmental Characteristics of the Areas that can be significantly affected by the Strategy

Environmental characteristics of the area that can be significantly influenced by the implementation of the Strategy are described in Chapter 3.3 Description of Environmental Components. This chapter describes identified expected impacts on the area environmental characteristics that can be significantly influenced by the implementation of the Strategy.

Air quality and climate features

At a strategic assessment level, when we exclude specific impacts that are either limited by legal regulations or are considered at the level of environmental impact, the Strategy has potentially positive and negative impact on air quality and climate features. Using the newly constructed transport infrastructure and increasing the number of vehicles shall increase the amount of harmful exhaust and greenhouse gases, which negatively affects the air quality. The implementation of the measures that contribute to the reduction of greenhouse gas emissions and the introduction of an intermodal system based on ecological and innovative solutions shall have a positive impact on the air quality and climate features.

Geodiversity

By analysing the locations of protected geoheritage sites and interventions planned in the Strategy, it has been established that there are no conflicts in the area, i.e. that the intervention shall not devastate the protected geoheritage sites.

Biodiversity

In the implementation of the Strategy, there are possible impacts on biodiversity, which are primarily reflected in additional fragmentation of rare and endangered habitats, disturbing species and reducing the stability of important ecosystems. Significant impacts are possible due to changes in hydromorphological conditions of water bodies, which may lead to changes in habitat conditions. In addition, new roads significantly reduce habitats by causing edge effects and barrier effects.

Landscape characteristics

Large transport infrastructure projects and associated infrastructure generate negative impact on the landscape. The impact intensity depends on the area through which it passes or its characteristics. The characteristics of each area are manifested through natural, anthropogenic (cultural) and visual experiential qualities. Given the number and types of projects, that is, the type of transport, the most significant impact of the Strategy is expected in the landscape region of the Lowland areas of northern Croatia.

Soil

The construction of railway tracks and roads shall lead to a negative impact on the soil in the form of soil contamination with pollutants which occur due to transport by trains and road vehicles and potential soil degradation due to erosion or soil displacement. Since the impacts on the soil are largely related to the narrow area around the roads themselves, significant impacts on the soil during the implementation of the Strategy are not expected.

Water

Due to the implementation of the Strategy, negative impacts are expected due to potential pollution of water bodies and water for human consumption, as well as impacts on the hydromorphological condition of water bodies. However, it is estimated that these impacts shall not be significant if the existing legal regulations and water protection measures prescribed by the subject Study shall be applied.

Cultural and historical heritage

Due to the implementation of the Strategy, negative impacts are possible on the architectural heritage (individual buildings, cultural and historical units) and the cultural landscape, as well as the archeological zones and sites. Nevertheless, the preliminary analysis of the Strategy implementation does not show significant impacts, given that due to the character of the impact it is possible to implement protection measures for the conflict areas.

Agriculture

Realising the measures in the road and rail transport sector and inland waterway transport may result in the conversion and fragmentation of agricultural land P1 and P2. Given the presence of P1 and P2 land, the influence of the conversion of P1 and P2 land can be significant in the Dinarides.

Forestry

Significant impacts may be expected in the implementation of planned measures in the area of endangered lowland forests, in particular common oak forests that are regularly flooded. The construction of roads and railway tracks shall lead to fragmentation of forest areas, and the construction of the Danube - Sava canal to significant changes in the water regime, which shall have a significant impact on the stability of the lowland forest ecosystem.

Wild game and hunting

The main impacts that may arise from the implementation of the Strategy are the fragmentation of hunting areas, disturbance and fatalities of wild game on the roads.

Tourism

Transport capability to meet tourism needs is determined by the size and condition of the transport infrastructure and transport capacities as well as their ability to meet demand requirements with their services. The importance of tourism for Croatian economy is great and therefore the transport system appears as a factor for improving or limiting the development of tourism. The development and equipping of passenger terminals and accompanying facilities, a systematic improvement of infrastructure and transport service and the uniform development of all transport modes within the traffic system shall positively influence the accessibility of tourist destinations, the comfort, speed and safety of travel and the mobility of tourists within destinations, which shall synergistically affect the increase in the indicators of the tourism intensity and the possibilities of improving or creating new tourist products.

Social and economic characteristics

Today, a harmonised economic development and valorisation of economic and natural resources is inconceivable without the adequate development of the entire transport infrastructure complex. It is even more important considering the attractiveness of the coastline and islands in our country and the primacy of the most developed tourist area where most of the country's GDP is generated. The wide offer of different means of transport, infrastructure and various transport systems has a major role to play in raising the quality of life of citizens by improving accessibility and increasing travel speeds. This strengthens the mobility of the population, ensures sufficient and rapid supply of remote parts of Croatia, which leads to the intensification of the business of economic entities, strengthening of tourism activities, increase in the number of employees and the growth of the general and economic well-being of the society. The synergistic impact of these effects is reflected in the slow economic emigration of the population from the emigration areas in Croatia, which directly affects the stable overall (general) movement of the population.

5 Existing Environmental Issues of Importance for the Strategy

5.1 Air Quality and Climate Characteristics

Concentration of Air Pollutants

The most common pollutants in the air, which caused the pollution of the largest number of zones and agglomerations in the period from 2013 to 2015, are PM_{10} and O_3. Floating particles with a diameter of less than 10 μm polluted each year three zones/agglomerations, which accounts for 33% of zones and agglomerations. Excessive air pollution by PM_{10} floating particles occurs mainly as a direct consequence of traffic, fireplaces and industry: The number of polluted zones and agglomerations by ground-level ozone (O_3) in the period 2013 to 2015 is increasing. In 2013, one agglomeration was contaminated by ground-level ozone, in 2014 two, and in 2015 as many as six zones/agglomerations were ozonecontaminated (66% in total).

According to the 2009-2012 Environmental Report, the ground-level ozone concentrations in Croatia are mostly influenced by natural conditions, strong summer insolation, vegetation that is a natural source of ground-level ozone precursor emissions and the geographic position, which is why our area is exposed to the remote transport of ground-level ozone and its precursors from the West Europe area. This is the reason for occasional episodic elevated ground-level ozone concentrations in almost the entire country.

In the period from 2013 to 2015, total concentrations of pollutants in the air increased and accordingly the number of zones and agglomerations evaluated as contaminated, at least with regard to one pollutant. The Zagreb and Osijek agglomerations and the Industrial Zone have been rated as contaminated for all three years.

The reasons for increasing concentrations of pollutants in the air in the period from 2013 to 2015 can be attributed to the following categories:

- small fireboxes
- local industry including electricity generation
- vicinity of main roads
- natural sources or natural events other reasons, etc.

Small fireboxes and the local industry, including electricity production, are one of the most common causes of pollution in certain zones. Their share in overall pollution for each particular year varies, but they are always at the top of the causes of pollution.

From 2013 to 2015, the highest number of exceeded limit values, target values and target values for ground-level ozone was recorded in the Industrial zone, followed by the Zagreb and Osijek agglomerations. According to the above mentioned, the lowest percentage of the category 1 air was recorded in the Industrial zone and Split and Osijek agglomerations.

Amount of greenhouse gases

The amount of greenhouse gas emissions, from 1990 to 2014, has been steadily increasing in the energy sector, and in 2014 the majority of the emissions occurred as a result of the combustion of fuel in traffic (34.8% in 2014). Road transport is the dominant source of CO_2 - eq and it accounts for 95.7% of total CO_2 - eq emissions in the transport sector. The remaining 4.3% of the emissions from the transport sector are produced by the maritime and river transport (2.4%), railway transport (1.3%) and the least part of air transport (0.6%). Compared to 1990, CO_2-eq emissions from the transport sector increased by 45.4%, as a result of an increase in the number of vehicles and the number of kilometers travelled in road transport.

5.2 Geodiversity

Vulnerability of geodiversity sites

The geological and geomorphological phenomena that make up geodiversity are the result of various processes that can take place during millions of years. Due of the aforementioned, environmental issues related to geological diversity are particularly emphasized, since any damage and destruction leads to their permanent disappearance.

The greatest pressures on geodiversity, which are the consequence of human activity, result from the exploitation of mineral resources, since exploitation causes permanent loss of valuable geodiversity areas. Additional problems are the consequence of the development of new construction sites, as well as the construction of infrastructure facilities such as roads and railway tracks. The primary impacts of the construction of these facilities are the direct destruction of geodiversity during construction, but their construction can also activate natural processes such as landslides that may also affect geodiversity. The collection and intentional destruction of fossils and minerals (especially in speleological facilities) is problematic and irresponsible.

5.3 Biodiversity

The biodiversity of areas in Croatia has been influenced by various anthropogenic pressures for years, due to the centuriesold population density, however, the development of the society in the past and this century has increased these pressures, leaving an evident trace on the nature. Urbanization and all its inheritance with the changes in the habits of the population have led to the subject intensification. One of the main drivers of the pressures is the increase in traffic with the development of transport infrastructure, resulting in an increasing fragmentation of areas, a reduction in wild species populations, introduction of invasive foreign species, changes in water conditions in habitats and others.

The most vulnerable habitats, with regard to the pressures of transport infrastructure, are forest and aquatic habitats and wetlands, which traffic routes affect by fragmentation, pollution, changes in water conditions and the introduction and spread of invasive species. However, unfavourable impacts have also been noted in marine habitats, which are, with the development of maritime traffic, under the great influence of invasive foreign species, which came to the Adriatic via ballast water and hulls of ships. The spread of invasive species is also contributed by the changes in climatic characteristics that enable the settlement of species from warmer seas. These impacts could be mitigated by improved ballast water control; however, a Ballast Water Monitoring Program for the Republic of Croatia has not yet been developed. A similar situation regarding the transfer of invasive species by ships is also present in river transport, through which the zebra mussel, one of the most invasive species in the world, has reached the Croatian rivers of the Danube River Basin.

Although the fragmentation of the Croatian territory is still at a lower level than most states in Europe and still has not significantly disturbed the balance of the ecosystem, the increase in habitat fragmentation and its consequent factors is expected with the development of transport. The construction of the transport infrastructure, apart from habitat fragmentation and preventing the undisturbed movement of animals, also results in the loss of individual animals on the roads as evidenced by the data specified in Chapter 3.3.3.2. The fatalities of individual animals depend on several parameters such as the category of roads, the accompanying infrastructure, and the species composition in the habitat. For example, the largest number of bear and vehicle collisions in Croatia has been recorded on railway tracks, while wolves are mostly killed on smaller roads passing through their territory. Air transport is a problem in Croatia, since it is also the cause of many fatalities, contributed to by the fact that Rijeka, Zadar and Split airports are located within the conservation areas important for the birds of the ecological network (POP), and all the others, with the exception of Dubrovnik, are located in their vicinity.

In addition, the development of transport in Croatia has resulted in increased stress in wild species resulting from the amount of noise and vibration in natural and semi-natural habitats. Despite a small quantity of data for Croatia, the noise and vibrations, together with the flash of vehicle lights, have adversely affected wild species and have further diminished their habitat. According to available data, the groups most vulnerable to these impacts on land are birds and mammals, and marine mammals and fish in the marine environment.

The impact of traffic has not bypassed the protected areas in Croatia, which is evident from the analysis of the presence of motorways, fast and state roads in national parks and nature parks. In the area of the Velebit Nature Park (covering Paklenica National Park and Northern Velebit), the largest area is covered by roads, and due to the share of road surface in the total land area of the protected area, the most unfavourable condition was recorded in the National Park Mljet.

5.4 Landscape Features

Negative changes in the Croatian landscape have so far resulted from different types of activities, starting from the unharmonized urbanization, which implies the growth of cities, i.e. the abandonment of villages, to major infrastructural interventions of roads, pipelines and power stations. Landscape issues are created by unplanned construction associated with urbanization and mass tourism that places the greatest pressure on the coastal area. Agricultural activity also plays a major role in the formation of landscape areas through systems of melioration, coagulation, monoculture, felling of forests and hedges.

An additional issue is the fact that the Strategic Plans and Landscape Conventions (European Landscape Convention) are not linked to any binding legal document that would condition the preparation of a document of identification, protection, planning and management.

Landscape issues have been addressed in the spatial planning documents, namely the 1997 Spatial planning Strategy and the 1999 Spatial planning Program. They are also mentioned in the environmental protection system through the 2002 National Environmental Action Plan and through the nature protection system in the documents: Strategy and Action Plan for the Protection of Biological and Landscape Diversity of the Republic of Croatia, based on the Convention on Biological Diversity and the European Biological Protection Strategy And Landscape Diversity. These documents failed to produce a shift in the landscape problem resolution, so negative impacts are visible in the areas.

5.5 Soil

Lack of legal framework for soil protection

Since the soil protection system is not normatively constituted as a single law but rather a standardized method of land use, it is also difficult to establish a unique soil monitoring system, i.e. systematic monitoring of the soil condition. The incomplete legal regulations of the Republic of Croatia related to the soil and its protection resulted in the lack of data on the state of the soil, as well as the lack of data on land use. Limit values of pollutants in the soil are prescribed exclusively for agricultural land, while they are not prescribed for land used for other purposes (for example forest land, settlements, parks and playgrounds, industrial zones). A consequence of such a situation is a further disruption in the determination of changes in soil condition, i.e. monitoring soil contamination caused by natural or anthropogenic sources. Due to the aforementioned, there are no specific preventive measures for soil protection and sustainable land management.

Soil contamination

With the 2006 Thematic Strategy on Soil Protection, the European Commission identified the most significant threats to soil in Europe, stating that, as in the case of the Republic of Croatia, soil contamination is caused by anthropogenic activities. Anthropogenic sources of soil pollution are mostly industrial production (nuclear, chemical, mining, metallurgical, electronic and other), disposal of industrial (hazardous) waste, disposal of municipal waste, agriculture, accidents, military activities and similar.

The most critical soil contamination locations in the Republic of Croatia are unofficially termed "black spots". These are locations where long-term and inadequate disposal of technological waste resulted in soil contamination. There are currently six other black spots in the Republic of Croatia presenting significant environmental hazards. Of these six spots, four are currently in the process of restoration, while the restoration for the remaining two is under preparation.

5.6 Water

Environmental problems related to road, rail, air, river and sea transport are the consequence of insufficient monitoring of the surrounding water body, i.e. the inability to directly link the pollution of water bodies caused by traffic. An additional issue is the lack of a legal framework that would prescribe measures to protect water bodies from contamination. Water protection measures are set out in the Ordinance on the Conditions for Determination of Sanitary Protection Area Areas and refer only to water for human consumption.

One of the environmental issues is the poor chemical status of certain water bodies of coastal waters. A good chemical status on the territory of the Republic of Croatia in a total of four water bodies has not been achieved. Two water bodies of the above four are particularly important for the Strategy. These are the Neretva canal in front of the Port of Ploče and Port of Split. The reason for the lack of a good chemical status in these water bodies is the presence of tributyltin above the permissible limit values. It is a chemical compound that has been used in the last 40 years as a biocide coating on ships for the purpose of preventing ship fouling. The issue with this compound is that it is gradually released into the marine environment where it is extremely toxic to marine organisms. For this reason, the application of this coating on ships is completely prohibited in the European Union, including the Republic of Croatia. However, irrespective of these prohibitions, ships with such coatings are not forbidden to enter ports of the European Union and their negative impact has not been eliminated. According to some estimates, 85% of the world fleet has biocide coatings based on tin.

The environmental issues associated primarily with river and sea transport are the consequence of the deterioration of the hydromorphological condition of water bodies of surface waters and water bodies of coastal and transitional waters and pollution from ships and floating facilities. The hydromorphological condition is disturbed during the construction of naval and river ports, and the arrangement of riverbeds that are navigable waterways, thus disrupting the natural condition of the sea shore, i.e. riverbeds. This causes deterioration of the morphological conditions of water bodies, and consequently their hydromorphological and ecological condition.

In river transport, this issue is evident in the hydromorphological condition of water water bodiescourses that represent larger waterways within the Republic of Croatia (Danube, Sava and Drava rivers). The hydromorphological condition of these water bodies is largely disrupted, and is generally considered as being in a moderate, bad or very bad condition. In maritime traffic, the hydromorphological condition of coastal and transitional waters is mostly assessed as very good or good. With regard to the transitional waters, a very good or good condition was found on 62% of the surface, and a moderate condition on 38%. In coastal waters, very good or good condition was found on as much as 99.6% of the surface and moderate only on 0.4%. A bad or very bad condition has not been established on no water body of transitional or coastal waters.

It should be noted, however, that an unfavourable assessment of the hydromorphological condition can not be directly related solely to the impact of the construction of the transport infrastructure, that is, an unfavourable assessment of the consequences and interventions on water bodies constructed for other purposes, such as water flood control or coastal settlement for the purpose of coastal tourism.

5.7 Cultural and historical heritage

The architectural heritage, which, apart from individual buildings and assemblies, includes urban and rural areas, is mostly in poor and unmaintained condition. In addition, it is exposed to lasting influences and pressures of modern development, and due to its material substance it is particularly sensitive and prone to decay. Due to the poor condition, the endangerment of numerous cultural and historical units and individual structures has been identified. Particularly difficult is the condition of the architectural heritage in rural ensembles and small historic towns where many buildings are without purpose. The unsatisfactory construction status of the architectural heritage is reflected in the abandonment of their function and lack of maintenance, which in many cases leads to a disastrous condition.

Cultural landscapes are subject to change, and are often destroyed due to social and technological changes, expansion of settlements, construction of transport and energy infrastructure and other forms of construction, but also due to the neglect and inadequate use. In many areas of Croatia, there are historical cultural landscapes in which traditional spatial relations, historical patterns and the manner of use are still preserved. Many are not protected by law, but are documented in spatial planning documentation. Today, landscapes are marked by new activities, a new way of life and new value systems. In many cases, the abandonment of traditional villages and small historical towns, as well as the past farming activities, is evident. The abandonment of the way of life, leaving rural settlements is a key issue in many Croatian regions, especially in mountain areas and on the islands.

Archaeological heritage is particularly sensitive because so far no complete topography - archaeological heritage database of the entire Croatian territory has been produced. Most of the known and recorded sites have not yet been researched. Moreover, for certain areas where the topography is relatively well established, the number of localities is not final. It can be safely said that there are at least three known unknown archeological sites. Locations are most often revealed during archaeological reconnaissance (field survey), and are often revealed only during construction works or, in the case of underwater sites, during sports and recreational diving. The degree of preservation of archaeological sites varies from intact to heavily damaged.

5.8 Agriculture

On the territory of the Republic of Croatia, according to the CLC database, 3506.98 ha of agricultural land have been converted during the period from 2006 until 2012. The highest number of agricultural areas was converted to the category "Forest succession (land healing)" with 1364.8 ha (Table 5.1). However, there has been a conversion from one category of agricultural land to another (e.g. from the "Pastures" and "Mosaic of Agricultural Plants" category to "Vineyards"), so we can not discuss conversion from agricultural to non-agricultural land.

208.02 ha of agricultural land in 2006 have been converted to "Road and railway network and associated land" category by 2012. This conversion is not spatially linked to one part of Croatia but is present in several separate locations (Figure 5.1). The conversion and fragmentation of agricultural land through line interventions in the space decrease the agricultural production potential at the state level and the already small agricultural areas are fragmented. According to the Programme of Consolidation of. Agricultural Land in the Republic of Croatia 2009–2021, the average agricultural plot size was 0.45 ha.

Table 5.1 Surface area of converted agricultural areas in the period 2006-2012 (Source: CLC database)

CLC 2006	CLC 2012	Converted surface area (ha)
Agricultural areas	Road and railway network and associated land	208.02
	Construction sites	362.35
	Industrial or commercial facilities	664.86
	Mineral resource exploitation sites	130.70
	Unconnected city areas	177.81
	Landfills	15.39
	Fire-damaged areas	143.06
	Sports and recreational areas	96.84
	Forest succession (land healing)	1364.80
	Vineyards	287.95
	Water bodies	58.15
	Ukupno	Total

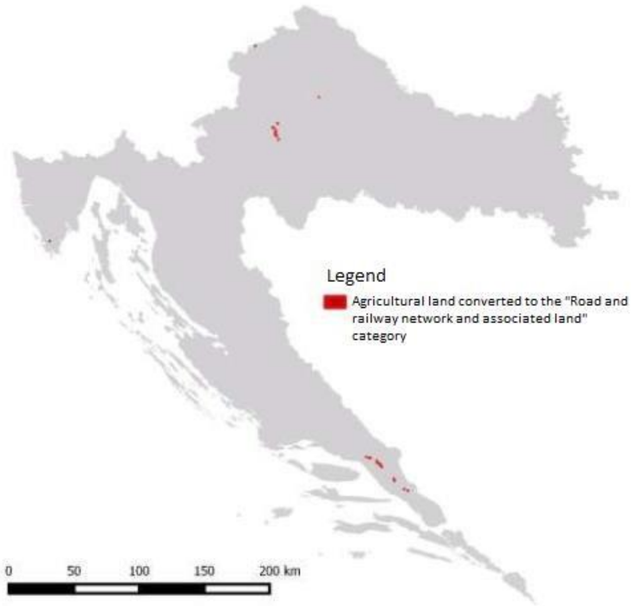


Figure 5.1 Agricultural land converted into the “Road and railway network and associated land” category (Source: CLC database)

5.9 Forestry

Forest area

In the period from 2004 to 2011, 23 298 ha of forests and forest land have been converted (extracted), and this figure has surely increased to date. The aforementioned is also contributed to by the Forest Act itself, which stipulates: "easement may be established over forest or forest land owned by the Republic of Croatia for the purpose of raising multi-annual crops on unproductive forest land and land covered by initial or degrading development stages of forest stands". The forest conversion trend has also been affected forest owner forests, who for this purpose decide on deforestation. However, the exact area of forest land lost in this manner is not known. The Road Act (OG 84/11, 22/13, 54/13, 148/13, 92/14) and the Act on the Regulation of Property and Legal Relations for the Construction of Infrastructure Buildings (OG 80/2011) also affect the reduction of forest areas. The Road Act states: "in the case of extracting forests and forest land owned by the Republic of Croatia from the forest and economic area for the purposes of construction, reconstruction and maintenance of public roads, no fee for the transferred rights prescribed by the act governing the management of forests shall be paid". For example, for the needs of the Sv. Rok – Dugo polje motorway section, 567 ha of forests and forest land were extracted from the forest and economic area, and without the fee for transferred rights the lost forest area could not have been compensate (Gallo, 2011).

Although the forests and their total surface area are of great importance, the trend of forest surface reduction in Croatia has been noted. This is also supported by the data from the table below (Table 5.2), which shows the forest area in Croatia from 1980 to 2012.

Table 5.2 Forest surface in Croatia (Source: CLC database)

Forest type	Years/ha					
	1980	1990	2000	2006	2012	Difference
Deciduous forests	1,706,106	1,694,509	1,695,173	1,667,894	1,653,401	-52 705
Coniferous forests	105,460	102,465	105,598	103,473	102,127	-3333

Forest type	Years/ha					
	1980	1990	2000	2006	2012	Difference
Mixed forests	273,643	275,068	272,636	274,578	273,965	22

It can be noticed that the total forest area decreased by 56 038 hectares in the period of 22 years. The largest share refers to deciduous forests, a smaller part to coniferous forests, while no significant changes have occurred in the mixed forests. The forests have changed into a transitional area of forests (healing), referring to the young forests after restoration. The cause of the loss of older stands that are most important for forest biodiversity is still unknown. Furthermore, in the same period, an increase in the surface area of artificial surfaces predominantly of unconnected city areas, industrial zones and the road and railway networks were recorded. The figure below (Figure 5.2) shows the relationship between the surface of forests and the aforementioned artificial surfaces in Croatia.

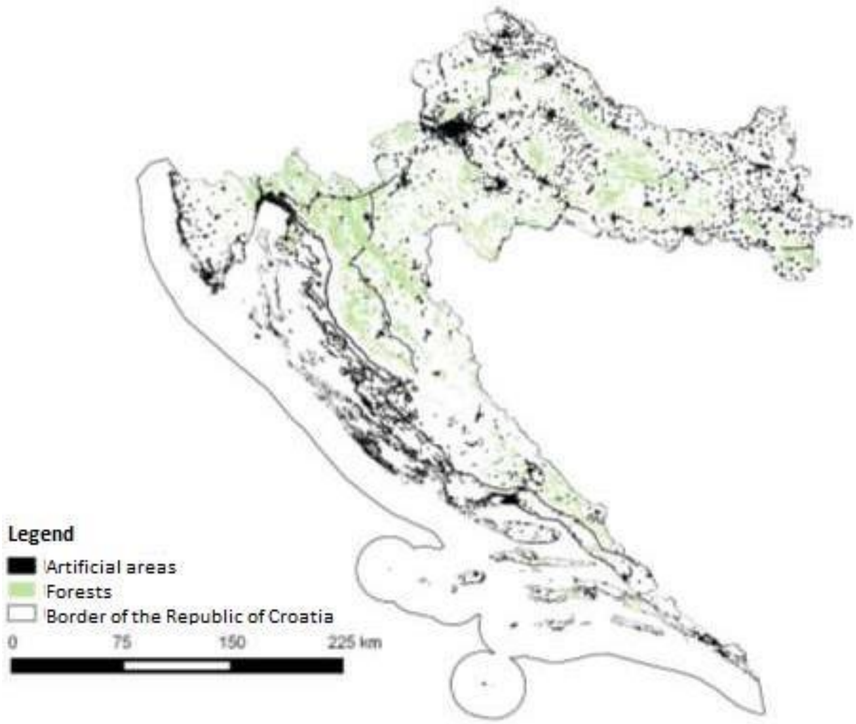


Figure 5.2 Ratio of forests and artificial surfaces (Source: CLC database, Habitat map)

Although the figure indicates forest areas in relation to infrastructure buildings, it does not necessarily mean that their construction has led to a conversion (fragmentation) forest land, as no other areas such as agricultural land, water areas, etc. are indicated. However, it can be noticed how the construction of a certain part of the artificial surfaces was performed through forest complexes, which caused their fragmentation, i.e. division into smaller segments.

Forest ecosystem stability

Although the condition of the Croatian Forests is one of the best in Europe, a large number of harmful factors (droughts, forest fires, diseases and pests) and the impact of human activities (air pollution, soil acidification, changes in the water regime of flood and groundwater) weaken the functions and quality of the forest ecosystem. The main causes of forest endangerment in Croatia are the pollution of air, soil and water (pine trees the most sensitive), changes in the water regime due to inappropriate hydrotechnical interventions (pedunculate oak forests are threatened) and road construction through large forest complexes. Hydrological interventions change the natural water regime of the watercourse and cause degradation of wetland habitats of high economic and biological value such as floodland pedunculate oak forests.

The management of the pedunculate oak forests is burdened by tree decline and tree dieback, which is gaining ever-greater proportions and represents the most significant economic and ecological issue of forestry in Croatia. Changing habitat conditions, combined with other stress factors, causes pedunculate oak decline and dieback. In the lowland pedunculate oak forests in the period 1995-2007, about 17.5 million cubic meters of dead pedunculate oak trees were cut, which represents 38% of its total wood stock, and about 30% of trees die back before the prescribed growing age (Tikvić et al., 2009). A special issue is the drying of pedunculate oak forest trees in Spačvanski bazen, and from the 20th century to the present day, a total of 4 million m^3 of wood stock has dried in this area. In addition to fungal diseases (powdery mildew), floods, climate changes and irrational forest interventions, the negative consequences on the drying of these forests were also caused by hydroelectric interventions on the Sava River that interrupted the water supply to the Spačva forests, and pedunculate oak water represents a dominant ecological factor (www. agroklub.com).

Since 1987, Croatia has participated in the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests), and since 2010, the monitoring is carried out in accordance with the Ordinance on the Method of Monitoring the Damage to Forest Ecosystems (OG 076/2013). Monitoring of the condition of forest ecosystems is carried out through visual assessment of ossification and crown damage. The parameters used in the estimation are crown defoliation and color loss (decoloration), and are expressed in defoliation classes: class 0 = 0-10% (no defoliation), class 1 = 11-25% (low defoliation), class 2 = 26-60% (moderate defoliation), class 3 and 4 => 60% (strong defoliation). The main causes of crown damage are air, water and soil contamination, changes in the natural characteristics of the water regime (e.g. hydrotechnical interventions in lowland forests), climate change, plant diseases and forest pests (insects).

According to the data of the Croatian Forestry Institute on forest ecosystem damage, an assessment of the condition of tree damage in Croatia for 2015 has been prepared. The evaluation was carried out on 95 bioindication points, with the evaluation including 2280 trees of different tree species, of which 1953 broadleaved trees and 327 coniferous trees. Although in 2015 the largest number of trees was classified as 0 and 1 (without defoliation or low defoliation), as much as 29.74% of trees have significant crown defoliation, which certainly affects the stability of the forest ecosystem. In the table below (Table 5.3), there is an overview of the crown defoliation over a ten-year period.

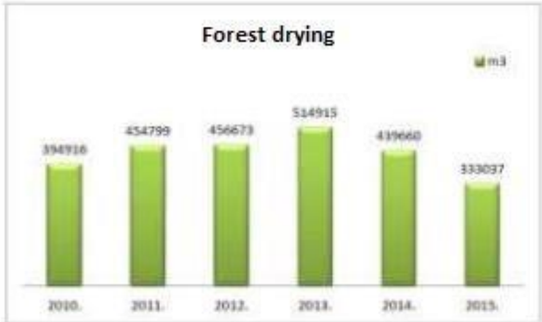
Table 5.3 Crown defoliation on the territory of Croatia (Source: Reporting and forecasting activities in forestry for 2015/2016)

Year	Classes and crown defoliation degree				Tree number	Significant defoliation
	0	1	2	3+4		
	0-10%	11-25%	26-60%	>60%	N	%
2005	36,44	36,58	23,69	3,30	2094	26,98
2006	41,45	33,84	21,84	2,87	2157	24,71
2007	37,41	37,17	21,93	3,49	2061	25,42
2008	39,02	36,26	21,13	3,59	2063	24,72
2009	37,42	35,80	23,00	3,78	2039	26,78
2010	35,07	37,00	22,92	5,01	2016	27,93
2011	39,76	34,84	21,63	3,77	2256	25,40
2012	36,62	34,92	25,21	3,25	2400	28,46
2013	32,86	38,02	25,32	3,81	2520	29,13

2014	29,17	39,36	25,57	5,91	2472	31,47
2015	31,97	38,29	24,56	5,18	2280	29,74

Wood stock

The Croatian Forestry Institute, together with the Ministry of Agriculture, performs Reporting and Forecasting Activities in Forestry (hereinafter: RFA). According to the RFA, the condition of our forests in the complex category of forest drying is not at a satisfactory level. Forest drying can occur through joint action of biotic, abiotic and anthropogenic influences. Anthropogenic impacts are mostly manifested by the construction of roads or hydrotechnical interventions in the area of forest complexes. All of the above affects the health status of trees and the quality of wood stock itself and leads to a decrease in height and thickness. The figure below (Figure 5.3) shows the damage to the wood stock for the period 20102015.



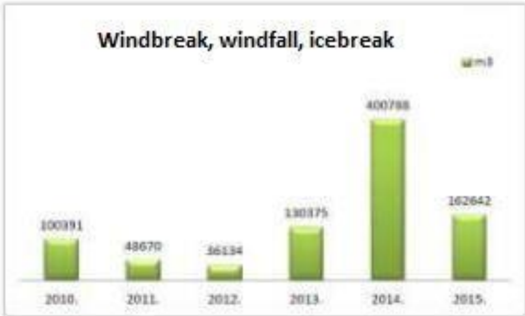


Figure 5.3 Damage to wood stock on the territory of Croatia (Source: RFA)

According to the Report for 2015, 333 037 m3 of wood stock of softwood and conifer have been damaged. As a major factor for complex forest drying, extreme climatic conditions are highlighted. Although the trend of forest drying in 2015 has reached the lowest level since 2010, it is assumed that in the coming years an increase in wood stock shall be expected due to climate change and adverse unfavourable conditions. Breakage due to wind and ice damaged 162 642 m3 of wood stock of leaflets and conifers. Also, the fires affect the state of the stock and the height and thickness of the crop. With the emergence of large-scale firewood, huge quantities of wood stock can be irretrievably lost. According to the data of the Croatian Forests in 2012, the woods damaged by wood fires amounted to about 433 million HRK.

Forest ecosystem services

Forest fires are the greatest threat to the forest ecosystem services of the Mediterranean part of the region. The table below (Table 5.4) shows the damage caused by fire in the forests of Croatia.

Table 5.4 Fire-damaged forest areas in Croatia (Source: Statistical Yearbook of the Republic of Croatia, 2016)

Year	2011	2012	2013	2014	2015
Total fire-damaged area (ha)	3277	5668	1999	191	6064

In a five-year period, a forest area of 17 149 ha was damaged in fires. In the period from 2008 to 2014, total estimated fire damage was higher than HRK 1.6 billion, and 94% of damage occurred in the karst area. In addition to damage to wood stock, particular environmental damage is associated with the forest ecosystem services. There are disturbances in the ecological conditions, forest ecosystem and water erosion in forest areas damaged by fires. In view of the climate conditions in the Mediterranean and the occurrence of forest fires, more difficulties in the management of forests and forest land can be expected in the future (Barčić et al., 2016).

5.10 Wild game and hunting

The road and railway infrastructure has fragmented the hunting areas and has reduced wildlife habitats, and traffic causes wild game fatalities. Generally, all types of transport infrastructure (railways, waterways and roads) affect animal habitats through which they pass, and thus the animals. Apart from direct loss of habitats or deterioration of their quality, the traffic also directly affects the game population in hunting grounds. Habitat fragmentation due to infrastructural interventions damages the integrity of the habitat, leads to loss of living space and forces the wild game to migrate.

In the period 2007-2009, a total of 7495 deaths by vehicle impact with deadly or severe wild game injuries were recorded (Table 5.5). The highest number of fatalities (34.7%) was found in Istria (1168), Karlovac (862) and Međimurje County (573). Most road fatalities were recorded on state roads and motorways, and less on County and local roads.

Table 5.5 Wild game fatalities in road traffic in Croatia (2007-2009) (Source: Šprem et al., 2013)

County	Year			Total	Share (%)
	2007.	2008.	2009.		
Istria	408	358	402	1168	15,58
Karlovac	198	309	355	862	11,50
Međimurje	201	177	195	573	7,65
Zagreb	191	173	160	524	6,99
Primorje-Gorski Kotar	160	174	173	507	6,76
Bjelovar-Bilogora	147	157	200	504	6,72
Osijek-Baranja	141	132	200	473	6,31
Varaždin	131	156	171	458	6,11
Krapina-Zagorje	100	136	169	405	5,40
Koprivnica-Križevci	102	111	146	359	4,79
Brod-Posavina	57	91	127	275	3,67
Vukovar-Srijem	77	71	119	267	3,56
Sisak-Moslavina	86	65	107	258	3,44
Lika-Senj	59	72	94	225	3,00
Požega-Slavonija	45	70	92	207	2,76
Virovitica-Podravina	47	62	78	187	2,49
Zadar	24	40	37	101	1,35
Šibenik-Knin	23	22	25	70	0,93
Split-Dalmatia	14	18	23	55	0,73
Dubrovnik-Neretva	5	7	5	17	0,23
Ukupno	**2216**	**2401**	**2878**	**7495**	**100,00**

Vehicle impacts mostly refer to roe deer with 73%, followed by: wild boar (9%), rabbit (5%), pheasant and fox with 4% each and red deer with a 2% share, as shown in the table below (Table 5.6).

Table 5.6 Wild game fatalities in road traffic in Croatia by type of game

County	Roe	Wild boar	Red deer	Fallow deer	Fox	Rabbit	Badger	Pheasant	Quail	Jackal	Wild cat	Partridge	Mallard	Wolf	Bear	Mouflon	Marten	Total
Istria	877	123	2	-	29	63	32	37	-	-	1	-	2	-	1	-	1	**1168**
Karlovac	746	65	1	-	17	20	2	4	-	-	5	-	1	1	-	-	-	**862**
Međimurje	460	2	9	-	8	47	4	42	-	-	-	1	-	-	-	-	-	**573**
Zagreb	409	39	5	-	30	15	7	19	-	-	-	-	-	-	-	-	-	**524**
Primorje-Gorski Kotar	409	30	32	-	8	9	2	-	-	-	1	-	-	-	16	-	-	**507**
Bjelovar-Bilogora	437	32	10	1	9	3	2	10	-	-	-	-	-	-	-	-	-	**504**
Osijek-Baranja	303	45	43	-	23	22	7	27	1	-	2	-	-	-	-	-	-	**473**
Varaždin	297	13	1	-	15	42	-	88	-	-	-	1	1	-	-	-	-	**458**
Krapina-Zagorje	354	3	1	-	8	18	-	20	-	-	-	-	1	-	-	-	-	**405**
Koprivnica-Križevci	282	23	8	-	11	22	5	6	-	-	-	-	2	-	-	-	-	**359**
Brod-Posavina	139	17	3	-	34	28	9	39	-	2	4	-	-	-	-	-	-	**275**
Vukovar-Srijem	175	42	1	-	16	11	8	11	-	1	2	-	-	-	-	-	-	**267**
Sisak-Moslavina	177	52	1	-	13	5	1	6	-	-	3	-	-	-	-	-	-	**258**
Lika-Senj	126	24	6	9	15	1	6	-	-	-	6	-	-	1	17	3	1	**225**
Požega-Slavonija	105	20	4	-	6	7	1	4	-	-	-	-	-	-	-	-	-	**207**
Virovitica-Podravina	116	17	32	-	7	3	2	10	-	-	-	-	-	-	-	-	-	**187**
Zadar	13	51	-	-	4	16	-	2	-	7	2	-	-	3	2	1	-	**101**
Šibenik-Knin	1	43	-	-	6	10	-	-	-	3	1	-	-	4	2	-	-	**70**
Split-Dalmatia	-	42	-	-	5	7	-	-	-	-	-	-	-	1	-	-	-	**55**
Dubrovnik-Neretva	-	13	-	-	-	1	1	-	-	2	-	-	-	-	-	-	-	**17**
Total	5486	696	159	10	264	360	89	325	1	15	27	2	7	10	38	4	2	**7495**

The highest number of train and animal collision was recorded on the railway line M301 State border - Beli Manastir - Osijek, i.e. in the area of Osijek, Darda and Beli Manstir train stations. The figure below (Figure 5.4) shows that red deer fatality is most common.

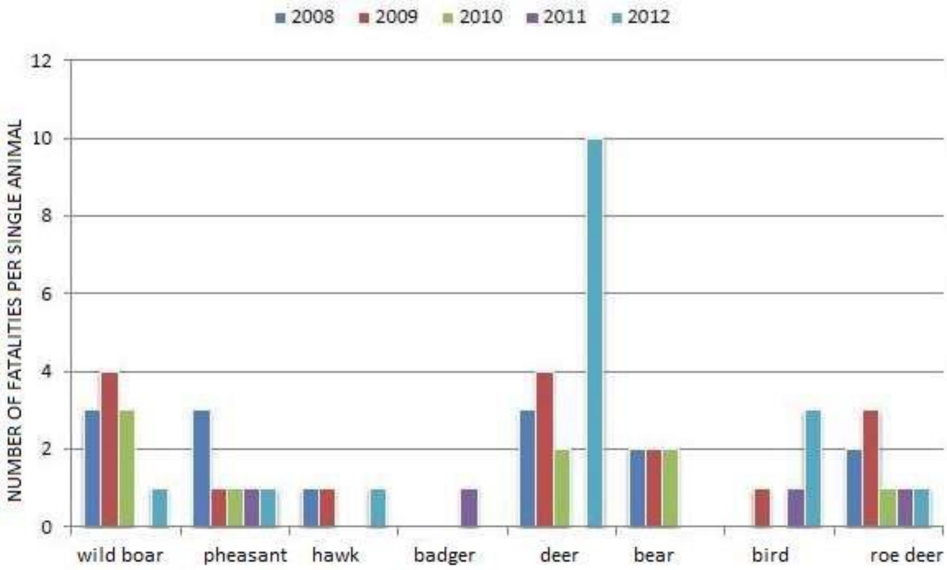


Figure 5.4 Fatalities per single animal species on railway tracks in the period 2008-2012 (Source: Analysis of the state of nature in the Republic of Croatia for the period 2008-2012)

5.11 Tourism

Croatia, in general, is characterized by the seasonality of tourism (the dominant tourist product is Sun and Sea) and a still insufficient use of comparative advantages of the natural-cultural attraction for the development of certain groups of tourist products. In addition, the more unfavourable investment environment, the lack of tourism infrastructure and the still uncompetitive management system and commercialization of tourism products are the reasons for a more difficult establishment of prerequisites for expanding the international recognition of different products, long-term market positioning in the special interest market, tourist activation of the continental area, including the area of the coastal hinterland and extending the season.

According to the Tourism Development Strategy, the condition of the transport infrastructure has improved significantly over the last ten years, most notably by the established motorway network. Regardless of the aforementioned, it should be emphasized that the development of state, regional and local roads has not been sufficient, and although visible progress has been made in the last decade, traffic and tourist signalization has not sufficiently improved, nor have the corresponding service facilities been constructed along the roads. There were also issues of transport organization in destinations, especially with regard to public transport, cycling trails, pedestrian zones and parking possibilities.

The situation in other aspects of traffic is much more unfavourable. This is the result of very poor investments in the transport network and in the improvement of the transportation system. There is a particularly problematic situation with railway transport, which due to the poor state of the network and the low speed of driving has virtually no importance for tourism. A significant part of the aquatorium and islands have an unsatisfactory situation with regard to the ferry and ship transportation, due to both the scarcity of island ports and the insufficient frequency and speed of connection, especially between the islands.

The situation in air traffic is somewhat more favourable, primarily due to the relatively large number of international airports. Of them seven, five are in the coastal area (Pula, Rijeka, Zadar, Split, Dubrovnik), allowing relatively good availability of almost all tourist destinations. However, there is an issue of insufficient commercial interest of air carriers for establishing permanent or intermittent lines and associated relatively small traffic of aircraft, particularly at the Rijeka and Osijek airports. Furthermore, the relatively poor condition of some airports is also worth mentioning.

5.12 Social and Economic Characteristics

Economic and social activities are mutually dependent. The city industry promotes the development of the service sector, and the stronger service sector promotes the development of new industries and services in the area. Every job in production creates 0.5-2 jobs in other sectors. This includes jobs in the quaternary sector, and it can also promote positive demographic trends, since a significant part of migration is economically driven (Development of Economic Activities in Space, 2014). The reasons for residing/migration of the population are therefore linked to the availability of health care, educational institutions, administration and transport connections, which are key elements of the development of a given area.

The spatial development and economic progress of the counties in the Republic of Croatia is uneven due to negative demographic trends, consequences of war (e.g. mining of the area), non-optimal use of comparative advantages of particular areas (e.g. agriculture in continental Croatia), lack of economic specialization of certain areas, inadequate transport connections, unfinished transition and privatization processes, industry shutdown, deagrarization, deruralization, neglect of certain areas, and litoralisation and tertiarization, which provided better social and economic features for larger regional and macroregional centers and coastal counties. Uneven spatial development creates uneven conditions for the development of entrepreneurship. This leads to an increase in social and economic differences between counties and population migration to the counties with greater availability of jobs and social infrastructure.

The population of Croatia is decreasing and the depopulation process has affected most of the counties. The combined effect of low birth rates, unfavourable age structure and emigration of young people in the reproductive age has led to the beginning of the extinction process of many areas of Croatia.

Demographic aging, i.e. changes in the age structure of the population, which are manifested through the reduction of the number of young people and the growth of the number of elderly in the population, represent a social and economic problem, primarily due to the rise in economic and social costs (lack of workforce, issues of the pension, health and welfare systems, political influence of the elderly, reduced economic growth and long-term innovation, etc.), which shall promote demographic aging, but also the viable functioning of many smaller environments that shall be most affected by aging. The growing aging trend of the population is visibly reflected in the mobility and social and economic needs of the total population.

Projections of future total mobility depend on the rate of increase in expected life expectancy, especially in older age groups, as well as trends in birth rates and migration trends. Demographic processes are relatively slow and quite predictable, and unlike many other factors affecting the social and economic development of a certain area, their effect is usually manifested in the long term. It is important to emphasize that demographic trends are a precondition, but also the limitation of spatial development, functioning of the labor market and polycentric economic and social development.

The continental and coastal part of Croatia in relation to the City of Zagreb has varying levels of development and quality of life. The counties of continental Croatia are significantly affected by depopulation, poor job vacancies, unemployment and large emigration, especially of young, productive and working age groups who ultimately migrate to better living standards under conditions of insufficient economic development. The lowest population density is particularly visible in rural areas and in the part of Croatia with poor traffic connections, namely Lika-Senj, Primorje-Gorski Kotar, Bjelovar-Bilogora, ViroviticaPodravina and Požega-Slavonia counties, followed by the islands and areas along the state border. This has great implications for the country's economy, and in the long term, it has the potential to determine future changes in the natural and overall movement of the nation's population. The coastal part of the country and central Croatia, particularly the areas around the capital city, have better social and economic indicators and living standards, primarily due to the greater utilization of comparative advantages provided by the natural resources and geographic position of that area, which have conditioned the development of tertiary and quaternary activities.

6 Environmental objectives established upon the conclusion of international treaties and agreements relating to the Strategy

The conventions and protocols are international treaties whose provisions of the signatories of documents shall be respected. Their ratification is formally binding for the countries with regard to the implementation of the provisions, both in legislation and practice.

International treaties and agreements	Goals and purpose of the document
European Agreeement on International Carriage of Dangerous Goods (ADR)	Dangerous goods are considered to be substances that can endanger human health, cause environmental pollution, or cause material damage, which have dangerous properties for human health and the environment, as defined by legislation, other regulations and international treaties which, by virtue of their nature or properties and conditions, in connection with transport, may be dangerous to public safety or order or have proven toxic, corrosive, irritant, flammable, explosive or radioactive effects, i.e. as dangerous goods are also considered raw materials from which dangerous goods and wastes are produced if they have properties of dangerous substances. Hazardous substances are classified as: • explosive substances and articles with explosive substances • gases • flammable liquids • flammable solids, self-reactive substances and solid desensitizing explosives • substances subject to spontaneous self-ignition • substances that create flammable gases in contact with water • oxidizing substances • organic peroxides • toxic substances • infectious substance • radioactive material • corrosive substances • other dangerous substances and articles. The regulations of the Republic of Croatia relating to the transport of dangerous goods in road transport are being gradually aligned with

International treaties and agreements	Goals and purpose of the document
	international regulations and the acquis communautaire of the European Community. The aim of alignment is to reduce the risk of pollution to the smallest extent possible, as well as to reduce the number of accidents with hazardous substances and to ensure uniformity of regulation in all signatories of the European Agreement on International Carriage of Dangerous Goods by Road (ADR). The European Agreement on International Carriage of Dangerous Goods by Road (ADR) entered into force on 29 January 1968. Attachments A and B as an integral part of the Agreement were subsequently adopted and annexed to the Agreement in 1969. In accordance with Article 2 of the Agreement, dangerous substances whose transport excludes Annex A may not be transported in international traffic while the transport of other dangerous substances shall be permitted in accordance with: • the conditions set out in Annex A for the packaging and labeling of dangerous substances and • the conditions set out in Annex B for the construction, manufacture, equipping and operation of vehicles carrying certain dangerous substances. Attachments A and B are integral parts of the Agreement that are amended by every other (odd) year, and these amendments directly affect national regulations and handling of dangerous goods and shall be continuously monitored and adopted. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6, RDT1, RDT3 and RDT5.
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)	The MARPOL Convention regulates the prevention of pollution by all harmful substances discharged from or discharged by vessels, either intentionally or by accident, which also regulates their obligations in ports. The Convention contains six chapters, or annexes, which prescribe measures to prevent pollution of the sea from shipwrecks. • Annex I - Rules on the prevention of pollution by oil & oily water • Annex II - Rules on the control of pollution by noxious liquid substances in bulk • Annex III - Rules on the prevention of pollution by harmful substances carried by sea in packaged form • Annex IV - Rules on the prevention of pollution by sewage from ships

International treaties and agreements	Goals and purpose of the document
	• Annex V - Rules on the prevention pollution by garbage from ships • Annex VI - Rules on the prevention of air pollution from ships. MARPOL 73/78 provides general provisions to be met by the ports, and IMO (International Maritime Organization) has prepared general guides (MARPOL How to do it – Manual of Practical Implications of Ratifying and Implementing MARPOL 73/78) that should assist ports in designing or installing appropriate waste disposal facilities, in order to facilitate the implementation of measures in accordance with the Convention. IMO recognized that the provision of marine waste management services is a key issue for MARPOL implementation. However, there is no general solution for all ports with regard to accepting waste. The final choice of equipment and waste treatment methods is still left to the ports. Each port in accordance with its needs shall: • install waste collection facilities • determine the manner of his or her care • adopt measures to ensure compliance with the regulations. However, in planning there are still elements that each port shall take into account and which shall facilitate the choice of capacity to meet the needs of ships, within the scope of ports. It is possible to define the key elements that each port should take into account when designing a system for receiving waste from ships: • international standards regulating and providing instructions on ports for the acceptance and disposal of waste from ships, • types of existing waste collection and disposal facilities. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2.
Annex I to the MARPOL Convention: Reception of oil & oily water	The Convention states that ports and terminals shall have sufficient reception facilities to receive oil and oily mixtures in the case of ports and terminals: • in which crude oil is loaded into tankers • in which oils are distributed • which handle ships equipped with sludge tanks • for bulk loading with regard to oil residues • which provide ship repair or tank cleaning services, i.e. ship repair yards. The capacity of the reception facility shall be such as to

International treaties and agreements	Goals and purpose of the document
	dispose of all ships without consequences to their failure. If any party finds that the facilities are installed inadequate, the competent international authorities shall be notified to inform all interested parties. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2
Annex II to the MARPOL Convention: Reception of noxious liquid substances	MARPOL 73/78 states that ports shall provide adequate capacity for the reception of noxious liquid substances. All ports and terminals shall have reception facilities for noxious liquid substances in accordance with the quantity and type of waste that can be expected from the ships concerned, without consequences to their failure. The same applies to repair ports, i.e. ship repair yards. The type of reception facilities, with regard to the type of cargo, shall be defined by the government of the country in whose territory the subject facilities are located and all interested parties shall be accordingly notified. If any party finds that the facilities are installed inadequate, the competent international authorities shall be notified to inform all interested parties. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2.
Annex IV to the MARPOL Convention: Reception of sewage	MARPOL 73/78 requires that ships (new ships larger than 400 GT or more than 15 passengers and existing ships with the same characteristics 10 years after the entry into force of the subject rule) have holding tanks for sewage. Under certain conditions, ships may discharge sewage into the sea, but in all other cases they shall land it. To accept sewage from ports, ports shall have adequate facilities and equipment in such a manner as to handle all ships, which they receive without delays. Furthermore, in the event that these facilities are inadequate, all interested parties shall be informed. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2.
Annex V to the MARPOL COnvention: Reception of garbage from ships	As with the acceptance of the aforementioned waste types, ports shall provide adequate capacities in accordance with the needs of ships. The same applies to information in case the capacities are inadequate. Although each of the aforementioned waste is specific and requires special treatment, the system for receiving and disposing of waste in ports shall generally cover the following: • installation of appropriate capacities, fixed or movable containers, for disposal of waste from ships,

International treaties and agreements	Goals and purpose of the document
	• establishment of an appropriate transport system for the transport of collected garbage to remote landfills or to final disposal sites, • final neutralization of waste, i.e. processing after which residues may be released into the environment or disposed of at dedicated locations. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2.
Convention for Protection of the Mediterranean Sea against Pollution (Barcelona Convention 1976.)	The most important international instruments for the protection and conservation of the Mediterranean Sea are the Convention on the Protection of the Mediterranean Sea against Pollution (hereinafter referred to as the Barcelona Convention) signed in Barcelona on 16 February 1976 and the Protocols adopted in the 20-year period from 1976 to 1996. The seven Barcelona Convention convention protocols are: Dumping Protocol - Protocol on the Prevention and Removal of Pollution from the Mediterranean Sea by Incineration of Waste and Other Substances by Ship and Aircraft or Incineration at Sea (1976, amended and amended in 1995) Emergency Protocol - Protocol on Co-operation in the Prevention of Pollution from Ships and, In Dangerous Matters, in the Suppression of Pollution of the Mediterranean Sea (1976, replaced by the new 2002) LBS Protocol - Protocol for the Protection of the Mediterranean Sea against Pollution from Land Resources and Activities (1980, supplemented in 1996) SPA and Biodiversity Protocol - Protocol on Specially Protected Areas and Biodiversity in the Mediterranean (1982, Replaced in 1995) Offshore Protocol - Protocol for the Protection of the Mediterranean Sea from Pollution Due to Investigation and Utilization of the Epicontinental Belt, Sea Bottom and Sea Underground (1994) Hazardous Wastes Protocol - Protocol for the Prevention of Pollution of the Mediterranean Sea by Transboundary Transport of Hazardous Waste and its Disposal (1996) IUOP (ICMZ) Protocol - Protocol on Integrated Coastal Zone Management of the Mediterranean (2008). This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2

International treaties and agreements	Goals and purpose of the document
Protocol concerning cooperation in preventing pollution* from *ships* and, in *cases of emergency, combating pollution of the Mediterranean Sea	The Parties shall, in accordance with generally accepted international rules and norms and the global mandate of the International Maritime Organization, individually, bilaterally or multilaterally, take the necessary steps to assess the environmental hazards of recognized routes used in maritime traffic and take appropriate measures with a view to reduce the risk of accidents or the consequence thereof for the environment. Each Party shall require that the authorities or operators responsible for the seaports and handling facilities under its jurisdiction, as deemed appropriate, should have pollution plans or similar arrangements that are in line with the national system of the competent state authority. The Parties shall take all necessary steps, whether individually, bilaterally or multilaterally, to ensure that their receiving facilities at their ports and terminals are adequate to meet the needs of the ships using them. The Parties shall designate national, subregional or regional strategies for accepting their shelter, including ports, for threatened marine lifeboats. Pursuant to the provisions of the present Protocol, the Contracting States shall define the level of port equipment in relation to the needs of the protection of the marine shall and the coastal area. Furthermore, infrastructure planning and port facilities should comply with the provisions of this Protocol. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2.
Protocol concerning specially protected areas and biological diversity in the Mediterranean (SPA Protocol)	The Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean within the framework of the Convention on the Protection of the Marine Environment and the Coastal Area of the Mediterranean is a document establishing a framework for the protection and conservation of biodiversity of valuable areas in the Mediterranean Sea. The SPA/BD Protocol is the basic tool for implementing the Convention on Biological Diversity in the Mediterranean related to the sustainable management of biodiversity in coastal and marine areas. The SPA / BD Protocol was adopted in 1982, and was replaced by a new one within the 1995 Mediterranean System Update. In the Republic of Croatia, the Protocol entered into force on 12 May 2002 (OG-MU 11/01). The Protocol provides for three main elements to ensure the conservation of biodiversity in the Mediterranean: • Creation, Protection and Management of Specially Protected Areas (SPAs)

International treaties and agreements	Goals and purpose of the document
	• establishment of a list of specially protected areas of Mediterranean importance (SPAMI) • protection and conservation of species. This Protocol defines measures for the protection of specially protected areas involving the ban on the discharge of waste and sewage into the sea (as far as ports are concerned) and imposes regulation of maritime traffic and stopping of ships within protected areas. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2 and SO2.
Protocol on Integrated Coastal Zone Management of the Mediterranean (Barcelona 2008)	The Protocol requires the implementation of a previous risk assessment related to various human activities and infrastructure to prevent and mitigate their negative impact on coastal areas. Infrastructure, power plants, ports and maritime structures and constructions shall be planned in such a manner as to minimize the negative impact on coastal ecosystems, landscapes and geomorphology. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2 and SO2.
United Nations Convention on the Law of the Sea (1982)	Pursuant to the provisions of the Convention, coastal States may, by exercising sovereignty over their territorial sea, adopt laws and other regulations to prevent, reduce and control seawater pollution from foreign vessels, including vessels that exercise the right to a safe passage. The National Legislative Acts of the Republic of Croatia have adopted provisions regulating port management. This document is harmonised with the following goals of the Strategy: GO4, GO5, GO6 and PP2 and SO2.
Convention concerning International Carriage by Rail (COTIF)	Member States agree to take all necessary measures to facilitate and accelerate international rail traffic. In that sense, each Member State undertakes its obligation, as far as its power is concerned: • remove any unnecessary procedures • simplify and standardize already existing formalities • simplify border controls. With the aim of facilitating and improving international rail traffic, Member States agree to give their support to achieve the greatest possible uniformity of the regulations, standards, procedures and methods of organization relating to railway vehicles, railway staff, railway infrastructure and auxiliary services.

International treaties and agreements	Goals and purpose of the document
	Due to the growing pressure from competitive road transport and the opening of the liberalization of the rail services market in the European Union in the 1990s, COTIF was amended by two protocols 1990 and 1999. The COTIF Amendment Protocol, drawn up on 3 June 1999 in Vilnius, the Convention structure was amended, and consists of the main provisions of the Convention itself and 7 annexes: • Uniform Rules concerning the Agreement on International Carriage by Rail (CIV), Appendix A to the Convention • Uniform Rules relating to the Agreement on International Rail Freight Transport (CIM), Appendix B to the Convention • Regulation on International Carriage of Dangerous Goods by Rail (RID), Appendix C to the Convention • Uniform Rules on the Use of Vehicles in International Railway transport (CUV), Appendix D to the Convention • Uniform Rules on Infrastructure Use Contracts in International Railway transport (CUI), Appendix E to the Convention • Uniform Rules on Validation of Technical Standards and Acceptance of Unique Technical Regulations Applicable to Rail Transfers for International Use (APTU), Appendix F to the Convention • Uniform Rules on Technical Approval for the Acceptance of Railway Devices Intended for Use in International Traffic (ATMF), Appendix G to the Convention. This document is harmonised with the following goals of the Strategy: GO1, GO2, GO4, GO5, SO1, RT1, RT2, RT3, RT4, RT5, RT6, and RT7
Convention on International Civil Aviation (OG MU 1/96)	Each State signing the Convention agrees that all aircraft of other non-scheduled air carriers are entitled, under the terms of this Convention, to fly in or out of its territory without landing and to perform non-commercial landing without the need to obtain prior approval, subject to compliance with the law of the state which requires them to land. Due to flight safety, however, each country reserves the right to request aircraft flying over inaccessible areas or areas without appropriate navigational means to comply with prescribed routes or to obtain a special permit for such flights. If in such international aircraft, such airplanes carry passengers, cargo or mail for remuneration or on the basis of a lease agreement, they shall be entitled to board or land the passengers, cargo or mail, subject to compliance with the law of the State where such boarding or landing is carried out to determine Regulations, conditions or limitations it considers desirable.

International treaties and agreements	Goals and purpose of the document
	This document is harmonised with the following objectives of the Strategy: ZP5.
UN Framework Convention on Climate Change (UNFCCC) (1992)	The aim of the UN Framework Convention on Climate Change is to achieve the stabilization of greenhouse gas concentrations in the atmosphere in such a manner as not to jeopardize the production of food and to enable the continuation of economic development in a sustainable manner. Related to this, traffic is recognized as one of the main sources of greenhouse gases, which, to a lesser extent, includes ports as an element of the transport system of the Republic of Croatia. The Republic of Croatia became a party to the UN Framework Convention on Climate Change in 1996. By adopting the Convention, the Republic of Croatia has undertaken to undertake protection measures to anticipate and prevent or reduce the climate change and adverse impacts that climate change causes. This document is harmonised with the following goals of the Strategy: GO1, GO4, GO5, RDT3, PP2, RDT3 and RDT5.
Convention on Biological Diversity (1992)	The Convention on Biological Diversity is a fundamental document for the protection of biodiversity, which establishes the conservation of biodiversity as a fundamental principle in the protection of nature. It was adopted in Rio de Janeiro in 1992 at the United Nations Conference on Environment and Development. The Republic of Croatia entered into force on 7 October 1996 (NN-MU 6/96). The main objective of the Convention is to preserve overall biodiversity, and its achievement can be achieved primarily through the incorporation of biodiversity conservation measures into all sectors, especially those that directly use natural resources, then by developing national strategies, programs and plans, or by incorporating biodiversity conservation measures into Existing strategies, programs and plans. Also, each Contracting Party should take care of the protection and sustainable use of biological resources when deciding on a national level. The national plan for port development of County and local importance should define port management models in a manner that does not undermine the biodiversity of the marine environment and the coastal area. This document is harmonised with the following goals of the Strategy: GO1, GO4, GO5, RDT3, RDT3 and PP2.
Charter for the Protection and Management of the Archaeological Heritage, Lausanne (1990)	Archaeological resources research is the main tool for the protection of archaeological heritage and shall be a general obligation under the protection and planning.

International treaties and agreements	Goals and purpose of the document
	Development projects are one of the biggest threats to archeological heritage. The duty of the developer of development projects is to provide archaeological heritage research in impact studies prior to the implementation of the project. This document is harmonised with the following goals of the Strategy: GO5.
Convention concerning the Protection of the World Cultural and Natural Heritage, UNESCO (1972)	The purpose of establishing this Convention is to effectively protect and preserve cultural and natural heritage on the territory of the signatory states, as well as to popularize the the subject heritage. This document is harmonised with the following goals of the Strategy: GO5.
Convention on the Protection of the Underwater Cultural Heritage, Paris (2001	The Convention confirms the importance of underwater cultural heritage as an integral part of the cultural heritage of humankind and a particularly significant factor in the history of people, peoples and their mutual relations with regard to their common heritage. The importance of the protection and preservation of underwater cultural heritage is emphasized and the responsibility lies with it in all countries, observing the increasing public interest and the public's concern for underwater cultural heritage. This document is harmonised with the following goals of the Strategy: GO5.
Stockholm Convention on Persistent Organic Pollutants (2001) (NN-MU 11/06)	It is necessary to ensure the reduction or elimination of the production, use, discharge, import and export of highly toxic substances for the purpose of protection of humans and the environment and to select alternatives for persistent organic pollutants. This document is harmonised with the following goals of the Strategy: GO1, GO4, GO5, SO2, RDT3, RDT3, RDT5, RDT6 and PP2.
Vienna Convention for the Protection of the Ozone Layer (1985) (NN-MU 12/93)	The protection of human health and the environment from the adverse effects, which come or may come from human activity that modify or modify the ozone layer. States shall take appropriate measures in accordance with the provisions of this Convention for the protection of human health and the environment against the adverse effects which come from or may come from human activity that modifies or may modify the ozone layer. This document is harmonised with the following goals of the Strategy: GO1, GO4, GO5, SO2, RDT3, RDT3, RDT5, RDT6 and PP2.
Montreal Protocol on Ozone Depleting Substances (Montreal, 1987)	The signatories undertake to reduce the use of freons by 50%. The Montreal Protocol was reinforced by two revisions in 1990 in London and 1992 in Copenhagen, which required general discontinuation of the use of freons, halons and other halogenated hydrocarbons until 2000.

International treaties and agreements	Goals and purpose of the document
	This document is harmonised with the following goals of the Strategy: GO1, GO4, GO5, SO2, RDT3, RDT3, RDT5, RDT6 and PP2
Convention on the Conservation of Migratory Species of Wild Animals (CMS) (1979) (NN-MU 6/00)	The objectives of the Convention are: • protection and conservation of migratory species and their habitats on a global scale. - promoting national policies for the conservation of wildlife and plants and their natural habitats. • ensuring the protection of wildlife and plants in planning and development policies and anti-pollution measures. • promoting education and information exchange on the need to preserve wildlife and plants and their natural habitats. The Convention on the Protection of Migratory Species of Wild Animals calls for the inclusion of wild animals and plants in national plans, strategies, and programs. This document is harmonised with the following goals of the Strategy: GO5.
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) (NN-MU 6/96)	The Parties to the Convention shall individually or jointly take all appropriate and effective measures to prevent, reduce and control significant negative impacts of planned activities on the environment across the state border. Furthermore, the country of origin shall ensure that environmental impact assessment is carried out in accordance with the provisions of this Convention before deciding to approve or carry out the planned activity. The signatories should pay particular attention to the development or intensification of specific research programs aimed at: • improve existing qualitative and quantitative methods for assessing the impact of planned activities • to achieve a better understanding of cause-and-effect relationships and their role in comprehensive environmental management • analyze and monitor the effective implementation of decisions on planned activities with a view to minimizing or minimizing consequences • develop methods to stimulate creative approaches in search of environmentally-friendly alternatives for planned activities, ways of production and consumption, to develop a methodology for applying the macroeconomic impact assessment principle to the environment. This document is harmonised with the following goals of the Strategy: GO4, GO5.

International treaties and agreements	Goals and purpose of the document
Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (OG 7/09)	The purpose of this Protocol is to ensure a high level of environmental protection, including health, through: (A) ensuring that environmental issues, including health, are fully taken into account in the design of plans and programs (B) contributing to the consideration of environmental requirements, including health, in drafting policies and legislation (C) establishing clear, transparent and effective procedures for strategic environmental assessment (D) ensuring public participation in strategic environmental assessment and (E) inclusion in such manner of environmental requirements, including health, in measures and instruments intended to encourage sustainable development. Pursuant to the Protocol, each Party shall ensure that strategic environmental assessment is carried out for plans and programs that may have significant environmental impacts, including health. If a Party of Origin considers that the implementation of a plan or program may have a significant transboundary impact on the environment, including health, or if a party that could be significantly affected so requests, the Originating Party informs the affected Party as soon as possible prior to the adoption of the plan or program. This document is harmonised with the following goals of the Strategy: GO1, GO4, GO5, SO2, RDT3, RDT3, RDT5, RDT6 and PP2.
Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) (NN-MU 6/00)	The Convention requires the protection of European wildlife flora and fauna and their natural habitats as well as endangered migratory species. Conservation measures require all forms of intentional capture, retention and killing, deliberate damage or destruction of sites that are important for mating or resting, as well as any form of disturbance or trade in these species. This document is harmonised with the following goals of the Strategy: GO5.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement aimed at preventing uncontrolled international trade and commercial exploitation of endangered species, maintaining ecological balance within species populations that are the subject of international trade and assisting States Parties to the Convention in achieving sustainable trade. CITES is an abbreviation of the English name, but is also known as the "Washington Convention". It entered into force on 1 July 1975 and since then it has been approached by a total of 180 countries, which is the most widely accepted international convention in the field of nature protection. CITES has been established as a system of

International treaties and agreements	Goals and purpose of the document
	international trade surveillance based on the procedure of issuing import and export permits that is uniquely applied in all signatory states. The European Union is fully implementing the CITES Convention since 1 January 1984. Due to a single European market, the provisions of the CITES Convention must be uniformly applied in all EU Member States under the provisions of the so-called " "EU Wildlife Trade Regulations", of which 7 are currently in force: • Council Regulation (EC) No. 338/97 • Commission Regulation (EC) 865/2006 • Commission Regulation (EU) No. 100/2008 • Commission Implementing Regulation (EU) no. 791/2012 • Commission Implementing Regulation (EU) no. 792/2012 • Commission Regulation (EU) No. 578/2013 • Commission Regulation (EU) No. 750/2013. This document is harmonised with the following goals of the Strategy: GO5.
Convention on European Landscapes (Florence, 2000)	The Convention aims at promoting the protection of landscapes, management and planning and organizing European co-operation on landscape issues. This document is harmonised with the following goals of the Strategy: GO5, RDT9.
European Convention on the Protection of the Archaeological Heritage of Europe (London 1969)	Objective of the Convention: • to protect the archaeological heritage of Europe as a source of collective memory and as a basis for historical and scientific research. This document is harmonised with the following goals of the Strategy: GO5, RDT9.
Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas, Xi'an (2005)	The recommendations refer to: Protection, preservation and improvement of the historical structures of the architectural and spatial heritage, and of the settlements and landscapes, preservation and improvement of the environment, location of historic buildings, settlements and landscapes, as a buffer zone in order to prevent the degradation of their values. This document is harmonised with the following goals of the Strategy: GO5, RDT9.

International treaties and agreements	Goals and purpose of the document
Convention concerning the Protection of the World Cultural and Natural Heritage, UNESCO, (1972)	The purpose of the establishment of this Convention is the effective protection and preservation of cultural and natural heritage on the territory of the signatory states as well as the popularization of the said heritage. This document is harmonised with the following goals of the Strategy: GO5, RDT9.
European Convention on the Protection of Archaeological Heritage, Valetta (1992)	Archaeological finds are all remains and objects, traces of human existence, which testify of epics and civilizations and are the main or one of the main sources of scientific data. This document is harmonised with the following goals of the Strategy: GO5, RDT9.
Charter for the Protection and Management of the Archaeological Heritage, Lausanne (1990)	Archaeological resources research is the main tool for the protection of archaeological heritage and shall be a general obligation under the protection and planning. Development projects are one of the biggest threats to archeological heritage. The duty of the developer of development projects is to provide archaeological heritage research in impact studies prior to the implementation of the project. This document is harmonised with the following goals of the Strategy: GO5, RDT9.
Venice Charter ICOMOS (1964)	Preservation and restoration of monuments as art and historical evidence. The aim of conservation is not just individual architectural works, but urban or rural settlements where we find evidence of the existence of a civilization or a historical event. This document is harmonised with the following goals of the Strategy: GO5, RDT9
Convention for the Protection of the Architectural Heritage of Europe, Granada (1985)	Each Party agrees to: • protect the architectural heritage which includes buildings, groups of buildings and places (a common work of man and nature) • prevent the destruction, destruction or destruction of the architectural heritage. This document is harmonised with the following goals of the Strategy: GO5, RDT9.

7 Environmental impacts of the Strategy

7.1 Impact assessment methodology

The impact assessment is based on a strategic level that excludes individual projects and a specific project-related environmental impact assessment. In line with the methodological recommendations for the development of strategic studies that analyse the strategies, plans and programmes proposed under the IPA 2010 project "Strengthening Capacities for Strategic Environmental Impact Assessment (SEIA) at Regional and Local Level" from 2014, the impact assessment was conducted through the selection of the strategic goal of the Study. The strategic goal of assessing the impact is "**Compliance of the Strategy measures with the environmental and nature requirements**". It is evident from the selection of the goal that the main methodological guideline for assessing the impact is an analysis of the acceptability of the measures proposed by the Strategy in relation to the relevant environmental topics with their components.

When assessing the impacts, four impact categories are used:

- ***Positive impact*** - describes the assessment that, due to the implementation of the measure, the state of the environmental elements in relation to the present situation shall be improved. This can be the result of solving some of the existing environmental problems, or due to the change in the existing negative trend.
- ***Neutral impact*** – the assessment has shown that there are no impacts on the environmental component.
- ***Moderate negative impact*** - describes the assessment that, due to the implementation of the measure, the state of the environmental elements in relation to the present situation shall slightly deteriorate, but not to the extent that it could lead to significant and persistent disturbance of the environment or nature. In this category, there are impacts involving the release of pollutants within the limits prescribed by legal regulations, taking of smaller parts of numerous or less valuable habitats, the risk of fatalities of a smaller number of individuals belonging to the species that are not in the protection regime etc.
- ***Significantly negative impact*** – describes the assessment that there is a risk that, due to the implementation of the measure, the state of the environmental elements shall deteriorate to the extent that it could lead to a significant disturbance of the environment or nature. A measure that would bring a significant impact to the level of moderate or eliminate it shall be prescribed for this impact.

In addition to the analysis of the Strategy measures, their justification in relation to the environmental and nature requirements is assessed, as well as possible direct, indirect, short-term, medium-term, permanent, cumulative and transboundary environmental impacts.

When describing the impacts of the proposed measures on the environment and nature, the following terms are used to provide a more detailed definition of the type and scope of individual impacts:

- *Direct impact* – if the measure is a direct source of the impact described
- *Indirect impact* – of the measure generates a change that is the source of the impact described (future)
- *Short*-term impact – if the impact on the environment/nature ceases within 5 years
- *Medium-term impact* – if the impact on the environment/nature ceases between 5th and 10th year from the beginning of the impact development
- *Permanent impact* – of the impact has permanent consequences on the environment/nature and does not cease even after 10 years
- *Cumulative impact* – if several measures from the Strategy generate equal impacts on the environmental component, their joint impact on this component is cumulative
- *Synergetic impact* - if several measures from the Strategy generate different impacts that jointly affect the environmental component in a manner that joint impact is stronger than the sum of individual impacts on the subject component, this impact is called synergetic
- *Transboundary impact* – if the measure can affect the environment/nature of other countries.

7.2 Environmental impact assessment of the strategy

For the purposes of the environmental impact assessment, the measures defined by the Strategy are divided into four categories:

1. General measures
2. Development measures
3. Management and organisational measures
4. Spatially located measures

The first three categories contain all the measures pertaining to the organization and management of the transport system or to the development and improvement of the transport infrastructure without mentioning specific projects. For these measures, the environmental impact assessment is shown in the tables below (subsections 7.2.1-7.2.3).

The last category of measures contains specific projects in the area and the impact assessment of the measures belonging to the category of Spatially located measures is shown in subsection 7.2.4. Cartographic representations in the Study are of an informative nature and serve solely for the purposes of this document.

7.2.1 Analysis of general measures

Code	General measure	Description of the measure	Environmental impact assessment
G.1	National concept for cargo logistics	Croatia shall define a national concept for freight logistics that would cover all aspects of traffic. It is very important, among other things, to determine the role of the Port of Rijeka and Port of Ploče, as well as the Zagreb hub. A special study shall be developed to include all relevant stakeholders. The establishment of logistic centres to exchange modes of cargo transport shall be based on further studies, which shall also define the technical measures for specific logistics facilities and units.	Planning cargo transport at national level, while following the guidelines and legal provisions defining the goals of environmental protection and spatial characteristics of functional regions (and lower spatial units), can contribute to better freight management and reducing the risk of accidental situations. The planned measure at this level has no impact on the environmental components.
G.2	Increasing access to international airports through public transport	The accessibility of airports by public transport is inadequate and therefore individual solutions tailored to the specific features of each airport shall be found. Solutions shall be considered in the context of the master plans of functional regions, taking into account the potential functionality of connections such as the connection between Velika Gorica and Zagreb, Trogir and Split.	This measure shall most likely be preceded by the adjustment of the existing legislative framework and alignment with the spatial plans of the city of Zagreb and the counties. This measure shall improve accessibility to airports, potentially reduce travel time and generally improve customer satisfaction. At a strategic level of assessment, this measure has no significant impact on the environment. Public transport in the Republic of Croatia today is not integrated. Intermodal terminals that allow switch from one transport mode to another, common timetables as well as common transport maps of different transport modes are not developed. Improving the public transport system, especially in terms of increasing accessibility of airports, shall greatly facilitate mobility and positively affect customer satisfaction.
G.3	Improving the safety of the transport system	Since safety is one of the main goals of the Transport Development Strategy, it is imperative to raise the safety level in all aspects of the transport system. In order to raise the level of the safety in the railway system, specific measures such as removing rail-road crossings, if justified by traffic flows, shall be implemented or protection measures shall be determined in cases where railroad crossings cannot be removed, devices for the detection of axle load and overheated axle	The basic objectives of international and national regulations within the transport sector relate to the safety of traffic participants and to the environmental protection against emissions caused by traffic. This measure plans to modernize the rolling stock and road fleet by purchasing new vehicles that meet the highest safety and quality standards, raise safety standards for air transport and increase the number of vessels for monitoring the safety of navigation and environmental protection vessels.

Code	General measure	Description of the measure	Environmental impact assessment
		bearings shall be placed. Specific studies shall specify specific measures for each part of the network. As regards road safety, the Commission has set as its general objective the zero number of accidents with deaths by 2050. In order to improve road safety in Croatia, the following measures shall be designed: Road safety shall be included in each phase of project implementation based on the impact study, at a strategic level, of various options of infrastructure project on the road safety, as one of the important elements for the selection of routes and the final solution. In later phases of the project, road safety checks shall establish in detail the elements of uncertainty of the road infrastructure project and propose corrective measures. In order to reduce the negative impact in terms of accidents, the procedures shall be reviewed and upgraded to shorten the response time. Information canals shall also be improved and simplified and monitoring of the state on back spots shall be introduced. In order to effectively mitigate the risks and the possibility of accidents, and to limit their negative consequences, it is necessary to introduce the highest safety standards of air transport in international, regional and national traffic. Airport infrastructure and aircrafts shall comply with all international safety regulations. The maritime sector needs to be developed in a safe and sustainable manner. The goal is to continuously increase the efficiency of safety supervision and protective measures on Croatian vessels and crafts, as well as increase the share of energy-efficient vessels. It is necessary to develop a system of targeted inspections and technical examinations to establish the highest international, European and national safety standards on Croatian vessels and crafts, in accordance with established priorities. It is also necessary to establish an efficient system for monitoring recreational vessels. - In order to raise the level of safety on the waterways, in addition to the introduction	In addition, the measure is planned to increase safety and protection in urban areas. In accordance with the above, it can be concluded that this measure is in line with the obligations arising from international and national strategic and planning documents as well as international contracts, and it primarily relates to improving the conditions for the quality of life and protecting the environmental components against pollution and degradation.

Code	General measure	Description of the measure	Environmental impact assessment
		of river information systems and timely availability of accurate information on the vessel movement, it is necessary to establish clear procedures for measures to be taken in the event of an incident, and to upgrade the existing navigation and tracking systems for inland waterways. For safety reasons, it is necessary to modernize ports and equip them with modern security systems. In order to achieve more efficient systems for monitoring the safety of navigation and inspection and install and maintain signalling systems on waterways, it is necessary to increase the number of vessels for monitoring the safety of navigation and vessels for environmental protection. Safety and protection in urban areas shall be improved at least on two different levels: identifying and removing black spots such as rail-road crossings, traffic signs and lights on pedestrian crossings, with additional protection of pedestrians and cyclists by building new sidewalks or bike paths at places where it is needed, constructing pedestrian islands that would reduce the length of path and extending curbs where necessary and constructing new footpaths or sidewalks, which would provide easier access to stops and terminals for public transport vehicles rolling stock and road fleet intended for public transport shall be modernized. One of the priorities is the purchase of new public transport vehicles that are in line with the highest safety and quality standards, which shall be equipped with state-of-the-art safety-management-control systems (e.g. video cameras). Infrastructure and stops shall also be modernized with adaptations necessary to safety and accessibility to public transport, and the installation of monitoring and control devices shall increase safety as well.	
G.4	Increasing intermodality in the passenger traffic and	In order to achieve the sustainability of the transport sector as a whole, it is important to increase the interoperability that shall enable the use of potentials of every transport mode. A network of intermodal terminals shall be set up, enabling passengers to easily switch from	In the Republic of Croatia, some projects are being prepared or implemented in order to promote the development of intelligent and integrated transport systems: Integrated Public Transport of the City of Zagreb, Zagreb and Krapina-Zagorje County, Integrated Development

Code	General measure	Description of the measure	Environmental impact assessment
	development of passenger hubs	one transport mode to another. A well-designed, balanced intermodal network is key to achieving the maximum efficiency of the entire system and reducing customer inconveniences to the level as low as possible. The location and form of each terminal shall be determined according to the studies for the specific area (e.g. master plan). In the road transport sector, it is important to provide an appropriate level of accessibility in accordance with the needs, i.e. hubs in gravitation areas (such as sea, river and air ports, railway stations, workplaces, business zones, etc.). Larger number of parking spaces linked to public transport systems, sea, river and air ports shall stimulate the transition from one transport mode to another in favour of public transport, and thus reduce the number of bottlenecks on the roads.	Project of Passenger Transport and Intermodal Cargo Transport in the Region of Northern Croatia (Varaždin, Međimurje, Koprivnica-Križevci Counties), Transport System of the City of Zadar: Intelligent Transport System and Reconstruction of Roads in the City of Zadar, Development of the Rijeka and Dubrovnik Region. As a priority of the public urban, suburban and regional mobility sector in the European Union *(Roadmap to a single European transport area — Towards a competitive and resource-efficient transport system, European Commission, 2011)*, the introduction of integrated transport systems in major cities and their suburbs and/or regional areas has been defined. Spatial and organizational rationalization of ports and bus stations, establishment of signalling and information system of various forms of public urban and suburban transport, equipping of public transport stops, ports and piers with accompanying facilities and services, greater number of parking spaces, as well as monitoring the number of public transport users in order to adapt routes and frequencies according to the needs, has a direct positive impact on increasing the number of public transport users, the economic productivity of public transport companies and the comfort and safety of passenger travel.
G.5	Maintenance concept for various transport systems	In general, transport infrastructure in Croatia is not well maintained. The owner of the national infrastructure should have a maintenance concept that shall guarantee the long-term sustainability of different transport modes. An appropriate structure and organization of maintenance needs to be established to enable railway service to be efficient and effective, that is, sustainable. The concept shall be derived from the purposeful and concrete analysis of the situation in Croatia and the company "HŽ Infrastruktura d.o.o.", taking into account the technical and financial conditions as well as the needs of users, as set out in Directive 2008/57/EC on the interoperability of the relating to Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) (HRN EN 50126).	When reliability and safety of signal-security devices are considered in the function of the availability of the railway system, then we talk about the reliability, availability, maintenance and safety, i.e. the process of managing these components. The first European standard mentioned in this context is HRN EN 50126, according to which the availability is the product's ability to perform the required function under the given conditions at a certain time or interval with external resources provided. In line with this, the availability of the railway system is the ability to provide a safe traffic flow in the function of passenger and cargo transport in line with the timetable. In recent years, many studies have been carried out and research on Intelligent Transport Systems has been conducted. In addition to a shift in terms of road safety and traffic jams, another benefit of these systems is

Code	General measure	Description of the measure	Environmental impact assessment
		Road maintenance is essential for preserving the roads in their original state, protecting nearby resources and user safety as well as traveling comfort along the route. It is necessary to introduce a maintenance system that is efficient and effective, that is, sustainable and characterized by an appropriate structure and organization. The concept of the maintenance system shall be derived from the purposeful and concrete analysis of the situation in Croatia and relevant stakeholders, taking into account technical and financial conditions and the needs of users. The concept of maintenance for the maritime sector can be divided into maintenance of ports and port infrastructure, on the one hand, and maintenance of the fleet, on the other. An appropriate structure and organization of maintenance needs to be established to provide a maritime transport service that shall be efficient and effective, i.e. sustainable. The concept of maintenance system shall be derived from the purposeful and concrete analysis of the situation in Croatia and vessel operators, taking into account technical and financial conditions and the needs of users.	reflected in reduced harmful emissions and fuel consumption. Significant progress in road traffic safety is expected from the development and implementation of the so-called cooperative systems, where data is exchanged between vehicles and between vehicles and infrastructure, enabling drivers to be informed at any time about the situation on the road. The development of the Republic of Croatia into a modern maritime country means that selective and thoughtful use of available potentials is necessary in order to improve and modernize all the activities of the maritime economy. The maintenance concept for the maritime sector shall be implemented in accordance with the provisions of nature protection documents, in particular taking into account the Program of measures for the protection of the marine environment and coastal area, whose measures relate to sustainable management while preserving marine and coastal biodiversity. The subject measure does not generate environmental impacts at a strategic level, but it may positively affect the environmental components in the long-term.
G.6	Increasing energy efficiency of the transport system	According to the guidelines for the development of the trans-European transport network, promoting efficient and sustainable use of infrastructure is one of the priorities in infrastructure development. In this sense, it is necessary to raise the level of energy efficiency and to identify low-carbon energy sources and power systems as a priority. Further studies shall aim at analysing specific requirements.	With the purchase of more environmentally friendly vehicles (gas and biofuel drive) and investing in the renovation of the fleet, a positive impact on the environment is expected at a strategic level of impact assessment. Transport system improvement leads to reductions in harmful emissions into the air and reduced fuel consumption. Additional infrastructure shall be required for electric vehicles in traffic, in terms of electric vehicle charging stations. Additional infrastructure changes shall also be needed for future electrification of the railways. Hydrogen as a fuel can be in the form of gas or liquid, and the infrastructure it requires can be developed gradually with market demands by introducing hydrogen-fuelling systems at existing gas stations. Biofuels can be distributed through existing oil and gas pipelines, when and where possible. The transport of liquefied petroleum gas from the place of exploitation to gas stations includes the combination of pipes, tankers, etc. (European Expert Group on Future Transport Fuels, 2011).

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			Infrastructure development, in terms of performing specific environmental interventions, can have adverse effects on the environmental components, which shall be recorded in the process of environmental impact assessment. If we exclude infrastructure needs, this measure has a positive impact on the quality of air and the quality of life of people due to reduced emissions of harmful gases. When it comes to biofuels, we need to consider the process of obtaining this energy product, that is, the impact of this process on the environment. Due to the unspecified biofuel resource, the impact assessment remains at this level. Replacing outdated vessels and purchasing new ecologically and energy efficient vessels shall have a positive impact on the environment, as it shall reduce emissions of pollutants into the environment and greenhouse gases into the atmosphere.
G.7	Reorganisation of the transport system for greater sustainability	Public service contracts concluded in accordance with Regulation 1370/2007 on public passenger transport services by rail and road and repealing Council Regulations (EEC) No. 1191/69 and (EEC) No. 1107/70 are one of the basic mechanisms to guarantee the transparency and efficiency of the public transport service. Therefore, their wider application is necessary not only to comply with the Regulation but also as a first step towards increasing the sustainability of the Croatian transport system. The type and duration of a public service contract shall be determined on the basis of an analysis of each individual case in combination with an analysis of existing internal models, either for conformity check, or after a thorough examination of technical and financial conditions. Increasing financial sustainability is one of the goals of the trans-European transport network. To achieve this goal, the organization of transport systems shall be optimised and the efficiency of operations and maintenance shall be raised. The financial sustainability of the transport system aims to reduce the system dependence on the subsidies from public revenue.	Traditionally, the traffic infrastructure is built from funds raised by public funding, at the level of regions, countries or the European Union. This method is used to finance most road or rail projects. By introducing new procedures in the sphere of public contracts, the Commission is trying to encourage greater private equity participation in financing infrastructure projects. The EU White Paper on Transport presents a number of recommendations aimed at achieving the integration of all types of transport for the benefit of a more efficient, sustainable, competitive, accessible transport system that is user-friendly. Some of the main points are change in the modes of transport and comfort, modern infrastructure and smart financing, urban mobility, users in the center of traffic policy and the global dimension of traffic. At a strategic level, this measure contributes to improving the quality of life of people, while not generating negative impacts on the environment.

Code	General measure	Description of the measure	Environmental impact assessment
G.8	Adjusting the legal framework and planning guidelines to relevant EU requirements and policies	The legislation and planning guidelines shall support sector development and follow best practices and European regulations, particularly in the area of safety, interoperability, sustainability and environmental protection. The entire legal framework shall be aligned to enable large infrastructure projects to be implemented, individual procedures need to be simplified, and the definitions shall be harmonised in all legal and subordinate acts.	Along with the expansion, i.e. development of the transport system, there is a new imperative - sustainable development. The goal of achieving sustainable development has been introduced for the first time by the Treaty of Amsterdam and is achieved by integrating environmental requirements into the corresponding European Community policies. At a meeting of the European Council in Gothenburg it was agreed that the change in the representation of individual transport modes is a key topic of the sustainable development strategy. Measures presented in the White Paper on Transport could be considered the first basic step towards sustainable transport system. In order for the transport sector in the Republic of Croatia to meet the highest standards of safety and environmental protection, national legislation shall be aligned with internationally recognized documents (guidelines for sustainable traffic planning). The planned measure at this level has no impact on the environmental components.
G.9	Preparation and compliance with the requirements of the Schengen Agreement	Possible future development of Croatia and neighbouring countries entering the Schengen Agreement area shall increase the importance of international traffic. Adaptation of transport systems requires removal of infrastructure and administrative bottlenecks. Removing the bottlenecks towards neighbouring countries outside the zone of application of the Schengen Agreement shall contribute to the growing importance of international transport in some corridors with international connections. Specific studies shall assess the technical conditions to be met in each particular case.	Effective international transport (removing bottlenecks) leads to improving travel conditions, reducing traffic jams and travelling time across EU countries. This has a positive impact on the quality of travel, that is, the customer's satisfaction.
G.10	Increasing administrative capacity/training	Lack of administrative capacity and properly trained staff are some of the key problems that have been identified in the transport sector and one of the priorities of the European Union cohesion policy. The introduction of new technologies and increased demand for the surveillance of traffic and means of transport implies the necessity of training existing staff and newly employed in accordance with their specific needs.	The subject measure has a positive impact on Social and economic characteristics as it contributes to the creation of new jobs, while focusing at the same time on strengthening the existing capacity with regard to future development of transport technologies.

Code	General measure	Description of the measure	Environmental impact assessment
G.11	Improving the public perception of the transport system in Croatia	Creating and promoting a positive image of the transport system in the public as a reliable, safe and ecological mode of transport is important for stimulating demand and thus investment. Better promotion requires the existence of complete and up-to-date information and knowledge of infrastructure, capabilities and development plans. In the road transport sector, it is extremely important that users are informed about traffic conditions and weather conditions so as to reduce traffic jams and number of accidents by informing users about alternative routes. It is also important for drivers to be informed about changes to existing regulations and new regulations in the sector relevant to users, as well as the current notification of incidents on motorways that require driving at a lower speed or a ban on driving in certain directions. For these reasons, it is extremely important that information technology and information canals are constantly adapted and renewed to improve the whole sector. It is also important to include more the media in transmitting information. In the maritime transport sector, information platforms shall be continually modernised and integrated in order to provide reliable and complete data and information to all users. It is also necessary to establish network services of electronic business for all users of public services, establish a unique port information system in ports to improve business processes and increase port competitiveness, set up a hydrographical information system, improve the maritime meteorology services, develop ICT solutions for emergency response at sea, and improve and develop nautical information service as well s public and free services relating to the safety of navigation of yachts and boats	Spatial and organisational rationalisation of the transport sector, with the measure encouraging users to be informed about traffic condition, has a direct positive impact on the user's comfort and safety during travel.
G.12	Reduce negative environmental impacts of traffic	Based on environmental monitoring, efficient planning / implementation of infrastructure and the establishment of necessary ecological protection measures, the negative environmental and socio-economic impacts of the transport system shall be reduced. The mitigation of negative environmental impacts of traffic shall be realised with greater energy efficiency, especially by using energy sources with	Given that G.12 and G.13 measures have the same content, the description of the impact is equal (part of the impacts described under the G.6 measure also applies to the subject measures - the use of energy sources with low or zero hydrocarbon emissions). The need for sustainable transport development, i.e. the inclusion of environmental and nature protection in the planning of transport routes and

Code	General measure	Description of the measure	Environmental impact assessment
		low or zero hydrocarbon emissions and by reducing noise emissions and the volume of continuous pollution and waste generation. To prevent the pollution of the Adriatic Sea from marine facilities and vessels, it is necessary to renew and modernise the fleet of cleaning vessels, ensure availability of services, equipment and devices for operative action, in particular for interventions in case of large-scale sea pollutions. The conditions for a sustainable and accessible service for the reception and disposal of ship waste and freight residues shall be provided in accordance with international and EU regulations and ballast water management shall be enhanced based on the risk assessment and in accordance with internationally agreed guidelines. The timely response to prevent sea pollution is particularly important, as sudden pollutions of the sea may have far-reaching consequences.	technologies has long been recognized as the main objective of the transport development strategy in the European Union. This measure does not generate environmental impacts at the strategic level, but a positive direction in which the measure promotes transport development shall be emphasised, which contributes to protecting the environmental components and the quality of life of people in particular.
G.13	Adapting to climate changes and their mitigation	The development of the transport sector in Croatia shall take into account the need to reduce CO_2 emissions, and thus mitigate the impact of the traffic on climate changes. At the same time, the transport infrastructure and business shall be built, taking into account possible consequences of climate changes and extreme weather conditions on them.	
G.14	Improving the data collection process	For further development of the transport sector, it is necessary to have the most recent data. The data collection system needs to be improved and simplified for easier access to data.	The subject measure does not generate environmental impacts, but it affects customer satisfaction in the long term.
G.15	Enhancing interoperability with neighbouring countries	Enhancing the interoperability of the Croatian transport system in all sectors with neighbouring countries is very important to ensure proper connection and strengthen the role of Croatia as a transport hub for the Western Balkans, thereby increasing demand for transport on the Croatian territory. Harmonisation of technical standards in different sectors and simplification of the procedures at border crossings with Schengen and non-Schengen countries are examples of the tasks to be implemented.	The subject measure has a positive impact on socio-economic indicators of the Republic of Croatia, in particular taking into account the role of Croatia as a transport hub for the Western Balkans.

Code	General measure	Description of the measure	Environmental impact assessment
		In order to determine the bottlenecks and to propose solutions, special studies are required in each sector.	

7.2.2 Analysis of development measures

Code	General measure	Description of the measure	Environmental impact assessment
Urban, suburban and regional transport			
U.2	Infrastructure development	Appropriate analysis of the existing situation and the anticipated development of the transport system and socio-economic context in urban and regional areas in the perspective of the functional region shall identify the needs for restoration/upgrading of the existing infrastructure or creation of new ones where the level of mobility allows it. On the other hand, this may also mean the termination or functional reduction of some parts of the network where the expected level of mobility becomes irrelevant. Infrastructure investments shall primarily focus on public transport and low/zero level of harmful emissions, and shall be accompanied by complementary mobility management policies and interventions along with appropriate ITS installations.	A quality transport system (infrastructure and services) is vital for the functionality of urban areas. Apart from contributing to all aspects of urban life in the form of safe and efficient mobility of a large number of people, it enhances the quality of life and has a wider economic impact. In addition to a positive impact on traffic safety and personal safety, the improvement of road, rail, air and maritime connections, shall contribute to environmental protection through focus on lower emission of greenhouse gases.
U.3	Development of stops	Appropriate analysis of the current state and expected movement in the transport system in the socio-economic context in urban and regional areas, and in the perspective of Sustainable urban mobility plans / Integrated transport plans shall identify the need for restoration/upgrading of existing stops or setting new ones where justified by the level of mobility. On the other hand, this may also mean the termination or functional reduction of some existing stops where the level of mobility is expected to become irrelevant. The development of the station shall primarily focus on improving access for passengers, particularly persons with reduced mobility,	The restoration / upgrading of existing stops or setting new ones would meet the needs of urban residents related to their mobility and ensure better and quality living conditions in the city and its surroundings. It is possible to increase the number of public transport users, the economic productivity of public transport operators and the comfort and safety of travel. Adjusting the stations to persons with reduced mobility would significantly contribute to their greater mobility, which indirectly positively affects their greater social inclusion.

Code	General measure	Description of the measure	Environmental impact assessment
		ensuring the safety of passenger movements and introduction of the information and speaker system.	
U.4	Separating transport modes – identifying priorities in public transport, elimination of bottlenecks	Public transport (mainly buses and trams) should simultaneously operate with personal cars, as available space in the cities is limited. In order to increase the efficiency of public transport, the level of separation of individual transport by cars and public transport shall be increased by the construction of dedicated public transport lanes and / or corridors intended for public transport (for trams and buses) and the implementation of the measures aimed at increasing the priority of public transport through traffic management systems such as traffic lights. Furthermore, obstructions and bottlenecks hindering the efficient operation of public transport shall be removed. Such obstructions and bottlenecks usually cause traffic jams for public transport vehicles and may even endanger road safety (e.g. railroad crossings).	Increasing the efficiency of public transport shall increase the use of public transport and the reduction in the use of personal cars, which may have an indirect positive impact on the quality of life of people in the city and its surroundings and the reduction of CO_2 emissions and other pollutants. Removing the bottlenecks that hinder the efficient operation of public transport shall improve the aspect of traffic safety, which may positively affect the decrease in the number of deaths due to traffic accidents. Public transport provides access to smaller regional centres and rural areas. On the other hand, the population of these areas has access to centres of work and services.
U.6	Alternative fuelling stations	Alternative fuels have considerably improved over the past few years, especially with regard to public transport in urban and suburban settlements. Consideration shall be given to constructing alternative fuelling stations with the aim of reducing the consumption of conventional fuels, CO_2 emissions and poisonous particle emissions. In any case, in order to identify appropriate technology, special studies are required within the concept of functional regions.	This measure has a positive impact on air quality due to the reduction of gas emissions generated by the combustion of diesel and gasoline.
Railway transport			
R.15	ETCS L1, L2 on other railway lines, GSM-R	Installation of the European Train Control System – ETCS) on railway lines, except those described in other measures (Railway Network Elements) would enable the increase in the interoperability of the entire network. Depending on the operative concept, the installation of the ETCS system and GSM-R system (Global System for Mobile Communications – Railway) could be feasible on other Croatian network railway lines as well	European standardisation of rail management aims to increase interoperability and facilitate the purchase of signal-security devices. Modernisation of signal systems improves infrastructure and traffic management. At a strategic level, the subject measure does not generate environmental impacts.

Code	General measure	Description of the measure	Environmental impact assessment
		(comprehensive and those that are not part of the TEN-T). Through the concept of functional regions, specific needs shall be defined an technical parameters that shall be met in each individual case	
R.16	Electrification of other railway lines	Depending on the operational concept, the electrification of railways would increase the efficiency of the existing infrastructure. Further studies shall define the specific needs and technical parameters as the source of electricity (ensuring the environmental performance of the measure) to be met in each individual case.	The introduction of railway electrification leads to a reduction in air pollution, as there is no chemical pollution in case of electric railway vehicles. The necessary infrastructure development for the implementation of this measure is addressed in the process of environmental impact assessment.
R.17	Restoration, upgrading of other railway lines	Individual case studies shall determine the need for restoration and upgrading of the railway lines along with those already described in the Strategy, taking into account the operational concept as well as the economic and environmental aspects.	Infrastructure development, in terms of performing specific environmental interventions, may have adverse effects on environmental components, which shall be recorded in the process of environmental impact assessment.
R.18	Regional transport except Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)	Railway transport can also play an important role in regional transport in regional centres that are not part of the basic TEN-T rail network due to the existing network configuration in these areas. Through the concept of functional regions, potential shall be analysed in cities such as Split, Varaždin and Osijek. These studies shall also assess the required technical parameters for each individual case.	The development of the railway network in cities can lead to negative impacts on the environment and nature at the level of implementation of specific projects, while at a strategic level, this measure is considered through a positive impact on the population if it contributes to a better connection and a potentially organised public transport system that can reduce the needs for daily commute by personal cars.
R.19	Improvements and new railway yards	Through the concept of functional regions based on demand estimates, the need for the development of new railway yards or the improvement of existing ones shall be analysed in order to increase the railway potential in the cargo transport sector.	The measure contributes to better freight management, while the intensity of impacts on environmental components can be recorded when defining and analysing specific projects.
Road transport			
Ro.17	Reorganisation of toll collection system	The toll collection system in the Republic of Croatia is mainly under the jurisdiction of four concessionaires with different toll collection methods. A unique toll collection method is required. Further studies shall analyse a full range of existing options, as well as the option of introducing EETS or EU vignettes.	During the implementation of the measure, there may be a need to change certain regulations defining the organisation of the transport system (e.g. Toll Regulation (OGof the Republic of Croatia 130/13)).

Code	General measure	Description of the measure	Environmental impact assessment
Ro.18	Development of the concept for the road network maintenance (including maintenance stations)	Covered by the G.5 general measure.	Description of the impacts as for G.5 measure.
Ro.19	Secondary and tertiary restoration of roads and connection	In order to ensure the cohesion of the territory and enable appropriate access to the road network with a high level of service, the status of existing secondary and tertiary roads shall be analysed and the need for their restoration shall be identified. The main problems affecting this category of roads are the lack of maintenance and funding. The conditions for proper maintenance shall be realised, in particular taking into account existing and planned levels of traffic on these roads. The concept of functional regions shall identify the need for constructing such roads and specific studies shall define the necessary technical parameters, taking into account the expected demand, the toll collection concept, and economic and ecological aspects.	The improvement of secondary and tertiary roads in terms of regular maintenance contributes to a more quality transport system that has a positive impact on user satisfaction. Better connection between secondary and tertiary roads with higher priority categories ensures better regional accessibility. In addition, the connections between the islands and the mainland are insufficient and hence the reconstruction of road links and other transport infrastructure indirectly positively contributes to the development of islands.
Ro.20	Developing the concept of rest stops for the road network with a high level of service	According to Directive 2008/96/EU, a sufficient number of rest stops is very important for road safety. Rest stops allow drivers to rest and continue their journey completely concentrated. Therefore, an integral part of the road infrastructure safety management should be to provide a sufficient number of secure parking lots. Although a number of service facilities have already been constructed next to motorways and expressways, this number is still not enough to take into account the increase in traffic, especially during the tourist season. Furthermore, Directive 2010/40/EU states that it is necessary to improve the infrastructure of secure parking lots for trucks and buses. At the same time, renovation of old parking lots is planned by introducing new facilities (gas stations, restaurants, toilets, playgrounds).	At a strategic level, the measure does not generate environmental impacts. It is in compliance with Directive 2008/96/EU on road infrastructure safety, i.e. the European Union guidelines for safer traffic. Potential impacts on environmental components shall be recorded when defining specific projects.

Code	General measure	Description of the measure	Environmental impact assessment
Ro.21	Traffic management and control, traffic counting and information system	New technologies shall be introduced to improve the methods and manners of collecting information to ensure that the collected information on traffic management meet the international level in terms of the content and quality. New technologies enable, inter alia, the collection of real-time data and control of traffic conditions. In order to use the benefits of new technologies, the need for new centralised traffic management centres shall be analysed, which would be equipped with the latest ITS (Intelligent Transportation Systems) solutions. Traffic management and control is of particular importance in managing incidents and traffic jams at the peak of the tourist season. This shall enable qualitative improvement of planning and monitoring alternative routes, information for passengers, traffic control and the collection of real-time data on traffic jams.	The introduction of intelligent transport systems, which improve traffic management and control, especially in increased traffic periods, contributes to the safety of passenger travel.
Ro.22	Junction development plan	In order to improve the connection with road networks with a high level of service, a junction development plan is needed. The plan shall take into account the functionality of each road, and hence the number and locations of junctions shall be determined in order to avoid, for example, a large volume of local traffic on interurban corridors, which could worsen the level of service. Specific seasonal requirements of the tourist season shall also be considered. A new toll collection system shall be proposed and evaluated.	The junction development plan shall contribute to a better traffic organisation, reduction in traffic jams and cars stopping when passing through bottlenecks, which shall contribute to user satisfaction and better environmental conditions.
Ro.23	Road transport safety	Covered by the general measure G.3.	Impact assessment of general measures is given in chapter 7.2.1.
Ro. 24	Development of networks to intermodal hubs, agglomerations in accordance with the demand	Covered by the general measure G.4	
Ro. 25	Interoperability improvement	Covered by the general measures G.4 and G.15.	

Code	General measure	Description of the measure	Environmental impact assessment
	(intermodal hubs, P&R facilities, etc.)		
Ro. 26	Environmental impact reduction	Covered by the general measures G.12 and G.13.	
Ro.27	Energy efficiency	Covered by the general measure G.6.	
Air transport			
A.10	Airport accessibility	Covered by the general measure G.2.	Impact assessment of general measures is given in chapter 7.2.1.
A.11	Airport safety	One of the main goals of the Transport Development Strategy of the Republic of Croatia is to develop the highest standards of air traffic safety at the international, regional and national level in order to effectively reduce air traffic hazards, reduce the likelihood of accidents and their negative consequences. Airport infrastructure and aircrafts shall meet international safety standards.	The development of the highest air transport safety standards shall reduce the risk of accidents and other adverse consequences in air transport. Improving the quality of service shall have a positive impact on airlines' business intensity. Indirect impact of the subject measure is reflected in a neutral impact on the total movement of the population in areas from where the users of air transport are coming.
A.13	Termination or change of the role/ownership of regional airports	In order to improve the efficiency and sustainability of the system, it is necessary to develop new airport management strategies while considering the possibility of changing the role / ownership of unsustainable airports.	Improving the efficiency and sustainability of the airport management system shall also positively affect the intensity of their operations. This can indirectly influence the improvement of socio-economic trends in the settlements where airports are located.
Maritime transport			
M.1	Increasing intermodality and accessibility	The modal share of maritime traffic is still very low in relation to road traffic. This share can be enhanced by increasing intermodality and improving access. The development of national ports shall be linked to the development of intermodal infrastructure (road and rail links and logistic zones). A planned extension shall be considered, as well as all the possibilities offered by a specific location for further development.	The improvement of organisational and operational system settings and the establishment of intermodal transport system are particularly important for islands and the hinterland settlements because increasing the number of intermodal nodes positively affects the integration and harmonisation of different types of public transport, enabling easier and faster flow of goods and services.

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M.2	Implementation of the "Motorways of the Sea" projects	Although there are already RO-RO lines connecting Croatian and Italian ports, the "Motorways of the Sea" projects are still to be implemented in a structured manner in Croatia. The implementation phases of the "Motorways of the Sea" projects in Croatia are the following: • determining the main corridors in cooperation with the EC (combined "land-sea" routes) • extending Croatian ports on the corridors for the acceptance of road and rail (RO-RO) traffic if necessary and • extending road and air links from and to the port if necessary. The "Motorways of the Sea" concept shall be aligned with the logistic concept (general measure G.1).	The "Motorways of the Sea" project is of great interest to the Member States of the European Union, created with the intent to redirect traffic from loaded road networks to sea routes due to a shorter travel time and reduced transport costs caused by the congested road system. In this context, the advantages of coastal transport connections are particularly emphasised, which, in addition to large economic impacts, can significantly contribute to the integration, cohesion and economic development of the entire Europe (T. P. Jugović, R. Šušan, 2013). On the other hand, when we talk about the impact on the environment and nature, we need to explore the Adriatic area in detail and define solutions that shall not degrade the marine environment. Potential threats arising from the "Motorways of the Sea" project may be significant for marine biodiversity, especially marine mammals and reptiles, but also other species. Apart from disturbing the species, this project can lead to pollution of the marine environment (primarily air, but also water due to possible accidents), significant increase in noise as well as entry and spread of foreign invasive species.
M.4	Fuel distribution facilities for gaspowered ships and ecoships	Croatian ship fleet shall be modernised in order to develop energy efficient eco-shipping by stimulating the purchase/construction of new eco-ships and adapting the existing ships in accordance with the highest ecological standards and MARPOL 73/78 Annex VI - Regulations for the Prevention of Air Pollution from Ships. Along with the development of eco-shipping, fuel distribution facilities for gas-powered ships and eco-ships shall be developed.	The modernisation of Croatian ship fleet in accordance with provisions of the MARPOL convention has a potential to positively affect the quality of marine environment due to the introduction of rules that prevent air pollution to the fullest extent, but also reduce the risk of other potential accidents that may result in the pollution/contamination of the marine environment.
M.5	Navigability	Covered by the general measure G.3.	Impact assessment of general measures is given in chapter 7.2.1.
M.6	Improving island accessibility, port development	Public transport in coastal line passenger transport is considered to be one of the key factors in the maritime transport segment, given that it provides a permanent and regular link between the islands and the mainland and between the islands themselves,	Better access to islands shall be facilitated through the development of public transport ports, which shall indirectly affect the social, economic and environmental sustainability of islands and the coast. Benefits shall be manifested through the

Code	General measure	Description of the measure	Environmental impact assessment
		without which the sustainable development of inhabited islands would be endangered. For the proper operation of maritime public transport, it is essential to ensure safety, regularity, reliability and comfort and to coordinate these services mutually and with an integrated land transport system. Ports need to be adapted and, if necessary, extended for the needs of coastal line passenger traffic, and availability and connectivity with ports need to be improved.	development of business activities on islands, which shall contribute to improving the demographic image of the islands. Quality shall be improved through the adaptation and extension of the existing infrastructure, with attention being paid to planning future activities in the coastal belt, which is very sensitive due to its nature and visual qualities.
M.7	Development of other ports (e.g. Korčula, Pula)	The Republic of Croatia has 418 ports open to public transport, of which 95 have at least one shipping line. In addition to 6 main ports of particular (international) economic interest, there are numerous County and local ports. Their development is important for island sustainability as well as tourism. In areas where this is important, existing public ports in the country need to be adapted to receive line passenger ships, and ports important for tourism shall be enabled to receive smaller ships on cruise journeys. The need for extension and reconstruction of existing County and local ports for the needs of the local population and for tourists shall be aligned with the national port development plan.	The development of public transport through their extension and reconstruction can have a positive impact on employment and entrepreneurship, especially during the season. Positive impacts shall be visible through increased economic productivity due to the transport of persons and goods and consequently the economic vitality and regeneration of islands and settlements in the hinterland. The modernisation and construction of new port infrastructure shall improve communication with islands and with other ports in the region. Negative impacts followed by the development of ports shall be reflected through the noise in the coastal area and the marine environment and the potential spread of invasive species in the marine environment.
M.14	Development of specialpurpose ports (ports for shipbuilding, nautical tourism, military ports, industrial ports, fishing ports, sports ports)	Depending on the nature of their activities, special-purpose ports are classified as ports for shipbuilding, nautical tourism, military ports, industrial ports, fishing ports and sports ports. Since the Croatian coast is developing as a tourist destination, special-purpose ports are to be developed in this direction: new nautical piers, dry docks and yacht piers, etc. Fishing ports on islands are needed for the sustainable development of islands. Industrial ports are mainly piers for industrial plants such as thermal power stations and oil refineries. There is potential for the development of liquefied petroleum gas terminal at the industrial port on the island of Krk. Further analysis shall identify possible measures	Special-purpose ports differ in a number of activities that generate impacts. Industrial ports are focused on the economic viability of the journey and goods. They have their own coast at their disposal and their own employees and therefore ships spend minimum time in the port, which contributes to the reduction of transport costs. Ports for shipbuilding are an important and necessary part of the industry that is located on the sea, and are therefore an important economic factor. Sports ports are intended for the local population for the purpose of mooring and anchoring small vessels. These vessels are not a threat to the environment, but the effect that a greater number

Code	General measure	Description of the measure	Environmental impact assessment
		related to the development of special-purpose ports and determine their priority, taking into account the actual needs and potential according to the expected demand.	of vessels create in a closed aquarium can be a significant source of pollution. Fishing ports also affect economic development. Ports for nautical tourism are linked to the territory of the city and the settlement in the aquatorium. The development of ports leads to changes in the environment and their planning shall be limited to areas already under anthropogenic pressure, where possible. Also, the future development shall be aligned with the research planned on the Adriatic Sea and aimed at protecting the marine biodiversity.
M.16	Closure or change of the role/ownership of unused ports	Some military, industrial and shipbuilding ports are not in use. It is necessary to decide how to put these unused or abandoned ports in use for the purpose of economic development (tourism, fisheries and small industries). Further analysis shall identify possible measures in this regard and set priorities, taking into account environmental requirements and actual needs as well as the potential according to the expected demand.	Special-purpose ports that are not in use shall be converted or given a new function. This would improve the quality of life of people in the nearby area, especially if they would be used for economic purposes (fisheries and industry). Also, in the area of the mentioned ports, it is possible to organise public manifestations and other cultural events, so their function does not have to be strictly related to economic activity.
Inland waterway traffic			
I.1	Improving the waterway of Danube and Drava rivers to Osijek	The Danube and Drava are part of the TEN-T Rhine-Danube Corridor. The total length of the Danube passing through the Republic of Croatia is 137.5 km. As the Danube tributary, Drava is also considered an international waterway to Osijek. It is therefore important to ensure the navigability of these international rivers in accordance with the required navigability levels according to class VIc for the Danube and IV for Drava to the port of Osijek, according to the European agreement on major inland waterways of international significance. For the purpose of meeting the navigability requirement, the dimensions of the waterways shall be increased and the bottlenecks shall be eliminated (using, among other things, dredging and / or building new waterway structures).	The realisation of the subject measure would have a potentially positive impact on the economy, but at the same time a negative impact on the environment and nature. The Drava area is significant for many wild species (especially its banks, which are very important for the nesting of sand martins), and the subject measure has the potential to endanger the habitat conditions in the area of river expansion to meet the navigability requirement. This measure shall be planned in cooperation with expert bodies (Croatian Agency for the Environment and Nature).
I.2	Improvement of the Sava River	The Sava River does not meet in its entire length on the territory of the Republic of Croatia the international requirements for the	Potential implementation of the measure may result in interventions in the area that could have a significant impact on

Code	General measure	Description of the measure	Environmental impact assessment
		navigability of waterways under the AGN agreement. However, the navigability level is sufficient for current operational requirements.	the environment. When defining the activities for the implementation of the measure, expert bodies shall be consulted in order to consider the impacts and risks that may arise from the implementation of the measure at a plan level. As in the previous case, this measure would positively affect the economy.
I.8	Safety, RIS, signalling system, etc.	Covered by the general measure G.3.	Impact assessment of general measures is given in chapter 7.2.1.
I.9	Interoperability, accessibility to other transport modes	Covered by the general measures G.4 and G.15.	
I.10	Energy efficiency	Covered by the general measure G.6.	
I.11	Terminals for hazardous substances and waste management facilities	In accordance with the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways, the port area management authorities are obliged to ensure the separate storage, processing and disposal of non-hazardous and hazardous waste in ports, as well as the reception of waste from ships and the supply of vessels with fuel. Croatian ports of inland waterways are poorly developed and to increase the safety and protection of the environment, it is necessary to build and extend the terminals for hazardous substances and to extend ports with waste management facilities, primarily international ports, but also other ports where this is necessary.	Increasing safety in ports receiving hazardous substances reduces potential adverse environmental impacts and reduces the risk of accidents. Equipping ports with waste management facilities improves the prevention of environmental pollution.
I.12	Environmental protection	Covered by the general measures G.12 and G.13.	Impact assessment of general measures is given in chapter 7.2.1.

7.2.3 Analysis of management/organisational measures

Code	General measure	Description of the measure	Environmental impact assessment
Urban, suburban and regional transport			
U.13	Ticketing and common ticket systems	One of the biggest advantages for the users of integrated transport systems is the introduction of integrated tariff systems. The level of tariff integration and the type of tickets and technology for use (unique tickets and / or electronic tickets, smart cards) or contactless payment methods, etc.) shall be analysed case by case based on the expertise of the responsible traffic authorities, taking into consideration all options as well as the option to use "smart cards" for the payment of “Park & Ride” service, parking on the street, customs zone	Integrated tariff systems shall have a positive impact on increasing the use of integrated transport systems for due to simplification of ticketing. The transport system thus has the potential to become more efficient and more sustainable. Integrated transport system shall increase economic efficiency by reducing transport system costs that are visible through traffic congestion, accidents and construction and maintenance. A positive impact on the quality of life of the inhabitants / users would be visible through the reduction of congestion in traffic, less pollutant emissions and economic viability.
U.14	Introduction of public transport services ondemand	Considering the fact that in some parts of the Croatian territory there is not enough demand for the introduction of regular transport lines (e.g. rural or poorly populated areas), the introduction of on-demand transport services shall enable the provision of transport services in these areas as well.	The introduction of on-demand transport services shall positively influence the increase of population mobility in rural areas whose traffic connection is very poor. The local population (especially the elderly) shall thus be provided with the access to the services provided by nearby larger settlements and this shall improve the quality of life of people and potentially prevent further depopulation. Flexibility of such transport has the potential to affect the increase in the number of users due to greater service satisfaction, and thus possible new employment.
U.15	Harmonisation oftimetables (coordination)	In order to increase the share of public transport in urban, suburban and regional transport, the reorganisation of timetables is required (e.g. TAKT <*regular interval timetable*>) with the aim of improving the connectivity, efficiency and coordination of different modalities. Further research shall analyse this option by taking into account the samples.	Given that cities have several public transport operators, very often the network of lines and timetables is not harmonised and well-coordinated. Problems occur at the expense of passengers who need to change buses/trains or wait for a long time to change e.g. a train and a bus. The harmonisation of timetables would lead to an integral public transport service and the improvement of settlement

Code	General measure	Description of the measure	Environmental impact assessment
			connectivity, which would positively affect the increase in the use of transport services, and thus the possible growth of employment.
U.16	Administrative capacity and training	Covered by the general measure G.10.	Impact assessment of general measures is given in chapter 7.2.1.
U.17	Purchase of the new fleet	Except for some exceptions, the existing public transport fleet is old and is based on obsolete and inefficient technology. In order to increase the competitiveness of public transport vehicles in relation to personal cars, it is necessary to modernise the fleet and ensure the highest standards of quality, safety and environmental protection as well as access to persons with reduced mobility. The purchase of a new fleet shall take place in coordination with the anticipated infrastructure improvement. The first step in the development of these measures is the preparation of a comprehensive analysis of the current organisational, operational and maintenance framework of relevant operators by analysing future requirements and operation and maintenance plans. Once the actual needs are identified, further research shall determine the technical requirements of the fleet.	The purchase of a new fleet shall increase the competitiveness of public transport, which shall positively impact the reduction of pressures on transport infrastructure due to a possible reduction in the number of personal cars. This could potentially lead to a change in part of the traffic infrastructure to the benefit of pedestrians and cyclists. Positive impact shall affect the population in terms of better mobility within a certain area. Also, the purchase of new and quality vehicles shall improve travel safety and environmentally friendly models shall have a positive impact on reducing CO_2 and other harmful substances as well as human health. The long-term effect of this measure is reflected in the increase in the quality of life of the population.
U.18	Transport reorganisation	Providing options competitive to the use of personal cars (taking into account the potential of car sharing service) is important for achieving the objectives of the Strategy and ensuring the sustainability of the transport system. Different transport hierarchy models shall be re-considered and transport shall be reorganised and integrated in order to give priority to the public transport and low-emission transport modes in relation to the transport by personal cars. At the same time, more pedestrian zones shall be built in urban areas, bike paths for daily ride, public bicycle systems shall be introduced and traffic plans shall be developed with the aim of adapting to the requirements of the seasons.	There is a large number of travels on a daily basis involving going to and from work by personal cars in which only one person is travelling. Such a manner of transport creates traffic jams on roads. Car sharing service has a multiple positive impact on the community and the individual The benefits for the community are manifested through reduced traffic congestion, reduced air and noise pollution and reduced parking lot occupancy. The benefits for the individual are manifested through reduced travel costs and company during travelling, but also psycho-physical health due to the possible

Code	General measure	Description of the measure	Environmental impact assessment
			increase in physical activity by developing cycling and pedestrian infrastructure.
U.19	Information platform	Covered by the general measure G.11.	Impact assessment of the general measure G.11 is given in chapter 7.2.1.
U.20	Support to non-profit organisations in the transport sector	The role of non-profit organisations promoting the use of alternative means of transport in relation to personal cars has proved to be very significant in many European cities. Among other things, there are organisations that promote the daily use of bicycles, organisations dealing with the rights of passengers, maintenance of footpaths or traffic control. These organisations (neighbouring associations or groups of common interest, non-governmental organisations, etc.) can assist local administration and traffic authorities in carrying out their duties and promoting the use of public transport vehicles. The involvement of these associations, local groups and non-governmental organisations in planning traffic-related decisions shall be further considered and promoted.	The role of non-profit organisations is very significant in the transport sector because they are familiar with the everyday situation in the field. Thus, for example, the Cyclists' Union advocates the improvement of conditions for riding a bicycle as a sustainable and healthy means of transport. Such means of transport contributes to the transformation of the city into the so-called "green city", or the city suited to a man. The operations and activities of non-profit organisations in the transport sector positively affect the safety of travelling of people and, in the long term, their psychophysical health.
U.21	Traffic and logistics management andinformation	New technologies enable, among other things, the collection of real-time data and control of traffic conditions and the use of public transport. In order to use the benefits of new technologies, centres for centralised public transport management shall be constructed and equipped with the latest ITS devices. New public transport vehicles shall also be adequately equipped, ITS travel planning platforms shall be used and traffic signs shall be modernised, which shall then be integrated into the central management system (e.g. "Smart traffic lights" or setting priority measures relating to public transport). These measures shall lead to a quality improvement of public transport planning and control, use of information, traffic control and collecting data on traffic congestion and arrival time of public transport vehicles.	ITS solutions lead to improved flow, safety, comfort, and generally better conditions for the users. An additional positive effect of the mentioned measure relates to informing passengers, which is recognised as a significant factor in improving the overall satisfaction of the transport infrastructure users. The goals of introducing the ITS system in urban areas include, among other things, reducing energy consumption and gas emissions as well as improving the quality of life in the city.

Code	General measure	Description of the measure	Environmental impact assessment
U.22	Review/updating local/regional Plans of Master	Regarding traffic planning obligations, functional regions and/or cities shall be required to develop relevant master plans for functional region (following the principles of the Sustainable Urban Mobility Plan - SUMP). These master plans for functional regions shall analyse the existing transport system status taking into account not only the infrastructure but also the operational and organisational aspects, and based on the results of these analyses, future needs shall be identified. The existence of these plans is a prerequisite for investments into the public transport system. The master plans shall be periodically reviewed and updated and shall be aligned with the highlevel planning instruments such as the Transport Development Strategy of the Republic of Croatia.	The obligation to develop sustainable urban mobility plans (master plans) at the level of one area or several cities that belong to a common agglomeration / functional region shall enable the needs of regional and local traffic to be met through an integrated set of infrastructure, organisational, operational and regulatory measures. Master plans enable the achievement of objectives related to: ensuring the basis for sustainable development of the sector, an integrated approach to transport planning at all levels (national, regional, local), identifying the needs of local mobility complemented with international mobility patterns identified in the Transport Strategy of the Republic of Croatia, identifying the actual needs for the development of a transport system as a tool to support contemporary socioeconomic trends (an increasing share of aged population, increase in the number of commuters, development of health services, tourism, industry, logistics, etc.) and so on.
Railway transport			
R.26	Reorganisation of charging fees for the use of railway infrastructure	The fee for the use of railway infrastructure can be used as a tool to improve the sustainability of the railway transport system. The fee for the use of the railway infrastructure shall be proportionate to the emission and is hence guided by the principle that those who pollute have to pay. Coordination of charging fees for the use of railway infrastructure with railway managers in neighbouring countries shall facilitate international traffic.	Payment of the fee for the use of railway infrastructure can contribute to improving its infrastructure through a fee financing system to ensure longterm competitive advantages. Such type of fees should be determined with regard to the condition, development, maintenance and management of the infrastructure. In the long run, this measure would have a positive impact on improving the air quality, reducing noise levels and safe disposal of hazardous and harmful substances.
R.30	Improving the rolling stock for passenger transport	The existing rolling stock is outdated and is based on obsolete and inefficient technologies. In order to increase the competitiveness of rail transport in comparison with other means of transport, it is necessary to modernise the railway vehicles, in coordination with the anticipated infrastructure improvements. The first step in the implementation of this measure is a detailed analysis of the current organisational and	Improving the rolling stock for passenger transport shall result in increased quality of the passenger transport service. Positive results shall be reflected in a greater availability and reliability of rail vehicles with lower operating costs. Stable timetables with the possibility of increasing train frequencies shall affect the increase in the number of passengers. Reliable mobility has a positive impact on increasing the

Code	General measure	Description of the measure	Environmental impact assessment
		operational structures and the maintenance structure of the railway operator, analysing the future needs, the operational plan and the maintenance plan. Once actual needs are identified, further studies shall define specific technical requirements for the rolling stock.	quality level and production time of the population. New trains shall contribute to reducing environmental pollution and reducing fuel consumption.
R.31	Improving the rolling stock for cargo transport	The existing rolling stock for cargo transport consists mostly of conventional covered and open wagons, some of which are suitable for combined traffic operations. A large number of locomotives need to be replaced and it is estimated that as much as 70% of locomotives shall reach the end of their life span in the next decade. The first step in the implementation of this measure is a detailed analysis of current organisational and operative structures and the maintenance structure of the railway operator, whereby future needs, operative plan and maintenance plan shall be analysed. Once actual needs are identified, further studies shall define specific technical requirements for the freight rolling stock.	Improving the freight rolling stock shall positively affect the quality and speed of cargo transport. This type of transport can be used for larger amounts of freight and thus reduce road infrastructure pressures. On the other hand, a positive impact on socioeconomic trends is expected, in terms of the growth in employment and increase in economic activity.
R.35	Liberalisation ofpassenger transport	Gradual opening of the transport market and the provision of equal opportunities for all potential operators is one of the main criteria of compliance that Croatia has met in the process of aligning with the acquis communautaire, in accordance with the White Paper goals. Croatian administrative bodies such as regulatory bodies and the security agency shall be prepared for the future.	The liberalisation of passenger transport, in line with the White Paper goals, advocates the opening of the transport market, whose key measure is to create a railway company with an independent management and sound financial structure. This would increase the user interest in rail transport and make it competitive on the market. It would also have a positive impact on improving the quality and speed of rail services, given the increased competition in the sector, which is indirectly reflected in improving the quality of life of the population.
R.36	Liberalisation of cargo transport	The liberalisation of the freight rail sector in Croatia has already begun and the following freight operators are active on the Croatian market: HŽ Cargo d.o.o., PPD Transport d.o.o., Rail Cargo Carrier Croatia Ltd., RAIL & SEA d.o.o., RTS Rail Transport Service GmbH, Train Hungary Kft, SŽ - Tovorni promet d.o.o. and Pružne građevine d.o.o.	The liberalisation of cargo transport, in line with the White Paper goals, advocates the opening of a transport market whose key measure is the to create a railway company with an independent management and sound financial structure. This would contribute to increased interest in rail traffic, thereby reducing the pressure on road traffic.

Code	General measure	Description of the measure	Environmental impact assessment
			Possible increase in cargo transport would result in new employments not only in the rail transport but also in the related industry.
R.38	Business/timetable reorganisation	In order to increase the share of railway transport, it is necessary to reorganise timetables (e.g. TAKT) in order to improve the connectivity and efficiency of the services provided. This option shall be analysed through the concept of functional regions, taking into account the patterns of the structure "destination-point of departure" as well as operational and infrastructure requirements.	Timetables shall be coordinated with other types of public transport through the integrated passenger transport system (IPT). This would enable faster and easier connections through a system of common stops where different means of transport stop. The IPT system usually uses the regular interval timetable, i.e. departures from each stop take place at regular intervals (e.g. every 10, 20, 30, 60 minutes). A positive impact is expected in terms of the improved quality of life of the population.
Road transport			
Ro.28	Updating of legal regulations andplanning guidelines	Covered by the general measure G.8.	Impact assessment of general measures is given in chapter 7.2.1
Ro.29	Increasing administrative capacity/training	Covered by the general measure G.10.	
Ro.30	Preparation/adaptation for Schengen borders	Covered by the general measure G.9.	
Ro.31	Preparation/adaptation of non-Schengen borders	Covered by the general measure G.9.	

Code	General measure	Description of the measure	Environmental impact assessment
Ro.32	Improving financial viability of the road network and the toll collection system	Covered by the general measure G.7.	
Ro.33	Information platforms	Covered by the general measure G.11	
Ro.34	Re-categorisation of the road network	A study shall be developed to analyse the need for re-categorisation of the road network in order to adapt it to the actual demand and functionality of each road for the purpose of increasing the efficiency and sustainability of the system.	Ponovna kategorizacija cesta sa ciljem povećanja učinkovitosti i održivosti sustava poboljšati će odvijanje prometa, njegovu sigurnost te će podići razinu prijevozne usluge. Dugoročan učinak ove mjere ogleda se u povećanju zadovoljstva korisnika cesta.
Ro.35	Implementation of safety measures	In the White Paper on Transport Policy for 2010, the Commission has set a general objective in terms of road safety, according to which the number of fatalities should be reduced to zero by 2050. Research has shown that implementation is an important and effective manner of preventing and reducing the number of accidents, fatalities and injuries, but implementing actions are optimally effective only when combined with actions that raise public awareness of the implementing actions and the reasons why they are being implemented. Further studies shall assess specific actions in terms of raising public awareness, implementation and transboundary information management.	Reducing the number of accidents and reducing the number of fatalities to zero by 2050 shall positively affect the sense of user safety and total satisfaction relating to the use of road transport.
Ro. 36	Improving the dana collection system	Covered by the general measure G.14.	Impact assessment of the general measure G.14. is described in chapter 7.2.1.

Code	General measure	Description of the measure	Environmental impact assessment
Air transport			
A.15	Enhancing cooperation with competent regional bodies	While the main role of air transport is related to passengers from distant destinations, good cooperation with relevant regional and local bodies is required in order to improve airport accessibility and ensure compliance of the airport development plans with the development plans of relevant cities and regions.	Airport development plans with city/region development plans shall positively affect the intensity of their business. Accordingly, a positive impact on socio-economic trends in the area of the airport may also be expected.
A.16	Croatia Airlines restructuring	In order to increase the sustainability of the system, it is necessary to complete and finalise the restructuring of Croatia Airlines. Additional analysis should facilitate the company privatisation process and the search for strategic partners that would bring additional capital and create clear plans for future development and growth of Croatia Airlines.	Restructuring of Croatia Airlines can lead to improvement of the business and creation of investment conditions, which shall lead to positive business flows. Possible negative impacts of restructuring shall be reflected in the reduction in the number of employees in this sector.
A.19	Cooperation with the aviation industry	The development of the aviation sector shall also be achieved through joint innovative projects for the modernisation of air navigation and aviation fleet, research, development and environmental protection, in cooperation with private investors and the Government of the Republic of Croatia in the form of special funds established for this purpose. More attention shall be paid to the application of innovation in transport technology and compliance with new technology standards.	Modernisation of the aviation sector would have a positive impact on increasing the number of passengers and facilitating the flow of goods. This shall result in a higher traffic density and usability of air lines and possible lower flight costs and prices. It is also important to develop smaller airline companies and infrastructure, which would connect islands with the coast and wider area and thus contribute to the development of islands.
A.20	Air traffic management, Single European Sky, SESAR	Developing a national coordination development plan for the implementation of the SESAR programme and the Concept of centralised services. Definition of national priority policy within the FAB CE integration as well as improvement of integration and cooperation with neighbouring countries and within the wider region. Regardless of the competitiveness of Hrvatska kontrola zračne plovidbe d.o.o. <*Croatia Control Ltd.*> in relation to regional operators and companies of similar size, it is necessary to increase the capacity, apply safety	The Single European Sky initiative, SESAR, was launched in 2004 by EU Member States to improve air traffic management regardless of national boundaries, which would result in the creation of a single European airspace. This would transform the existing airspace model, which would have the effect of reducing delays, reducing service costs, increasing safety and reducing environmental impact.

Code	General measure	Description of the measure	Environmental impact assessment
		standards, achieve cooperation on common air navigation and to establish a flight control training centre.	
A.21	Raising awareness of customer satisfaction	In order to raise awareness of customer satisfaction, the quality of the service shall be monitored using key performance indicators (KPIs). This should be used to define the differences between a high and low season (if any), passenger requirements, their perception of facilities, etc. The results should be made available in a clear and concise manner and include the opinions of the public and participants in the process.	For achieving the objectives of the Strategy, including the objectives related to the improvement of rail transport, specific key performance indicators have been defined with the aim of measuring the achievement of the objective. Additional indicators should be defined in order to identify potential additional customer requirements. The measure leads to a potential increase in the quality of the service, which shall be in accordance with the expectations of the users.
A.22	Increasing financia viability of airports	Covered by the general measure G.7.	Impact assessment of the general measure G.7 is described in chapter 7.2.1.
A.23	Limiting environmental impacts	Covered by the general measures G.12 and G.13.	Impact assessment of the general measures G.12 and G.13 is described in chapter 7.2.1.
A.24	Revision/update of airport Master plans	Planning of infrastructure and the manner it deals with increased traffic is crucial to the development of a sustainable airport system in the Republic of Croatia. The first step is to coordinate the actions and activities that are planned by each airport Master plan. Upon the completion of Master plans, the next step shall be to coordinate action plans and prioritise them.	The coordination of actions and activities planned by the airport Master plan, as well as the prioritisation of action plans, can lead to a rise in the quality of services and can thus contribute to greater customer satisfaction.
A.25	Cooperation/agreements with other international airports	Although Croatian airports are competitive in relation to airports of other neighbouring countries, cooperation in border crossing control and security standards is needed in the interest of all sides. It may also be possible to reach specialisation agreements, e.g. cargo airports, operating bases for airline operators, etc.	Cooperation/agreements with other international ports can lead to an increase in passenger and cargo transport, thus indirectly affecting employability. Border crossing controls and improved security standards shall increase the user sense of security.

Code	General measure	Description of the measure	Environmental impact assessment
Maritime transport			
M.17	Cooperation with the shipping industry	Support to shipping shall be achieved through joint innovative projects in shipping and shipbuilding, research and development and environmental protection, with the participation of private investors and the Government of the Republic of Croatia in the form of special funds for this purpose. More attention shall be paid to modernising the fleet, implementing innovation in transport technology in line with new technology standards, and in cooperation with administration, working on the improvement of automated data exchange with information platforms of ship owners/companies.	Paying attention to the fleet modernisation and the implementation of innovations in transport technology in line with new technology standards shall positively influence the potential reduction of pollutant emissions into the marine environment.
M.18	Strategic maritime definition	Croatian maritime strategy and intermodal transport strategy shall be developed with a view to increase the intermodality and accessibility of maritime transport. The development plans of the ports of international economic importance (Rijeka, Šibenik, Zadar, Split, Ploče, Dubrovnik) shall be aligned with national development plans and plans for the development of transport infrastructure. It is necessary to prepare a risk assessment relating to the safety of navigation and marine environment pollution caused by maritime traffic with a proposal for risk management, to classify the navigable areas, and to optimally dimension the projects, measures and the system of navigation safety as well as the protection of the sea against pollution from marine facilities.	Planning the development of ports of international economic importance shall be in accordance with the National plan for the development of ports of special (international) economic interest for the Republic of Croatia and with the Program of measures for the protection of the marine environment and the coastal area as well as other requirements for the protection of the marine and coastal area.
M.20	Operational plan improvement (ship routing etc.)	A key part of Croatian shipping is passenger transport and it is therefore necessary to improve and develop an appropriate operational plan for optimising ship routing and planning services in cooperation with public transport systems in all relevant land cities. In the case of need for ship routing, the opening and closure of the lines between the islands shall be considered. Regardless of public transport, the	Planning maritime transport in accordance with public transport systems in cities positively affects the passenger flow and travel comfort. This measure contributes to the development of islands due to their better connection with the mainland.

Code	General measure	Description of the measure	Environmental impact assessment
		operational plan shall be improved taking into account the need for passenger ships on cruises in ports with important lines of navigation due to the congestion of the port and the city.	
M.21	Traffic management using the IT system, VTMIS	Traffic management using the ITS system (Intelligent Transport Systems) for public maritime transport shall be improved. Improvements of maritime safety and environmental protection can be achieved by increasing cooperation with neighbouring countries, modernising Croatian coastal radio stations and upgrading the Vessel Traffic Monitoring and Information System (VTMIS) to establish a comprehensive maritime surveillance and management service in inland sea waters, territorial sea and the Ecological and Fisheries Protection Zone of the Republic of Croatia in technical and operational segments. Furthermore, a system for early detection and removal of safety risks in maritime transport shall be established through the establishment, development and implementation of the e-Navigation concept for the collection, exchange and analysis of data on navigation, in particular for cruise ships.	Maritime traffic management using the Intelligent Transport Systems (IT system) and systems for automatic ship identification (VTMIS) as well as modernisation of Croatian coastal radio stations shall improve the working conditions in maritime traffic, thus positively affecting the efficiency of management and employee satisfaction in this sector.
M.22	Improvement of the Maritime Education andTraining (MET)	Covered by the general measure G.10.	Impact assessment of general measures is described in chapter 7.2.1.
M.23	Training and capacity building	Covered by the general measure G.10.	
M.24	Reorganisation of the maritime transport system	Covered by the general measure G.7.	

Code	General measure	Description of the measure	Environmental impact assessment
M.25	Information platform, database	Covered by the general measure G.11	
M.26	Concession agreements and reorganisation	Covered by the general measure G.8.	
M.27	Inspections, cooperation with SAR (Search and Rescue)	Covered by the general measure G.3.	
M.28	Modernisation of vessels (safety, energy efficiency and environmental protection	The shipping industry shall be developed in a safe and sustainable manner. The aim is to continually increase the efficiency of the security surveillance system and safety measures for the protection of Croatian ships and craft as well as to increase the share of energy efficiency of ships. A system for targeted and technical supervision for the implementation of the highest world, European and national safety standards of Croatian vessels and craft shall be developed according to established priorities. An effective system for tracking pleasure craft and marinas shall also be established.	The modernisation of vessels, the increase in energy efficiency of ships, as well as the development of a system for targeted and technical surveillance shall positively influence the emissions of pollutants into the environment, which shall directly affect the quality of air and water bodies in ports and along the waterway.
M.29	Cooperation/agreements with other international ports	In order to increase the traffic in Croatian ports, achieve their greater competitiveness on the international market and their alignment with the latest port technologies, cooperation with other international ports on the Adriatic shall be enhanced.	Cooperation/agreements with other international ports can lead to an increase in passenger and cargo transport, thus indirectly affecting employability in the maritime transport sector.
M.30	Increasing financial	Covered by the general measure G.7.	Impact assessment of general measures is described in chapter 7.2.1.

Code	General measure	Description of the measure	Environmental impact assessment
	viability		
M.31	Maintenance concept development	Covered by the general measure G.5.	
M.32	Improving datacollection	Covered by the general measure G.14.	
		Inland waterway transport	
I.13	Harmonisation of the national legal framework and the application ofrules	Covered by the general measure G.8.	Impact assessment of general measures is described in chapter 7.2.1.
I.14	Increasing administrative capacity/training	Covered by the general measure G.10.	
I.15	Increasing financial viability	Covered by the general measure G.7.	
I.16	Cooperation with Croatian ship owners	Support to Croatian ship owners shall be achieved through joint innovative projects in the field of shipping and shipbuilding, research, development and environmental protection, in cooperation with private investors and the Government of the Republic of Croatia in the form of funds specially created for this purpose. More attention shall be paid to the modernisation of vessels, the implementation of innovations in transport technology and the achievement of conformity with new technological standards.	Modernisation of vessels, implementation of innovations in transport technology and achievement of compliance with new technology standards shall have a long-term positive effect on the reduction of emissions in the environment and thus on the quality of air and water. Improving the quality of air improves life conditions along the waterways and also indirectly affects people's health.

Code	General measure	Description of the measure	Environmental impact assessment
I.17	Information platform	Covered by the general measure G.11.	Impact assessment of general measures is described in chapter 7.2.1.
I.18	Support to companies for inland waterway transport	Support instruments shall be established to facilitate the integration of ship owners into the European transport market. In order to stimulate the inland waterway transport, different fiscal policy measures in this sector shall be applied, especially in terms of fuel price formation.	The problem and limitation in the development of inland waterway transport is a diminished interest in shipping professions. This problem is felt the most by ship owners, but it is much wider and includes other participants in river traffic (ports, port administrations, port authorities, shipbuilders, Waterways Agency, etc.). Providing support and stimulation to inland waterway transport shall positively affect this sector, and indirectly the employment in it.
I.19	Sector reorganisation	Covered by the general measure G.7.	Impact assessment of general measures is described in chapter 7.2.1.
I.20	Increase the fleet of vessels for monitoring the safety of navigation and vessels for environmental protection	In order to achieve more effective monitoring of the safety of navigation and inspection, as well as the installation and maintenance of signalling systems on the waterways, the number of vessels for monitoring the safety of navigation and vessels for environmental protection shall be increased.	Increasing the fleet of vessels for monitoring the safety of navigation and vessels for environmental protection shall improve the control of vessels, as well as monitoring the protection of waterways from pollution from vessels. The implementation of this measure indirectly affects the reduction of pollutants from vessels to the environment.
I.21	Cooperation/agreements with other international ports	The rivers Sava, Drava, Danube and Una are in some parts border rivers and therefore, close cooperation with neighbouring countries is necessary, especially in the area of security and application of River Information Services. Close cooperation of Croatian ports of inland waterways with other international ports is also necessary to achieve greater competitiveness in the international market and compliance with new port technologies.	Cooperation/agreements with other international ports can lead to an increase in passenger and cargo transport, thereby indirectly affecting employability in inland waterway transport.

7.2.4 Environmental impacts of spatial measures

The impacts of the interventions arising from the measures listed in the table below are presented for all elaborated environmental components and are shown below.

Code	Measure	Description of the measure
Railway transport		
R.1	Zagreb – state border with Slovenia towards Ljubljana (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor)	The M101 railway is part of the TEN-T core network and RH1 corridor and is one of the major international connections towards Zagreb and the only urban node of the core railway TEN-T network in Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger transport. Future scenarios such as the entry of Croatia into the Schengen area shall increase the volume of traffic on this railway line. Although some activities are being developed to improve this railway line, the fact is that some parts of the M101 railway currently have a speed limit of up to 60 km/ h. Through the concept of functional regions, the technical requirements to be met in terms of capacity and allowed speed shall be assessed taking into account economic and environmental aspects. Since the subject railway line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t/a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.2	Zagreb – Karlovac (TEN-T core network/TEN-T Mediterranean corridor/Pan-European corridor RH2)	The corridor connecting Zagreb and Rijeka is primarily important for cargo transport and partly for suburban passenger transport. The analysis shows that suburban passenger transport primarily takes place on the section from Zagreb to Karlovac. Currently, this part of the M202 railway is mostly single-track, which limits the potential to increase capacity. It is expected that the importance of this railway line for cargo transport shall increase in the medium to long term, given that Rijeka is defined as the main Croatian port within the TEN-T network. Further studies shall analyse planned speed and capacity needs, taking into account economic and ecological aspects. In addition to the capacity increase, cargo transport requires that the railway line meet the following technical criteria: axle load (mass per axle) 22.5 t/a; ERTMS; usable length of railway tracks for reception and dispatch depending on the logistic concept.
R.3	Karlovac to Rijeka (TEN-T core network/TEN-T Mediterranean corridor/Pan-European corridor RH2)	The analysis shows that this part of the corridor connecting Zagreb and Rijeka is mainly used for cargo transport. Currently, this part of the M202 railway is mostly single-track and electrified, with some parts having a speed limit of 50 km / h. Rijeka is defined as the main Croatian port within the TEN-T network and therefore it is expected that the importance of this f railway line for cargo transport shall increase in the medium to long term. This section should therefore meet the following technical criteria: axle load (mass per axle) 22.5 t/a; usable length of railway tracks for reception and dispatch depending on the logistic concept, ERTMS. According to feasibility studies, the best variant of the strip was chosen, "Low-lane", bearing in mind the possible construction of a container terminal on Krk and a connection to the Dalmatian railway, the planned speed and capacity needs, taking into account economic and ecological aspects.
R.4	Railway network around Rijeka	According to current preliminary analyses, there might be potential for the reorganisation of the Rijeka railway node with the introduction of suburban lines, giving priority to the modal shift from the use of personal cars. Additional analyses should explore the capacity of the railway, taking into account the logistics concept and capacity of the Port of Rijeka

Code	Measure	Description of the measure
		terminals. The remaining capacity can be utilised for regional passenger transport. Improvement of the connection with Slovenia shall be harmonised with measures R.2 and R.3.
R.5	Zagreb – Križevci (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor RH2)	The corridor connecting Zagreb and Rijeka with Eastern Europe via Hungary is primarily important for cargo transport and partly for suburban transport. The analysis shows that suburban travels in this part of the corridor are mostly related to Dugo Selo (15 568 passenger trains in 2012) and Križevci (11 516 passenger trains in 2012). Currently, this part of the M201 railway line is double-track to Dugo Selo singe-track to Križevci. This fact limits the potential to increase capacity, especially if it is taken into account that the importance of this railway line for cargo transport shall increase in the medium to long term given that Rijeka is defined as the main Croatian port within the TEN-T network. Since this line is important for cargo transport, in addition to increasing capacity, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.6	Križevci – state border with Hungary towards Budapest (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor RH2)	The analysis shows that this part of the corridor connecting Zagreb and Rijeka with Eastern Europe via Hungary is most important for cargo transport and partly for suburban transport. Hungary is currently working on the further development of this corridor (development of Gysev and Szekesfehervar network - the development of the Boba railway line). Currently, this part of the M201 railway is mainly single-track and electrified, with some parts having a speed limit of 80 km / h. Rijeka is defined as the main Croatian port within the TEN-T network and therefore, it is expected that the importance of this railway line for cargo transport shall increase in the medium to long term. For this reason and taking into account that this section is a part of the core network and TEN-T corridor, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.7.	Zagreb – Novska (TEN-T core network/Pan-European Corridor RH1)	The railway lines M102 and M103 are part of the core TEN-T network and RH1 corridor and are one of the major international connections towards Zagreb, the only urban node of the core railway TEN-T network in Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger transport (over 59,000 passenger trains between Zagreb and Dugo Selo in 2012). Future scenarios such as the entry of Croatia into the Schengen area shall increase the volume of traffic on this railway line. Although some activities are being developed to improve the railway line from Dugo Selo to Novska, the fact is that currently some parts of both lines have a speed limit of up to 50 km / h. Further studies shall analyse planned speed and capacity needs, taking into account economic and ecological aspects. Since this line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.8	Novska – state border with Serbia (TEN-T core network/Pan-European Corridor RH1)	The M105 railway is part of the core TEN-T network and RH1 corridor and one of the major international connections towards Zagreb. RH1 has historically been the most important corridor in terms of long-distance passenger transport. Future scenarios such as the entry of Croatia into the Schengen area or the entry of neighbouring countries like Serbia into the European Union shall increase the volume of traffic on this line. At present, the M105 railway line is double-track between Novska and Tovarnik, which was constructed as a border crossing between Croatia and Serbia on the core rail network. Further studies shall assess the technical requirements to be met, taking into account both the economic and environmental aspects. Since this line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.9	State border with Hungary – Osijek – State border with Bosnia and Herzegovina (TEN-T core network/Pan-European Corridor RH3)	The M303 railway is part of the core TEN-T network in Croatia, and Slavonski Šamac is the border crossing of the core railway network with Bosnia and Herzegovina. The railway lines M301 and M302 are part of a comprehensive network, but serve as a link between Bosnia and Herzegovina - Croatia - Hungary, following the Pan-European Corridor Vc. The

Code	Measure	Description of the measure
		NPM shows that there is currently no traffic need. The potential of this international corridor shall increase if the Schengen borders move in relation to the current position.
R.10	Regional link Vinkovci – Vukovar (TEN-T core network/access to Pan-European Corridor RH1)	The railway line M601 Vinkovci - Vukovar shall serve as a railway connecting RH1 and the only Croatian port of internal waters of the core TEN-T network on the Danube, Vukovar. Future scenarios related to Vukovar port development shall increase the importance of cargo transport on this line in the medium to long term perspective. Further studies shhall assess the technical requirements to be met, taking into account both the economic and environmental aspects. Since this line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.11	Zagreb node	Current configuration of the Croatian railway network and the fact that Zagreb is the only urban node of the TEN-T core network demonstrate the importance of the Croatian capital in the entire transport system. In order to increase the importance of the role of the railway in the regional connection and the urban transport system, further studies shall analyse specific conditions to be met.
R.14	Zagreb Central Station	Zagreb Central Station shall play a key role not only in long-distance transport but also in local and regional transport. It shall probably be necessary to adapt the existing access and platforms and the organisation of the movement of passengers inside and outside the station in favour of the modal hub. Specific technical requirements shall be the result of further studies that shall take into account economic, social and ecological aspects.
Road transport		
Ro.1	Connecting via the bridge near Gradiška	The bridge near Gradiška over the Sava River is part of the road corridor Hungarian border - Virovitica - Okučani - Bosnia and Herzegovina border (Stara Gradiška). This road is located on the corridor of the existing state road D5, and the bridge is an integral part of the international agreement between Croatia and Bosnia and Herzegovina. The Republic of Bosnia and Herzegovina has already completed the motorway from Banja Luka (Bosnia and Herzegovina) to Gradiška, however, a planned bridge shall be constructed to connect the motorway from Bosnia and Herzegovina with the existing Zagreb-Lipovac (A3) motorway. Border crossing Gradiška is one of the two largest border crossings between Croatia / EU and Bosnia and Herzegovina for all types of transport.
Ro.2	A5 Osijek – state border with Hungary Pecs (TEN-T comprehensive network/Pan-European corridor RH3)	The A5 motorway is part of the comprehensive TEN-T network and the Pan-European Corridor Vc. The total length of the A5 motorway is 86.8 km and extends from the border with Bosnia and Herzegovina via Osijek and Beli Manastir to the border with Hungary. Various sections of the motorway are in various stages of construction. The section from Osijek to Hungarian border, the section Osijek-Beli Manastir (24.6 km) and the section Beli Manastir – Hungarian border (5 km) are at the earliest stage of construction. Other sections, like the bridge over the Drava River (2.4 km long), are part of the planned corridor and construction is in progress. Through the concept of functional regions, the stages of completion and schedule for the remaining sections shall be analysed, as well as the technical parameters required, taking into account the expected demand and economic and ecological aspects, for example the planned section passing through parts of the Natura 2000 area.
Ro. 3	A5 from A3 to the state border with Bosnia and Herzegovina (TEN-T comprehensive network/Pan-European corridor RH3)	The A5 motorway is part of the comprehensive TEN-T network and the Pan-European corridor Vc, and Svilaj is listed as a border crossing of the EU core network. The total length of the A5 motorway is 86.8 km and extends from the border with Bosnia and Herzegovina via Osijek and Beli Manastir to the border with Hungary. Various sections of the motorway are in various stages of construction. The section from Sredanci (A3 motorway) to the border with Bosnia and Herzegovina is 3.5 km long and is under construction. This section also includes the bridge over the Sava River (660 m long). The

Code	Measure	Description of the measure
		award of the contract for bridge construction is currently in the public procurement process. The extension of the section on the side of Bosnia and Herzegovina has already been built
Ro.4	A7 Križišće – Žuta Lokva (TEN-T comprehensive network/Adriatic-Ionian direction)	The NPM results show that there are certain disadvantages in terms of the capacity on the subject corridor, mainly during the tourist season and related to local / regional transport (including short tourist trips). Due to the aforementioned, certain corridor interventions may be necessary to increase the level of service. Through the concept of functional regions, problems shall be identified and further special studies shall determine the technical parameters, taking into account the expected demand and economic and ecological aspects, especially the orographic features due to the very complex terrain of the coastal relief.
Ro.5	A11 Lekenik - Sisak	The A11 motorway Zagreb - Sisak, with a total length of 41.9 km, is divided into three sections: Jakuševec - Velika Gorica, south, 10.9 km long, Velika Gorica - Lekenik 20.2 km long and Lekenik - Sisak 10.8 km long. Two sections are open for traffic: Jakuševec - Velika Gorica south and Velika Gorica south - Lekenik, with a total length of 31.1 km. Through the concept of functional regions, the need to build a motorway to Sisak shall be analysed. In this case, special studies shall be prepared to determine the stages of completion and the schedule for the remaining sections in the terms of intermodality as well as the necessary technical parameters, taking into account the expected demand and the economic and environmental aspects. The stages of completion and the schedule for the remaining sections shall be determined through the concept of functional regions.
Ro.6	DC 10 Vrbovec – Križevci – Koprivnica – State border with Hungary towards Kaposvár	State road DC10 was previously categorised as the A12 motorway. The A12 motorway is a partly built motorway in the central Croatia, northeast of Zagreb, and extends towards the town of Vrbovec. The two-lane 23 km long road is built between the A4 and motorway and Sveta Helena. The state road DC12 is the western branch of the so-called "Podravski ipsilon", and it is planned that be DC12 shall be the eastern branch and shall finally connect Zagreb with the Hungarian border towards Kaposvár. The corridor is divided into several sections and the completion stage of the project documentation (project and permits) differs from section to section.
Ro.7	DC 12 junction Vrbovec 2 – Ivanja Reka – Vrbovec – Bjelovar – Virovitica – State border with Hungary towards Barcs	The state road DC12 is the eastern branch of the so-called "Podravski ipsilon", and it is planned that DC10 shall be the western branch and shall finally connect Zagreb with the Hungarian border towards Pecs. Currently, only the Vrbovec 2 junction and initial (western) section of the state road DC12 are completed. The rest of the corridor is divided into several sections, and the completion stage of the project documentation (project and permits) differs from section to section. Through the concept of functional regions, the completion stages and the schedule for the remaining sections as well as the required technical parameters shall be assessed, taking into account the expected demand and the economic and environmental aspects.
Ro.8	Reorganisation of the main Zagreb network	Zagreb is the capital of the Republic of Croatia and the junction of the main road corridors. Currently, all corridors of the motorway are connected via the Zagreb bypass, the road with the highest traffic load in Croatia. The main road network within the city also needs to be reorganised, taking into account the effects calculated through the concept of functional regions.
Ro.9	D2 from the state border with Slovenia to the state border with Serbia	D2 is the current state road for transit traffic in the northern parts of Croatia. It extends from the border crossing with Slovenia in Dubrava Križovljanska in the west, via Varaždin, Osijek, Vukovar, and ends on the bridge Ilok - Bačka Palanka at the border crossing with Serbia. Most of the D2 route is parallel to the Drava river (Podravska magistrala <*main road in Podravina*>). The relevant intensity of very high volume of cargo traffic affects the features of the existing route, thus

Code	Measure	Description of the measure
		evidently reducing the level of safety. A new corridor for D2 is planned but the construction stages and the schedule for the construction of sections shall be determines as well as the required technical parameters through the concept of functional regions, taking into account the expected demand and the economic and environmental aspects. At certain sections of this road, the NPM results show a lack of capacity.
Ro.10	Reorganisation of the Rijeka network	The Rijeka road junction is one of the main traffic junctions in Croatia and plays an important role in connecting the Croatian motorway network: A7 motorway connects the A8 motorway (Istarski ipsilon <*Istrian Y*>) and the A6 motorway (Rijeka - Bosiljevo). Port of Rijeka is the most important Croatian port (the main port of the TEN-T network) and the development of the port shall be coordinated with road development. The planned Western container terminal in Rijeka shall be connected with the planned state road D403, whose feasibility has been proved by the created and adopted Feasibility Study. The Rijeka bypass is part of the A7 motorway and is one of the roads in Croatia with the highest traffic intensity. All these measures shall be coordinated with the reorganisation of the city's internal road network, taking into account the need for public transport and cycling and walking, port development and other relevant development plans of stakeholders such as railway companies. For these reasons, further analyses are needed through the concept of functional regions to determine the final package of measures as well as the necessary technical parameters, taking into account the expected demand and the economic and environmental aspects.
Ro.11	Dubrovnik – State border with Montenegro	The corridor Dubrovnik – State border with Montenegro is in various stages of construction, depending on the section. By the construction of this corridor the Dubrovnik Airport should be bypassed. Through the concept of functional regions, the completion stages and the schedule of construction as well as the technical parameters needed shall be assessed, taking into account the expected demand and the economic and environmental aspects.
Ro.12	Capacity increase – dedicated lane for public transport between Zagreb and Karlovac	The road corridor from Zagreb to Karlovac is covered by the European core network due to the international and regional importance of traffic coming from the direction of Rijeka towards the interior. The Zagreb - Karlovac section is one of the oldest sections of the motorway network in Croatia with poor ecological standards. According to the feasibility study, the limitations of of the capacity are caused by the existing toll collection system and the need to increase the capacity in the medium term has not been proved to be necessary. The potential to change the toll collection system, see Measure Ro.17, would have a clear impact on this section of the motorway. Specific interventions to increase the safety and ecological standards on this section can be justified. Further analysis and studies will show the character and justification of capacity expansion in line with the indicators and conclusions of the Transport Infrastructure Development Master Plan on the Zagreb-Karlovac highway, which serves as the basis for sustainable development of the stock. At this point there is no justification for building a dedicated public transport lantern, as at the same time planning to invest in the reconstruction of the railway line on the Croatian Leskovac-Karlovac axis, and at the same time the significance of marking this measure as red.
Ro.13	Capacity increase – dedicated lane for public transport on the Zagreb bypass	Zagreb bypass is the busiest route in Croatia and the traffic level is constantly increasing. Some sections of the Zagreb bypass need to be extended with a new public transport lane. Through the concept of functional regions, the existing options for capacity increase shall be analysed, the stages and schedule of construction shall be assessed as well as the necessary technical parameters, taking into account the expected demand and economic, social and environmental aspects, as well as the development planned for other means of transport.
Ro.14	Improving access to the Port of Slavonski Brod	Slavonski Brod, as the main port on the Sava River, is the only port of inland waterways in Croatia on the Sava River, which is an integral part of the core TEN-T network. The development of the port and the additional business zone needs

Code	Measure	Description of the measure
		to be coordinated with the improvements of other transport infrastructure, especially the road. The NPM points to the good accessibility of the Port of Slavonski Brod.
Ro.15	Reorganisation of the Split network	Split is one of the main tourist centers in Croatia. Tourism related to cruise trips is particularly important for the road network because it creates large seasonal loads on the road network. The road network in Split shall be reorganised, taking into account the public transport system and the planned development of the city, the port and other transport systems such as the railway. One of the potential measures is the Split bypass: Trogir - Split - Omiš, which is planned for regional and local traffic, and different sections are in different stages of construction: the Split-Trogir section has already been completed, while the access road from Split to A1 motorway is under construction. Through the concept of functional regions, a final package of measures shall be set as well as the required technical parameters, taking into account the expected demand and the economic and environmental aspects.
Ro.16	Preparations for the accessibility of Dubrovnik after Croatia joins the Schengen Area (Pelješac Bridge)	The long-distance accessibility in mid-term scenario is of course the Dubrovnik airport. For the further development of the road infrastructure it is necessary to build the "Peljesac" bridge, in combination with the road network on Peljesac and the Ston bypass. The continuation of the construction of the Adriatic - Ionian Corridor from Ploče to the state border with the Black Mountain and its course will be determined after the studies have been conducted and taking into account the European transport corridors.
Air transport		
A.1	Dubrovnik Airport development (TEN-T comprehensive network)	Dubrovnik is one of the main destinations on the Adriatic coast. The main problem of this airport is the bottlenecks that are created at the peak of the season. Given the characteristics and geographic position of the surrounding area, which forms an enclave, it is necessary to maintain and improve the traffic connections to ensure good connectivity. Planned measures include the extension of existing transport / infrastructure capacities to maintain the existing quality levels of services, reduce/remove the bottlenecks, restore existing ones and build new road structures and facilities that are required for safe and unobstructed airport operations, the implementation of environmental protection measures, the implementation of measures to increase energy efficiency and the purchase of necessary equipment and devices.
A.2	Pula Airport development (TEN-T comprehensive network)	Pula Airport is important for the accessibility of this region from distant locations. Airport traffic is seasonal, which can cause bottlenecks due to limited infrastructure. Two important operational aspects need to be considered, including: 1) the quality of service, primarily due to the competitiveness of neighbouring international airports and 2) the balance between safety and operational capacities. These aspects, among other things, point to the need for increasing the capacity of this airport by adding certain elements: access signalling system, runways, aprons, terminals, and access. Through the concept of functional regions, the feasibility of these measures and the schedule according to priorities shall be established, taking into account the environmental requirements, the actual needs and the potential according to the expected demand.
A.3	Brač Airport development	The development of the Brač Airport is planned to improve the connectivity of the island of Brač with distant locations and thus the connection of Central Dalmatia, in line with various safety requirements and traffic demand. The analyses show the need for achieving the ICAO 3C code and compliance with ICAO, EASA and national standards. Through the concept of functional regions, feasible measures and the schedule according to priorities shall be established, taking into account the environmental requirements, the actual needs and the potential according to the expected demand.
A.4	Mali Lošinj Airport development	The development of the Mali Lošinj Airport is planned to improve the connectivity of Mali Lošinj with distant locations and thus the connection of Northern Dalmatia, in line with various safety requirements and traffic demand. The analyses show

Code	Measure	Description of the measure
		the potential need for the extension of the runway, aprons and terminals. Through the concept of functional regions, feasible measures and the schedule according to priorities shall be established, taking into account the environmental requirements, the actual needs and the potential according to the expected demand.
A.5	Osijek Airport development (TEN-T comprehensive network)	Regional connectivity and connectivity with distant locations, along with national cohesion, are the main reasons for the extension of the Osijek Airport taking into account cargo transport due to synergy with other means of transport. Through the concept of functional regions, feasible measures and the schedule according to priorities shall be established, taking into account the environmental requirements, the actual needs and the potential according to the expected demand.
A.6	Rijeka Airport development (TEN-T comprehensive network)	Rijeka Airport shows a big increase in passenger transport and has additional potential for cargo transport due to synergy with the Port of Rijeka. The restoration/extension/replacement of the apron, operational equipment and control tower equipment is in progress. The aforementioned is part of the airport plan for development and alignment with ICAO, EASA and national standards. For the purpose of achieving energy efficiency and environmental protection, projects for a solar power plant, the facade of the passenger terminal building and wastewater treatment plant are planned to be realised. Through the concept of functional regions, the feasibility of these measures and the schedule according to the priority shall be established, taking into account the environmental requirements, the actual needs and the potential according to the expected demand.
A.7	Split Airport development (TEN-T comprehensive network)	With similar levels of traffic as the Dubrovnik Airport, Split is the second most important access point to the Dalmatian coast when it comes to passenger transport. The main problem of this airport is the bottlenecks that are created at the peak of the season. By expanding the land and air facilities, which is currently in progress, the problem of seasonality and the quality of service shall be solved.
A.8	Zadar Airport development (TEN-T comprehensive network)	The connection of central Dalmatia with distant locations is the main reason for expanding this airport. Analyses indicate that investments need to focus on improving the transport and infrastructure capacities of the airport for airplanes corresponding to ICAO 4E code. Through the concept of functional regions, the feasibility of these measures and the schedule according to the priority shall be established, taking into account the environmental requirements, the actual needs and the potential according to the expected demand.
A.9	Franjo Tuđman Airport development (TEN-T comprehensive network)	Franjo Tuđman Airport is the main entry point in Croatia and operates as a hub for domestic and international traffic. It is currently operated by the concessionaire who founded the new company, Međunarodna zračna luka Zagreb d.d. <*Zagreb International Airport Ltd.*> and whose investment plan is periodically revised by the Ministry of Maritime Affairs, Transport and Infrastructure. The company Zračna luka Zagreb d.o.o. <*Zagreb Airport Ltd.*> is still active and now has the role of a mediator between the Government of the Republic of Croatia and the concessionaires with a view to further develop the infrastructure and all transport segments that are not the subject of Zračna luka Zagreb d.o.o. shall immediately take over the airport from the concessionaire to ensure the continuous and uninterrupted operation of the Zagreb Airport. The airport development plans include the construction of a new terminal to increase capacity.
Maritime transport		
M.8	Specialisation of the Port of Rijeka (container, liquid cargo transport and LNG terminal)	Port of Rijeka is classified as the only TEN-T core sea port in Croatia. It is a port open for public transport of particular (international) economic interest to the Republic of Croatia. This is the largest port in the Republic of Croatia whose advantage is the existence of the deepest natural channel on the Adriatic. Much of the traffic is transit freight to the wider hinterland of central Europe, with regard to volume, dominated by

Code	Measure	Description of the measure
		liquid and bulk cargo, followed by container and cargo. Further development of the port will be focused on the specialization of container and cargo traffic. For the port's success, it is necessary to ensure the interoperability and accessibility of the port and to complement the development of the port with the necessary development of road and rail infrastructure and logistic areas. At this time, a number of projects on the island of Krk, such as the LNG terminal and the container terminal, are planned, and according to further projects, adequate infrastructure needs to be planned in terms of accessibility (road, rail) to the island of Krk. Further analysis will identify the projects needed to realize this specialty and set priorities, taking into account environmental requirements and real needs as well as the potential for the expected demand. An emphasis will be put on improving warehouse facilities and better connectivity with the hinterland. If there is a significant increase in transport demand, it is necessary to analyze the possibility of using the locations on the island of Krk.
M.9	Specialisation of the Port of Ploče (container and bulk cargo)	Port of Ploče is classified as a TEN-T comprehensive port in Croatia, which is of particular importance to Bosnia and Herzegovina. Further development of the port shall be focused on the specialisation of container and bulk cargo transport. According to development plans, the focus shall be on the construction of a new terminal for dry and bulk cargo, a container terminal and modernisation of the existing infrastructure and new logistics area. Although it is beyond the scope of this strategy, it should be noted that the success of this port is directly linked to the development of road and rail infrastructure in the Republic of Bosnia and Herzegovina. Further analyses shall determine the feasibility of these measures and determine their priority, taking into account environmental requirements, actual needs and the potential according to the expected demand.
M.10	Specialisation of the Port of Dubrovnik (cruise ships)	The port in Dubrovnik is classified as a TEN-T comprehensive port in Croatia. It is a port that is open for public transport of particular (international) economic interest to the Republic of Croatia. In recent years, the Port of Dubrovnik has become one of the most popular destinations for cruise journeys in Europe, and its development is focused on passenger transport on cruise ships. The planned development includes the modernisation and reconstruction of the passenger terminal and the expansion of the facilities for ferry traffic. Further analyses shall determine the feasibility of these measures and determine their priority, taking into account environmental requirements, actual needs, and the potential according to the expected demand.
M.11	Specialisation of the Port of Split (RO-RO, passenger transport and cruise ships)	The Port of Split is classified as a TEN-T comprehensive port in Croatia. It is a port that is open for public transport of particular (international) economic interest to the Republic of Croatia. The port in Split is also called the doors to the islands. This is the largest passenger port in Croatia and therefore, its development is focused on passenger transport and cruise travels. The planned development shall be focused on the construction of new areas for anchoring ferries, road and rail traffic and cruise ships including the expansion of passenger piers. Further analyses shall determine the feasibility of these measures and determine their priority, taking into account environmental requirements, actual needs, and the potential according to the expected demand. Port of Split has the potential to develop freight transport on a market basis, in particular with the appropriate specialization and the corresponding development of the railway freight infrastructure.
M.12	Specialisation of the Port of Zadar (RO-RO, passenger transport and cruise ship traffic)	Zadar port is classified as the port of a comprehensive TEN-T network. It is a port that is open to public transport of particular (international) economic interest to the Republic of Croatia. The port of Zadar is the second largest Croatian port. Freight traffic has a great potential for development, especially since there is a railway infrastructure nearby and a possible link to a new port in Gaženica is also planned. The development of the port is focused on road and rail traffic (it is necessary to see / evaluate compliance with the concept of "offshore freeways" described in measure M. 2) and

Code	Measure	Description of the measure
		passenger traffic and traffic on cruise ships. The construction of a new passenger port outside the core of the old town in Gaženica has been completed infrastructure and is under construction of a terminal building for the reception of domestic and international passengers. The new harbor also enables the expansion of the capacity for connecting major international ferries and modern cruise ships (home port), as well as the international standard of passenger and cargo facilities for passengers and vehicles. Further analysis will identify the necessary projects in order to achieve this specialization and to prioritize them taking into account the actual needs and the potential for the expected demand.
M.13	Specialisation of the Port of Šibenik (smaller vessels and superyachts)	The Port of Šibenik is classified as a TEN-T comprehensive port in Croatia. It is a port that is open for public transport of particular (international) economic importance for the Republic of Croatia. Further development of the port shall be focused on the specialisation of passenger transport as a port for the exclusive navigation of smaller vessels (boutique boats) and superyachts. Further analyses shall identify the necessary projects to achieve this specialisation and to determine the priorities taking into account actual needs and the potential according to the expected demand.
Inland waterway transport		
I.3	Development of the Port of Vukovar (TEN-T core network)	The Port of Vukovar is located on the Danube and is classified as the core TEN-T port. Vukovar is a port of inland waters that can receive class 5 ships. It was assigned navigability class VIc. Passenger and goods traffic in the port is increasing. Further analyses shall identify the necessary measures and prioritise them, taking into account the actual needs and potential according to the expected demand. While waterway transport has the potential to lead to a change in the mode of transport and can contribute to the reduction of emissions, noise etc., environmental protection requirements relating to the Water Framework Directive, the protection of vulnerable protected areas and Natura 2000 shall be applied during the development of the measure.
I.4	Development of the Port of Osijek (TEN-T comprehensive network)	Port of Osijek is located on Drava and is classified as a TEN-T comprehensive port. Passenger and goods traffic in the port is increasing. Port of Osijek has a great opportunity to become an intermodal logistics centre thanks to its size and excellent potential due to the connection with the hinterland by road and rail. Further analyses shall identify the necessary measures and prioritise them, taking into account the environmental requirements, the actual needs and the potential according to the expected demand. While waterway transport has the potential to lead to a change in the mode of transport and can contribute to the reduction of emissions, noise etc., environmental protection requirements relating to the Water Framework Directive, the protection of vulnerable protected areas and Natura 2000 shall be applied during the development of the measure.
I.5	Development of the Port of Slavonski Brod (TEN-T core network)	Port of Slavonski Brod is located on Sava and is classified as a TEN-T core port. The potential of Slavonski Brod, which is of particular importance to Bosnia and Herzegovina, depends to a large extent on the development of the Sava River navigability in Bosnia and Herzegovina and Serbia and / or the construction of the Danube-Sava canal through Slavonia. Reliability and safety of navigation on the Sava River are key factors that affect the attractiveness of the port. Most of the cargo transport is comprised of crude oil transshipment and general cargo. Further development of the port depends on the logistics concept.
I.6	Development of the Port of Sisak (TEN-T comprehensive network)	The Port of Sisak is located on the Sava River and is classified as a TEN-T comprehensive port. Reliability and safety of navigation on the Sava River are key factors that affect the attractiveness of the port. These factors are located at three locations: in the town of Sisak on the Kupa river, near the village of Crnac on the Sava river and in Galdovo on the Sava river. The potential of Sisak depends to a great extent on the development of the Sava River navigability in the border area with Bosnia and Herzegovina and Serbia and / or the construction of the Danube-Sava canal through Slavonia.

Code	Measure	Description of the measure
		Construction of a new port of Sisak south of Crnac village is planned. Cargo transport is mostly related to the Refinery Sisak, that is, crude oil transport. Further development of the port depends on the logistics concept.
I.7	Construction of the Danube-Sava multipurpose canal	It is planned for the Danube - Sava multipurpose canal to have four equally important functions: navigation, tourism, irrigation and drainage. Due to its multiple functions, the canal shall have an important impact on the Croatian economy. From the traffic perspective, the canal is part of the 560 km long intermodal transport corridor Podunavlje-Jadran, which includes the Sava River waterway and the railway connection with the Port of Rijeka. The acceptability of the canal construction shall be assessed through the results of the Canal Feasibility Study.

7.2.4.1 Air quality and climate features

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Decrease of air pollutants	+	✓	x	x	x	✓	x	x	x
Increase of air pollutants	-	✓	x	x	x	✓	x	x	✓
Reduction of greenhouse gases	+	✓	x	x	x	✓	x	x	x

Legend: + the impact is positive, - the impact is negative, ✓ the impact has the feature, x the impact does not have the feature

The strategy is designed to introduce new road and rail routes, but it also tends to reduce the use of fossil fuels through the electrification of existing railway tracks. Increasing the number of vessels in maritime traffic and inland waterways and ports, as well as increasing airport traffic, has an impact on the increase in air pollutants. The introduction of new road routes, in comparison with other measures, contributes most to the increase in air emissions. Part of the new road routes bypasses larger cities, where the pressure on air and climate features is greatest, so the Strategy also contributes to reducing emissions in cities.

Concentration of air pollutants

If diesel is used in railway transport, the Strategy may have a moderately negative impact on the quality of the air along the railroad passage area. Diesel powered vehicles emit carbon monoxide (CO), carbon dioxide (CO2), nitric oxides (NOx), sulfur oxides (SO2), hydrocarbons (CH) and smoke with solid particles into the atmosphere. The emission of these harmful substances is caused by the type of fuel, the engine's operating principle, and the technical condition and age of the vehicle. Given that the share of pollutants from railway transport is considerably lower than other transport sectors, this impact is not considered significant and the development of diesel traffic shall not affect the change of the air quality category in certain zones and agglomerations.

The modernization of the existing railway tracks, with the aim of achieving the appropriate standard, as well as the construction of new railway tracks, can positively influence the reduction in road traffic, which directly affects the concentration of air pollutants. If by increasing the use of rail traffic, especially on local transport routes, reduces the daily migration to personal vehicles, then the concentration of air pollutants in larger cities shall be positively affected in the long term.

The construction of new roads negatively affects air quality through the introduction of light and heavy vehicles in areas where road traffic emissions did not exist. The share of air pollutant emissions is largely due to road traffic, and those zones and agglomerations that have a larger number of roads, i.e. that have a number of light and heavy vehicles also have a lower share of the category 1 of air per pollutant. Increasing concentrations of pollutants mostly occur in the vicinity of the roads and their concentration, depending on weather conditions, decreases with the distance therefrom. Furthermore, concentrations of pollutants are greater by the roads with more heavy vehicles, as well as on roads with higher speed limits.

Apart from contributing to the increase in pollutants in their immediate vicinity, the construction of bypasses outside settlements has a beneficial effect on reducing pollutant concentrations in the settlements themselves by reducing traffic jams and waiting times causing largest road emissions.

Increasing the number of vessels in maritime traffic and inland waterways and ports shall also increase pollutant emissions in the air. Gases and vapors are released from the ships into the air as a result of combustion, evaporation or leaking of various gas installations. Combustion fuels produce exhaust or flue gases, which are released into the atmosphere. For the full combustion of fuel, a large amount of air is needed and it is physically and chemically altered and returned to the environment. The composition of the exhaust and flue gases from ships depends mostly on the type of fuel and the quality of combustion. The most ecologically hazardous gases are generated by the combustion of residual fuels in marine diesel engines. The most hazardous gases that occur on ships today are certain groups of freons and halons. Freons are used in refrigeration plants while halons are used as fire extinguishers. From other gases, inert gases in tankers, CO_2, acetylene, propane-butane, etc. pose a risk to human and the environment. All technical gases are contained in tanks or associated installations and in the environment usually come due to improper handling (Analysis of the Harmful Effects of Ships on the Marine Environment, Jelavić and Kurtela, 2007). Consequently, it is possible to have a negative impact on air quality due to the increase in pollutants in the air as a result of the increase in the vessel number.

Increasing traffic at airports may have an impact on the concentration of pollutants in the air, especially those arising from combustion of fossil fuels in aircraft engines. However, in addition to airplanes, pollutant emissions in airports are also caused by fuel combustion needed to operate ground equipment for aircraft maintenance and servicing. Air traffic emissions present the smallest part of the total amount of pollutants in the air.

Based on the above, it is evident that the indicator value, depending on the transport sector, increases or decreases. Any reduction in the indicator positively affects the air quality and contributes to the increase of the category 1 air in certain zones and agglomerations. The increase in the indicators leads to the reduction of air quality and to the increase in the number of contaminated zones and agglomerations at least with one pollutant. Given that the number of contaminated zones and agglomerations increased in the period from 2013 to 2015 and since only Split Agglomeration was rated as clean in 2015, the overall situation shall slightly worsen with the implementation of the Strategy compared to the current situation, hence the influence of increased pollutants in the air is estimated to be moderately negative.

Amount of greenhouse gas emissions

Rail traffic has a small share in greenhouse gas emissions if diesel vehicles are used, and if the track is fully electrified, then there is no greenhouse gas emissions from the railways.

The construction of new road routes, and thus the use of new vehicles on new routes directly leads to increased greenhouse gas emissions. Road transport, in relation to other transport sectors, is by far the largest source of greenhouse gas emissions and the additional development of this sector contributes to the creation of new or redistribution of existing sources of greenhouse gas emissions.

The share of air traffic in total greenhouse gas emissions is subordinated, but the development of airports, as well as the increase in air traffic, can lead to greenhouse gas emissions, which in part increases their share in total greenhouse gas emissions.

The specialization of seaports, as well as the development of inland waterway ports through increased passenger and freight traffic and the use of vessels with greenhouse gas emissions directly affect the increase in greenhouse gases along their waterways as well as in port locations.

The transport sector is the largest source of greenhouse gas emissions, and its contribution over the years is increasing, and road transport emissions are far greater than other forms of transport within the transport sector. Therefore, road traffic largely leads to an increase in the indicators, while other transport sectors have less influence on the increase in the indicators. Any modernization or construction of railway and maritime traffic and inland waterway transport, which directly leads to a reduction in the use of road traffic, whether in a passenger or freight traffic, leads to a reduction in greenhouse gas emissions.

Since CO_2 – eq emissions from road traffic in 2014 were dominant, and their total share in total emissions in transport amounted to 95.7%, new road routes shall slightly alter the existing amounts of greenhouse gas emissions, so the impact of the increase in volume of greenhouse gas emissions is assessed as moderately negative.

7.2.4.1.1 Climate change

Impact of the Strategy on climate change

The following table presents the relationship of the Strategy with identified climate change drivers. The drivers have been identified using the European Commission Guidance document on integrating climate change and biodiversity into Strategic Environmental Assessment.

Identified drivers that contribute to climate change	Relationship with the Strategy
Energy demand in the industry	The Strategy does not directly lead to the increase or decrease of energy demand in the industry. However, the Strategy encourages the use of low carbon technologies through the development of an electrified railway tracks.
Energy demand in the household	The strategy does not affect the increase or decrease in the demand for housing construction or the use of energy in housing.
Greenhouse gas emission from the waste management sector	The strategy indirectly leads to increased waste generation, but it does not affect the waste management system, as well as the overall CO_2 and CH_4 emissions from waste management.
Greenhouse gas emissions from traffic	The Strategy shall affect the amount of greenhouse gas emissions through the development of all transport sectors. Traffic is recognized as the sector that contributes most to emissions of pollutants into the air, including greenhouse gases. The development of road traffic, which is dominantly involved in greenhouse gas emissions, shall have an impact on their growth. The Strategy contributes to the reduction of greenhouse gas emissions through electrification of the tracks and the stimulation of intermodal transport.
Greenhouse gas emissions due to energy production	The strategy does not directly lead to the increase or decrease of greenhouse gas emissions due to energy production.

Impact of climate change on the Strategy

The potential impact of climate change on the implementation of the Strategy has been analyzed in line with the guidelines of the European Commission Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment.

Climate occurrences	Impact
Drought	Increasing temperatures can lead to a decrease in precipitation and the occurrence of long-term droughts. By reducing the amount of precipitation and increasing drought periods, no negative impact on the measures envisaged by the Strategy is planned.
Flood and extreme precipitation regimes	Additional climatic events caused by climate change, which potentially negatively affect the activities planned by the Strategy, are extreme precipitation and flooding. They can influence the implementation of the measures planned by the Strategy such as the development of road and rail infrastructure.
Stroms and strong winds	The strategy plans for the development of road infrastructure containing structures that cross valleys, rivers, bays ... Storms and strong winds can affect the implementation of the measures planned by the Strategy, such as the development of road and rail infrastructure.
Landslides	Landfills may adversely affect the development of road and rail infrastructure if they occurs in areas at risk of landslide without adequate protection.
Increase in sea level, severe weather, coastal erosion, hydrological regime and saltwater intrusion	The development of seaports affects the rise of the sea level in a manner that prevents the normal flow of passenger and freight traffic, thus preventing planned development. Changes in the river hydrological regime affect the development of inland waterway ports, as well as the transport of ships by waterways.
Extremely low temperatures	Low temperatures and snow, as well as freezing and thawing caused by climate change may adversely affect the development of road and rail infrastructure if it is not adequately protected against these occurrences.

7.2.4.2 Geodiversity

Preservation of protected geolocality features

By analyzing spatial data on protected geolocality sites and interventions planned, the Strategy did not identify conflicting areas that would point to the potential of endangering protected geolocalities during construction of the project. Given the aforementioned, it is estimated that the implementation of the measures prescribed by the Strategy shall not have a negative impact on the geodiversity of the Republic of Croatia. In other words, the value of this indicator shall not change with the implementation of the Strategy.

7.2.4.3 Biodiversity

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Fragmentation of nonfragmented areas in the Republic of Croatia	-	✓	x	x	x	✓	✓	x	x
Fragmentation of wild species' habitats	-	✓	x	x	x	✓	✓	x	x
Wild species fatalities in traffic accidents	-	✓	x	x	x	✓	✓	x	x
Disturbance of wild species	-	✓	x	x	x	✓	✓	x	x
Entry and spread of invasive species	-	✓	x	x	x	✓	x	x	x
Disruption of protected areas	-	✓	x	x	x	✓	x	x	x

Legend: + the impact is positive, - the impact is negative, ✓ the impact has the feature, x the impact does not have the feature

Given the complexity of the impact, this chapter is conceived according to the indicators (while in the other chapters it is presented by traffic sectors), so that the sectors and the impact they have is provided for each indicator.

7.2.4.3.1 Habitat fragmentation

As already described in Chapter 3.3.3 Biodiversity, the most significant impact of transport infrastructure is reflected in the fragmentation of the areas, i.e. habitats, especially those with conserved natural features. Given the amount of areas preserved from fragmentation in transport infrastructure and human settlements, Croatia is one of European countries with a lower fragmentation category, with 58% of non-fragmented territory. Non-fragmented areas without traffic infrastructure and human settlements or permeated by smaller roads and settlements are important for biodiversity conservation, so the goal of nature conservation is to preserve them in the present condition without disturbing their natural characteristics, as outlined in the Draft Strategy and Action Plan for Nature Conservation Of the Republic of Croatia for the period 2017 to 2025, in which, although not yet in force, the importance of these areas was recognized.

The development of the railway infrastructure provided for in the Strategy includes the planning of new railway corridors through the natural and semi-natural areas within the borders of the Republic of Croatia, which shall contribute to a greater fragmentation of the area and thereby increase the value of this indicator. According to the fragmentation map (Figure 7.1), this indicator is still in a favourable condition compared to most European countries.

The strategy plans for more measures relating to the development of this type of transport and shall not all affect the status of habitat fragmentation in the Republic of Croatia with equal intensity. The greatest impact intensity is expected in areas that are not currently affected by fragmentation of anthropogenic character. With a cartographic overview of non-fragmented areas over 100 km^2 and a digital orthophoto of the Republic of Croatia, a more intensive impact with respect to the habitat fragmentation indicator is possible during the realization of measures R.3 (Corridor Karlovac - Rijeka) and R.11 (Zagreb junction) passing through non-fragmented areas larger than 100 km^2, while other measures plans for the development of railway infrastructure in areas already under a high degree of fragmentation and anthropogenic influence. The figure below (Figure 7.1) shows the relationship between the railway infrastructure corridor and the aforementioned non-fragmented areas.

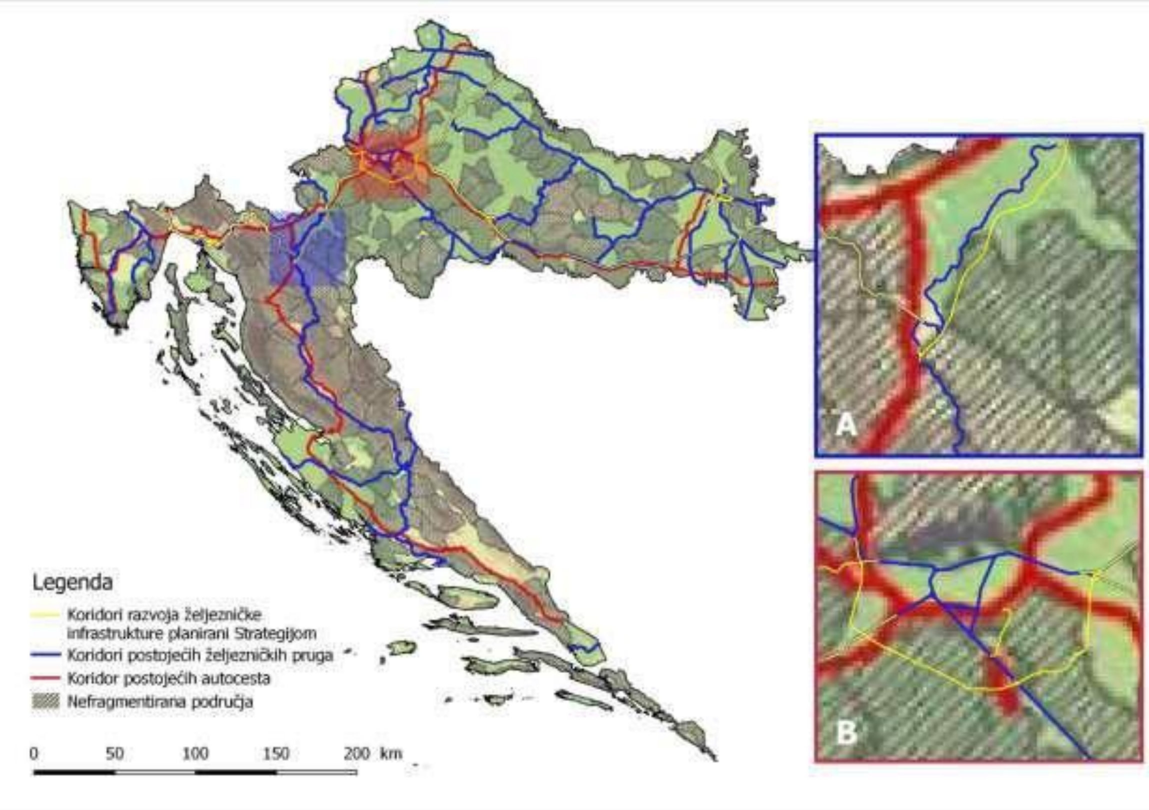


Figure 7.1 Relationship between the existing and planned railway infrastructure with non-fragmented areas greater than 100 km^2 (A: part of the Karlovac - Rijeka corridor Measures R.3; B: Zagreb junction corridor Measures R.11) (Source: State of the Environment in the Republic of Croatia for 2008 -2012; Modified by: IRES EKOLOGIJA d.o.o.)

Given the barrier effect as a form of fragmentation of wild species habitats, the realization of measures R.3 and R.11, where a more intense impact of the growth of the habitat fragmentation indicator is noticed, no significant impact is expected on the present wild species that are capable of crossing the rails because the predicted railway infrastructure with the planned nature of rail traffic shall not significantly affect the movement of animal species. Significant barrier effects occur at railway transport density of 300 trains per day, and due to the state of railways in Croatia (described in Chapter 3.1.3 Railway transport), traffic volumes are not expected to increase in planned routes. Rail corridors can disrupt lesser, isolated populations of slower moving groups such as turtles (Figure 7.2), however, introducing appropriate measures to protect these species during the design and construction of tracks can mitigate undesirable consequences and reduce them to an acceptable level.

Figure 7.2 Barrier effect of the railway track for turtles (Source: Dorsey et al., 2015)

The development of the road traffic infrastructure planned in the Strategy would have negative impacts on non-fragmented areas over 100 km^2, as identified in the document of the State of the Environment for the Republic of Croatia for the period 2008-2012. According to the map analysis in the GIS environment, potential fragmentation of the subject areas was identified, which could be achieved through the implementation of the Strategy measures related to the development of road traffic, with the potential loss of parts of such areas at the national level. However, most of the planned roads go through non-fragmented areas by dividing them into segments larger than 100 km^2, which is the scale of non-fragmentation of an area. However, with the realization of some measures, it is possible to separate smaller areas of 100 km^2, which further increases fragmentation. The largest share of the newly developed areas of less than 100 km2 is connected with the development of traffic through the lowland part of Croatia, while in the rest of Croatia this phenomenon is expected along the planned motorway within the measures Ro.4 and Ro.16. Using a computerized analysis of maps of non-fragmented areas, it was found that the surface area of these areas was reduced by about 1% at the national level, suggesting a possible significant negative impact, but the impact can be mitigated and reduced to an acceptable level by applying appropriate protection measures.

Apart from direct impacts on non-fragmented areas, the measures of the Strategy planning for the development of road infrastructure with their linear corridors can have an effect on the effect of wildlife barriers, which can be particularly affected by species that have large areas (large carnivores) and daily and seasonal migrations. The figures below (Figure 7.3, Figure 7.4, Figure 7.5, Figure 7.6) present the relationship between the planned roads and the area of distribution of three large carnivores in Croatia with high availability habitats.

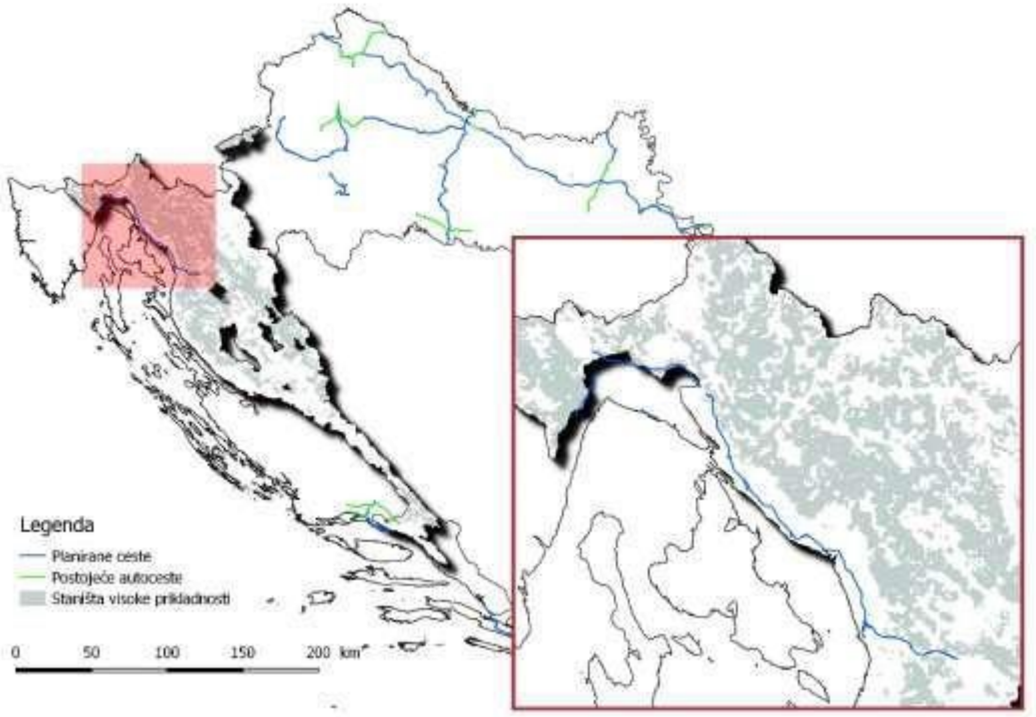


Figure 7.3 Relationship between the existing and planned roads and the habitats of high suitability for bear denning (Prepared by: IRES EKOLOGIJA d.o.o., Source: Croatian Agency for the Environment and Nature)

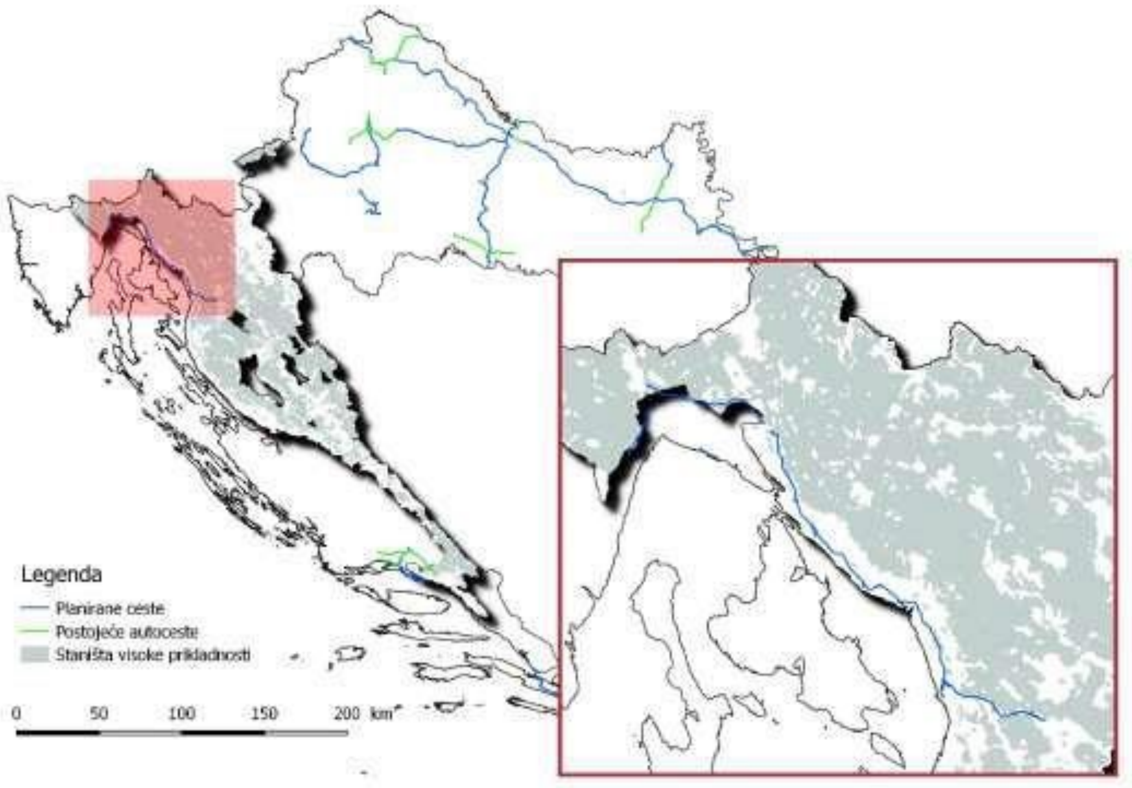


Figure 7.4 The relationship between the existing and planned roads with habitats of high suitability for bears (Prepared by: IRES EKOLOGIJA d.o.o., Source: Croatian Agency for the Environment and Nature)

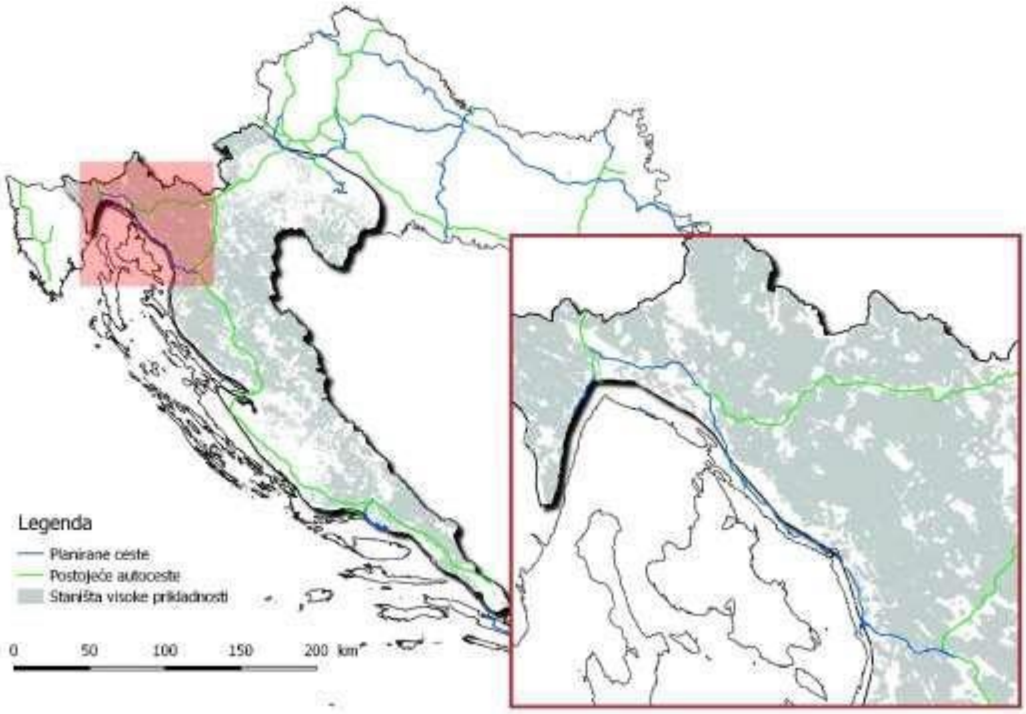


Figure 7.5 The relationship between the existing and planned roads with habitats of high suitability for wolves (Prepared by: IRES EKOLOGIJA d.o.o., Source: Croatian Agency for the Environment and Nature)

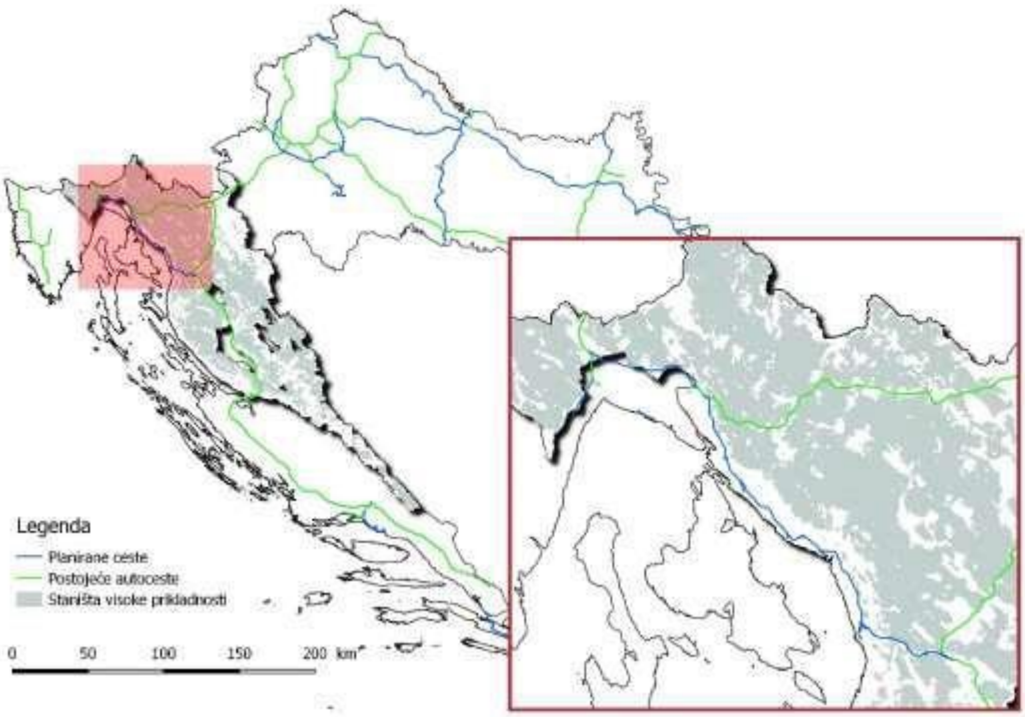


Figure 7.6 The relationship between the existing and planned roads with habitats of high suitability for bobcats (Prepared by: IRES EKOLOGIJA d.o.o., Source: Croatian Agency for the Environment and Nature)

According to the mapping of high suitability habitats within the area of distribution of large carnivores, it can be concluded that the effects shall be generated by the measures Ro.4 (Križišće - Žuta Lokva), Ro.10 (Rijeka network).The unfavourable impacts of the greatest intensity on all three large carnivores are possible when realizing the planned road crossing on the section Križišće - Žuta Lokva, because the existing area of their distribution shall be fragmented, which shall be particularly pronounced by closing the now unobstructed movement corridor between Senj and Žuta Lokva. However, taking into account the positive results of the previous survey of the permeability of Croatian motorways for large carnivores, the expected significant adverse impacts that would have arisen through the realization of the mentioned route could be reduced to an acceptable level. The more pronounced adverse impacts on the wolf population are still possible through the development of the Rijeka network, which refers to the motorway A6 (Rijeka - Zagreb) and A7 (Rupa - Križišće), as well as the development of the motorway link between Ploče and the border with Montenegro. However, with the application of appropriate protection measures when designing and building the planned routes, it is possible to mitigate the negative impacts.

Except for large carnivores, the influence of fragmentation and the barrier effect affects other animal groups, and the intensity of influence depends on the species present in the habitats. Habitat fragmentation has a particular impact on endangered herpetofauna, which is spread throughout Croatia, with the largest number species inhabiting Dalmatia (Figure 3.39), followed by floodplains along the Sava, Danube and Drava rivers, while dry semi-steppe grasslands in the lowland part of Croatia represent rare habitats of certain species. Therefore, it is expected that negative impacts shall be generated almost entirely by the planned transport infrastructure related to the construction of new routes, which requires prescribing environmental protection measures at the level of the environmental impact assessment.

Road permeability, i.e. the intensity of barrier effects for other land mammals depends to a great extent on the volume of traffic, and so far it has been found that roads with traffic density between 4000 and 10 000 vehicles/day represent a significant barrier, while the traffic volume above 10 000 vehicles a day represents an insurmountable barrier, not taking into account the fences surrounding the roads. According to the data of Croatian Roads Ltd., Croatia's state roads belong to the first category of barriers, while traffic denser than 10,000 vehicles per day is present on motorways. Strategy measures include the construction of both road categories, suggesting a potentially unfavourable impact on land mammals. However, the development of new roads shall results in the reduction in the load on existing roads and thus their impact on wild species, and with the implementation of modern construction technology and protection measures when designing the planned roads, these impacts would have a moderately negative character.

By implementing Strategy measures related to the development of air and maritime transport and inland waterway transport, given the definition of available data, no significant negative impacts on non-fragmented areas in the Republic of Croatia are expected at the strategic level, as well as no significant generation of barrier effects on wild species.

7.2.4.3.2 Favourable population status

Railways, as well as road traffic, cause the fatalities of wild species, which is directly reflected on the state of their populations in nature, especially those species whose migratory routes have been cut off. The most frequent fatalities are in areas densely inhabited by wild species, i.e. in areas of small anthropogenic influence. Large carnivores are, due to the size of the population, particularly vulnerable to road traffic.

Bears are the most frequent fatalities in rail traffic, which according to available data have the second highest mortality in traffic (after hunting), which accounts for 16% of total mortality, while railways cause about 70% of traffic fatalities. The highest number of collisions between bears and trains was recorded in the mountainous part of Croatia, which is in correlation with the population density (Figure 3.38). Particularly dangerous locations for large carnivores are cuts and tunnel openings, where individual animals have shortened reaction times, but also the inability to escape the train.

Given that the Strategy plans to develop the railway network from Zagreb to Rijeka, which includes new corridors through the area of distribution of all three large carnivores (Figure 7.7), the adverse impacts of the Strategy R.3 measure on the status of their populations can not be excluded, given the percentage of fatalities of large carnivores on the railway tracks particularly refers to the bear population (Figure 7.8, Figure 7.9). Data analysis found that new railway routes, including both variants, are less invasive to such habitats than the existing railway corridor, while still a large part of the planned route spatially coincides with the existing ones. This points to the conclusion that the construction of planned new shares shall somewhat mitigate the possibility of collision of train and large carnivores if the existing routes are not used anymore. However, using more modern building technology shall allow for faster train movement with less noise emissions, which ultimately can lead to more wildlife fatalities, as the reaction period is shortened (from moment of sighting to crash). In accordance with all of the above, measure R.3 can also result in positive and negative impacts on the existing condition of large carnivore populations, but without mitigation measures, the positive impacts shall be negligible.

In order to improve the current state of affairs, apart from the strategic level, it is also necessary to include additional protection measures during the design of the railway tracks to reduce the adverse effects of rail traffic to a level lower than the existing one in the mountainous part of Croatia. An overview of the variants proposed for the railway track included in measure R.3 defined a potentially less disturbance of the habitat of high suitability for bears, but also all three large carnivores, using a variant that runs through the southern part of Zlobin settlement (Primorje-Gorski Kotar County) than the variant passing through northern part.

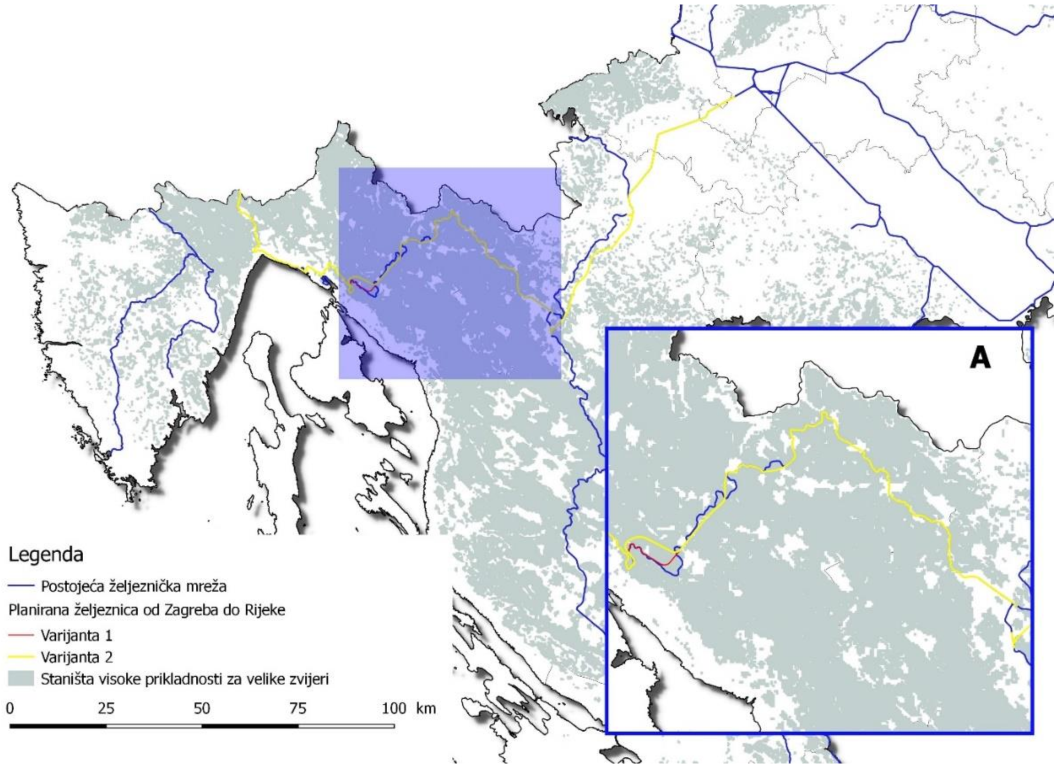


Figure 7.7 Planned corridor of the railway infrastructure from Zagreb to Rijeka (Figure A represents the area of most frequent collision of bears and trains) (Prepared by: IRES EKOLOGIJA d.o.o.; Source; HAOP)

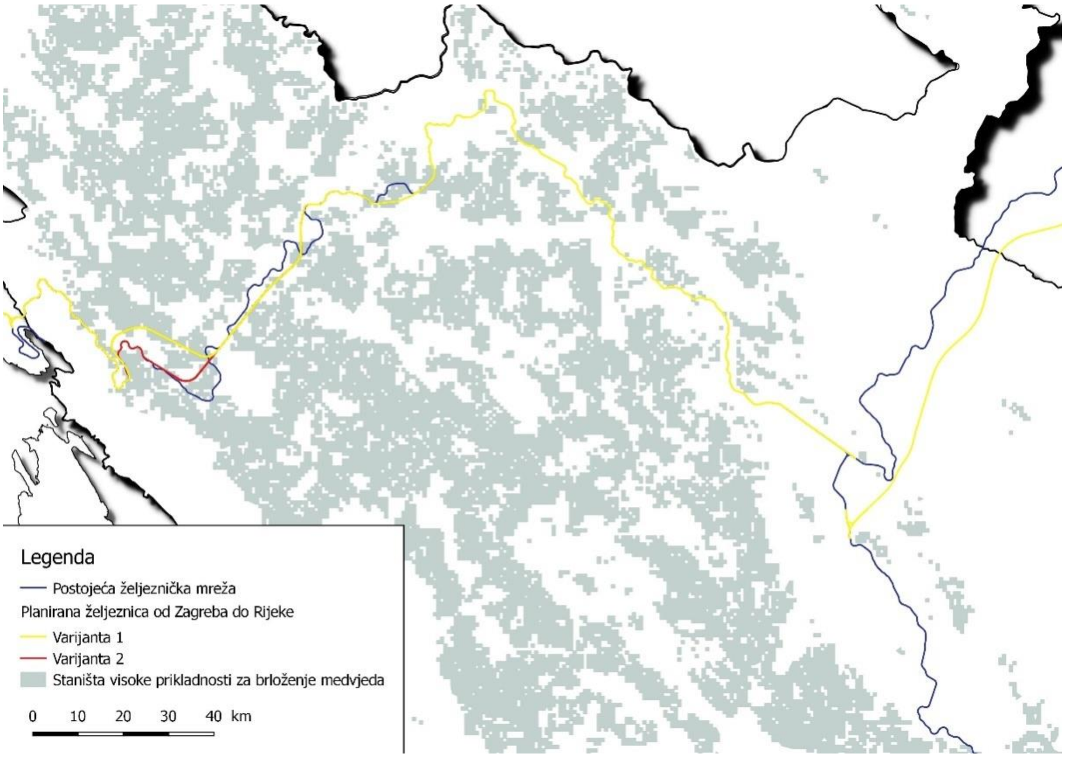


Figure 7.8 Planned corridor of the railway infrastructure from Zagreb to Rijeka passing through habitats of high suitability for bear denning (Prepared by: IRES EKOLOGIJA d.o.o.; Source; HAOP)

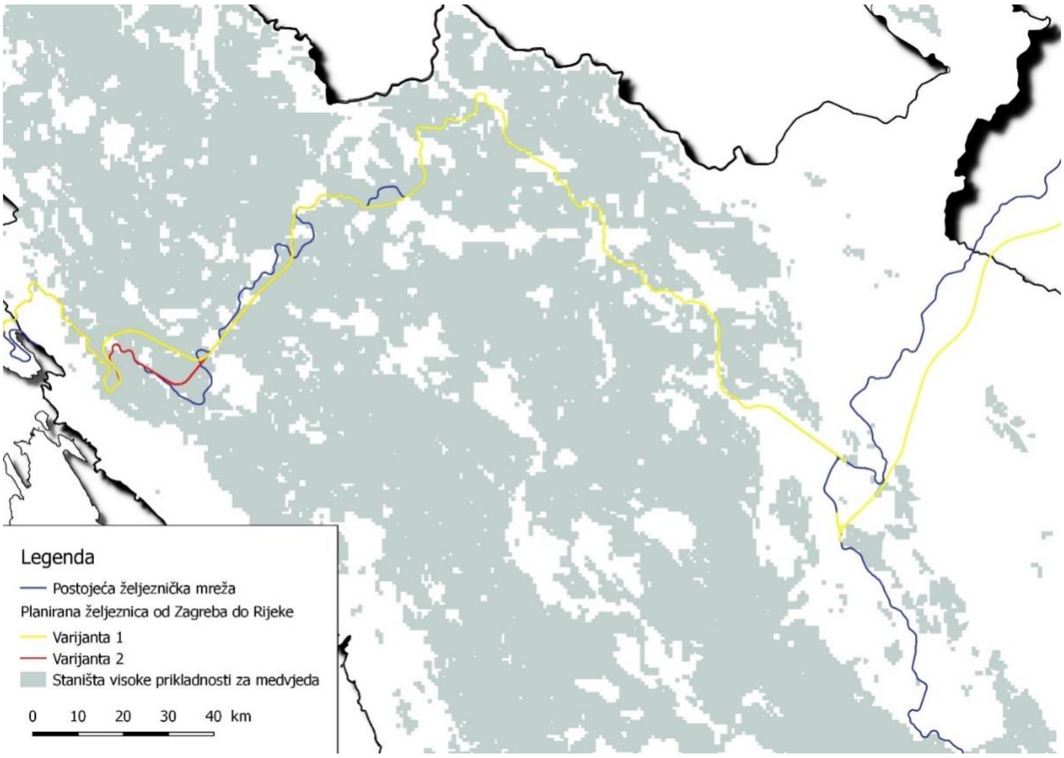


Figure 7.9 Planned corridor of the railway infrastructure from Zagreb to Rijeka passing through habitats of high suitability for bear denning (Prepared by: IRES EKOLOGIJA d.o.o.; Source; HAOP)

Effects similar to those described above are also possible during the realization of Measure R.4, which also foresees the improvement of the railway network towards the Republic of Slovenia. However, with regard to the shorter section of the strip passing through the habitat of high benefits for large carnivores and the fact that the planned actions relate only to the reconstruction and improvement of the existing railway line, no significant impact on the strategic level is expected.

During the implementation of the other measures envisaged in this Strategy related to the development of the railway infrastructure, the expected negative impact on the wild species resulting from fatalities due to collisions between individual animals and trains is of a moderate nature, according to the available data analysis.

Road transport closely related to the development of transport infrastructure is the cause of a large number of wild species fatalities that is directly reflected on the state of their populations in nature. The development of road routes covered by the Strategy can not exclude the negative impact of fatalities of large carnivorous animals in collisions with vehicles, which applies to the same roads that shall affect the fragmentation of their habitats (Figure 7.3, Figure 7.4, Figure 7.5, Figure 7.6). The current tracking data of bear and wolf fatalities on roads described in Chapter 3.3.3.2 indicate the least frequent collisions on motorways, whereas, due to the size of the population of the three large carnivores, the most endangered by this type of road are the bobcats because they can skip the protective fence the easiest. Considering that within the area of distribution of the motorway planned by the Strategy (with the exception of shorter routes of the road covered by the reorganization of the Split network), with a favourable permeability in habitats suitable for large carnivores and their inability to access the surface, the expected impact would not significantly affect the population of bear, wolf and bobcat In Croatia.

In addition to the aforementioned species, a large part of the land fauna of Croatia is endangered by road traffic, which shall be further affected by the development of new traffic routes. For amphibians and reptiles there is no statistically detailed data on the impact of single species on different categories of roads per area, but given the spread of endangered species and their population density, at a strategic level it can be concluded that the roads that pass through the areas of greater diversity and density also have a more intense impact on the national level. The most varied areas are, as already mentioned in the Chapter on traffic impacts on non-fragmented areas, Dalmatia, floodplain areas along the Sava, Danube and Drava rivers, while the types of dry semi-steppe grassland in the lowland part of Croatia are particularly sensitive because they are located on very limited habitats.

Adverse impacts on birds and mammals (otter and beaver) are also possible. According to available data from the Red Books, bird fatalities on the roads is not one of the main causes of endangerment of species characterized as regionally extinct (RE), critically endangered (CR), endangered (EN) and vulnerable (VU), while endangered mammals (except large carnivores) include especially the Eurasian beaver (*Castor fiber*) and the Eurasian otter (*Lutra lutra*).

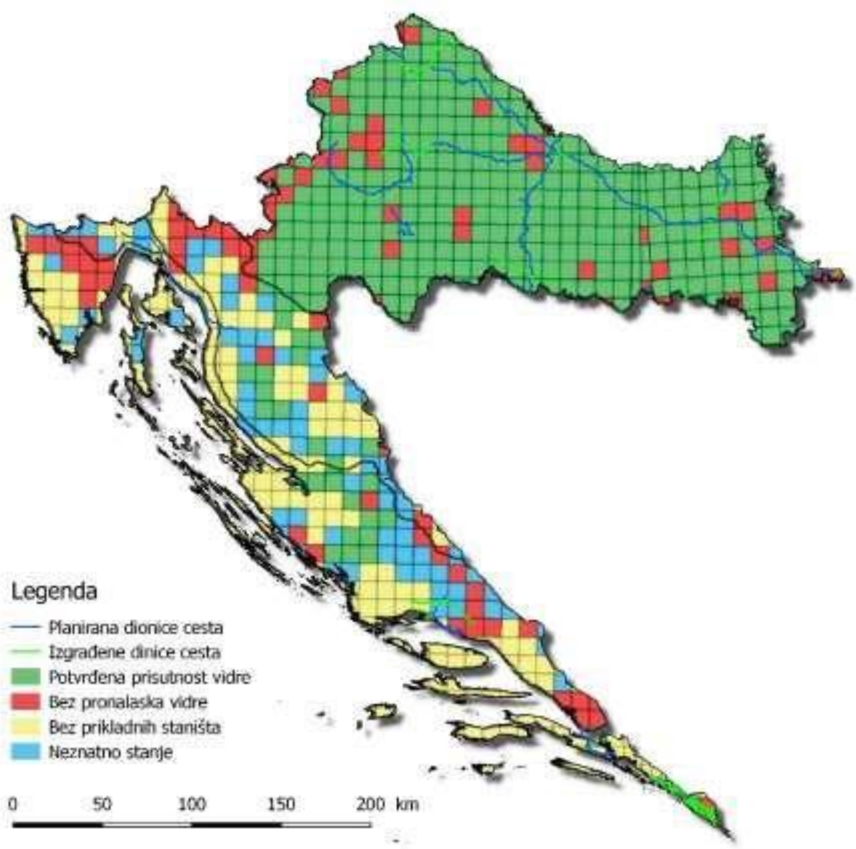


Figure 7.10 Relationship of road routes planned by the Strategy and areas of distribution of the species *Lutra lutra* (Eurasian otter) (Source: National Monitoring Programs for Species in Croatia – otter; Modified by: IRES EKOLOGIJA d.o.o.)

As evident from the map view (Figure 7.10), the roads potentially affecting the Eurasian otter population in Croatia are: Ro.1 (bridge linking near Gradiška), Ro.2 (A5 Osijek - State border with Hungary, Pecs), Ro. 5 (A11 Lekenik - Sisak), Ro.6 (DC 10 Vrbovec - Križevci - Koprivnica - State border with Hungary towards Kaposvar), Ro.7 (DC 12 junction Vrbovec 2 - Ivanja

Reka - Vrbovec - Bjelovar - Virovitica - Hungary towards Bars), Ro.8 (Reorganization of the main Zagreb network) and Ro.9 (D2 from the state border with Slovenia to the state border with Serbia).

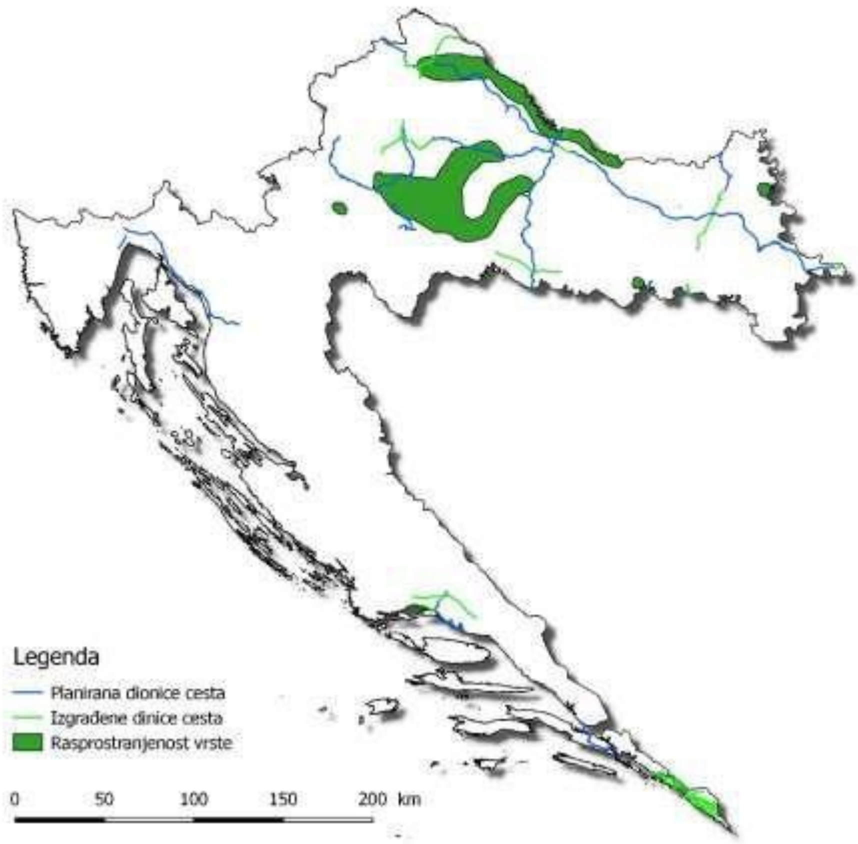


Figure 7.11 The relationship between the road routes planned by the Strategy and areas of distribution of *Castor fiber* (Eurasian beaver) (Source: Red Book of Mammals of Croatia; Modified by: IRES EKOLOGIJA d.o.o.)

From the map view in the figure above (Fig. 7.11), it can be concluded that the following roads shall have a potential negative impact on the Eurasian beaver population: Ro.5 (A11 Lekenik - Sisak), Ro. 6 (DC 10 Vrbovec - Križevci - Koprivnica - State border with Hungary towards Kaposvar), Ro.7 (DC 12 junction Vrbovec 2 - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - State border with Hungary towards Bars), Ro.8 (Reorganization main Zagreb network), Ro.9 (D2 from the state border with Slovenia to the state border with Serbia).

For the majority of the planned road directions, moderate negative impacts on the Eurasian otter and Eurasian beaver populations have been recorded at the strategic level in Croatia.

It should be pointed out that, apart from the physical location of the roads and the manner in which they are constructed, driver irresponsibility (e.g. improper speed) has a significant role in the fatality rate of wild species in traffic, which this Strategy can not influence.

Fatalities of individual wild animals, especially birds, is the result of collisions with aircraft, which in most cases occurs in the immediate vicinity of airports. The registered bird species that were fatalities also include individual animals of endangered species. With the improvement of airports, an increase in traffic density is expected, which shall lead to increased risk of collisions, but since the Strategy does not plan to develop new airports, significant negative impacts on the national level are not expected.

By implementing the measures of the Strategy relating to the development of maritime traffic and inland waterway transport, given the definition of available data, at the strategic level, no significant negative impacts on the status of wild species caused by the fatalities of individual animals are expected.

7.2.4.3.3 Occurrence of invasive species

According to the Strategic assessment, significant negative impacts are not expected with regard to the introduction and expansion of invasive foreign species when implementing the Strategy measures related to the development of railway and road infrastructure in the Republic of Croatia, as well as the development of airports.

Strategic measures that encompass the development of maritime traffic and inland waterway transport shall have a potential impact on the status of invasive foreign species in the Republic of Croatia through the introduction of new foreign species and the expansion of existing ones. The cause of this phenomenon is the increase in the volume of national and international traffic, as well as the creation of new suitable habitats by the degradation of existing ones. The most intensive quantitative and qualitative change in the status of invasive foreign species is expected in the ports, since their reconstruction and construction shall open new suitable habitats. Given that the Strategy plans to specialize existing ports, which are already under high anthropogenic influence, the realization of the measures planned does not provide for a significant change in the current status of invasive species. There are similar expectations for measures related to the construction of the existing river ports, but the Strategy also plans for the construction of a new industrial jetty on the Danube in Ilok, the construction of a new eastern port in Vukovar and the construction of a new infrastructure for the inland waterway traffic in Sisak, which shall result in favourable conditions for the spreading of invasive species. Although the impacts shall be more intense, no significant change in the status of invasive species is expected, as the subject areas have already been invaded.

Inland waterway transport in the Republic of Croatia has been present for many years, and the development of existing ports and the planned construction of infrastructure elements on the Sava and Danube rivers refers to existing waterways, and the impact of introducing new foreign species by vessels is of moderate character. The impact of introducing new foreign species by increasing maritime traffic, given the definition of existing data, can not be quantified.

The planned construction of the Danube - Sava canal shall also contribute to the introduction and spread of invasive foreign species, thus creating numerous new habitats suitable for their settlement, as well as creating the accelerated possibility of spreading to new surrounding areas, so the significant impact of this project can not be excluded.

In 2013, the BALMAS project was launched, which is designed as a project to link the scientific research of the Adriatic, experts and responsible national institutions to eliminate the undesirable risk to the environment and humans by the transmission of harmful aquatic organisms and pathogens through the control and management of marine ballast waters.
The project encompassed several sub-topics:

- preparing the zero state of sea in 12 Adriatic ports covered by the project (Bari, Ancona, Venice and Trieste - Italy, Kopar - Slovenia, Pula, Rijeka, Šibenik, Split and Ploče - Croatia, Bar - Montenegro, Drač – Albania)
- creating a monitoring plan in ports,
- establishing an early warning system in ports,
- developing a system to support competent institutions for faster and more effective decision-making on ballast water management.

7.2.4.3.4 Stress

Stress in individual animals of wild species that is caused by rail and road traffic is the result of noise and vibration caused by the wheel and track (railway) interactions, engine noise and vehicle and road surface interactions, while road traffic causes stress and light flash.

Improving the railway infrastructure shall result in the reduction in the noise levels in the environment caused by the installation of new tracks, which would be neutralized with the increase in the train speed (higher train speed emits noise of higher intensity), and the anticipated increase in rail traffic volume would lead to more frequent environmental noise. However, at a strategic level, it is not possible to define the impact of noise on wild species in more detail due to the lack of more detailed data. On the other hand, with the fact that the railway noise has a lesser effect on the wild species than noise caused by road traffic and that the noise generated by the train often prevents animal and train collisions and taking into account that most of the measures in the Strategy relate to the reconstruction and improvement of already existing railway lines, no significant negative impacts of traffic noise on the biodiversity of Croatia are expected at a strategic level.

Stress caused by road traffic has the greatest impact on the bird and mammal group. As already mentioned above, the decline in populations of open habitat birds has been noted already at traffic density of 5000 vehicles/day when the vehicle movement is slower than 120 km/h, and at higher speeds, the population also decreases at a density of 3000 vehicles per day. Although it depends on the species, on average, forest bird species are more susceptible than open-air birds, however, due to the nature of environmental noise distribution, the impact on forest habitats is limited to somewhat smaller areas.

In accordance with the abovementioned, as well as the described effects of road traffic on the above indicators and taking into account the data on the existing density of traffic on state roads and motorways in the Republic of Croatia and the speed limitation, a more intense impact on bird species populations shall be generated by the development of new motorways, which shall be most prominent in areas significant for them. However, by performing an assessment at a strategic level, while respecting legal regulations and traffic constraints, the stress caused by the implementation of the Strategy measures related to the development of road traffic shall not significantly affect Croatia's ornithology.

Road traffic also has an impact on mammalian stress, which is mainly related to large mammals. The available data indicates a reduced movement at a distance of 100 - 200 m from the road. The potential impact of stress on mammals of road traffic at a strategic level was assessed as moderately negative.

With the development of new road routes, it is expected that the traffic on existing roads shall be relieved, thus potentially reducing the stress in wild species in the areas of their impact, however, this positive impact is at a strategic level is of very low intensity.

Stress in wild species caused by noise in the environment is a consequence of air traffic, but the impact of air traffic noise has a lesser scope because it is closely related to the area of the airport and its surroundings. Given that the Strategy plans to improve the existing ports, despite the increase in traffic volume, the expected impact on the increased noise-induced stress is moderate.

Marine and river vessels by their action have an impact on increasing environmental noise, which generates impacts on increased stress of wild species, particularly in aquatic habitats. Physical properties of water contribute to the intensity of the influence. Data on the effects of noise on inland waterways on biodiversity are very scarce, while the effects of noise on maritime transport are better explored, although still insufficient for the Adriatic. Despite the lack of relevant data on the pollution of the Adriatic by noise, it can be concluded that this aspect of pollution is present in the Adriatic and it is certainly reflected in the increase of the stress of marine organisms. According to research carried out in the Northern Adriatic, it was established that noise affects the marine mammal (bottlenose dolphin) and fish. The impact intensity is correlated with the tourist season and increased traffic volume (Rako et al., 2013). At the strategic level, due to lack of data, it is not possible to estimate the extent to which the intensity of noise in the Adriatic, the Sava and Danube rivers shall increase, as well as the negative impact on biodiversity, but with the expected increase in maritime and river traffic noise. However, environmental protection measures can mitigate the occurrence of significantly negative impacts on the marine environment.

7.2.4.3.5 Preservation of protected area features

The railway network of the Republic of Croatia has been conceived in a manner that avoids protected areas, which has somewhat continued with the Strategy measures related to the further development of the railway infrastructure. However, the railways planned by Strategy measures R.3 and R.9 enter the protected area with one part of the new section of the route. Namely, the planned railway line from Karlovac to Rijeka passes through the edge of the Japlenški vrh Forest Park, while the smaller part of the route crossing the border with Hungary - Osijek - the state border with Bosnia and Herzegovina crosses the Mura - Drava Regional Park at the location of Darda and Osijek. Part of the Mura - Drava Regional Park has in the immediate vicinity of the planned route already been crossed by the state road G.P. Duboševica (R. R. Hungary) - Beli Manastir - Osijek - Đakovo - G.P. Sl. Šamac (BH border) and is under great anthropogenic influence. Accordingly, the expected impacts of the implementation of these measures on protected areas are moderately negative.

The planned development of road transport, as is the case with railways, is mainly conceived outside protected areas (no roads are planned through national pairs and nature parks), but parts of the route are still covered in some protected areas (Figure 7.12), as follows:

- Mura - Drava Regional Park: Ro. 2 (A5 Osijek - State border with Hungary Pecs), Ro.6 (DC 10 Vrbovec - Križevci - Koprivnica - State border with Hungary towards Kaposvar), Ro.7 (DC 12 node Vrbovec 2 - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - State border with Hungary towards Bars)
- Special reserve in the sea: Ro.16 (Preparations for Access to Dubrovnik after the Accession of Croatia to Schengen - Peljesac Bridge)
- Significant landscape of Prapratno Bay: Ro.16 (Preparations for accessibility of Dubrovnik after the accession of Croatia's Schengen - Peljesac Bridge)
- Significant Cetina Landscape - Lower Flow: Ro.15 (Splitting Network Reorganization)

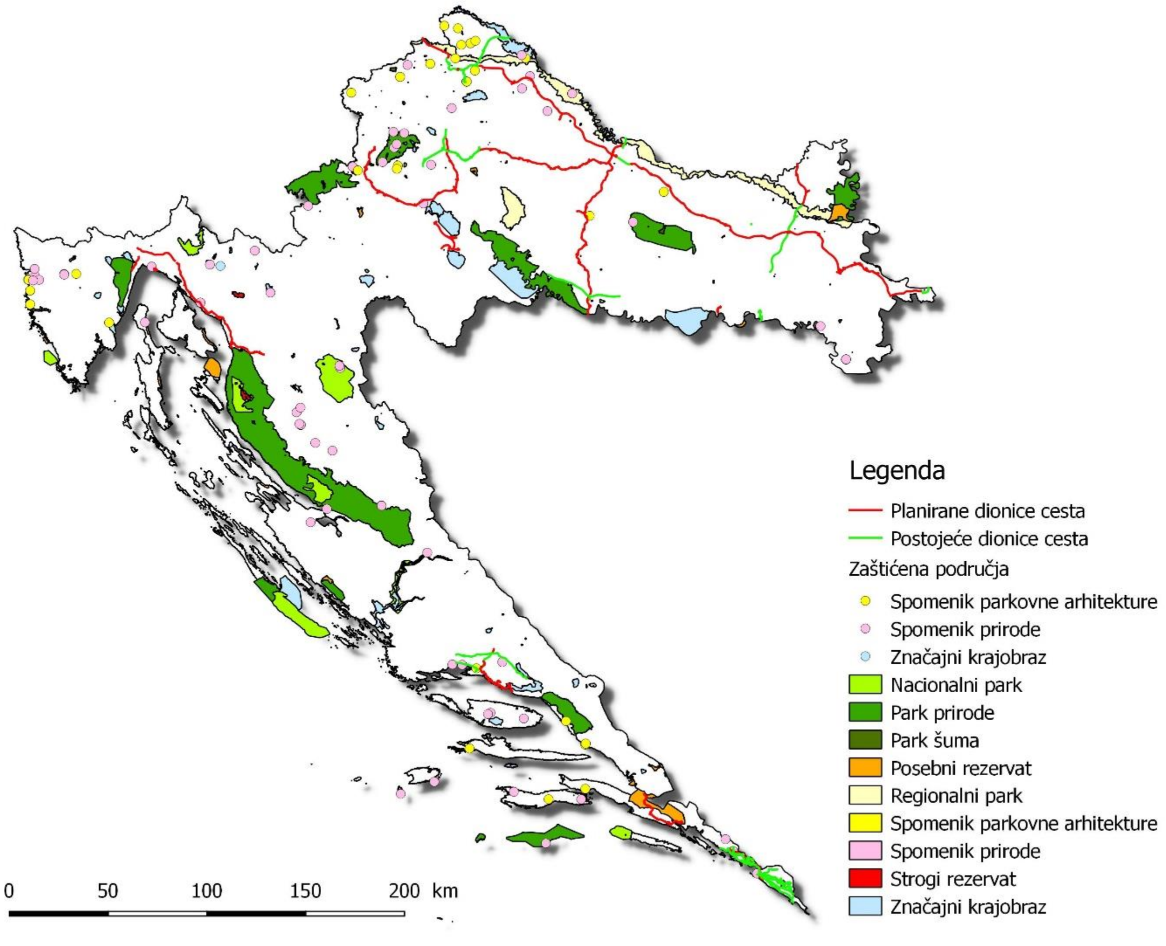


Figure 7.12 Relationship between road routes planned by the Strategy and Protected Areas of the Republic of Croatia (Prepared by: IRES EKOLOGIJA d.o.o.)

Taking into account the nature of the protected areas, as well as the phase in which the road section is covered by an individual measure, at a strategic level, it is possible to have a significant negative impact on the section passing through the Significant landscape of the Cetina River - lower course, referring to measure Ro.15, while the

implementation of other measures would generate moderately negative impacts. Namely, the construction of the traffic network along the lower course of the Cetina River can significantly distort the features of this protected area.
Existing airports covered by this Strategy are not located in protected areas and therefore shall not affect the condition of their preservation.
Planned infrastructure related to the development of maritime and river transport is mainly located outside the protected areas, while some measures envisage interventions on the outskirts of protected areas of nature, namely:

- M. 10 Specialization of the Port of Dubrovnik - Significant Landscape Rijeka Dubrovačka
- I. 3 Development of the Port of Vukovar - Special reserve of forest vegetation of Vukovar Danube Ait
- I. 4 Development of the Port of Osijek - Kopački rit Nature Park and Mura - Drava Regional Park

A potentially negative impact could arise as a result of the construction of a new eastern port in Vukovar that would significantly deteriorate a part of the Vukovar Danube Ait Special Reserve for forest vegetation if the planned port is planned to be located within the boundaries of the reserve. A significant negative impact can be avoided by planning a port outside its boundaries.

7.2.4.3.6 Habitat endangerment

The realization of the Strategy's measures related to the development of railway and road infrastructure can lead to a disruption of natural habitats, which only applies to measures providing for the construction of new routes, while no additional negative impact on the level of strategic assessment is expected for reconstruction and improvement measures. The construction of land transport infrastructure is mentioned as one of the main causes of endangered forest habitats in Croatia.

A spatial data analysis, with a review of the already constructed sections of the transport infrastructure, has found that a more noticeable disturbance in the forest habitats shall be caused by the realization of the measures of the Strategy, which plan for the construction of new railway routes on the Karlovac - Rijeka, Zagreb junction and the construction of new road routes Vrbovec 2 - Hungarian border Towards Barč, Križišće - Žuta Lokva, Permani - Grobnicko polje, Zagreb Ring (reorganization of the Zagreb network) and new road roads in the Dubrovnik-Neretva County. Namely, the realization of these measures would lead to the loss and fragmentation of forest habitats.

By inspecting the variants proposed for the section of the Karovac - Rijeka railway line, a smaller loss of forest habitat was found for the variant that passes through the southern part of Zlobin settlement (Primorje-Gorski Kotar County) than the variant passing through its northern part.

The most prominent impact of the loss and degradation of forest habitats would be evident in the continental region of Croatia, where mostly the construction of new railway lines, according to the map of habitats, would cause disturbances of mixed oak-hornbeam and exclusively hornbeam forests, while road traffic would deteriorate the above mentioned habitats, as well as the habitats of Central European neutrophilic to low-dideophilous, mesophilic beech forests. However, given the character of the project and the share of loss of certain forest habitats in their total surface in some biogeographic regions of Croatia, at strategic level the impacts are moderately negative.

It should be noted that certain measures provide for the development of railway and road corridors through larger rivers, i.e. through inland water habitats, which shall lead to the construction of bridge crossings. The planned section of the Karlovac - Rijeka railway crosses the Mrežnica River into two places, the Zagreb junction route crosses the Sava river at three locations, while the route Hungarian border - Osijek crosses the Drava river at the Retfala settlement in Osijek.
Road traffic development measures that affect inland waters by building bridges are:

- Ro. 1 bridge connection over the Sava river between Croatia and BH near Gradiška on the corridor Hungarian border - Virovitica - Okučani – BH border
- Ro. 3 bridge connection over the Sava river between Croatia and BH near Svilaj on the A5 from A3 motorway corridor to the BH border

- Ro. 5 which with its last route passes at two locations across the Kupa river
- Ro. 9 bridge connection over the Drava river between Croatia and Slovenia on the road corridor DC 2

The construction of bridges could deteriorate the characteristics of aquatic habitats, but at a strategic level, given the character and range of potential impacts, they are characterized as moderate.

By analyzing the data from the cadastre of speleological objects, the planned routes of the railway and road infrastructure and the areas of the sea ports, it has been established that a large number of planned projects enter the areas of recorded speleological objects. Speleological objects are habitats rich in endemic endangered species and are extremely sensitive to external influences that may be caused by the construction of a transport infrastructure. Given that squares in the cadastre of speleological objects occupy 1 km^2, the precise intensity of influence can not be identified at a strategic level. Possible significant negative impacts shall be identified at the project level, when their intensity can be accurately defined, and, depending on the field situation, impact mitigation measures can be proposed.

The planned improvement of airports may lead to the occupation of habitats whose status is characterized as endangered, however, given the definition of available data, the potential share of the affected shall not be of significant character.

The Strategy measures that encompass the development of maritime traffic and inland waterway transport shall potentially affect the degree of vulnerability of habitats in the Republic of Croatia through their loss and disturbance during the implementation of the measures planned. The most intense impact is expected in the ports, as their reconstruction and construction shall permanently affect the quality of the habitat, or increase the anthropogenic character. However, the Strategy plans for the specialization of existing seaports, which are already under high anthropogenic influence and the implementation of the measures planned does not provide for a significant change in the degree of habitat endangerment, which does not refer to habitats in speleological objects. There are similar expectations for measures related to the expansion of the existing river ports (other than the impact on the speleological objects not located near the planned ports of inland navigation), but the Strategy also foresees the construction of a new industrial jetty on the Danube in Ilok, the construction of a new eastern port of Vukovar and the construction of a new infrastructure for Sisak inland waterways, which shall result in more intense impacts. Although the impacts shall be more intense, no significant change in the degree of vulnerability is expected, as a large share of the area is already under certain anthropogenic impact, while habitats unpopulated by human activity are negligible at the national level.

The aforementioned does not apply to the planned construction of the Danube - Sava canal, which shall also affect the natural and semi-natural habitats, but in a much larger and more significant volume. The most intense impacts would be evident on the surrounding stands of oak trees, which would be particularly affected by changes in the groundwater dynamics resulting from the construction of the canal. If the groundwater permanently drops more than 0.5 m, the oak tree physiologically weakens and is dried. The same happens if the groundwater level is permanently raised and produces a swamp effect on the ground where the roots of oak trees are located. The above impacts are described in more detail in the Chapter on impact on forestry. Significant damage to oak forests would greatly reduce the habitat for numerous and varied fauna of the area. Accordingly, significant impacts resulting from the realization of measure I 7 can not be excluded.

An additional significant impact on the development of inland waterways on inland waters and surrounding habitats would be caused by a need for an increase in the water flow, which would require additional works on deepening, extending and streamlining.

Cumulative impacts

Measures of the Strategy that can have a cumulative impact through common interaction are related to the development of railway and road infrastructure, while for other types of traffic at a strategic level, this type of impact on biodiversity and protected areas of the Republic of Croatia is not expected. Namely, the railway and road sections provided for in Measures R 11 and Ro. 8 on most of the corridors are placed side by side, which has its advantages on the habitat because fragmentation occurred only on one corridor. However, such a type of linear infrastructure in the space leads to an increase in almost all other individual impacts, of which the barrier effect is significant, as it creates almost insurmountable obstacles to many wild species, which ultimately can result in permanent segregation of populations.

The cumulative effect also applies to non-fragmented areas, although with the impact of the rail traffic fragmentation and the road influence, there shall be no more noticeable changes in the intensity of the impact which for road traffic in the individual assessment is marked as significantly negative.

7.2.4.4 Landscape characteristics

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Change (degradation) of natural, cultural and visual experiential qualities of the landscape	-	✓	✓	x	x	✓	✓	x	x

Legend: + the impact is positive, - the impact is negative, ✓ the impact has the feature, x the impact does not have the feature

Landscape character

7.2.4.4.1 Railway transport

Measures in the railway sector that generate impacts have been brought into relation with the landscape regionalization of Croatia, as indicated in the table below (Table 7.1). The above table shows the number of measures within a particular landscape region, whose effects are described in more detail and mapped in the text below (Figure 7.13).

Table 7.1 Railway transport Measures within Croatian Landscape Regions (Producer: IRES EKOLOGIJA d.o.o.)

Landscape region	Measure
Lowland areas of northern Croatia	R.2., R.6., R.7., R.8., R.9., R.10.
Pannonian Hills	R.7., R.8.
Bjelovar and Bilogora area	R.5., R.6., R.7.
Northwest Croatia	R.1., R.11., R.14.
Žumberak and Samobor Hills	/
Kordun plateau	R.2., R.3.,
Gorski Kotar	R.3., R.4
Lika	/
Peak Velebit strip	/
Kvarner and Velebit area	R.3., R.4
Istria	/
Northern Dalmatia plateau	/
Zadar and Šibenik archipelago	/
Dalmatian hinterland	/
Coastal area of central and southern Dalmatia	/
Lower Neretva	/

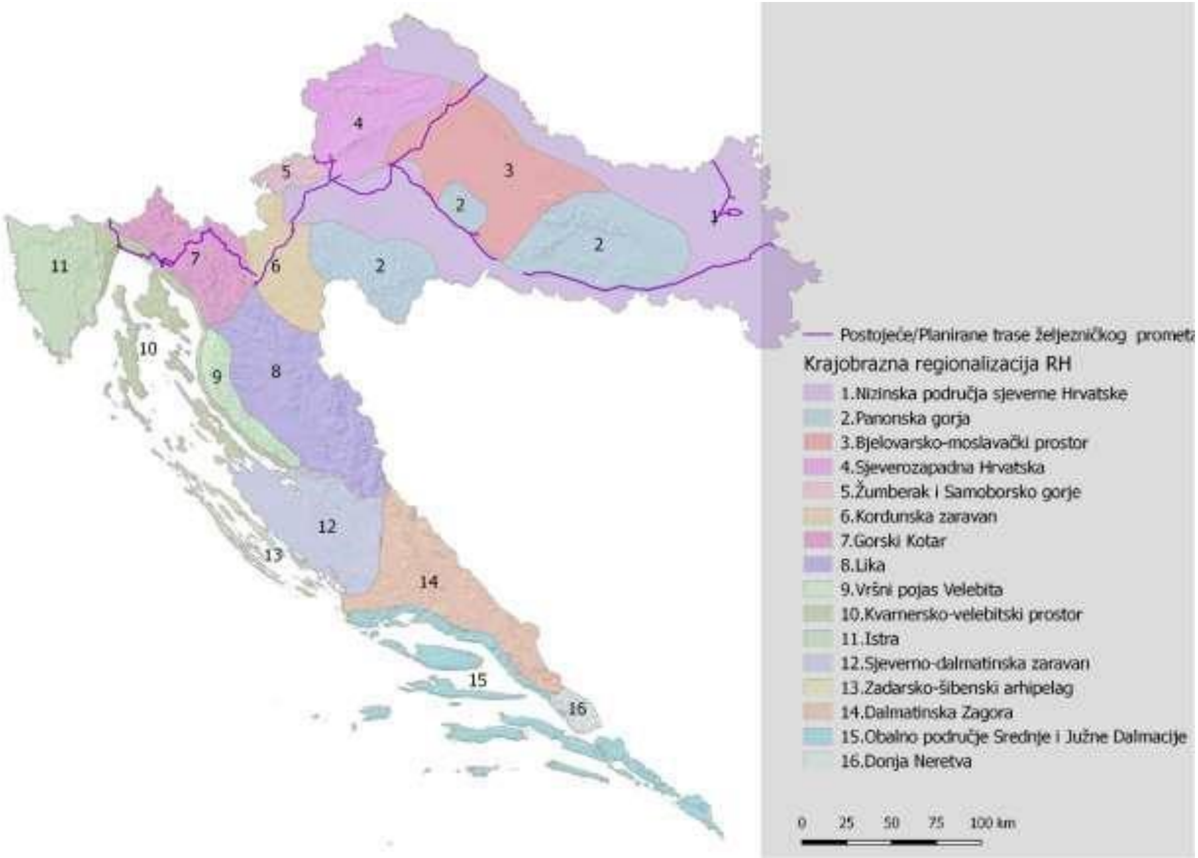


Figure 7.13 Railway transport routes in relation to the landscape regions (Prepared by: IRES EKOLOGIJA d.o.o.)

Within the landscape region **Lowland areas of Northern Croatia**, the largest number of interventions are planned, so the impact on this area is more pronounced than in other regions. The impacts generated by these infrastructure interventions shall be reflected potentially negatively on the natural, cultural and visual quality of the landscape. The measures planned within this region relate to the construction of new and reconstruction of existing railways, which can permanently affect the quality of landscaping. The impact on natural qualities shall be reflected through the removal of the natural surface cover and the interruption of the water surfaces, while the impact on the relief shall be negligible due to its character. It shall also have an impact on the cultural quality of the landscape because the intervention shall cross the mosaic of agricultural surfaces, which shall result in an additional division within the plot and the possible neglect of the cultivable surfaces. The visual impact shall be very pronounced as it is a lowland area, but with the possibility of vegetation repression, this effect would be less pronounced in space.

Within the landscape region of the **Pannonian Hills**, there shall be a lasting impact on the landscape characteristics. Interventions planned by the measures cross the peripheral parts of this landscape region, so the impact on relief features shall not be significant as it is a transitional area between the lowland and the hill part. The eastern part of this landscape region is characterized by higher altitudes in relation to the west, so a greater impact of the R.8 measure is possible during its realization. The impact on cultural qualities shall be reflected in the cultivable areas and the associated infrastructure, because crossings of water melioration canals and fragmentation of the parcels are possible. Visual exposure shall be moderate because the interventions cross the areas that are continuously and line-developed along the already existing infrastructure.

Within the landscape region **Bjelovar and Bilogora area**, there shall be a lasting impact on the landscape characteristics. The interventions provided for in Measure R.5 go cross the peripheral parts of the subject landscape region and cover only some parts in the length of their route, so the impact of the aforementioned measure shall be smaller in relation to measures R.6 and R.7, whose route cross almost all the region. The areas where the new route shall be built shall suffer a direct impact on the natural characteristics (water surfaces and forests) and the cultural characteristics (mosaic of different uses) of the landscape, which shall in turn directly affect the creation of new visuals.

Within the landscape region **Northwest Croatia**, there shall be a lasting impact on the landscape quality for interventions that foresee the construction of new track routes. The natural features of the landscape shall be disturbed depending on the relief aspect and the area of the new path. Furthermore, the impact on the mosaics of cultural surfaces (gritty parcels on hills) may be possible, which shall result in additional divisions in space. Due to the appearance of the project as a line element, large visual exposure is possible, especially from larger settlements/cities.

Within the landscape region **Kordun plateau,** there shall be a lasting impact on the landscape quality because the planned interventions shall generate the reconstruction and construction of the routes. Natural quality can be jeopardized by new construction near water surfaces that are characterized by its naturalness and curving shape. The plateau is characterized by a greater number of geomorphological forms (sinkholes) used for agricultural purposes, which shall be permanently converted and occupied by the realization of the measures planned.

Within the landscape region **Gorski Kotar**, there shall be a lasting impact on the quality of the landscape reflected in the naturalness of the surface of the forests. Because of the relief gap, which in some parts suddenly and steadily rises, there is a significant negative impact on the measures that define the construction of new routes. There is also a large visual exposure from the mountain peaks, as the anthropogenic elements of infrastructure projects are more pronounced in the natural landscape.

Within the landscape region **Kvarner and Velebit area,** there shall be a lasting impact on landscape quality. The changes shall occur through the realization of interventions that plan for the construction of the new track on very steep mountainous areas at the entrance to the Kvarner area. Impacts are possible on the cultural landscape of the Bakar hinterland by taking a certain surface and visual exposure from the seaside.

Access to railway infrastructure reduces the value of the indicator because it is a major infrastructure approach that changes the existing characteristics of landscape regions and has a significant impact on the natural, cultural and visual quality of the landscape. Because of the natural nature of the project and the number of measures in the mentioned landscape, a cumulative impact on the landscape features is possible.

7.2.4.4.2 Road transport

Measures in the road transport sector that generate impacts on the landscape are brought into relation with the landscape regionalization of Croatia and are presented in the table below (Table 7.2). The subject table shows the number of measures within a particular landscape region, whose effects are described in more detail and mapped in the text below (Figure 7.14).

Table 7.2 Road Traffic Measures within Croatian Landscape Regions (Producer: IRES EKOLOGIJA d.o.o.)

Landscape region	Measure
Lowland areas of northern Croatia	Ro.1., Ro.2., Ro.3., Ro.5., Ro.6., Ro.7., Ro.8., Ro.9., Ro.13., Ro.14.
Pannonian Hills	Ro.9.
Bjelovar and Bilogora area	Ro.6., Ro.7., Ro.8., Ro.9., Ro.13.
Northwest Croatia	Ro.8., Ro.9., Ro.12., Ro.13.
Žumberak and Samobor Hills	Ro.8.
Kordun plateau	Ro.12.
Gorski kotar	Ro.4.
Lika	Ro.4.
Peak Velebit strip	/
Kvarner and Velebit area	Ro.10., Ro.4.
Istria	/
Northern Dalmatia plateau	/
Zadar and Šibenik archipelago	/

Landscape region	Measure
Dalmatian hinterland	Ro.15.
Coastal area of central and southern Dalmatia	Ro.11., Ro.15., Ro.16.
Lower Neretva	Ro.16.

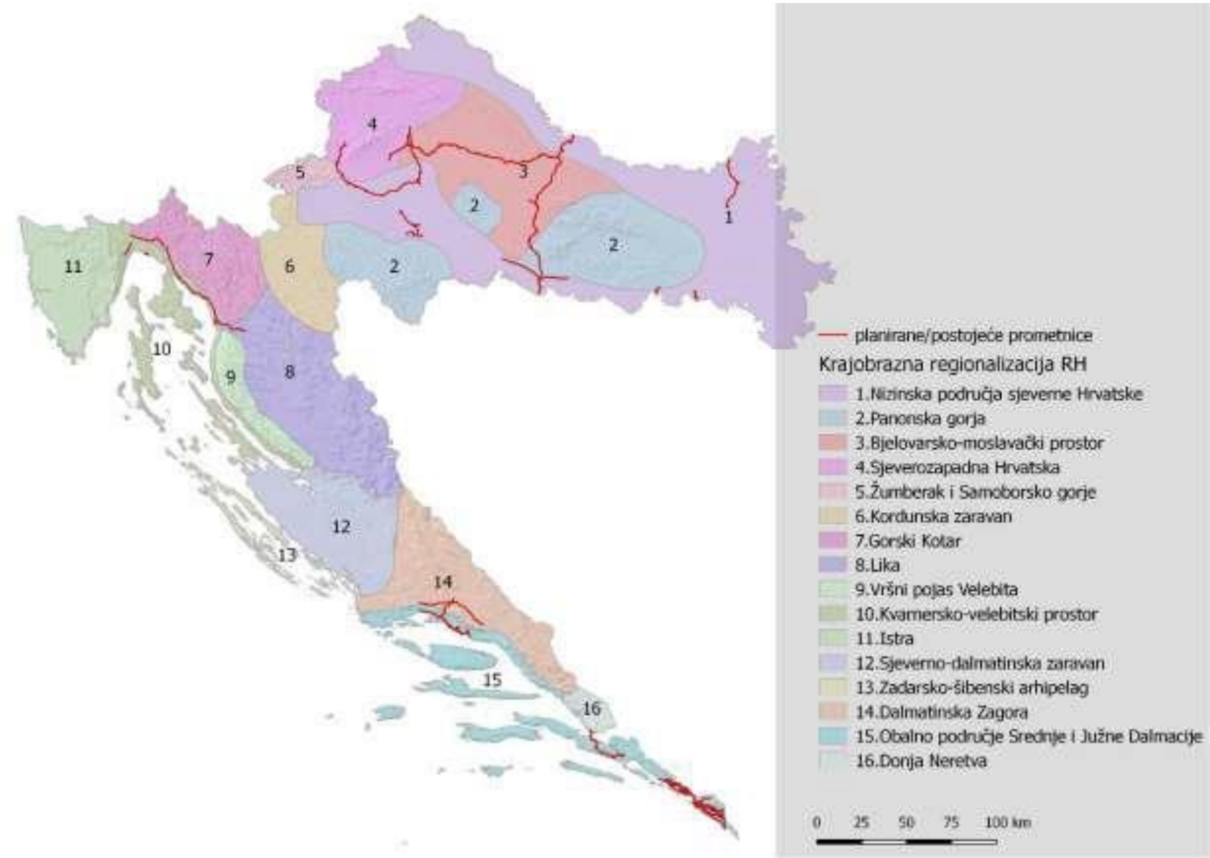


Figure 7.14 Road traffic routes in relation to landscape regions (Prepared by: IRES EKOLOGIJA d.o.o.)

Road traffic along with rail traffic accounts for a major infrastructure intervention. Furthermore, they share a line appearance in the space, therefore they generate similar impacts. Given that the impacts are conceived on the basis of landscape regions, the measures planned within the road traffic measures shall have equal impacts on the landscape characteristics of the area, as well as rail traffic.

Within the landscape region **Lika**, there shall be a lasting impact on the landscape characteristics of the area by realization of the measure under measure R.4. Considering that a minor part of the procedure goes through this region, the impacts shall not be significant. Changes shall affect the landscape characteristics in the immediate vicinity through the change of the surface of the forests and change of relief features. Realization of the project shall affect the changes within the karst fields, which can further affect the vision and perception of the changes caused by the introduction of the anthropogenic element into the rural area.

Within the landscape region **Dalmatian hinterland**, there shall be a lasting impact on the landscape characteristics of the area. Influences on natural and cultural features are possible through karst depression that are characteristic of the cultural landscape of the field, while the higher areas are specific for livestock activities and drywall construction. Given that the road infrastructure is noticeable in its color and appearance in the area, a disturbance of the quality of the area on the higher mountainous areas that are obscured by vegetation shall occur.

Within the landscape region **Coastal area of central and southern Dalmatia**, there shall be a lasting impact on the landscape quality. The impacts shall be of a negative nature, as the interventions that generate new infrastructure (roads and bridges) shall bring permanent changes to the coastal area. Given the sensitivity of the coastal area, additional anthropogenic elements shall impact the already endangered nature of the coastline, which is degraded by unplanned building. It shall also change the visual quality of the area, as the roads stand out with their color and shape, and are visually most visible on higher steep terrain.

Within the landscape region **Lower Neretva**, there shall be a lasting impact on the landscape quality of the observed region. Negative impacts are possible on the cultural landscape of the Neretva valley, which is specific to its natural features and the traditional manner of processing some parts. The anthropogenic element shall create a new move in the space, which shall permanently occupy a certain surface and directly affect the visual quality of the landscape. It is possible to divide the parcel and create a new spatial pattern.

Road infrastructure interventions reduce the value of the indicator because of the large infrastructural interventions that change visions within the landscape regions and equally affect the landscape quality of the area they pass through. Due to the nature of the project and the number of measures in a particular landscape region, a cumulative impact on landscape quality is possible.

7.2.4.4.3 Air transport

The aforementioned actions resulting from air traffic measures that generate impacts have been brought into relation with the landscape regionalization of Croatia and are indicated in the table below (Table 7.3). The above table shows the number of measures within a particular landscape region, whose impacts are described in more detail and mapped in the text below (Figure 7.15).

Table 7.3 Air traffic measures within Croatian landscape regions (Prepared by: IRES EKOLOGIJA d.o.o.)

Landscape region	Measure
Lowland areas of northern Croatia	A.5., A.9.
Pannonian Hills	/
Bjelovar and Bilogora area	/
Northwest Croatia	/
Žumberak and Samobor Hills	/
Kordun plateau	/
Gorski Kotar	/
Lika	/
Peak Velebit strip	/
Kvarner and Velebit area	A.6., A.4.
Istria	A.2.
Northern Dalmatia plateau	A.8.
Zadar and Šibenik archipelago	/
Dalmatian hinterland	/
Coastal area of central and southern Dalmatia	A.1., A.3., A.7
Lower Neretva	/

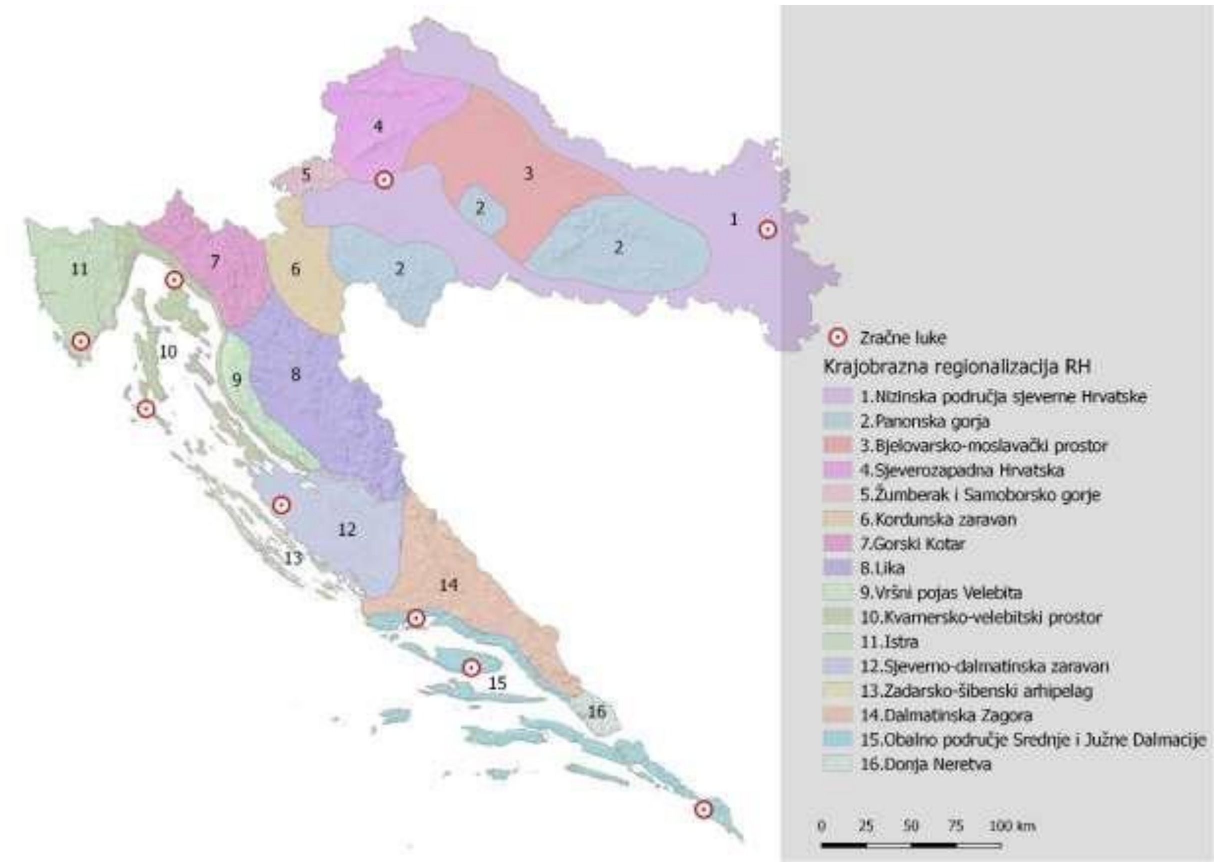


Figure 7.15 Air traffic in relation to landscape regions (Prepared by: IRES EKOLOGIJA d.o.o.)

The interventions planned by the measures are located within the five landscape regions: **Lowland areas of northern Croatia, the Kvarner and Velebit area, Istria, the Northern Dalmatian plateau and the Coastal area of central and southern Dalmatia**. The measures plan for the reconstruction and upgrading of already existing terminals and the possible new surface occupation in their immediate vicinity. Expanding the boundaries of the airports may have a potentially negative impact on the quality of the landscape, which is most evident through the interventions within Measures A.1, A.2, A.4, A.5. and A.6., which generate several different activities (remediation, extension, replacement and construction). It may also have a negative impact on cultural quality, given that the area close to it is characteristic of the drywall construction and decaying and / or mosaic of cultivable surfaces. Rural landscapes are characterized by recognizable visual identity, depending on their region, so the impact of different interventions varies depending on the landscape characteristics of the area. Additional impacts on the visual and experience features of the landscape shall be reflected in the increase in air traffic that shall arise after the realization of all planned interventions.

Realization of measures may have a moderately negative impact on landscape characteristics due to additional spatial order disturbance with new construction, which shall, in view of all the aforementioned problems, affect the reduction of the indicator value.

7.2.4.4.4 Maritime transport

Measures in the sector of maritime traffic, generated by the impact, have been brought into relation with the landscape regionalization of Croatia and are indicated in the table below (Table 7.4). The above table shows the number of measures within a particular landscape region, whose impacts are described in more detail and mapped in the text below (Figure 7.16).

Table 7.4 Maritime traffic measures within Croatian landscape regions (Developer: IRES EKOLOGIJA d.o.o.)

Landscape region	Measure
Lowland areas of northern Croatia	/
Pannonian Hills	/
Bjelovar and Bilogora area	/
Northwest Croatia	/
Žumberak and Samobor Hills	/
Kordun plateau	/
Gorski Kotar	/
Lika	/
Peak Velebit strip	/
Kvarner and Velebit area	M.8.
Istria	/
Northern Dalmatia plateau	M.12., M.13.
Zadar and Šibenik archipelago	/
Dalmatian hinterland	/
Coastal area of central and southern Dalmatia	M.10., M.11.
Lower Neretva	M.9.

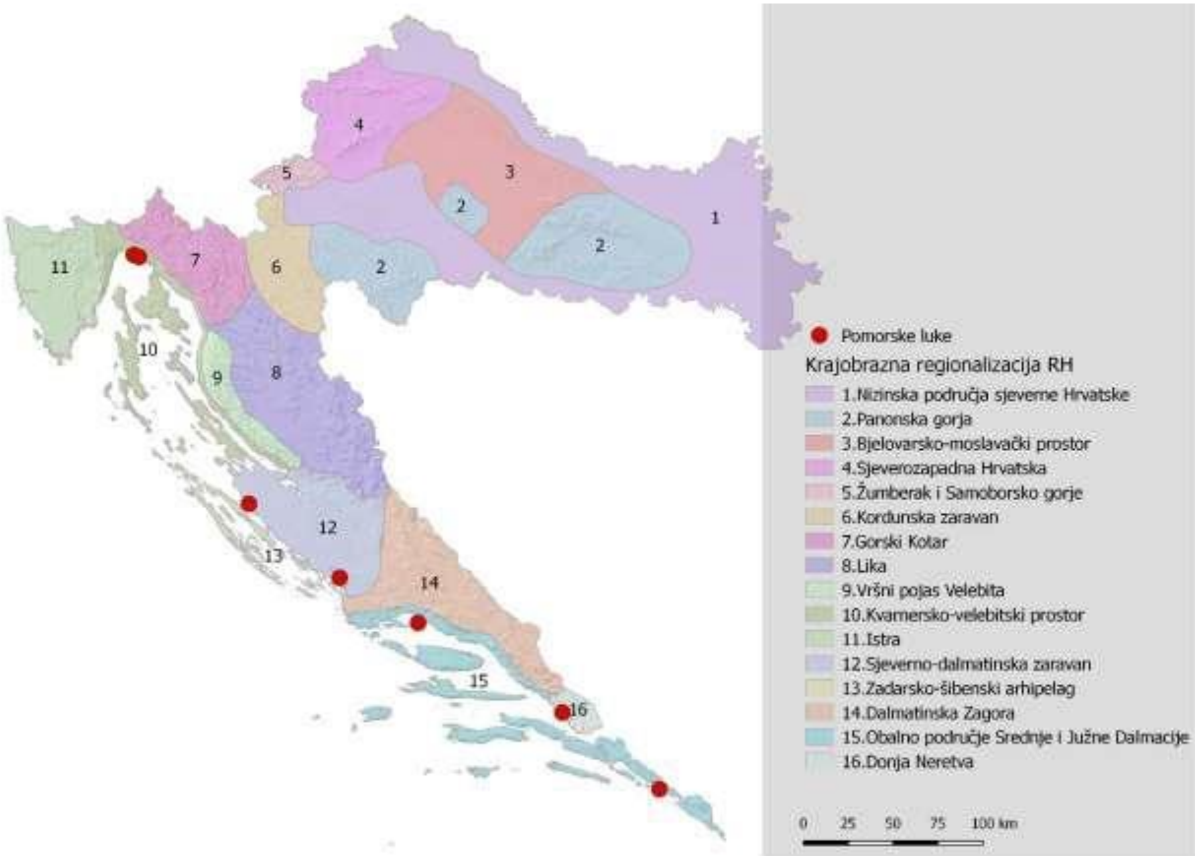


Figure 7.16 Maritime traffic in relation to landscape regions (Prepared by: IRES EKOLOGIJA d.o.o.)

The measures planned by the Strategy are located within four landscape regions: **Kvarner and Velebit area, Northern Dalmatian plateau, Coastal area of central and southern Dalmatia and Lower Neretva**. The measures plan for the reconstruction and upgrading of already existing terminals, leading to new occupation of the surface within the coastal line. Realization of the project shall result in impacting the quality of the landscape, which can affect the appearance of the coast. The coastal belt, the sea and the coastal zone and the sea make the natural features of the landscape, so the realization of the interventions planned by the measures in the maritime transport sector shall have a negative impact within the mentioned landscape regions. The process of urbanization and mass tourism has created strong pressure on the coastal area, which shall be further emphasized by occupying and extending the current port area.

By realizing the M.9 measure, which generates the construction of a new terminal, its impact on the Lower Neretva landscape region shall be greater with regard to other regions covered by the measures. The impact in this area shall depend on the positioning of the new terminal. If the planned operation is close to the cultural landscape, it is possible to have a negative impact on its characteristics. By damaging the original landscape, the shadows represent a valuable part of the coast, which leads to a reduction in the ambient values.

The realization of measures in the maritime transport sector shall likely have a moderate negative impact on the landscape characteristics of the area, which shall in turn affect the reduction in the indicator value and the creation of additional pressure on the coastal area.

7.2.4.4.5 Inland waterway transport

The interventions resulting from the measures of inland waterway transport, which generate impacts, were brought into relation with the landscape regionalization of Croatia and are indicated in the table below (Table 7.5). The subject table indicates the number of measures within each landscape region, whose impacts are described in more detail and mapped in the text below (Figure 7.17).

Table 7.5 Measures of inland waterways transport within the Croatian landscape regions (Producer: IRES EKOLOGIJA d.o.o.)

Landscape region	Measure
Lowland areas of northern Croatia	I.3., I.4., I.5., I.6. I.7.
Pannonian Hills	/
Bjelovar and Bilogora area	/
Northwest Croatia	/
Žumberak and Samobor Hills	/
Kordun plateau	/
Gorski Kotar	/
Lika	/
Peak Velebit strip	/
Kvarner and Velebit area	/
Istria	/
Northern Dalmatia plateau	/
Zadar and Šibenik archipelago	/
Dalmatian hinterland	/
Coastal area of central and southern Dalmatia	/
Lower Neretva	/

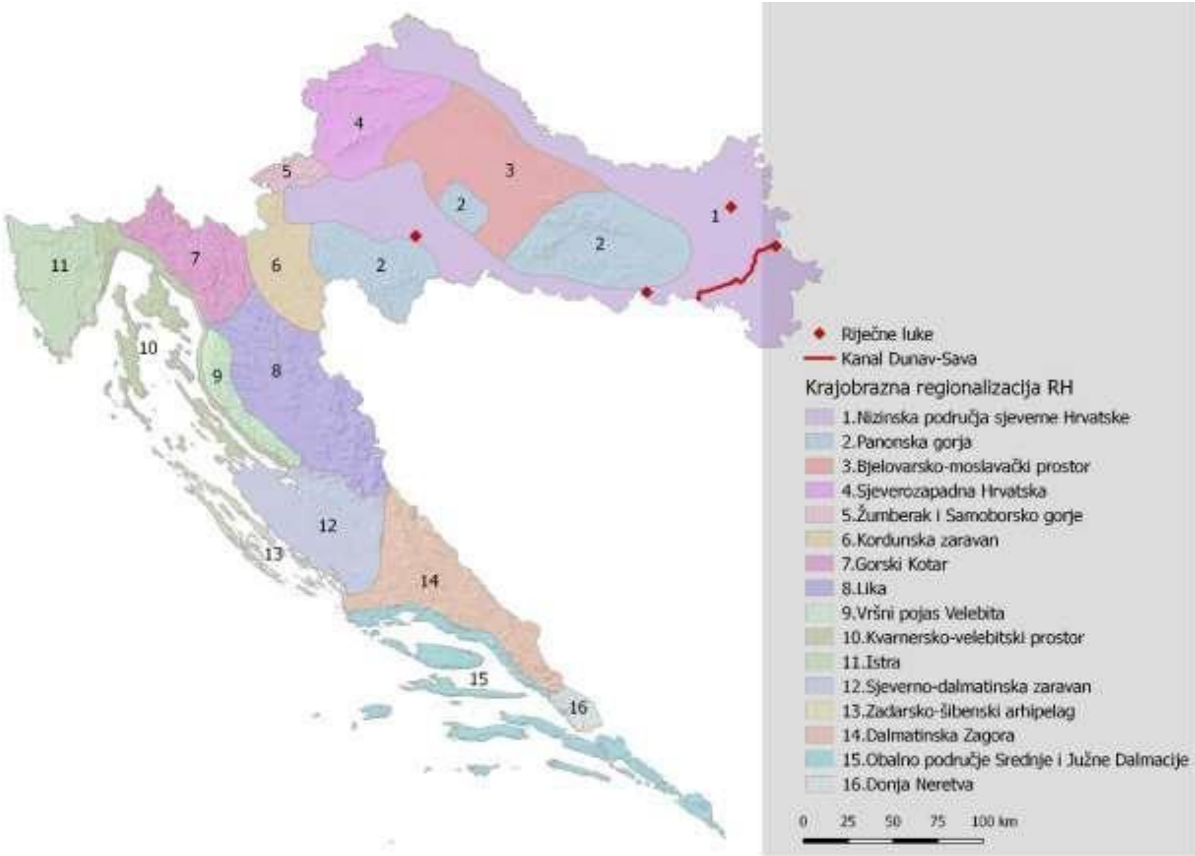


Figure 7.17 Inland waterway transport in relation to landscape regions (Prepared by: IRES EKOLOGIJA d.o.o.)

Within the landscape region **Lowland areas of Northern Croatia**, interventions are planned regarding the modernization and construction of river ports in the area of Vukovar, Osijek, Slavonski Brod and Sisak, and the construction of the Danube - Sava multipurpose canal. The effects of the ports are dotted in character and refer to the immediate area within the given landscape region, while the influence of the multi-canal canal of the line character. The impact of the development of the port development shall most be reflected on the natural quality of the river bank and the riverbank, and less on the relief features, given that it is a lowland area. Furthermore, it is possible to have a negative impact on the backwater and stillwater, because the realization of certain interventions shall lead to the creation of new anthropogenic structures and the loss of spatial exemption thereof. The measures generate various construction and modernization projects, which shall reflect on the cultural quality of the landscape, especially on the mosaic of agricultural lands along the river. The visual experience of the river area shall change due to the realization of the project, given the new spatial order and structure. The impact of the Danube - Sava canal is of linear character and shall, given the other measures within this category of traffic, generate the greatest impact. Permanent impacts on the natural quality of landscapes are likely to be through the forests and the water (river), which would be transformed from a curving (natural) to an unnatural form. This would change the spatial pattern (which would be further transformed through irrigation and drainage systems), which would in turn affect the appearance and quality of cultural landscapes of river areas. Given that this is an operation that changes the image of the wider area of northeastern Croatia and creates a whole new spatial pattern, large visual exposure and perception of change is expected.

The development of river ports shall have a moderately negative impact, while the Danube - Sava multipurpose canal can have a significant negative effect on landscape quality, which is expected to lead to a decrease in the indicator value.

7.2.4.5 Soil

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Soil pollution	-	✓	x	x	x	✓	x	x	x
Removal of vegetation	-	✓	x	x	x	✓	x	x	x

Legend: + the impact is positive, - the impact is negative, ✓the impact has the feature, x the impact does not have the feature

Amount of pollutants in the soil

7.2.4.5.1 Railway transport

When using and maintaining railway tracks in the environment, pollutants are released that can contaminate the soil and permanently modify its characteristics. Potentially polluting contaminants are the chemicals used to treat the wooden railway gauges. Most commonly, it is creosote - a chemical agent that is used as a biocide and for wood impregnation. The negative consequences of using this agent are soil contamination if it leaks from the wooden gauge into the ground. In order to mitigate this negative impact, protective measures are prescribed.

Increasing pollutants in the soil is expected due to the use of herbicides in the zone around the railway line. Herbicides are used to prevent soil healing around the railroad track, but its excessive use also has a negative impact on soil properties.

In the narrow zone around the railway line, an increase in the concentration of heavy metals due to wear of train brakes, train wheels, rails and electric lines is also expected.

Taking into account the fact that most of the aforementioned impacts shall occur only in a narrow zone around the planned railways and that, in order to mitigate some of the aforementioned impacts of the prescribed protection measures, it is estimated that the value of this indicator shall not significantly increase.

7.2.4.5.2 Road traffic

Soil contamination with road traffic pollution is generally more pronounced on high-traffic roads. Road vehicles are the sources of various types of contaminants such as fuels, lubricants, heavy metals such as chrome, lead, zinc and copper, etc. The contaminants that end up in the ground around the roads can negatively affect its characteristics and vegetation and organisms in the soil. This impact is localized and refers only to a relatively narrow roadside zone.

In the winter months, soil can also be polluted and salt used to prevent the fall of road surfaces. Increased concentration of salt in the soil negatively affects its properties and decreases its fertility.

The most significant negative impacts on the ground are possible in case of accidental situations when significant quantities of pollutants of different types can end up in the soil and permanently contaminate larger soil surfaces.

Given that the majority of negative impact on the ground shall only work in a narrow zone around the planned roads, a significant increase in the value of this indicator is not expected.

Soil erosion

The described impacts refer to all traffic sectors.

Due to the vegetation cover, especially in forest or grassy vegetation, leaf litter and remains of plant parts accumulate, which allows for considerable retention of rainwater, thus protecting the soil from a certain degree of soil water erosion.

Removing the permanent vegetative cover destroys the favourable structure of the soil, which reduces its water infiltration capacity and results in a reduction in the rate of drainage of surplus water. This affects the reduction of surface drainage, and indirectly to the intensity of soil erosion with water.

Vegetation, with its roots system, strengthens the soil and secures it against abrupt removal. Due to the lack of vegetation cover, which protects the soil from the destruction of structural aggregates from the impact of raindrops, the stability of the structural aggregates of the soil is disturbed. Furthermore, in the absence of a vegetation cover, the freezing of soil is facilitated.

It should be noted that the significance of a negative impact on soil erosion can only be assessed when project designing measures. The negative impact on soil erosion is most pronounced in areas of high risk of erosion.

7.2.4.6 Waters

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Pollution of surface and underground waters	-	✓	x	x	x	✓	✓	x	✓
Pollution of water for human consumption	-	✓	x	x	x	✓	✓	x	x
Change in hydromorphological condition	-	✓	x	x	x	✓	x	x	x

Legend: + the impact is positive, - the impact is negative, ✓ the impact has the feature, x the impact does not have the feature

7.2.4.6.1 Railway tranport

Ecological and chemical status of surface and groundwater

The effects of railway transport on the ecological and chemical status of surface waters, i.e. the chemical status of groundwater, are limited during normal operation of the trains. Pollutants on the railway line or resulting from its use are agents for treating track gauges, herbicides that treat surfaces around the railway line and fuels, lubricants and other pollutants that can leak from the trailing trains.

Chemical agents, such as creosote, treat railroad railways and serve as biocides and for the purpose of wood impregnation. Their leakage to the environment can occur in old and worn wooden thresholds, so these compounds can reach the surrounding waters and affect their ecological and chemical condition. It should be noted, however, that today, when constructing railway lines, concrete gauges are mainly used, which are not harmful to the surrounding water bodies. Herbicides are used to prevent healing of the surface around the railway track. These substances may also adversely affect the ecological and chemical state of the surrounding waters if they come into contact with them. Train traffic can lead to fuel, lubricant and other pollutant discharge that are used during normal operation of the train in the surrounding water, and by contact with the surrounding waters, they may have a negative impact on their status. However, although the railway track represents a contaminant of the environment, the amount of pollutants it generates during normal operation is negligible and the impact on surface and groundwater is considered moderately negative.

An additional negative impact is possible on locations where new railway track planned cross over surface watercourses. Negative impacts are expected if the construction of the surface water streams is diverted during the construction works. Their reorientation, i.e. the physical changes of the bed, negatively affects their hydromorphological state, and consequently their ecological state. In order to mitigate this negative impact, protective measures are prescribed.

The main negative impacts on surface and groundwater are the result of accidents. The impact intensity during accidents depends primarily on the load transmitted by the train, and in the case of highly polluting substances such as hydrocarbons, chemicals or hazardous waste, when there is potential for persistent contamination of surrounding water bodies, it can be significantly negative.

Taking into account the above, it is estimated that the implementation of the Strategy shall reduce the value of this indicator.

Ecological and chemical status of coastal and transitional waters

Immediate impacts on the status of coastal and transitional waters are not expected. There is a possibility of their indirect contamination with the substances generated by the use and maintenance of the railway, if they are transmitted by surface flows or groundwater to the water bodies of coastal and transitional waters. This impact applies only to the Karlovac - Rijeka railway track, as the other planned railways are not located on the Adriatic coastal zone.

As with surface waters, the amount of pollutants generated on railway tracks in normal conditions is negligible, and as their concentration shall be further diluted when transporting surface or groundwater to coastal or transitional waters, the potential impact on their ecological and chemical status shall be moderate.

A possible significant impact is possible, as well as surface water and groundwater, in case of accidents, only on the route of the Karlovac - Rijeka railway track.

Given the aforementioned, no significant reduction in the indicator's value is expected due to the implementation of the Strategy.

Water for human consumption

By analyzing the route of the planned railways, it was established that eight railway tracks for which the Strategy is planning to build new routes pass through the sanitary protection zones of sources.

Since any pollution that reaches the surface or groundwater within the boundaries of the sanitary protection zone can potentially come into contact with the watercourse and thus contaminate the reservoirs of water for human consumption, the planned railway tracks represent additional pressure on the quality of water for human consumption. The exact representation of the spatial overlap of eight of these railways with sanitary protection zones is indicated in the table below (Table 7.6).

Table 7.6 Overlap of the sanitary protection zone of sources with planned railway tracks (Prepared by: IRES EKOLOGIJA d.o.o.)

Measure code	Sanitary protection zone			
	I	II	III	IV
R3	×	✓	✓	✓
R4	×	✓	✓	✓
R5	×	×	✓	×
R6	×	×	✓	×
R8	×	×	✓	×
R9	×	×	✓	×
R10	×	×	✓	×
R11	×	×	✓	×

The remaining two railway tracks, for which the construction of new tracks is planned, do not pass through the sanitary protection areas of the source. Those are railway lines Dugo Selo - Novska (measure R.7) and Zagreb - Airport (measure R.13).

Overlapping of planned railway tracks with sanitary protection zones is indicated in the figure below (Figure 7.18).

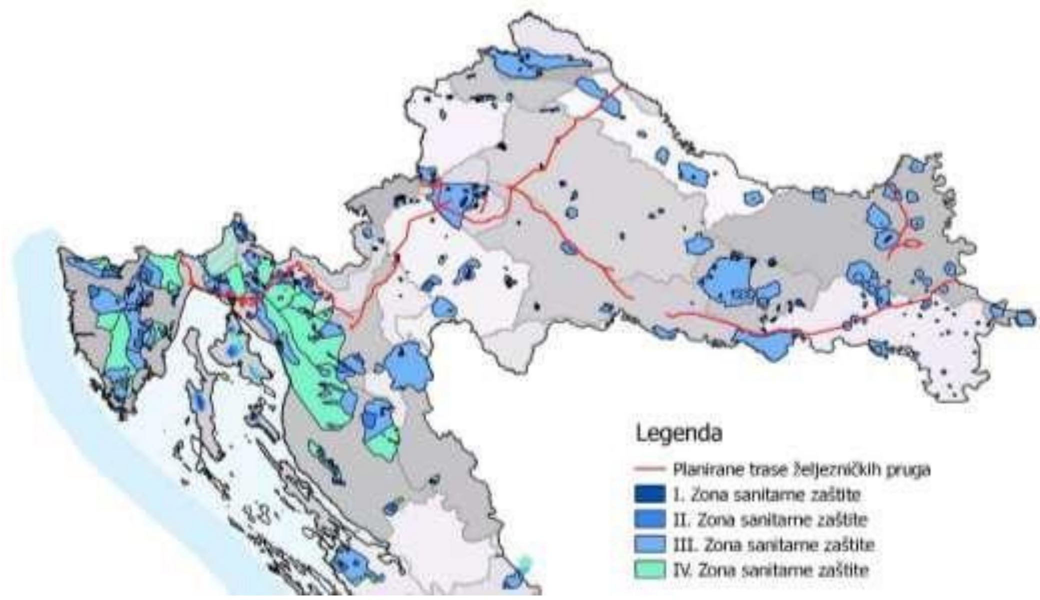


Figure 7.18 Overlapping of planned railways with sanitary protection areas (Source: Water Management Plan 2016-2021)

However, most of the planned routes of the railway lines within the sanitary protection area are planned to extend already existing railway tracks to additional tracks or to reconstruct the existing tracks, while only a minor part is the construction of new tracks of the railway lines. Due to the aforementioned, the pressure of railway transport on the quality of water for human consumption in these areas already exists and shall not create new pressures, but shall intensify the existing ones. Furthermore, as mentioned above, the quantities of pollutants generated during the normal operation of the railway line are negligible and no significant contamination of surface or ground water is expected and consequently no significant contamination of the water supply basins.

Given the aforementioned, no significant reduction of the indicator value is expected.

7.2.4.6.2 Road transport

Ecological and chemical status of surface and groundwater

The main negative impacts of road traffic on the ecological and chemical status of water bodies are the consequence of pollution of water bodies by pollutants from rainwater from the roads. The primary source of pollution on the roads are the vehicles. Pollutants that in this manner reach traffic surfaces are fuel and lubricants that can leak from the engine, wear products of automotive tires and brakes, waste and similar. These substances accumulate on impermeable road surfaces and, during precipitation drain off the road into the environment, where they can come into direct contact with surface waters, or by percolation through the soil into groundwater. Due to its properties, these water substances have adversely affected the ecological and chemical status of water bodies.

The particular negative impact of waterways on the roads occurs in the winter months when roadways, with the purpose of preventing the fall of the road surface, are sprinkled with salt. Like other pollutants, the salt is retained on the roads until precipitation occurs when it drains off the road along with other pollutants. The salt on the roads causes accumulation of sodium and chlorine ions in precipitation waters, further increasing concentrations of these ions in surface and groundwater.

Additional adverse impacts are possible at locations where the roads cross over surface watercourses. Such sites may have a negative impact if construction work, such as bridges, embankments etc., is constructed in such a manner as to divert surface water flows. By altering the natural surface water flow, they negatively affect their hydromorphological state as natural beds are canaled, the natural water regime of the watercourse is altered, the interconnection between surface and groundwater is reduced, etc. The consequence of the deterioration of the hydromorphological state may also have a negative impact on the biological indicators of the water status, since any change in the existing surface water conditions can have a negative impact on the biodiversity of water bodies. Given that the hydromorphological and biological conditions are constituents of the ecological condition, their disruption shall also negatively affect the ecological state of the water bodies. In order to mitigate this negative impact, protective measures are prescribed.

Given the aforementioned, it is possible to conclude that the construction of new roads shall result in a decrease in the indicator values.

Ecological and chemical status of coastal and transitional waters

The direct impact of road traffic on coastal and transitional water is generally not expected. Exceptions are possible for planned roads whose route runs along the coast where there is a possibility that contaminated rainwater from the traffic surfaces shall flow directly into coastal or transitional waters. The main negative impacts on the state of coastal and transitional waters, as well as surface waters, are the consequence of the drainage of various pollutants accumulating on the surface of the road, and the precipitation in the surrounding water bodies. In most cases, they are surface flows, or groundwater, which due to precipitation come into contact with the soil. In this case, it is possible that contaminated water is transported to the coastal or transitional water bodies and has a negative impact. Given the hydrographic division of the Republic of Croatia into the Adriatic water area and the river Danube river area, this negative impact is expected only due to the construction of road roads in the coastal part of the Republic of Croatia.

Given the aforementioned, the possibility of reducing the indicator value can not be ruled out.

Water for human consumption

By analyzing the routes of the planned roads, it was established that eight planned road routes pass through the sanitary protection areas, while six of them do not. Since surface and groundwater within these zones can naturally come into contact with watercourses within any of these zones, any pollution of them can potentially contaminate water resources for human consumption. The construction of new road roads within the sanitary protection area shall increase the existing pressures on the water bodies within the zone, thereby further jeopardizing the quality of water on the bound waterworks. Overlapping of planned road roads with sanitary protection areas is shown in the table below (Table 7.7).

Table 7.7 Overlap of sanitary protection area with planned roads (Prepared by: IRES EKOLOGIJA d.o.o.)

Measure code	Sanitary protection zone			
	I		I	
Ro. 1	×	×	✓	×
Ro. 2	×	×	✓	×
Ro. 4	×	✓	✓	✓
Ro. 7	×	×	✓	×
Ro. 8	×	✓	✓	×
Ro. 9	×	×	✓	×
Ro. 10	×	✓	✓	✓
Ro. 15	×	✓	✓	×

The road traffic routes planned under the remaining measures of the Strategy (measures 3, 5, 5, 10, 16, 16, 16) do not pass through the sanitary protection zones.

Overlapping of planned roads with sanitary protection areas of the source is indicated in the figure below (Figure 7.19).

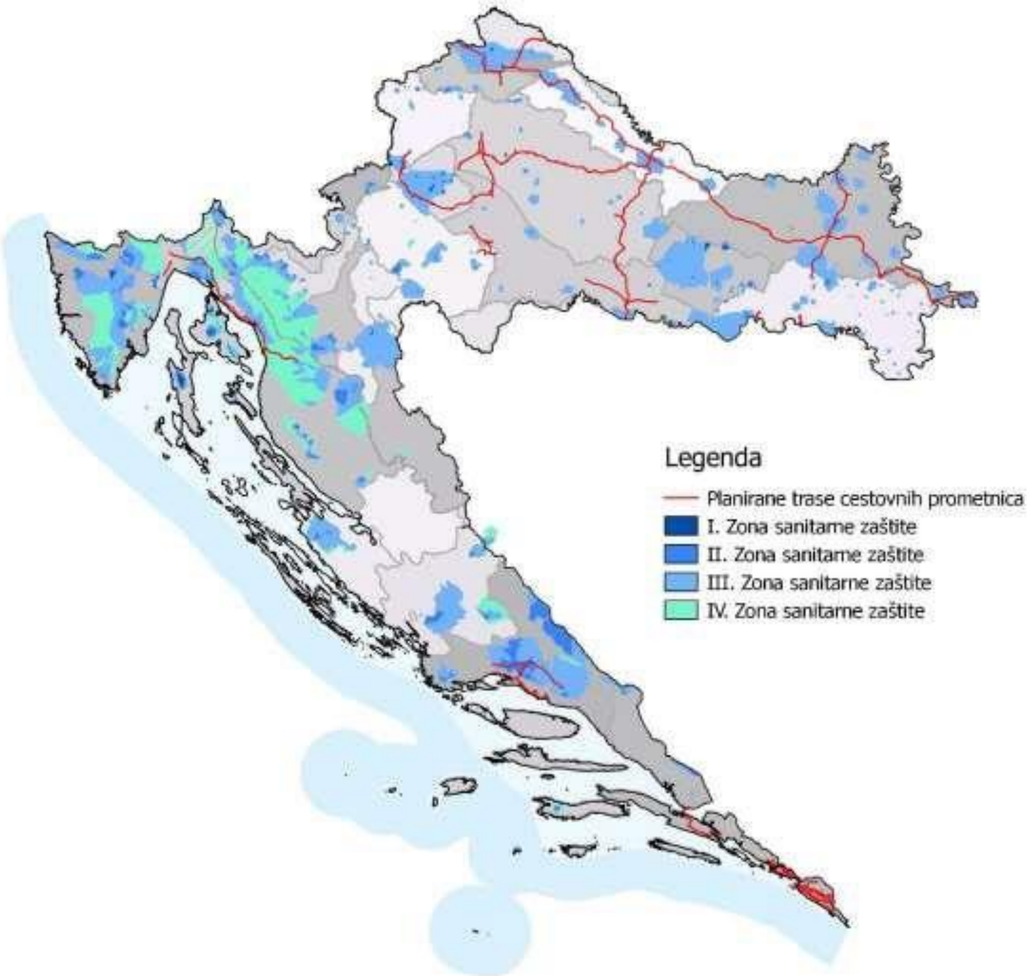


Figure 7.19 Overlapping of roads with sanitary protection areas (Source: Water Resources Management Plan 2016-2021)

However, within the area of sanitary protection of sources, water protection measures have already been prescribed under the Ordinance on the conditions for establishing the sanitary protection area of the source and by keeping the same potential negative impacts at a negligible level, i.e. there is no need for prescribing additional water protection measures.

Taking into account the above, it has been estimated that the implementation of the Strategy shall not significantly reduce the value of this indicator.

7.2.4.6.3 Air transport

Ecological and chemical status of surface and groundwater

The negative impacts of air traffic on water status are expected only at airports. There are a number of activities that can result in the discharge of pollutants into the surrounding water bodies during the operation of the airports. These activities include aircraft dehumidification, fuel storage, aircraft refueling, cleaning and maintenance of aircrafts and vehicles, etc. of the aforementioned, the highest risk for surface and groundwater are aircraft dehumidifying chemicals, which, due to their properties, may cause increased bioavailability (BPK) Waters and thus negatively affect their ecological status.

Given the aforementioned, in the event of pollution occurring at the airports in the surrounding waters, there is a potential negative impact on the ecological and chemical status of surface and groundwater. Protection measures are prescribed for the purpose of mitigating the intensity of this impact.

It is estimated that the implementation of the Strategy shall not significantly reduce the value of the indicator if the protection measures prescribed by the Study shall be respected.

Ecological and chemical status of coastal and transitional waters

Contamination of coastal and transitional water bodies is possible through the implementation of seven out of nine Strategy measures regarding air traffic. The remaining two measures refer to the airports in Zagreb and Osijek that are not located in the Adriatic water area and there is no possibility of their impact on the ecological and chemical status of coastal and transitional waters.

At the seven airports in the Adriatic basin, there is a potential for direct or indirect pollution of water bodies of coastal and transitional waters. Since airports are sources of different types of pollutants that can adversely affect the ecological and chemical status of water bodies, direct impacts are possible at airports located near water bodies of coastal and transitional waters. Possible impacts are possible if the pollutants are transported by surface or underground waters and thus reach coastal and transitional waters. These negative impacts can be alleviated by adhering to the protection measures prescribed for the previous indicator for the purpose of protecting surface and groundwater from pollution from airports.

Given the aforementioned, it has been estimated that the implementation of the Strategy shall not significantly reduce the value of the indicator if it complies with the measures prescribed by the Study.

Water for human consumption

Negative impacts on the quality of water for human consumption are possible at the airports of Zadar and Pula. Zadar Airport is located within the scope of Zone IV of sanitary protection of sources, the limit zone, while the Pula Airport is within the scope of Zone III of sanitary protection of sources, limit and surveillance zone. The strategy plans for the expansion of these two airports, which shall also intensify pressures on the ecological and chemical status of water.

Since any pollution of water within these zones could potentially endanger the quality of water for human consumption, the expansion of airports shall have a negative impact on the reservoirs of water for human consumption. It is estimated that the intensity of this impact shall not be significant if the general measures prescribed for the purpose of protecting the ecological and chemical status of groundwater, which are within these sanitary protection areas, and the Ordinance on Conditions for Determination of Sanitary Protection Areas, are respected.

Since the measures for the protection of water for human consumption are stipulated, apart from the Study and the Ordinance on the Conditions for Determination of the Sanitary Protection Area of the Source, it is estimated that there shall be no significant decrease in the value of the indicator if these protection measures are respected.

7.2.4.6.4 Maritime transport

Ecological and chemical status of surface and groundwater

A negative impact on the ecological and chemical status of surface or chemical groundwater status is not expected. All potential negative impacts shall be related to coastal and transitional waters and are described in a separate indicator below.

Ecological and chemical status of coastal and transitional waters

The implementation of the maritime sector strategy measures shall result in adverse impacts due to an increase in the amount of maritime traffic and the work on expanding the ports.

During the works on the port expansion, interventions shall be carried out in the area where the seacoast and the seabed shall be physically modified, which represent elements of the hydromorphological state of the coastal and transitional waters. Due to the above, the implementation of these measures may have a negative impact on the hydromorphological state of water, and consequently on their ecological status. The mitigating factor is the fact that with all measures of this type aimed at planning to expand the existing ports, i.e. that there are already pressures of this type in these locations, which shall be intensified in this case.

The primary impact on coastal and transitional waters shall result as a consequence of increased maritime traffic due to the implementation of the Strategy measures. The implementation of the measures is expected to increase the number of freight forwarders, including liquid, bulk and container freight, and passenger vessels, cruise ships, and smaller yachts and vessels.

The marine environment is exposed to intense ecological damaging effects from ships of various shapes, the most significant of which are the harmful substances that are discharged from ships. The manner and intensity of the damaging effect depend mainly on the type of vessel. In cargo ships, the risk of pollution depends primarily on the type of freight transported and its aggregate state. Liquid cargo is highly damaging for waters, which, depending on the properties of the liquid and the external conditions (sea temperature, sea condition, sea currents), can endanger a wide area. Passenger ships cause most of the negative impacts by the discharge of wastewater produced by travelers during travel. These are gray and black wastewater that present an ecological and toxic hazard to the surrounding sea.

Apart from the release of harmful substances, the negative impact on water is possible due to the use of biocidal coatings for the purpose of protection against overflow of the hull. The coatings are generally applied while the ship is in the dock, and after drying, they do not represent a more serious environmental problem. However, it is important to note that two of the planned ports (port of Ploče and port of Split) are located within the water bodies of the coastal waters that did not meet the conditions for achieving a good chemical status. The reason for the lack of good condition is the presence of tributyl tin above the permissible limit values. This compound is contained in biocide coatings on ships and the further increase in maritime traffic within this area shall further increase pressures that have caused unsatisfactory chemical status evaluation.

Taking into account the above, the value of this indicator is expected to decrease.

Water for human consumption

Given that the interventions planned by Strategy measures from the maritime transport sector are not within the boundaries of the sanitary protection zone, the impact of these measures on the quality of water for human consumption is not expected, i.e. no change in the value of this indicator is expected.

7.2.4.6.5 Inland waterway transport

Ecological and chemical status of surface and groundwater

The impacts to be generated by the implementation of measures in this sector derive from the project of upgrading and extension of river ports, increasing the concentration of river traffic and the construction of the Danube - Sava multipurpose canal.

The effects of the extension of the river ports are primarily related to the hydromorphological state of the surface waters, since the works shall change the natural appearance of the watercourse basin. The negative influence on the hydromorphological condition shall also affect the ecological state of the surface waters, as it is an integral part of the ecological condition.

Generally, the impact with the highest risk of ships on the surrounding water is caused by harmful substances discharged from ships. The manner of the harmful impact and the intensity of the environmentally harmful effects depend primarily on the type of vessel. Although all ships in a smaller quantity pollute water due to leakage of lubricants and similar substances, dissolving biocide coatings or rejecting waste, the main impacts depend on the type of cargo being transported by ship. Depending on whether the liquid cargo, dry bulk cargo or other types of cargo (including passengers) are transported, the type and intensity of the negative impact depend on the condition of the water bodies. However, given that each ship poses additional pressure on the status of water bodies, it is to be expected that the existing pressures shall intensify by the implementation of measures related to the development of inland waterway transport.

The construction of the Danube - Sava multipurpose canal shall divert a part of the Danube and Sava water, which shall affect the natural water regime of these watercourses, i.e. their water flow dynamics shall be changed. Water flow dynamics form an integral part of the hydromorphological state of surface water and, due to its modification, can lead to significant changes in the habitat conditions, thus making a negative impact on the biological state of surface water. Since the hydromorphological and biological state of the water is an integral part of the ecological water status, the construction of the project shall have a direct negative impact on their ecological status.

Taking into account all the above, it has been estimated that the implementation of the Strategy shall reduce the value of this indicator.

Ecological and chemical status of coastal and transitional waters

All planned Strategy measures aimed at the development of inland waterway transport are located within the Danube river basin, i.e. within the catchment area of the Black Sea. Since the surface and groundwater of this area are not hydrologically related to the coastal and transitional waters of the Republic of Croatia, the impact of these measures on the ecological and chemical status of coastal and transitional waters is not expected or is not expected to change the value of this indicator.

Water for human consumption

Negative impacts on water quality for human consumption, due to the implementation of measures from the inland waterway transport sector, are potentially possible in the case of surface or groundwater contamination.

The direct impact on the water reservoirs for human consumption due to water pollution in the ports is possible in Osijek, near which there are sanitary protection zones of sources. Since at this level of impact assessment there is no precise information on the extent of the interventions for that port, it is not possible to estimate whether the extension of the port shall include the area of the sanitary protection zone and therefore, in the event of any pollution, whether reservoirs of water for human consumption shall be endangered.

Indirect impacts are possible in case of contamination of surface water bodies with pollutants from ships. Pollution of watercourses can potentially contaminate the groundwater that is in contact with them, and in the case of groundwater within the sanitary protection area of the source, it is possible to contaminate water for human consumption.

However, pollutants that are released from surface water in normal working conditions are small quantities, i.e. not concentrations of pollutants that could seriously jeopardize the waterworks, and thus the quality of water for human consumption.

Taking into account the above, the reduction in the value of this indicator is not expected.

7.2.4.7 Cultural and historical heritage

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Endangerment of architectural heritage (certain buildings,	-	✓	✓	×	×	✓	✓	×	×
cultural and historical units) and the cultural landscape	-	✓	✓	×	×	✓	✓	×	×

Legend: + the impact is positive, - the impact is negative, ✓the impact has the feature, x the impact does not have the feature

The presence and proximity of the architectural heritage (individual buildings and cultural and historical monuments, cultural landscapes) and archaeological zones and sites registered in the Register of Cultural Goods of the Republic of Croatia and recorded in the spatial planning documents from the scope of the Strategy.

7.2.4.7.1 Road and rail transport

Measures R.1, R.7, R.8, R.1, R.11, Ro. 2, Ro. 3, Ro. 14 and Ro. 15 have a neutral impact on cultural heritage. With regard to their implementation, they are mostly not near the elements of cultural heritage. As required by the implementation of measures for the protection of possible cultural goods near the works - recording and documenting the existing cultural condition - the impact can be positive.

Measures R.2, R.3, R.5, R.6, Ro.11 and Ro.12 shall have a negligible negative impact on cultural heritage. The impact of the implementation of the Strategy is neutral or negligible if the routes are not close to cultural goods and if there is no evidence of archeological finds or sites on the tracks.

Measures R.4, R.9, Ro.1, Ro.4, Ro.5, Ro.6, Ro.7, Ro.8, Ro.9, Ro.10, Ro.13 and Ro.16 shall have a negligible negative impact on cultural goods due to mitigating effects.

The impact of the project shall be negligently negative for the implementation of mitigation measures in cases where the route passes close to the cultural good by carrying out mitigation measures (implementation of the environmental impact assessment during the planning stage, recording and documenting the existing situation before and during execution).

New paths may have a negative impact on archeological heritage, but by carrying out mitigation measures - archeological site inspection during the planning stage, in case the route passes over a protected or recorded archaeological site, archaeological research and documentation shall be carried out, while archeological surveillance shall be carried out during construction.

Measure R.14 - Adaptation and reconstruction of the main train station in Zagreb shall have a positive impact on the individually protected cultural good, as it shall be further valorized and protected by recording and documenting the existing state.

For the above categories of road and rail traffic, i.e. their impact, there are mitigation measures, so they are evaluated depending on the strength of the influence as neutral, moderately negative and positive. Generally, the Strategy measures are acceptable for cultural and historical heritage with the implementation of mitigation measures.

7.2.4.7.2 Air transport

Measures A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9 have a neutral impact on cultural heritage. With their implementation, they are mostly not in the vicinity of the cultural heritage elements. Where appropriate, the implementation of measures for the protection of any cultural goods in the vicinity may cause the impact to be positive.

Although it is planning at the strategic level, detailed locations of works are mostly known. In accordance with current legislation, planning and practice system, a more detailed selection of final locations and placement of certain interventions is planned in the future stages of Strategy implementation and development. By lowering to the lower levels, more attention shall be paid to impacts on cultural goods and to prescribe the necessary mitigation measures. Therefore, only those mitigation measures and/or recommendations that could be defined at a strategic level are listed here.

There is a possibility of degradation of the spatial and visual integrity of historic buildings, cultural and historical units, and cultural landscapes near the planned interventions. If adequate measures are set at project levels, it is possible to mitigate the negative impact.

There is a risk of damage or destruction of potential archaeological sites. However, if prior archeological reconnaissance and research is carried out, considering the evaluation/valuation of the findings, it is possible to find the find or to adapt to the microposition.

From the aspect of cultural and historical heritage, the greatest impact of the Strategy has been identified in relation to archaeological heritage. Negligible negative impact is expected on historic rural and urban integrity, individual architectural heritage. For all the assessed impacts, mitigation measures are included, which include, analyzing and evaluating the spatial and visual integrity of historic buildings and archaeological reconnaissance of the route and areas of the planned operations.

7.2.4.7.3 Maritime transport

Measures M.8, M.12, M.13 have a neutral impact on cultural heritage. With their implementation, they are mostly not in the vicinity of the cultural heritage elements. Where appropriate, the implementation of measures for the protection of any cultural goods in the vicinity(recording and documenting the existing cultural condition) may cause the impact to be positive.

Measures M.9, M.11 (Split and Šibenik) can potentially have negative impacts on individual buildings and cultural and historical units if they are realized in close proximity. The impacts of the project shall be negligibly negative for the implementation of mitigation measures in cases of possible impact in the vicinity of the cultural good (recording and documenting the existing state before and during the execution).

Measures M.9, M.11 (Split and Šibenik) can have potentially negative impacts as they can lead to potential degradation of submarine archeological heritage. However, by implementing mitigation measures - archeological examination of the terrain at the planning stage, possibly with prior archaeological research and documentation, the impacts may be negligibly negative.

Measure M.10 can have a potentially negative impact on the wider visual environment of the historic whole of Dubrovnik - the monuments of the world heritage, and in particular the physical, spatial and visual integrity of the summer houses (Bunić Kaboga and Stay) and the urban area of the suburbs of Dubrovnik.

There are mitigation measures for the mentioned categories of maritime traffic, i.e. their impacts, and are therefore assessed depending on the strength of the impact as neutral or moderately negative. Generally, the Strategy measures are acceptable for cultural and historical heritage with the implementation of mitigation measures.

7.2.4.7.4 Inland waterway traffic

Measure I.5 has a neutral impact on cultural heritage. With its implementation, it is mostly not in the vicinity of the cultural heritage elements.

Measures I.3, I.4, I.6 and I.7 may have potentially negative impacts on individual buildings and cultural and historical units if they are realized in the immediate vicinity. The effects of the procedure shall be negligibly negative for the implementation of mitigation measures (recording and documenting the existing state before and during the performance).

Measure I.7 shall have an adverse effect on the cultural landscape and landscape. By producing quality project documentation with a horticultural solution, it is possible to reduce the impact.

Measures I.3, I.4, I.6 and I.7 may have potentially negative impacts on archeological heritage, but by means of mitigation measures - archaeological site screening at the planning stage, in case the route passes through a protected or recorded archaeological site, conducting previous archaeological research and documentation, and carrying out archaeological surveillance during the construction.

For the mentioned intervention categories regarding inland waterway traffic, i.e. their impacts, there are mitigation measures, and are therefore considered to be moderately negative. To conclude, the Strategy measures are acceptable for cultural and historical heritage with the implementation of mitigation measures.

7.2.4.8 Agriculture

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Conversion of P1 and/or P2 land	-	✓	×	×	×	✓	✓	×	×
Conversion of agricultural land	-	✓	×	×	×	✓	✓	×	×
Pollution of agricultural land	-	×	✓	×	×	✓	×	×	×

Legend: + the impact is positive, - the impact is negative, ✓the impact has the feature, x the impact does not have the feature

7.2.4.8.1 Railway transport

Areas of P1 and P2 land capability class

Spatial analysis of the existing substrates (digital pedological maps) and spatial measures revealed that the planned railway infrastructure crosses the P1 and P2 land capability class. The diagram below (Figure 7.20) indicates all planned corridors and the impacts mentioned below refer only to those parts of the corridors that have not been built.

Given that this is a line type of intervention, their realization shall result in the conversion and fragmentation of the land. The extent of the change over the total width of the line is not significant, but long-term negative impact on agricultural production is still possible due to the loss of the highest quality agricultural land.

Fragmentation of land is a more significant issue because agricultural areas are already small and their additional fragmentation increases the costs of agricultural production, primarily because of the impracticability of using mechanization on small agricultural parcels. These impacts are most pronounced in measures R.3, R.6, R.9, R.10, R.11 and R.13 from this sector, but if during the development of the project there is conflict with P1 and P2 land capability class, the measures prescribed by the Study shall be followed. This impact was assessed as moderately negative, since most potential conversion of P1 and P2 land capability class occurred in the Pannonian part of Croatia, where there are larger quantities of that land than in the Dinarides.

Given the aforementioned, it is expected that the indicator value shall decrease.

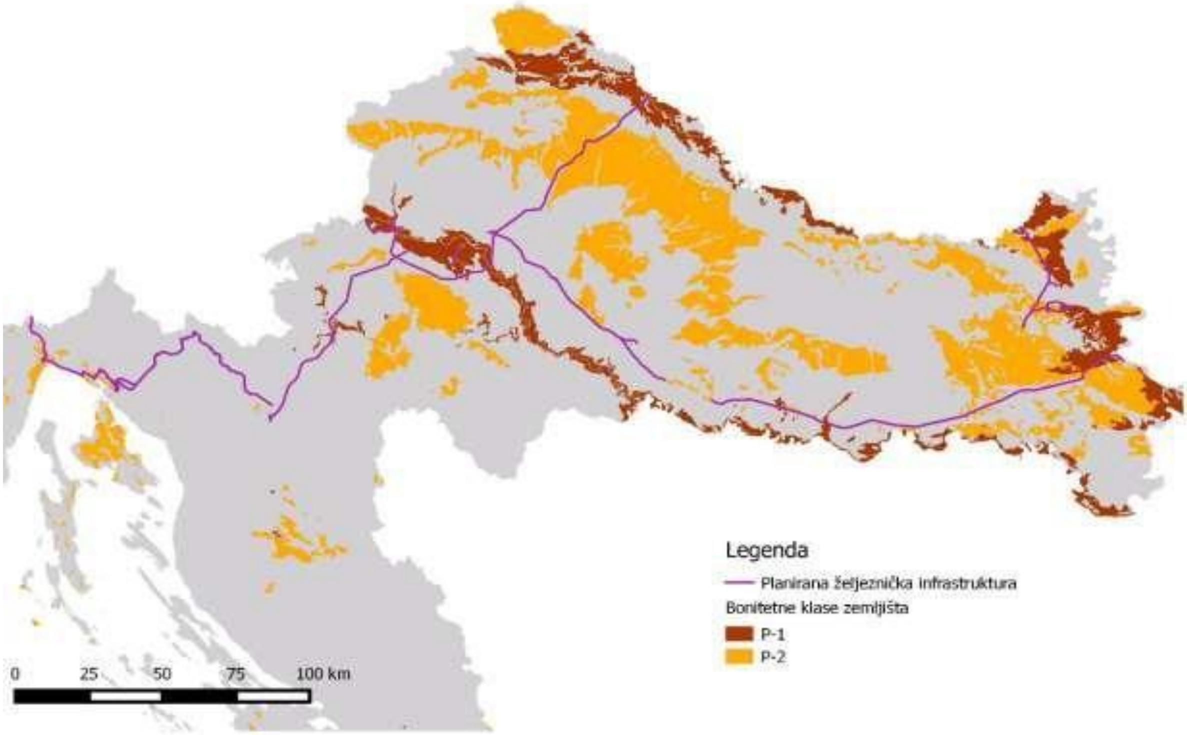


Figure 7.20 Railway infrastructure on P1 and P2 land capability class (Prepared by: IRES EKOLOGIJA d.o.o.)

Agricultural land areas

The spatial analysis of existing substrates (CLC) and spatial measures identified that the planned railway infrastructure crosses agricultural areas dominantly from the category "Pastures", "Mosaic of Agricultural Areas", "Non-Irrigated Arable Land" and "Predominantly Agricultural Land with a Significant Share of Natural Plant Covers", because they are the most widespread. The figure below (Figure 7.21) shows all the planned corridors and the impacts mentioned further in the text refer exclusively to those parts of the corridors that have not been built.

The conversion and fragmentation of land used for agricultural purposes reduces agricultural production both locally and at the level of the Republic of Croatia. It may be expected that these negative effects on agricultural production shall be reflected in the change of the use of agricultural land, in a manner that their use shall increasingly be directed towards the use of these areas for extensive lawns and the abandonment of land use for agricultural purposes in the immediate vicinity of the track. These impacts are expressed in all spatially analyzed measures in this sector. However, given the relatively small conversion of agricultural areas and their availability on the territory of the Republic of Croatia, this impact is assessed as moderately negative.

Given the aforementioned, it is expected that the indicator value shall decrease.

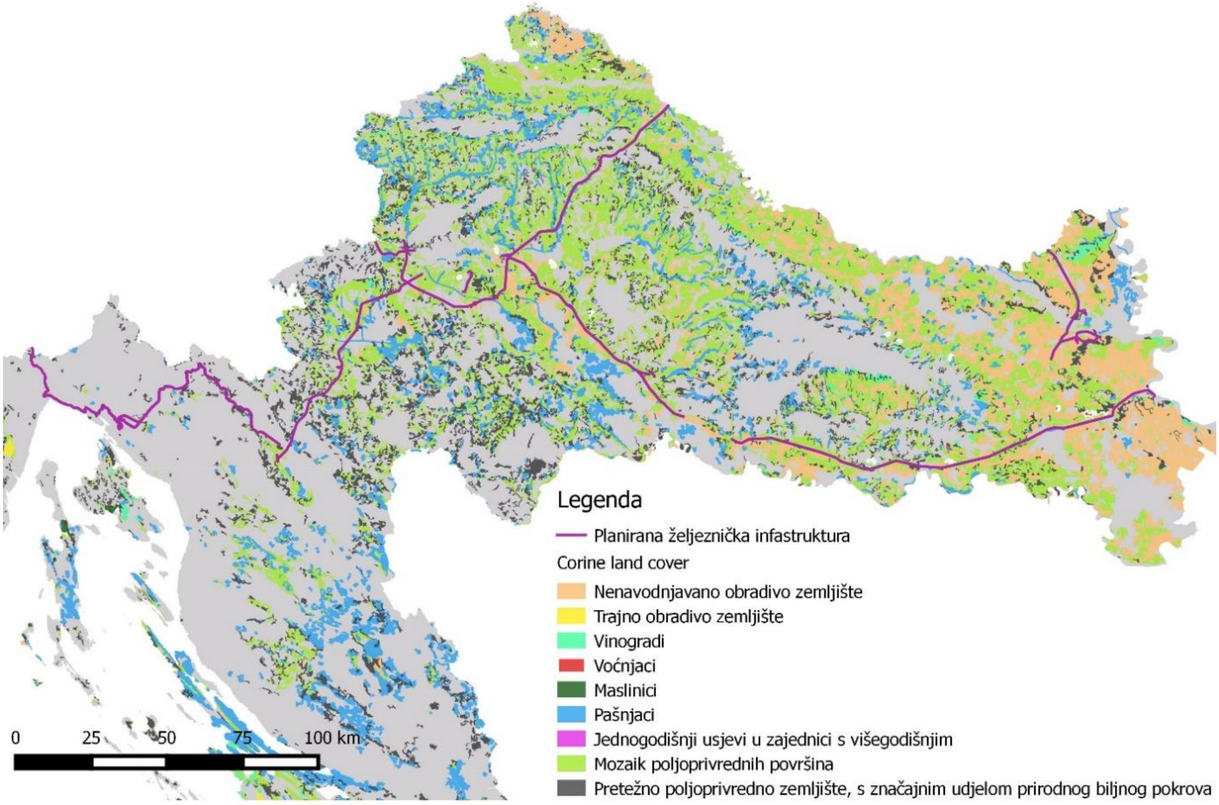


Figure 7.21 Agricultural land according to CLC and planned railway infrastructure (Prepared by: IRES EKOLOGIJA d.o.o.)

7.2.4.8.2 Road transport

Areas of P1 and P2 land capability class

Spatial analysis of the existing substrates (digital pedological maps) and spatial measures revealed that the planned railway infrastructure crosses the P1 and P2 land capability class. The figure below (Figure 7.22) shows all the planned corridors and the impacts mentioned below refer only to those parts of the corridors that have not been built.

Soil contamination along the road itself, which is elaborated in more detail in Chapter II, due to increased traffic indirectly affects agricultural production as it reduces soil quality by increasing the concentration of heavy metals. In addition to the pollution, due to the realization of measures in this sector, the conversion and fragmentation of P1 and P2 soil prudential values would have occurred and these impacts are described in detail in the subsection above. Conflicts of certain measures and the mentioned land are shown in the table (Table 7.8).

Table 7.8 Conflict between the road sector and P1 and P2 land capability class (Prepared by: IRES EKOLOGIJA d.o.o.)

Measure	P1 land capability class	P2 land capability class
Ro. 1	✓	✓
Ro. 2	✓	✓
Ro. 3	✓	✓
Ro. 5	✓	
Ro. 7	✓	✓
Ro. 8	✓	
Ro. 9	✓	✓
Ro. 10		✓
Ro. 14		✓

Given their total small representation, P1 and P2 land value prudential value in the Dinarid area is required to be fully protected, since they are significant for agricultural production of that part of Croatia. Taking into account the above, for the determined conflicts of measures in this sector and P1 and P2 of the prudential value of land in the Dinarid area, the impact is assessed as significantly negative, whereas for the same conflict in Pannonian Croatia the impact is assessed as moderately negative.

Given the aforementioned, it is expected that the indicator value shall decrease.

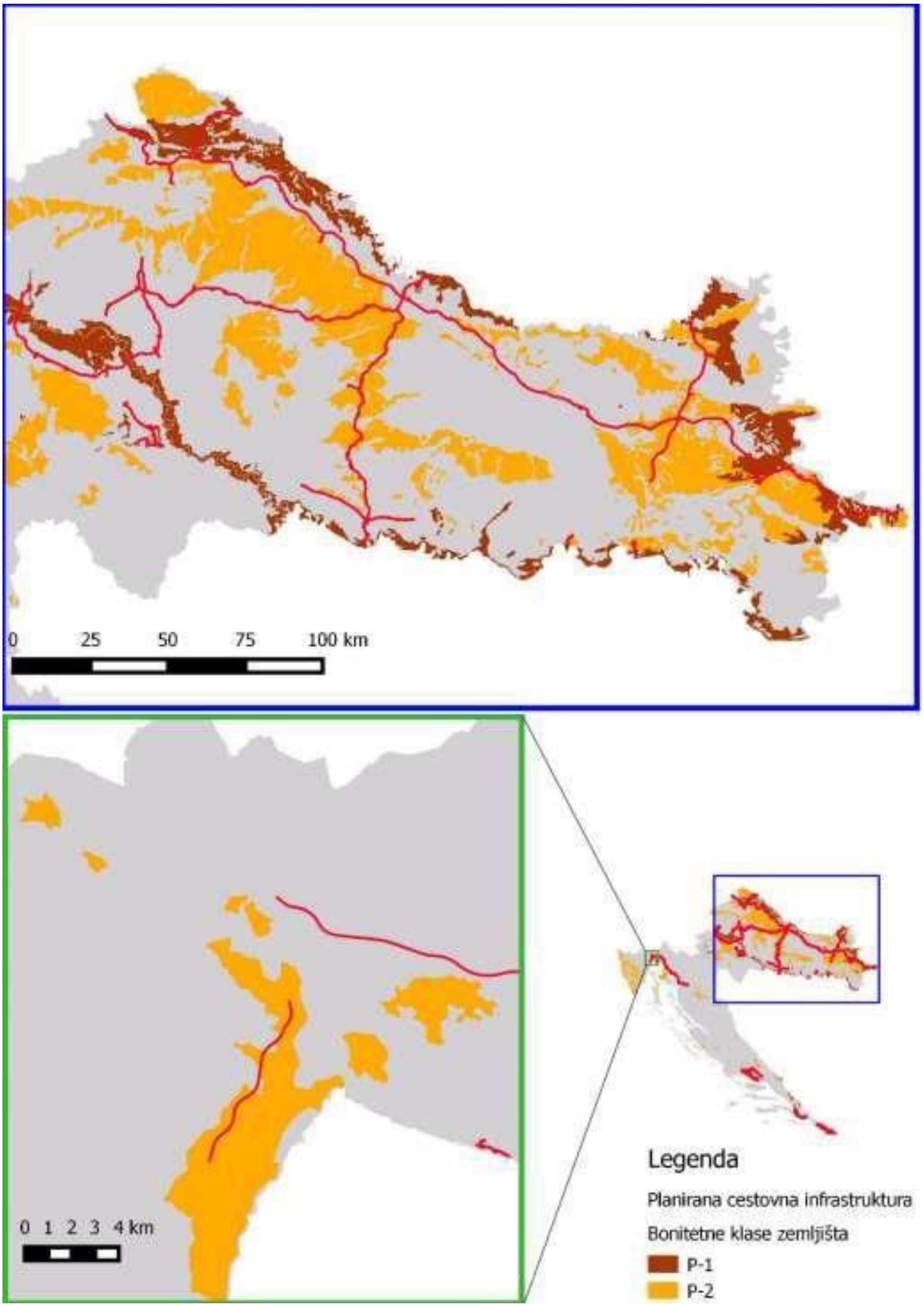


Figure 7.22 Road infrastructure on P1 and P2 land capability class (Prepared by: IRES EKOLOGIJA d.o.o.)

Agricultural land areas

Spatial analysis of the existing substrates (CLC) and spatial measures revealed that the planned road infrastructure crosses the same categories of agricultural areas as the railway infrastructure. The diagram below (7.23) indicates all the planned corridors and the impacts mentioned below refer only to those parts of the corridors that have not been built.

The effects of transformation and fragmentation are described in more detail in the subsection Rail Traffic. With the conversion and fragmentation of agricultural areas through the use of roads, soil contamination increases, which negatively affects agricultural production near the roads. The described impacts relate to all spatially analyzed measures from this sector.

Given the relatively small conversion of agricultural areas and its availability on the territory of the Republic of Croatia, this impact is assessed as moderately negative.

Given the aforementioned, it is expected that the indicator value shall decrease.

Agricultural land areas

Spatial analysis of the existing substrates (digital pedological maps) and spatial measures revealed that by implementing Measure A.7, it is possible to convert land from the category "Agricultural Area Mosaic" (Figure 7.24). By inspecting the ortophoto footage, it has confirmed that agricultural land has been found on these areas. The abandonment of agricultural land reduces the agricultural production potential at the local level, but at the level of the Republic of Croatia it can not be said to have a negative impact with regard to the potentially minor conversion of the areas. Consequently, this impact is assessed as neutral.

For other planned ports, for which at the time of the Study we did not have the limits of potential expansion, the constraints in the estimation are the same as in the previous indicator and the measures prescribed by the Study shall be respected when implementing the measures.

Given the aforementioned, the indicator value is not expected to change.

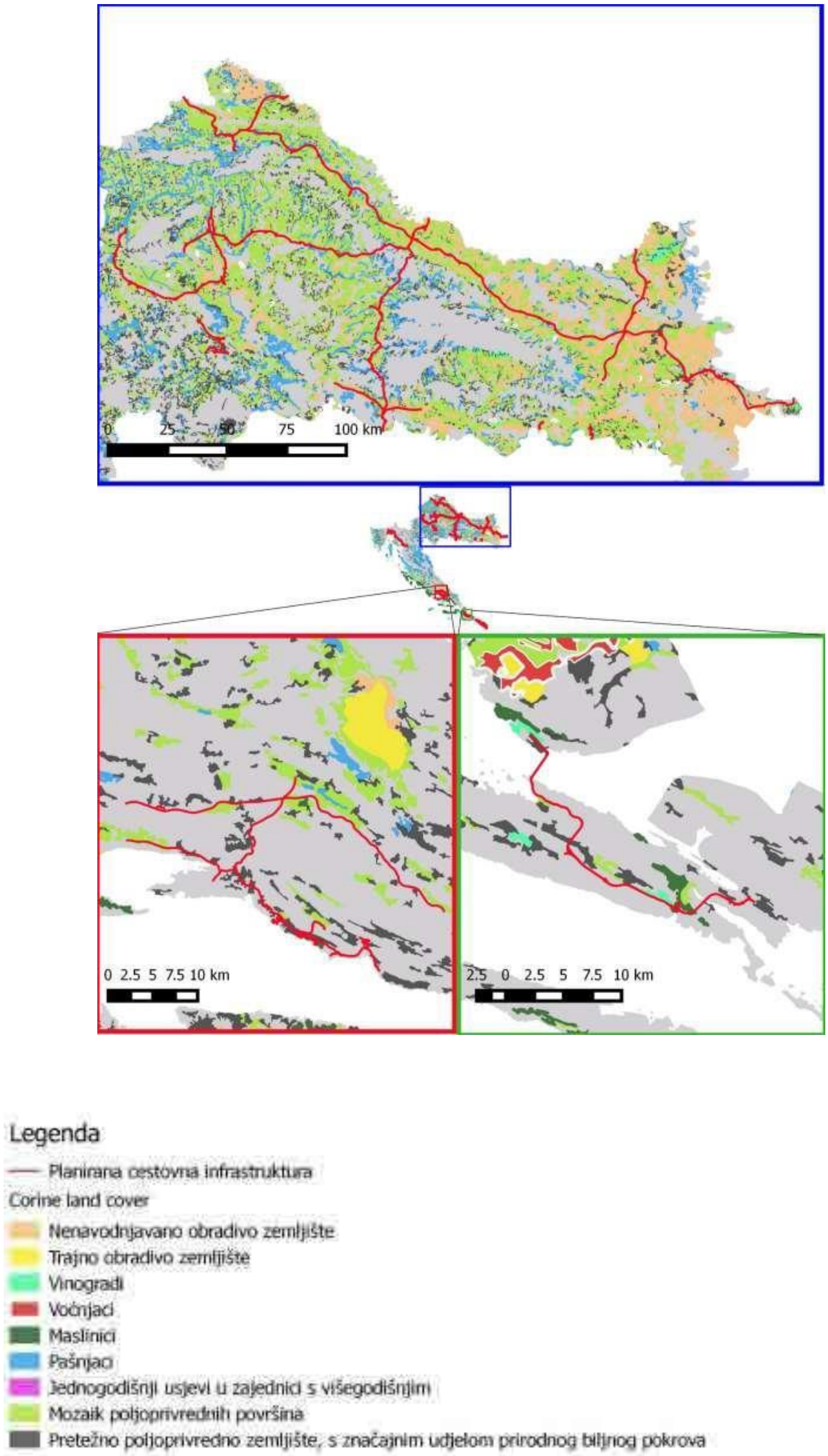


Figure 7.23 Agricultural land according to the CLC database and planned road infrastructure (Prepared by: IRES EKOLOGIJA d.o.o.)

7.2.4.8.3 Air transport

Areas of P1 and P2 land capability class

Spatial analysis of the existing substrates (digital pedological maps) and spatial measures revealed that Pula Airport is located on the P2 land capability class. However, the P2 land capability class at the airport location has already been converted for the needs of the airport, so there is no additional land conversion. Since Measure A.2 provides for the improvement of the quality of the service and the increase of the balance between security and operational capacity, no additional conversion of P1 and P2 land capability class is expected if the measure does not go beyond the current borders of the Pula Airport. Consequently, this impact is assessed as neutral.

At the locations of other spatial airports no conflict with P1 and P2 land capability class was found. At the locations of other ports, for which at the time of the Study we did not have the limits of potential expansion, it is not possible to determine potential conflicts with the P1 and P2 land capability class and the measures prescribed by the Study shall be respected during the implementation of the measures.

Given the aforementioned, the indicator value is not expected to change.

Agricultural land areas

Spatial analysis of the existing substrates (CLC) and spatial interventions revealed that by implementing Measure A.7, it is possible to convert land from the category "Agricultural Area Mosaic" (Figure 7.24). Inspecting the ortophoto footage, it is confirmed that agricultural land has been found on these areas. The abandonment of agricultural land reduces the agricultural production potential at the local level, but at the level of the Republic of Croatia, it can not be said to have a negative impact with regard to the potential minor area conversion. Consequently, this impact is assessed as neutral.

For other planned ports, for which at the time of the Study we did not have the limits of potential expansion, the limits in the assessment are the same as in the previous indicator and the measures prescribed by the Study shall be respected when implementing the measures.

Given the aforementioned, the indicator value is not expected to change.

Figure 7.24 Agricultural land according to CLC at the location of Split Airport (Prepared by: IRES EKOLOGIJA d.o.o.)

7.2.4.8.4 Maritime transport

Areas of P1 and P2 land capability class

Agricultural land areas

Since measures in the maritime transport sector provide for the specialization of individual ports for the acceptance of different types of cargo, the modernization and reconstruction of terminals and docks, as well as directing the ports for the reception of ships on round trips, and since the port boundaries are not expected to be expanded, conversion of agricultural land is not expected. Consequently, the impact of measures in the maritime transport sector is assessed as neutral and no change in the indicator values is expected.

7.2.4.8.5 Inland waterway transport

Areas of P1 and P2 land capability class

Spatial analysis of the existing substrates (digital pedological maps) and spatial measures revealed that the location of the planned port of Sisak (I.6) and the port of Slavonski Brod (I.5) is P1 land capability class, i.e. P1 and P2 agricultural land capability class (Figure 7.25). With its conversion, we can expect the need for greater investments in agricultural production in order to maintain the same profits, that is, a smaller profit with equal investments. However, given the small area that would be converted and considering the amount of P1 and P2 land capability class in the vicinity of the planned project, this impact is estimated to be moderately negative.

The realization of measure I.7 would result in the conversion of P1 and P2 land capability class. Given that this is a line object, there shall be fragmentation of agricultural land. The effects of fragmentation and conversion of P1 and P2 land capability class are described in more detail in the subsection Rail Traffic. Given the relatively small potential conversion of agricultural areas and their availability on the territory of the Republic of Croatia, this impact is assessed as moderately negative. However, the implementation of this measure plans for the irrigation of agricultural land, which has a positive impact on agricultural production at the local level and, if it includes larger areas, at the regional and national level, so that the implementation of this measure can have a positive impact.

Given the aforementioned, it is expected that the indicator value shall decrease.

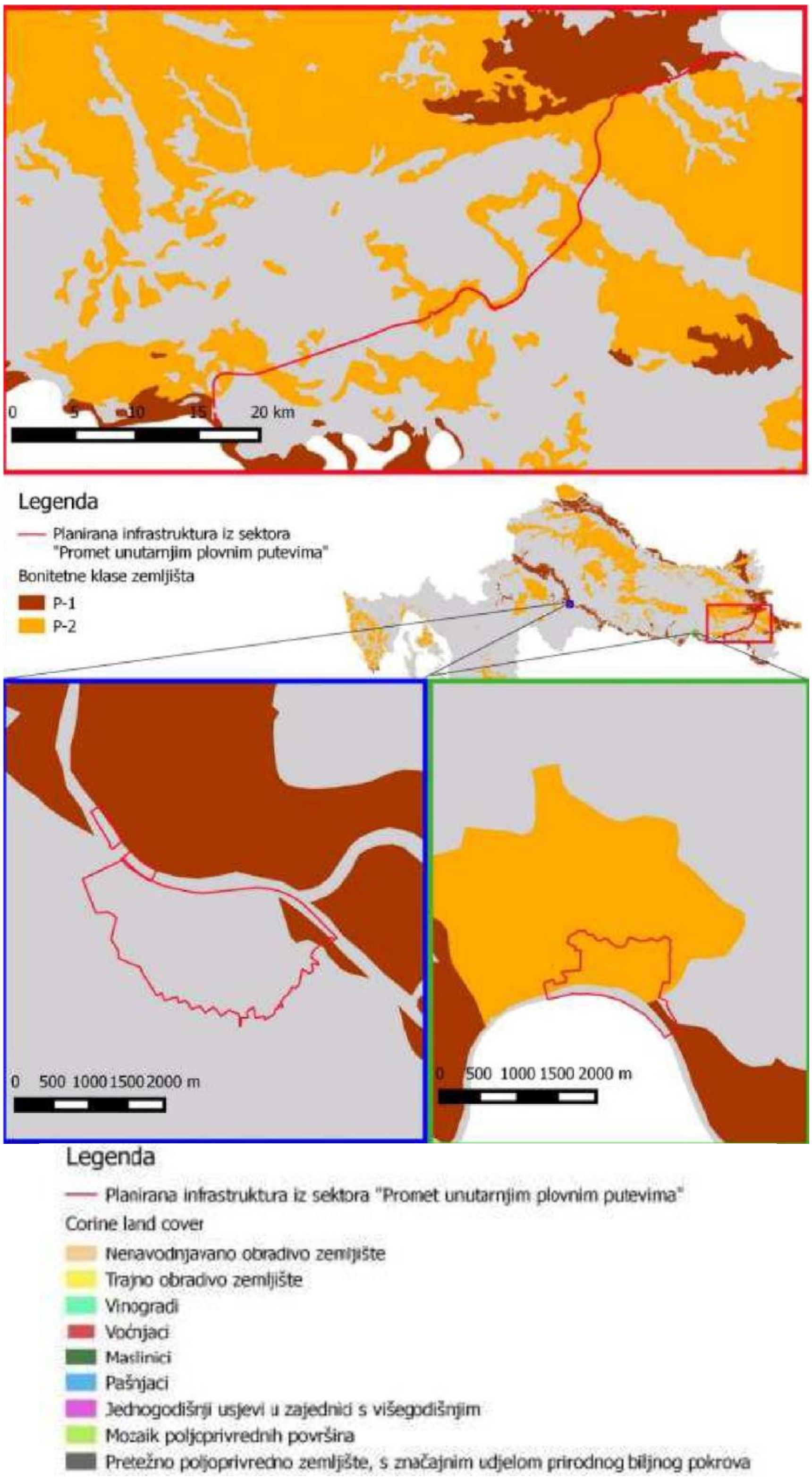


Figure 7.25 P1 and P2 land capability class and planned interventions from the sector Inland Waterway Transport (Prepared by: IRES EKOLOGIJA d.o.o.)

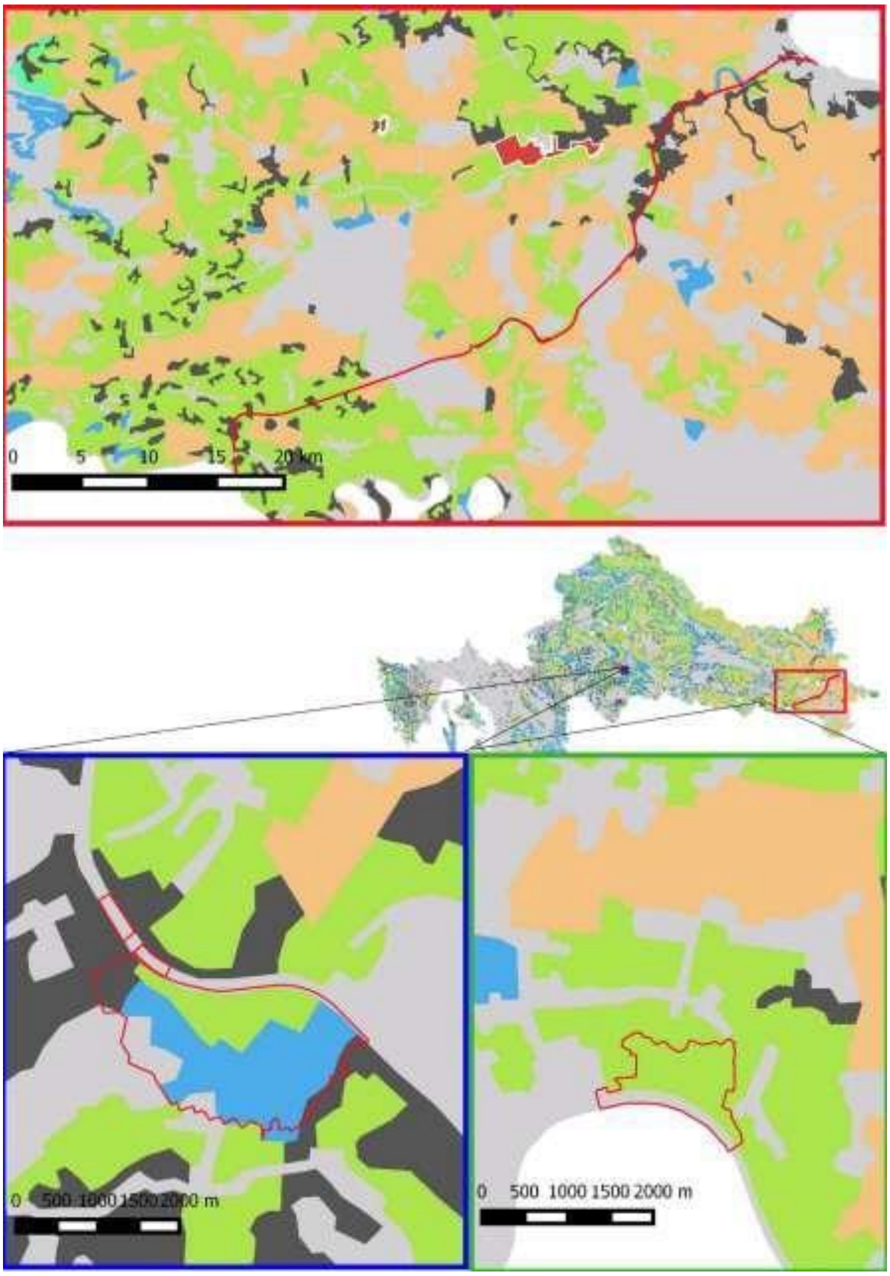
Since other measures in this sector did not have the exact limits of the planned interventions during the Study, it is not possible to assess their impact on the P1 and P2 land capability class and the implementation of the Strategy shall be respected in the implementation of the measures prescribed by the Study.

Agricultural land areas

Spatial analysis of the existing substrates (CLC) and spatial measures revealed that on the location of the planned measures there is agricultural land from the category "Pastures", "Agricultural Area Mosaic", "Non-irrigated Arable Land" and "Predominantly Agricultural Land with a Significant Share of Natural Plant Cover "(Figure 7.26). By converting these areas, and especially the surface of the "Agricultural Area Mosaic" category, where the most intensive agricultural production takes place would cause a reduction in the agricultural production potential at the local level, as these areas could not be used for agricultural purposes. However, given the presence of these areas in the immediate vicinity and the surrounding area, no significant negative impact on this element of the environment is expected, both locally and at the level of the Republic of Croatia. Consequently, this impact is assessed as moderately negative.

As noted in the previous indicator, for other measures in this sector, during the study we did not have the exact limits of the planned coverage of the implementation of the measure. For this reason, it is not possible to estimate their impact on the agricultural land area and during the implementation of the Strategy, it is necessary to respect the measures prescribed by the Study.

Given the aforementioned, it is expected that the indicator value shall decrease.



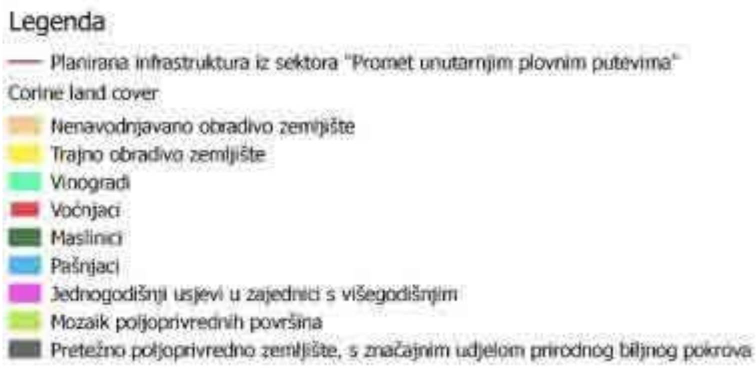


Figure 7.26 Agricultural land according to CLC at the location of port of Sisak (Prepared by: IRES EKOLOGIJA d.o.o.)

Cumulative impacts

Cumulative impacts are possible due to the transformation and fragmentation of P1 and P2 land capability class, i.e. all agricultural land due to the realization of the measures that generate the previously described negative impacts on agriculture. They are most prominent in measures in the road and rail sector, which may have the most significant negative impacts.

7.2.4.9 Forestry

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Loss of forest areas	-	✓	×	×	×	✓	×	×	×
Forest fragmentation	-	✓	×	×	×	✓	×	×	×
Change in the water regime	-	×	✓	×	×	✓	✓	×	×
Loss of growing stock	-	✓	×	×	×	✓	×	×	×
Reduction of the stability of the forest ecosystem	-	×	✓	×	×	✓	✓	×	×
Reduction of the potential allowable cut	-	✓	×	×	×	✓	×	×	×
Decrease in the quality of growing stock	-	×	✓	×	×	✓	×	×	×
Loss of beneficial forest functions	-	✓	✓	×	×	✓	×	×	×
Increased risk of forest fires	-	×	✓	×	×	✓	×	×	×

Legend: + the impact is positive, - the impact is negative, ✓the impact has the feature, x the impact does not have the feature

The impacts that shall be generated by the measures implemented by the Strategy shall be discussed further in the text. The impacts shall be assessed based on four indicators: forest area, forest ecosystem stability, wood reserves and forest ecosystem services. Described are impacts relating only to unconstructed corridors, i.e. the construction of new elements in space. Given the complexity of the impact, this chapter is conceived according to the indicators (as in subchapter 7.2.4.5 Nature) so that each indicator indicates the sectors and how they influence it.

7.2.4.9.1 Forest area

The impacts on forests and forestry are primarily due to the permanent loss of forest area by the direct occupation of forest and productive areas, thus forest and forest land are permanently separated from the forest management area. In addition to the permanent loss of forest areas, forest fragmentation also occurs, leading to further negative impacts on the forest ecosystem (described in the next indicator). The measures that shall generate the most pronounced impacts on forest surfaces are listed in the table below (Table 7.9).

Table 7.9 List of measures which are in conflict with the forest area (Prepared by: IRES EKOLOGIJA d.o.o.)

Traffic mode	Railway transport	Road traffic	Air traffic	Inland waterway traffic
Measure	R3, R4 and R11	Ro.1, Ro.4, Ro.5, Ro.7, Ro.8, Ro.9, Ro.15, Ro.16	A1, A2, A3, A4, A8	I.6, I.7

These measures shall result in the loss of forest areas of different sizes covering the forest communities in the continental and Mediterranean part of Croatia. For the construction of line elements such as railway and road traffic and the Danube – Sava multipurpose canal, it shall be necessary to cut the forest vegetation that is on the planned tracks. Such line elements in the space do not occupy large areas with their volume, so their negative impact is less pronounced. The implementation of measure I.6 is in conflict with the forest area, and by considering the situation in the field, it is evident that only a small area of the forest area shall be lost. For measures involving the expansion of airports, negative impacts may occur if they are planned in the forest area. The impact on this indicator is estimated to be moderately negative as no direct crossing of larger forest areas would occur. In the area of other measures there are no larger forest areas that shall be lost and their impact shall not be felt.

As one of the environmental problems of forestry, the forest area at the level of Croatia has decreased over the years, i.e. the presence of the trend of converting forestland for other purposes, and with the Strategy implementation, this trend shall continue, which shall reduce the indicator value.

7.2.4.9.2 Forest ecosystem stability

The implementation of the line deforestation for the construction of roads and railways shall lead to the direct interruption of forest areas, which shall fragment larger segments of the forest into smaller segments. Fragmentation of forest areas leads to the opening of new forest edges, changing the microclimate habitat conditions (higher insolation, reduced humidity) in that part of the forest stands, which results in a slower life cycle and drying of the trees over a certain period. Depending on the conservation and species of forest communities through which routes pass, different degrees of influence shall be generated.

The route of the railway track covering the area south of Karlovac towards Josipdol (R3) crosses the area of sessile oak and common hornbeam. On the majority of the route, there are large areas of sessile oak and common hornbeam forests, which have been reclaimed and turned into different types of anthropogenic vegetation, and only in the smaller part there are complete forest complexes. Furthermore, sessile oak and common hornbeam forests are not sensitive and are relatively stable in Croatia, therefore the negative impacts shall be of lower intensity. The R4 track route runs through the beech and silver fir forests and silver fir forests. Silver fir according to the degree of crowning defoliation represents the most endangered species of forests in Croatia. Although the creation of a new forest edge in that part of the stands shall cause a certain degree of damage to the stability of the forests, the overall stability of the forests shall not be significantly affected, given that these forests are much more endangered by air, water, and soil pollution. The Ro.9 road route passes through a very small part of the forest areas, whereas the Ro.15, Ro.16 road routes mostly cut off the degraded forest forms of evergreen oak and downy oak forests (macquis and coppice). Ro.4 road route passes mostly through degraded forms of downy oak forests, and to a lesser extent through unendangered forest areas of common beech. Although part of the Ro.1 and Ro.7 measures are planned through the lowland forests, their routes only partially pass through endangered forest areas and largely go through unendangered forest areas, such as beech and sessile oak and hornbeam forests. Given all the mentioned, the implementation of these measures shall have a moderately negative impact on the forests in the Republic of Croatia.

Measures R11, Ro.8 and I.7 (Figure 7.27) shall have the most pronounced impact on the forests of the lowland part of Croatia, given that in the lowland ecosystems the greatest changes have been determined in natural biological and ecological balance compared to other forest ecosystems. Especially endangered are pedunculate oak forests that are under heavy strain of debris and dehydration, contributing to changes in the habitat conditions combined with certain other stress factors. This issue represents the most significant problem of forestry in Croatia, so it is very important to protect these economically and ecologically valuable forest complexes.

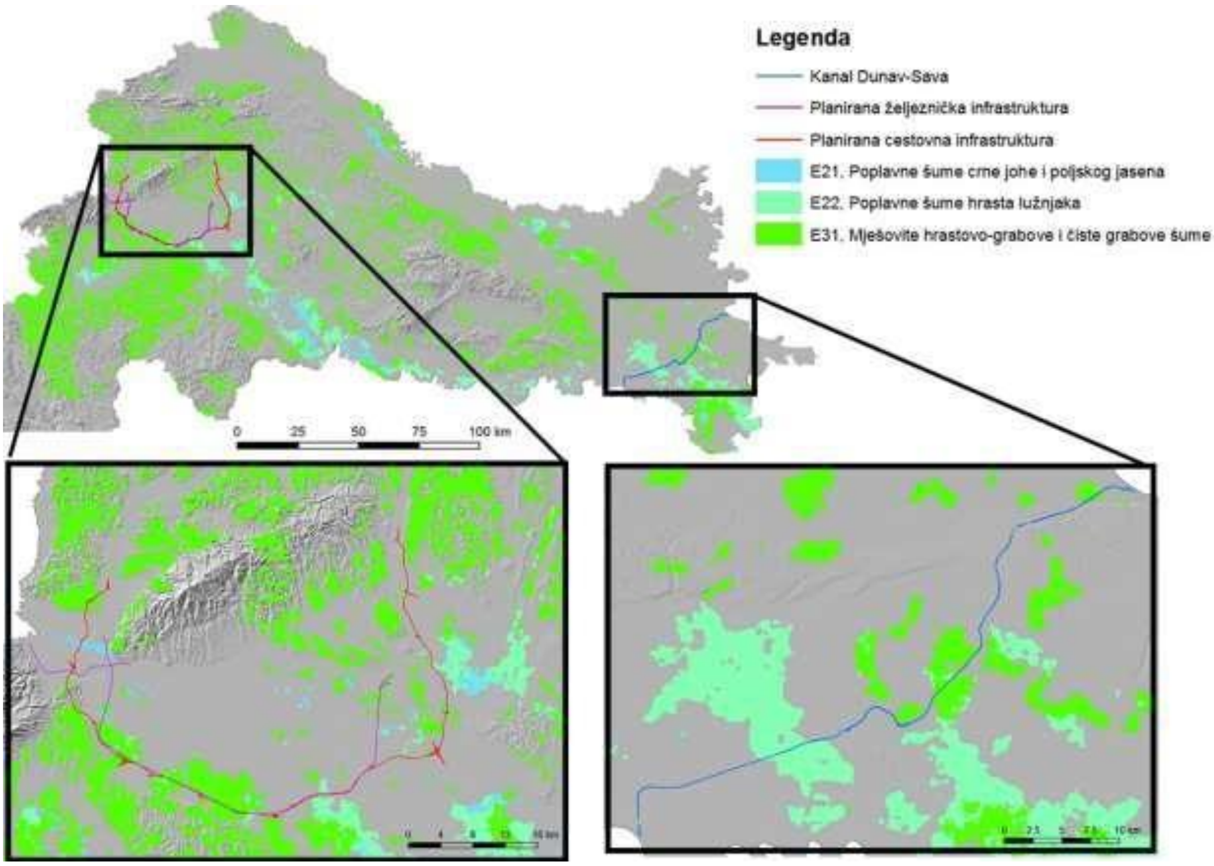


Figure 7.27 Representation of R11, Ro.8. and I.7 measures and their spatial distribution in relation to the lowland forest ecosystems they may impact (Prepared by: IRES EKOLOGIJA d.o.o.)

The manner in which road construction affects the health status of trees, more specifically pedunculate oak, shall be indicated by the following research. Tikvić et al. (2009) evaluated the condition of pedunculate oak tree trees along the Županja - Lipovac road in the length of 16 km and 10-30 m from the road during 2002 and 2003. An estimation of the percentage of crown defoliation on a sample of 100 pedunculate oak tree trees compared to local reference trees was made. The crown defoliation data were classified into the following degrees of defoliation: 0 to 10% defoliation, 1 – from 11 to 25%, 2a - from 26% to 40%, 2b - from 41% to 60%, 3a - from 61% to 80% , 3b - from 81 to 99% and 4 - 100% defoliation. In the figure below (Figure 7.28), presents an overview of pedunculate oak tree trees with varying degrees of crown defoliation.

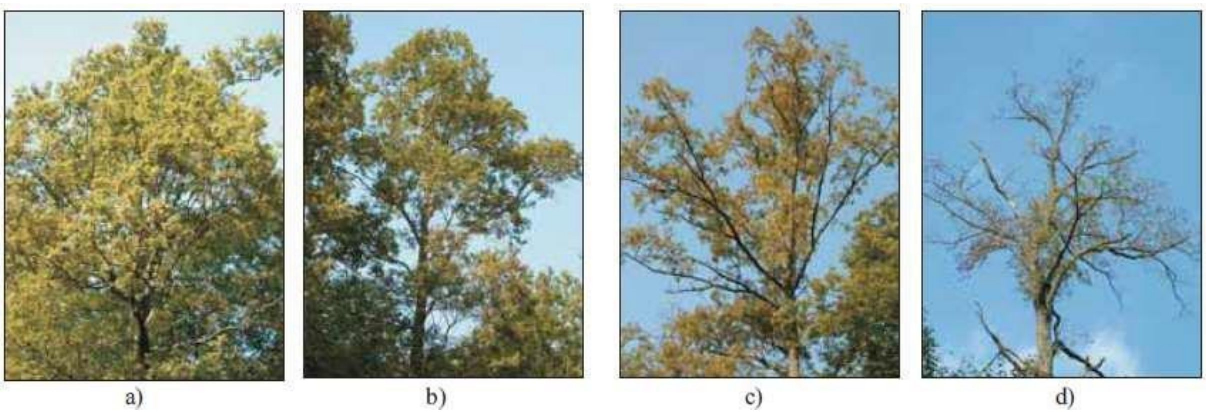
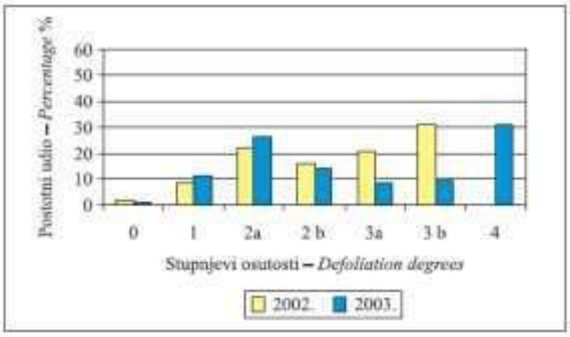


Figure 7.28 Pedunculate oak (a and b) trees and large degrees of crown defoliation (c and d) (Source: Tikvić et al., 2009)

The average crown defoliation of trees growing along the Županja - Lipovac road in 2002 was 53%, and in 2003 60%, indicating the reduced vitality of these trees and a worsening of the situation in only one year. In 2002, large crown defoliation of the growth of oak tree trees was found in 52% of trees, and there were no dead trees. In 2003, the percentage of significant crown defoliation of pedunculate oak trees was 17% and dead trees 31% (Figure 7.29), which is an indicator of significant instability of these forest ecosystems.



Significant defoliation and reduced tree vitality along the road indicates extremely unfavourable conditions for the growth of forest trees. Trees with a high degree of defoliation have died out intensively in a very short period of time, while in the more vital trees the process of dying is slower.

Figure 7.29 Percentage share of pedunculate oak tree trees according to the degrees of crown defoliation (Source: Tikvić et al., 2009)

It can be concluded that the construction of roads leads to the creation of new forest edges, i.e. the edge effect, which along the entire line of the route reduces tree vitality (higher defoliation), affecting the reduction of the stability of the forest ecosystem. The implementation of measures R11 and Ro.8 shall generate a significant negative impact, given that part of the route of these roads passes through a lowland forest ecosystem, and includes endangered areas of pedunculate oak trees. Due to the cumulative effect, the impact shall be most pronounced by the implementation of measures R11 and Ro.8 whose tracks jointly cross the valuable flood areas of pedunculate oak in the area of the Economic Units (EU) Obreški lug and Šiljakovačka dubrava II. According to Tustonjić et al. (1999), those Cus contain a valuable complex of lowland pedunculate oak forests that represent the most sensitive forest ecosystems that respond by drying to a whole range of changes in the area of their distribution. The Sava river regulation has already caused major changes that have led to the decay of forest vegetation and habitats, the flow of river and the area of flooding has changed, and the possibility of damage due to wind and other disasters is open. Furthermore, the authors point out that for each operation in these forests, especially for the construction of roads, canals and so on, they seek ecological solutions to prevent the drying of forest trees in large groups.

As mentioned earlier, the passage of the route of the road would lead to greater crown defoliation in trees, the weakening of tree vitality throughout the corridor line, and in the already endangered lowland area, this operation would have additional negative impacts. Since in this area of pedunculate oak forests there is a significant degree of degradation and dehumidification, it is very important to preserve such forest ecosystems in order to reduce this negative trend. These forest areas are already under pressure from fragmentation with the previous line deforestation and changes in the water regime, and further fragmentation would certainly further adversely affect this valuable forest complex. Therefore, the measures prescribed by the Study shall be respected when implementing these measures, in order to reduce the negative impact to an acceptable level.

Compared to the construction of road and rail traffic, a much greater impact on the stability of the lowland forest ecosystem would have the construction of the Danube - Sava multipurpose canal. By the implementation of this measure, a direct interruption of the lowland floodplain forest of oak in the area of Spačva basin would occur. Spačva is the largest forest of oak-tree oak in Croatia, and in Spačva it is the fifth of all bulbous forests in Croatia. The total surface area in Croatia is 39 789 ha, but the spreading spa pool extends also in the part of Vojvodina Srijem and has a total area of 51 592.92 hectares.

For the development of lowland forest ecosystems, both surface and groundwater are very important. Floods and groundwater dependent on microrelief affect the emergence and development of forest communities. Changes in the microflow associated with floods and groundwater level cause changes in the type of soil, flora and fauna of other communities, and regulation may have significant negative consequences. Various water management interventions in the forested areas of river valleys Sava, Drava and Danube have so far caused changes in water relations and habitats of lowland forests, as well as physiological weakening and drying of forest trees, and especially oak trees. Examples in the area of Croatia include drying in picking forests near Karlovac (Kupa - Cup and Motorway Zagreb - Karlovac), Turopoljska lugu and Kalje forest (Sava - Odransko polje), in spačná šuma (construction of a protective embankment along the river Sava) In the Posavina forests between Sunja and Croatia

Dubica (melioration of the Bosnia Dubica ravine), in floodplain forests along the hydroelectric power stations of Varaždin, Čakovec and Dubrava and in almost all parts of the lowland forests in Croatia, only slightly smaller.

In Croatia, in 1932, the first defensive embankment was built on the left bank of Sava, south of Spačva basin. This operation has caused changes in the habitats of spawning forests, leading to the drying of oak tree trees, and the consequences are still present. By constructing the waterway through these habitats there would be significant changes in hydrological conditions. Through their construction, they divide and open water bodies of groundwater, and depending on the water supply and the flow of the canals in space, before or after the interchanges, the groundwater level changes. Spačva's forests and other forests near the canals (forests north of Spačva to the Danube and forests of the upper Bosut) could be seriously compromised due to landslide deep in the field and interruption of groundwater flows. The young juniper tree trees can be adjusted to changes in groundwater levels, while older stands over 40 have no ability to do so. Considering that in Spačva basin there are predominant old and old habitat trees, i.e. trees that are very susceptible to a permanent decline in groundwater levels, the construction of the canal would significantly endanger the survival of these forests. Also, Kalifadžić et al., (1993) found on the basis of aerial photographs a great damage to the trees in the area of Spačva, along the artificial line objects in the forests (public roads, dried bars and dugout canals). The above indicates the correlation between the degree of damage to trees and artificial line objects in the forests.

Forestry science and the profession are unified in their dissatisfaction with the Danube - Sava canal. There is a reasonable concern about the possible ecological catastrophe due to the construction of this canal. According to Jurjević (2007), who shares the view of the forestry profession regarding the Danube - Sava canal, the decision on the impact of the Danube - Sava canal on the forests can not be adopted before 2020. In 1988, the first piezometers were set up in the Spačva forests, and the first reliable results of these researches are expected around 2020. In order to obtain reliable information on the impact of the canal on the forests of Upper Bosut and Spačva forest, it is necessary to conduct long-term monitoring of the groundwater levels in these forest areas and in the space between the route of the planned canal and the Spačva forest. Compared to the 1932 waterworks intervention, the construction of the Danube - Sava canal would cause several times more changes in the sparsely populated forests, and the consequences of its implementation on the forests of eastern Slavonia can be assumed. The construction of the Danube - Sava canal can have a significant negative impact on the forest ecosystem of the lowland forests of Croatia.

Given the aforementioned, it is expected that the indicator values shall decrease as a result of implementing the Strategy.

7.2.4.9.3 Wood stock

Impact on the quantity and quality of wood stock would be most prominent in the implementation of measures planned to be implemented in the area of continental and mountainous forests in Croatia. Measures whose implementation is planned in the coastal and Dalmatian part of Croatia shall have a negative impact on the wood stock, as they are mostly located in oak and elm oak and chicory forests, the primary role of which is not the production of wood stock but the general function.

By damaging the forests, there would be a direct loss of wood stock, a reduction in the potential for harvesting and a decline in the quality of wood. As mentioned earlier, the construction of roads through forest areas increases the shrinkage of tree sprouting, resulting in reduced vitality and tree decompression. Tikvić et al., (2009) analyzed the structure and utilization of wood volume on 60 oak trees with varying degrees of crown defoliation in the area of Zupanja, Otok and Vrbanja forests.

Of the total wood volume, in the defoliation degree 1 and 2 (low and medium defoliation), there were 20% of veneer logs and in the defoliation degree 3 and 4 (high defoliation) 19% of veneer logs. Similar values were found for class I logs and for spatial wood. The share of technical assortments of the lower classes was higher in higher degrees of crowning. The share of logs II in grades 1 and 2 was 11%, and in the degree of ossification 3 and 4 16%. The share of the III class saw in grades 1 and 2 was 15% and in the degree of ossification 3 and 4 19%. The outbreak was more in the degree of condensation 3 and 4 (30%), and slightly less in the stiffness 1 and 2 (27%) (Figure 7.30).

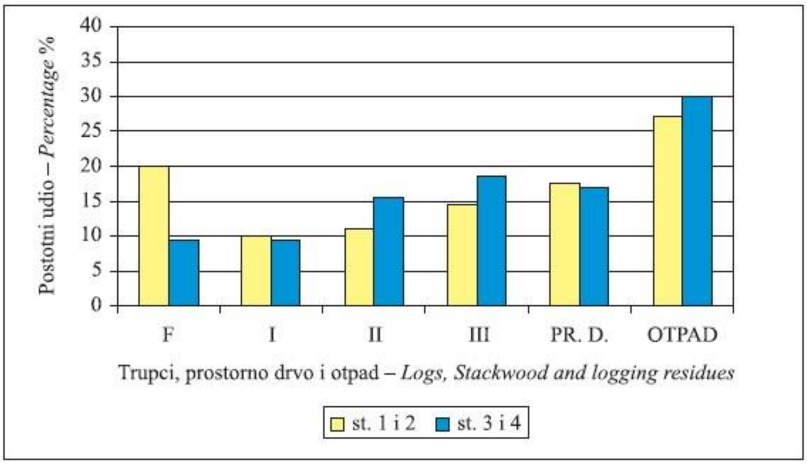


Figure 7.30 Percentage share of veneer and sawn timber for greater or less defoliation in the total technical roundwood (Source: Tikvić et al., 2009)

Thus, it can be noticed that the share of the most valuable assortment is higher for trees with a lower degree of defoliation (1 and 2), while the percentage share of lower grade logs and waste is higher in trees with higher crown defoliation and dead trees. This is indicated by crown defoliation, that is, their vitality in correlation with the quality of wood. Rail (R3, R4 and R11) and road traffic (Ro1, Ro4, Ro7, Ro8) measures shall cause a direct loss of wood stock, thus reducing the potential for cutting. Furthermore, the quality of wood in the entire zone of the edge effect shall be reduced in the area of new forest edges. Given the large quantities of wood supplies available to the Economic Units that contain the routes of the aforementioned measures, they shall have a moderately negative impact. However, a much more significant impact on wood stock can be expected by building the Danube - Sava canal. Since the construction of the canal can lead to the drying of lowland forests of eastern Slavonia, where the highest quality and the most valuable timber reserves are of paramount importance for the Republic of Croatia, its significant negative impact can not be ruled out.

Given the aforementioned, it is expected that the indicator value shall decrease.

7.2.4.9.4 Forest ecosystem services

All measures implemented in the forest area, which are reminiscent of and fragmented by forest areas, lead to a reduction in the general forest functions. The influence shall be most pronounced in the coastal or Mediterranean part of Croatia, where the general forest functions represent the primary function and the construction of the Danube - Sava canal, given the possible impact on the general functions of the lowland forests of eastern Croatia.

Roads Ro.4, Ro.15, Ro.16 are mostly interrupted by degraded forest forms of oak and oak forests of oak (mackerel and chicory). By the degree of fire endangerment, these forest areas are the most popular for forest fires (Figure 7.31). Construction of road traffic in these areas may increase the risk of forest fires.

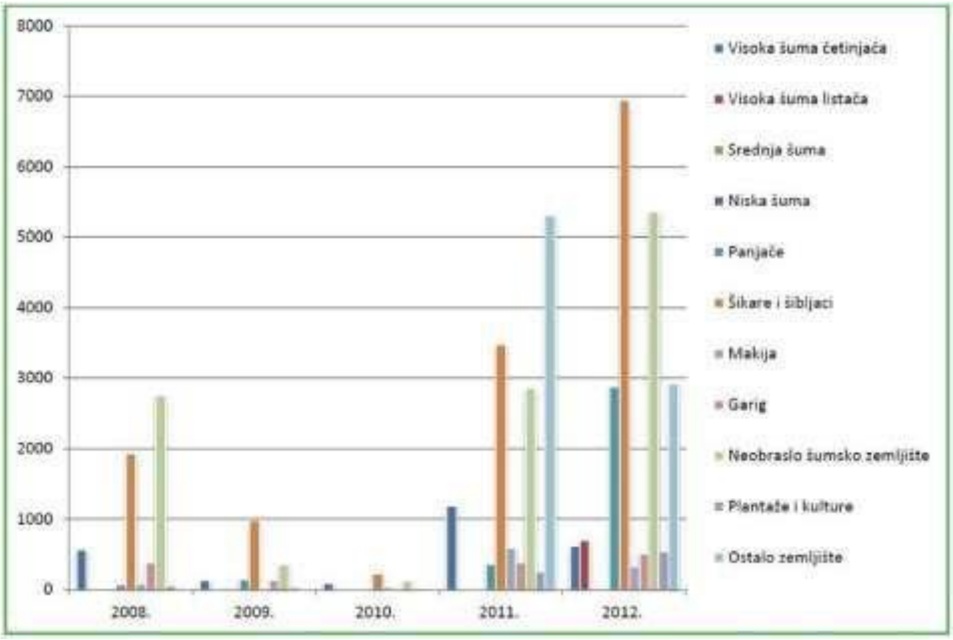


Figure 7.31 Annual survey of fire-damaged area (ha) for different types of forests in the karst area of the Republic of Croatia in the period 2008 - 2012 (Source: State of the Environment in the Republic of Croatia for the period 2008-2012)

According to the data of the Croatian Forestry Society (2007), the value of the forest ecosystem services for the area of lowland forests of eastern Slavonia which the Danube - Sava canal can impact amounts to approximately HRK 80 billion, and the forest ecosystem services of the permanently lost state forests by building the canals amounts to approximately HRK 91 million. Much higher values are obtained if the approximately are calculated as they do in Germany, according to Sabada et al. (2001). The value of the forest ecosystem services of the entire affected area amounts to approximately HRK 356 billion, while for permanently lost forests approximately HRK 400 million. If the calculations by Barford et al. (2001) that a hectare forest aged between 60 and 80 years is sequestered between 1.6 and 2.4 t CO2 per year are considered, it indicates that the entire Spačva pool is sequestered between 82.447 and 198.117 t CO2 per year. The figures show that the construction of the Danube - Sava canal can lead to significant losses in the area of general forest functions at the level of the Republic of Croatia, so its construction can not exclude a significant negative impact on the general forest functions.

Given all this, it is expected that the indicator values shall be reduced by implementing some of the Strategy measures.

Cumulative impact

The most significant cumulative impact is expected through the implementation of measures planned for lowland forests, particularly pedunculate oak forests. Environmental issues of lowland forests have been mentioned earlier, in which various interventions in these forest ecosystems have caused the degradation and dying of trees, especially pedunculate oak. Such negative impacts are a direct consequence of changing habitat conditions in lowland forests. By implementing measures through lowland forest ecosystems, there is a further weakening of the already endangered stability of these forests.

7.2.4.10 Wild game and hunting

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Fragmentation and reduction of hunting-productive areas	-	✓	×	×	×	✓	✓	×	×
Wild game disturbance	-	×	✓	×	×	✓	✓	×	×
Wild game fatalities in traffic	-	×	✓	×	×	✓	×	×	×

Legend: + the impact is positive, - the impact is negative, ✓the impact has the feature, x the impact does not have the feature

7.2.4.10.1 Hunting ground conditions

By implementing the measures of road and railway transport, potentially negative impact on wild game and hunting in the form of fragmentation of habitats and reduction of hunting-productive areas may occur. Fragmentation of wildlife habitats, with the reduction of the usable biotope area, also prevents the migration that is essential for the genetic material exchange and maintenance of population vitality. Reduction of the hunting-productive areas occurs due to withdrawal of wild game from the sources of sound and light generated by the newly built objects. Furthermore, the construction of roads in the area creates the possibility of wild game collision with the vehicles.

Fragmentation of habitats and the barrier effect on wild game produce the following two impacts: (1) reduction of usable biotope area (hunting-productive areas) and (2) prevention of species migration (essential for genetic material exchange and maintenance of population vitality). Such fragmented populations are less resistant to changes in the environment and more susceptible to pathogens, which can ultimately result in economic losses in the hunting ground. Traffic as the main cause of fragmentation in the environment is a direct pressure on sustainable hunting ground management.

According to the GIS analysis of the potential fragmentation of non-fragmented areas caused by the implementation of the Strategy measures, total fragmentation in Croatia shall increase by more than 1% (as explained in chapter 7.2.4.3 Biodiversity), primarily related to the development of road and railway infrastructure. The largest share of fragmentation is connected with the development of traffic through the lowland part of Croatia and through Gorski Kotar region and Dubrovnik-Neretva County (Figure 7.32).

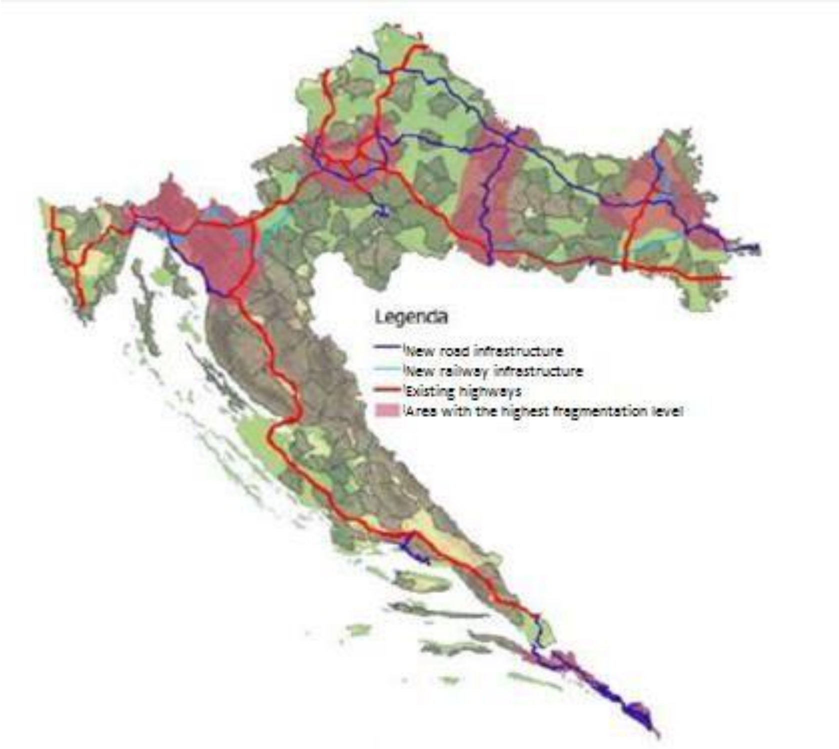


Figure 7.32 Areas under the greatest risk of fragmentation (Prepared by: IRES EKOLOGIJA d.o.o.)

Road permeability, i.e. the intensity of the barrier effect to large and small furry wild game depends largely on the traffic volume. According to current research, it has been found that roads with a traffic density between 4000 and 10 000 vehicles per day are a significant barrier, while the traffic density above 10 000 vehicles per day is an insurmountable barrier, not taking into account the fences surrounding the roads. For railway it is considered that the volume of 300 trains per day creates an insurmountable wild game barrier.

According to the data of Hrvatske ceste d.o.o. <*Croatian Roads Ltd.*> (Traffic counting on the roadways of Croatia in 2015), state roads in Croatia are a significant barrier, while the motorways are an insurmountable barrier to wild game, and there are no data for the railway. Strategy measures include the construction of both road categories and the railway, suggesting a potentially unfavorable impact on hunting. On the other hand, the effects of fragmentation and barrier effects can be alleviated by the implementation of modern construction technology and environmental protection measures when designing the planned interventions.

As far as the wild game disturbance is concerned, road traffic as well as the railway is stressful to wild game, and the negative effects in the form of noise, vibration and light are particularly prominent. In this respect, railway transport has a lesser impact on wild game than the road traffic since the noise generated by locomotives often prevents wild game collisions with traffic. Road traffic affects all types of wild game, particularly the big game, which reduces the level of its movement at distances up to 200 m from the road. Furthermore, the measures implemented by the Strategy mostly include the reconstruction of the existing track routes and thus the negative impacts shall be less pronounced, while the new road routes would relieve the traffic on the existing roads, and thus at the level of the Republic of Croatia there shall be no significant impacts.

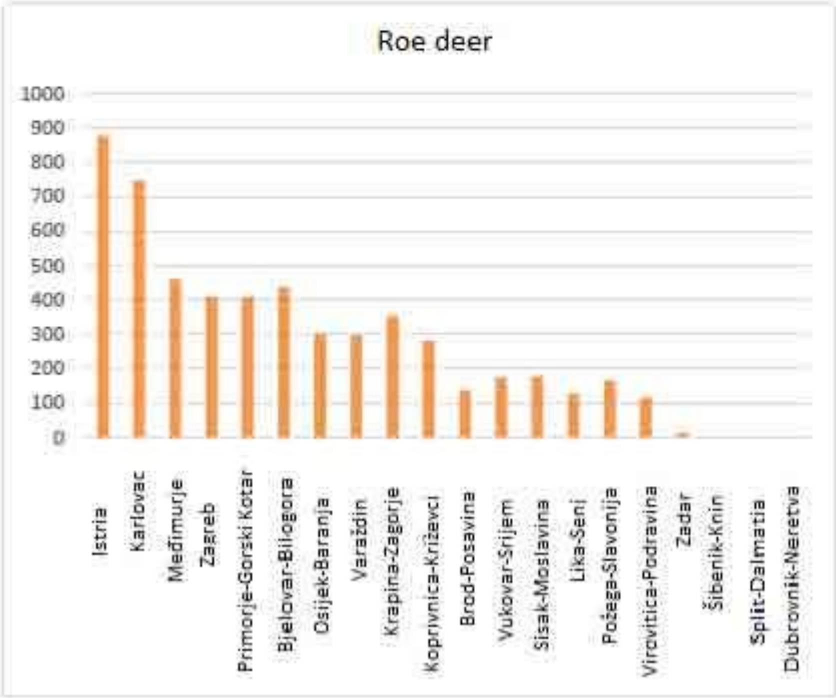


Figure 7.33 Roe deer fatality in the Republic of Croatia (Source: Šprem et al., 2013)

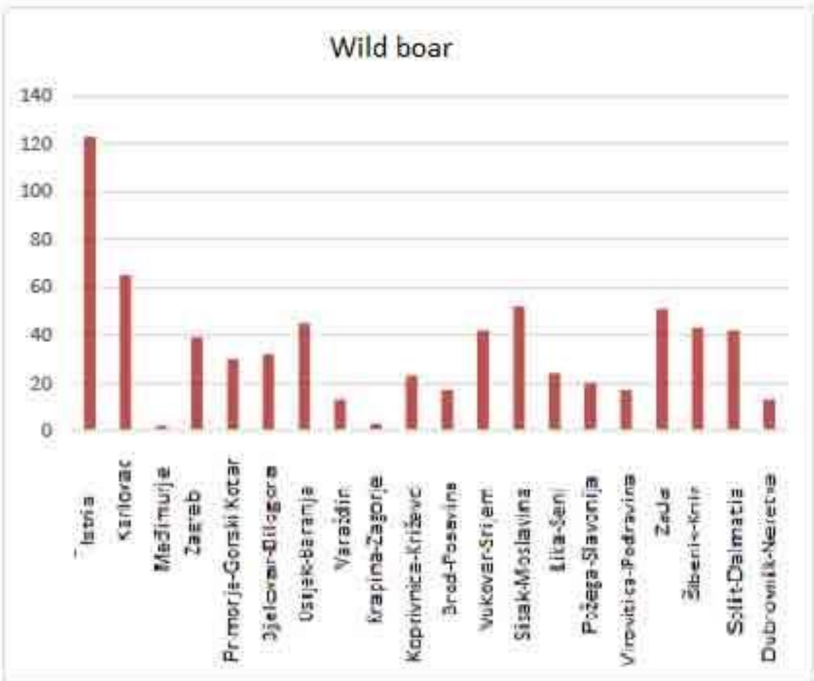


Figure 7.34 Wild boar fatality in the Republic of Croatia (Source: Šprem et al., 2013)

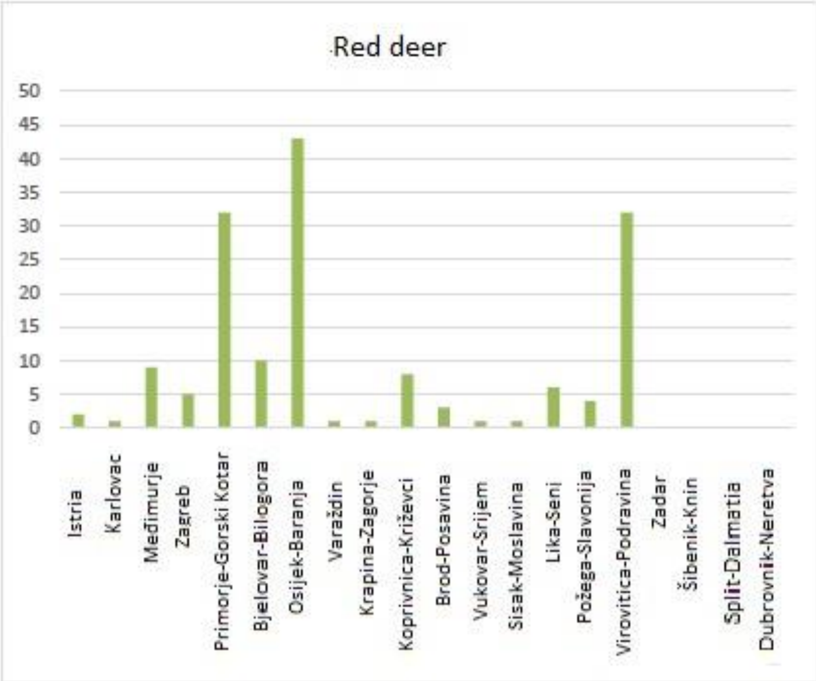


Figure 7.35 Wild boar fatality in the Republic of Croatia (Source: Šprem et al., 2013)

In the figures above (Figure 7.33, Figure 7.34, Figure 7.35), the counties in the Republic of Croatia in which the number of roe deer, wild boar, red deer fatalities are most common, i.e. the three species which are most susceptible to fatality in traffic. The biggest problem here is the unavailability of data on the causes of their fatalities.

With the Strategy implementation, there shall be an increase in wild game traffic fatalities, but wild game traffic fatalities do not cause a significant reduction in wild game populations, so the subject impact shall be moderately negative.

Given that there is no clear information on the causes of wild game fatalities in traffic (inadequate traffic infrastructure, driver speeding), it is necessary to perform research for the critical sections within individual counties in order to mitigate the existing as well as the future pressures of roads on wild game.

With regard to the above, the indicator value is expected to decrease.

7.2.4.11 Tourism

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Increased availability of tourist destinations	+	×	✓	×	✓	×	×	×	×
Increased comfort, speed and safety of travel	+	×	✓	×	✓	×	×	×	×
Better supply of tourist destination	+	×	✓	×	✓	×	×	×	×
Increased tourist mobility in the destination	+	×	✓	×	✓	×	×	×	×
Increased tourism intensity	+/-	✓	✓	×	✓	×	×	✓	×
Decrease in visual quality of the area due to intensified construction	-	×	✓	×	✓	×	×	×	×
Enrichment of the tourist offer and development of supporting activities	+	×	✓	×	✓	×	×	×	×

Legend: + impact is positive, - impact is negative, ✓ impact has the subject feature, x impact does not have the subject feature

7.2.4.11.1 Railway transport

Tourism intensity

Traffic affects the tourism in a way that it enables people to travel for tourist purposes, that is, with the transport capacities being larger and more contemporary, and the routes with organized traffic connections more numerous, the possibilities for tourism development are more significant. Conversely, the tourism affects the traffic by determining the scale of traffic development in a tourist area. Thus, the role of traffic in tourism is extremely significant and is one of the key elements which enables the production and sale of tourist services.

In recent decades, railway transport has lost its tourist clientele because it is less appealing than the road and air transport due to poorer network development, technical deficiencies and insufficient investment in modernization and maintenance of the existing infrastructure. Certain tourist areas on the coast are crowded with tourists and overburdened by their traffic needs, creating serious conflicts between the attractiveness of the area and the aspect which is threatening this attraction (mass of tourists and traffic congestion). Many European tourist countries have already turned to ecotourism as an elite type of tourism, in which health care has been incorporated. Therefore, encouraging the development of sustainable tourism and preferring modes of transport which are less harmful for the natural environment opens up new and far greater opportunities for including the railway in the traffic market.

Therefore, with the development of the railway infrastructure in Croatia (measures R.1, R.2, R.3, R.4, R.5, R.6, R.7, R.8, R.9, R.10), railway transport would have a more significant role in transporting tourists to tourist destinations in Croatia. This directly encourages the mode of transport which is less harmful for the environment, providing the Croatian tourism market an opportunity to create new tourist products or to improve the existing ones, but also to include new market segments in the Croatian tourism market. Hence, by intensifying the tourism activity in Croatia, the impact of railway transport development on tourism is assessed as positive.

Railway modernization shall have a particularly favorable impact on the possibilities of tourism activity intensification in the mainland part of Croatia (measures R.2, R.5, R.6, R.7, R.8, R.9, R.10), facilitating easier and cheaper accessibility of mainland tourism destinations.

A special trend of using the railway for tourist purposes are excursion trains (agency, party trains) which, apart from providing a richer offer of transport services, facilitate tourist trips in a financially acceptable and comfortable manner, avoiding traffic congestions. Although they are mainly seasonal between regional centers in mainland Croatia, as well as from cities of Western, Central and South Eastern Europe to coastal tourist towns in Croatia, the modernization of the railway infrastructure shall enable extended tourist service provision beyond the high season and, given the better accessibility to mainland cities, greater opportunities for development of a land tourism product.

7.2.4.11.2 Road transport

Tourism intensity

The role of traffic in satisfying tourism needs in Croatia is largely determined by the size and condition of road traffic infrastructure and traffic capacities. Over 70% of foreign tourists come to our country with motor vehicles, especially after the construction of modern motorways towards the Adriatic destinations, and 70% of vessels (up to 7m), coming to the Adriatic for nautical tourism, arrive by road. They all expect the European level of traffic infrastructure; fast, secure and quality transportation from the place of permanent residence to a tourist destination. That is why the level of development, driving characteristics, permeability and road equipment determines the development of tourist destinations. This is the basic principle, as a more accessible destination shall have better capacity utilization than the one that is not. However, when talking about the availability of a tourist destination, it is not just about the shorter or longer travel time, but also about the price of travel and mostly about the comfort of travel. Therefore, the journey to a tourist destination is intended to turn into a tourist experience, which means creating an attractive offer which the tourists use throughout their journey to a selected destination and which significantly exceeds their primary needs during travel. Such is, for example, a special offer of accompanying service buildings along the road.

Since tourism in Dalmatian destinations is characterized by mass tourism rates in the summer part of the year, a positive impact of reducing the limited possibilities of transit traffic infrastructure is expected in order to accommodate more vehicles. Modernization of the road network by building and reconstruction of road infrastructure (measures Ro.2, Ro.3, Ro.4, Ro.5, Ro.6, Ro.7, Ro.9, Ro.11 and Ro.16) shall positively affect the accessibility of tourist destinations throughout Croatia, the comfort and speed of travel, the tourist flows between tourist destinations and indirectly, in the long term, greater tourism intensity and the development of accompanying contents in the function of tourism.

Due to the dominance of road traffic in tourist arrivals to the northern Adriatic, the northernmost tourist destinations are in a better market position than the southern ones, because they are more accessible and offer more frequent arrivals. In the south, however, the destinations are naturally more attractive, but tend to experience difficulties in valorizing this advantage due to a poorer traffic accessibility. Areas recognizable by their poorer road traffic connection, particularly the southern part of Croatia and the eastern part of Croatia, have the potential to use the development of traffic infrastructure for better tourism product development due to increased availability of tourist destinations.

Although all the larger tourist towns have bypasses, which relieve traffic congestion during the tourist season, there are occasional problems in traffic flow (congestion, deadlocks) in city centers which disturb the tourist vacation and disrupt the tourist experience of the area. The reorganization of internal traffic network in Zagreb (Ro.8), Rijeka (Ro.10) and Split (Ro.15) shall thus help alleviate the subject problems.

Growth, development and dimensioning of road traffic capacities has a negative impact on tourism, which is reflected in the need for ever larger space, the reduction of visual landscape quality and the impact on the pollution of natural resources (by noise, vibration, pollution of soil, water and air). Negative impact primarily refers to the most valuable coastal area. Namely, road routes often contribute to additional construction (e.g. housing and tourism capacities) and thus prevent the proper valorization of certain coastal parts, disrupting the organization of space and mutual communication, and due to the constant presence of noise and intensive traffic, the intense traffic area becomes less attractive for a tourist stay.

7.2.4.11.3 Air transport

Tourism intensity

Due to geographic indentedness and poor road infrastructure, tourists did not come to certain parts of Croatia by cars in equal percentage. In parts of the country whose destinations are closer to emissive countries, such as Istria and Kvarner, tourists mainly arrive by roads, while in more distant destinations (southern Dalmatia), they arrive mainly by plane or boat.

Today, air traffic in Croatia with regard to the speed, frequency, comfort and favorable prices of low-fare flights accounts for the major part of the realized tourism traffic in the high season, thereby better connecting the northern and southern domestic tourist destinations with the European emissive markets. An important aspect in the arrival of tourists by air is the good road connection between the centers of Dalmatian destinations and other tourist resorts and airports, i.e. the proper connection of Croatian airports to the traffic system, and especially an inadequate role of maritime transport in connecting airports with tourist destinations. Quality of airport connections to the traffic systems in their environments, measures A.1, A.2, A.3, A.4, A.6, A.7, A.8 and A.9, shall positively affect, by facilitating the accessibility of tourist destinations, the establishment and realization of a number of air traffic connections with foreign destinations and consequently the increase of emissive tourist markets and tourist traffic.

Unlike at the summer vacation coastal destinations, tourists in the mainland Croatia tend to stay for a shorter period. Therefore, the impact of measure A.5 on a larger number of tourist arrivals in Slavonia is assessed as positive because it has the potential to remedy limiting factors in the development of tourism in this area, which are the significant distance and tourist attraction when compared to the position, i.e. attractiveness of the Adriatic destinations.

7.2.4.11.4 Maritime transport

Tourism intensity

Tourism growth requires a quality additional offer and accompanying services of all kinds of traffic to increase the attractiveness of the travel destination and ease the way to the desired location. Increased arrival of tourists to the Adriatic by personal cars creates additional difficulties for maritime carriers, who in a relatively short time have to provide large ship capacities which are not properly utilized for the rest of the year. The pronounced seasonality of the traffic capacity utilization creates difficulties for traffic planners, transport companies, but also for the state as a whole, which must ensure the traffic flow under all conditions and thus the cohesion of the state territory. Therefore, organization plays an important role in destination attractiveness, which greatly influences good positioning on the tourist market. This primarily relates to the introduction of intermodal traffic and the introduction of new and reorganization of the existing public maritime transport lines, the harmonization of time and the increase of departure and arrival frequency of various means of public transport, improvement of signaling and information systems in public transport, establishment of international waterways and provision of traffic routes (and port terminals) with accompanying amenities. This consequently affects the frequency of tourist flows and the traffic flow in all conditions, the cohesion of the state territory, year-round sustainability, and in the long term the continuous growth of tourist activity and a greater degree of tourist offer utilization.

Modernization and reconstruction of passenger terminals shall reorganize maritime passenger transport services in Croatia, resulting in a positive shift in the accessibility of islands and other destinations, speed of travel and positive changes in market segments (especially thanks to cruising and yachting tourism), which shall indirectly and in the long term influence the tourism sustainability of the cities of Dubrovnik, Split, Zadar and Šibenik (measures M.10, M.11, M.12 and M.13) and Dalmatian islands.

7.2.4.11.5 Inland waterway transport

Tourism intensity

In order to provide quality service to river tourism clients, it is necessary to ensure a continuous and safe ship navigation under a certain draught. In Croatia, the Danube, the Sava and the Drava rivers have the comparative advantages.

Realization of measures I.3, I.4, I.5 and I.6 can positively impact the gradual increase of one-day cruises and yachting in nautical tourism on the rivers and intensify the tourist activity of the river tourism products in all cities which are suitable for the docking of river cruise ships (Vukovar, Ilok, Osijek, Aljmaš; Batina, Sisak, Slavonski Brod).

River cruisers most frequently dock in Vukovar, and additional activities regarding the modernization of ports, construction of new facilities and improvement of road and railway infrastructure connectivity shall positively influence the number of dockings, i.e. increase Croatia's competitiveness in the river cruise market.

It is an incentive for the economic development of river port cities because with every river cruise ship, the cities and their sights and tourist attractions are included in the tourist offer of tourists who arrive on cruisers. This is also an opportunity for creating and implementing new land itineraries for river cruise visitors, improving the existing and creating new tourist attractions in the continental Croatia, and enhancing the management and interpretation of continental protected nature and cultural heritage.

Development of supporting activities and the enrichment of tourist offer in river ports and tourist destinations in the hinterland of river ports can represent a benefit for the local population due to increased consumption of river cruise visitors and other revenues.

7.2.4.12 Social and economic characteristics

Impact	Positive/ Negative	Direct	Indirect	Short term	Medium term	Permanent	Cumulative	Synergetic	Transboundary
Cohesion of the Croatian territory through increased accessibility and regional connections	+	✓	×	×	✓	×	×	×	×
Increased interoperability of transport systems	+	✓	×	×	✓	×	×	×	×
Growth of the quality of life	+	×	✓	×	✓	×	×	✓	×
Increase in the number of daily and weekly commuters	+	×	✓	×	✓	×	×	×	×
Regeneration, social inclusion and economic vitality of peripheral areas in terms of traffic	+	×	✓	×	✓	×	×	✓	×
More reliable transport systems	+	✓	×	×	✓	×	×	×	×
Improvement of bilateral relations between Croatia and	+	×	✓	×	✓	×	×	✓	✓
Bosnia and Herzegovina	+	✓	✓	×	✓	×	×	✓	×
Increase in the number of employed persons	+	✓	×	×	✓	×	×	×	×
Traffic safety improvement	+	×	✓	×	✓	×	×	✓	×
Growth of development index	-	×	✓	×	✓	×	×	×	×
Increased risks to human health	+	×	✓	×	✓	×	×	✓	×

Legend: + impact is positive, - impact is negative, ✓ impact has the subject feature, x impact does not have the subject feature

7.2.4.12.1 Railway transport

Overall (general) population movement

In the Zagreb urban system, the railway has already been integrated into the public and suburban transport system, and its modernization has played a major role in the socio-economic transformation of space, urbanization dynamics and the development of traffic axles in Croatia. This is primarily related to the trend of population growth in the settlements along the railway tracks, which are within an hour's drive from Zagreb due to the weakening of permanent migration in favor of daily migration (e.g. in Zagorje and Moslavina). Therefore, the measures R.1, R.2, R.5, R.7, R.11 and R.14 shall continue the current trends and strengthen the function and position of Zagreb railway hub within the cargo and passenger European railway transport system.

The integration of the railways into the public urban and suburban transport system within the urban area of Rijeka shall revitalize the railway transport in the city and activate its role in the transformation and organization of the spatial structure of the Rijeka urban system. Therefore, the realization of Measure R.4, and in particular the integration of the railway system and car transport, has the potential to unburden the roads within the city and reduce congestion. This indirectly causes an increase in the quality of life and enables reliable and safe mobility and transport as well as independence from weather and climate conditions.

The modernization of the railways in passenger transport by adapting the tracks, increasing the train speed, equipping with the accompanying infrastructure and the comfort of trains which meet the modern needs and the modern way of life shall increase the demand for railway transport, not only within the growing agglomerations in daily migration, but also in the Croatian areas where the population migrates on a weekly and periodical level (measures R.7, R.8 and R.10), and increase the accessibility of peripheral traffic areas of Croatia. The railway thereby has the potential to re-affirm itself as a competitive means of transport.

The impact that modernization of the railway network can have on overall population movement in settlements along the main railway tracks is positive, especially in areas experiencing the emigration types of general population movement and a large share of older population in the total population (Mountainous Croatia, Slavonia and Podravina) due to faster and quality mobility that enables the population to remain in the place of residence and increase daily and weekly migration (measures R.3, R.6 and R.9).

Development index, employment

Traffic system is the fundamental infrastructural segment of the economy with exceptional significance for the functioning of virtually all economic and social activities of each country, for the life of the population and for inclusion in international flows of goods and passengers. That is why the economic power of a country is directly related to the state of development of its traffic flows and roads. The use of railways in passenger transport is not only economical for the population, but it also, along with the potential financial savings, has a positive impact on increasing their living standard, intensity increase of railway utilization in cargo transport (measures R.3, R.6 and R.10) directly affects the market widening (geographically and economically), reduces transport costs, increases production marketability, enables market integration and competition, increase the economy of exchange, etc. Indirect lowering of commodity prices affects the production growth, which also influences the employment increase in production locations and cargo exchange places (logistics centers such as the Rijeka port and Vukovar port).

Potential growth of employment in the railway passenger sector is expected due to increase of line frequency and intensification of operations. This directly influences the integration of railway transport into socio-economic trends and positively influences the development index growth and economic well-being of the society.

Human health risk

Since the railway is considered the (most) ecologically acceptable form of land transport, the impact on population health is assessed as neutral. On the other hand, train tracks construction forms the line noise sources due to train traffic. The intensity of noise impact on the population depends primarily on the distance of the railway track from the settlement and it is not possible to exclude the possibility of a significant negative impact of noise generated by trains on the population.

7.2.4.12.2 Road transport

Overall (general) population movement

The construction and completion of state road and motorway sections listed in Ro.2, Ro.3, Ro.4, Ro.5, Ro.6, Ro.7, Ro.9, Ro.11 and Ro.16 measures shall have a positive impact on integration of Croatian territories and better connectivity and easier and faster access areas in Croatia where the existing infrastructure has reached the upper limit of permeability, and alternative modes of transport (public railway, coastal line) are not economically valid or where there is no alternative road infrastructure. The development of road infrastructure shall positively influence the provision of optimal planning and more efficient use of the wider space for life and work. The traffic thus increases the satisfaction and the quality of life for people.

Polycentric and balanced spatial development, which would make more counties more competitive, would reduce the difference in living standard and income level, stimulate symmetric migration movements and alleviate depopulation and aging processes.

Reorganization measures of the Zagreb, Rijeka and Split road networks (Ro. 8, 10 and 15) shall positively affect the reduction of congestion, which interferes with the interurban and urban mobility, which shall in the long term affect the perception of urban systems in Zagreb, Rijeka and Split as urban areas of high life quality. It is assumed that the realization of these measures shall have a positive impact on increasing the daily circulation of population and the mobility of the workforce between their hometown and its surroundings and faster and easier access to work and housing, city facilities and institutions (e.g. health and education and other services). The realization of measures Ro.12 and Ro.13 also contributes to the aforementioned. Construction of the bypass shall divert the transit traffic outside the city, which contributes to strengthening of the vitality and functionality of urban areas and to the safer and more efficient mobility of the inhabitants within urban agglomerations.

Development index, employment

High quality transport system (infrastructure and services), besides being of vital importance to the functionality of urban areas, also facilitates the easier and faster input and flow of goods and services and has a wider economic impact. This applies in particular to emigration areas with lower development index, where the development of the transport system has the potential to indirectly affect the regeneration of negative socio-economic trends.

Generally, the development of road traffic meets the socio-economic needs due to its great flexibility and adaptability to different requirements of transport users, the independence of movement from other similar vehicles (it can fully adapt the time of departure to passengers or the needs of cargo transport) and the independence of the transport units from each other, enabling a flexible organization of work with regard to transport needs in different directions and relations.

Measures Ro.1 and Ro.3, i.e. the construction of bridges across Sava shall, besides directly connecting the border areas of the Republic of Croatia and Bosnia and Herzegovina, enable the territorial integration of Bosnia and Herzegovina with Western Europe (A3 motorway), i.e. Eastern and Northeast Europe (A5 motorway). Therefore, these measures have a transboundary impact. In addition to a better regional connection, a significant increase in the transboundary fluctuation of the local population can be expected, which shall also have a positive impact on local economic co-operation and trade.

On the other hand, construction of a bridge near Gradiška can help solve daily traffic congestions, as this is one of the most frequent border crossings and has the status of BIP, i.e. a crossing with all necessary inspection controls for the traffic of all types of goods.

Due to the realization of the bridge construction, creation of new jobs at the border crossings can be expected and, given the fact that Croatia is in the process of signing the Schengen Agreement, the translocation of existing police personnel to this border crossing. With the creation of new jobs at the border crossings, there is the possibility of developing service activities in the immediate vicinity of the bridge. Therefore, the construction of the Sava bridges shall have a positive impact on socioeconomic trends in the Brod-Posavina County in terms of reducing unemployment and possible GDP growth.

Human health risk

Planned roads represent line sources of noise and can adversely affect the quality of life of the population, and the intensity of this impact primarily depends on the distance of the roads from the settlement and the type of planned traffic. The noise generated on the roads depends on the volume and structure of traffic and on the technical characteristics of the road. Noise is a daily environmental factor which is stressful, and people are not capable of adapting to it. Noise produced by means of transport can cause fatigue, reduced working ability, and disruption in communication, concentration, rest and sleep. It causes various negative mental conditions, from feeling of discomfort to stress and certain health disorders (as well as exacerbation of the existing ones), such as the impact on the cardiovascular system. Reactions to noise are individual and, depending on the noise level and frequency, as well as the exposure time, may range from mild and transient to permanent damages.

Elevated emissions of air pollution from road traffic directly adversely affect human health. Pollution is the largest beside the roads, and twenty meters away the amount of nitrogen dioxide and floating particles drops drastically. Floating particles are the most dangerous for health because they can cause serious health problems, especially in children and the elderly. Although air in Croatian cities rarely reaches or exceeds the alert threshold, long-term exposure can have a serious impact on human health. Headaches, blood vessel system disorders, eye irritation, asthma, function impairment, and even lung cancer are the consequences that can be caused by air pollution. A large share of nitrogen dioxide air pollution in our cities is caused by road traffic, and the greatest concentration is beside the road and at the height of the human respiratory system. The highest extreme levels of air pollution occur in peak hours when the traffic density is the highest. With regard to the above, it is not possible to exclude the possibility of negative impact on the health of the population.

On the other hand, the predicted bypass construction (measures Ro. 8, 10 and 15) shall reduce the traffic frequency through the city center, which shall result in the reduction of noise levels and harmful emissions in the city. By reducing the noise levels in the city center, its negative impact on the population shall also be reduced, which is why the implementation of measures Ro. 8, 10 and 15 is rated as positive.

7.2.4.12.3 Air transport

Development index, employment

Of the nine airports in Croatia, whose development is planned through measures A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8 and A.9, three are larger: Zagreb, Dubrovnik and Split, while the other six are smaller and can be characterized as secondary. These are Pula, Rijeka, Zadar, Osijek, Mali Lošinj and Brač. There are many factors that affect the volume of traffic, and one of the most important demand generators is certainly tourism. Due to the commercial attractiveness of the airport on the coast to low-cost carriers, the largest increase in traffic over the past few years has been noted there. New business models have led to better offer and lower transport prices and more accessible air transport services to a wider range of people. This large increase in traffic burdened the existing infrastructure and conditioned further investment in the development of passenger buildings, aprons and access roads and parking areas.

Further increase in spatial capacity and improved access infrastructure shall have an impact on the elimination of bottlenecks, especially during summer season at coastal airports, and shall increase the availability of airports, the flow of passengers and luggage and improve the quality of service. In addition, the speed and comfort of traveling by air using the shortest and most convenient directions and the well-arranged landings shall positively impact the increase in passenger traffic at airports.

Air transport industry is the only one, from the aspect of the entire transport industry, which can ensure an efficient global connectivity and national cohesion (the development of Osijek airport is of special importance), which is a major prerequisite for further development of all aspects of business in the country. Therefore, the aviation industry has a direct positive impact on the environment, regional development and economic development. The positive influence of the development of airports in Brač and Mali Lošinj is reflected in the growth of the island economic vitality.

Measures A.5 and A.6 influence the development of cargo air traffic, whereby synergistic effects can be expected with other modes of transport (e.g. road and maritime).

Analyses show that GDP growth directly affects the double growth of air traffic. Since the GDP growth in Croatia can mainly be linked to an increase in the number of tourists, tourism can be regarded as the generator of modern air traffic development. Therefore, the indirect influence of air traffic intensification on the development of other activities of the tertiary sector is assessed as positive.

Human health risk

In accordance with increase of airports capacity and increase in air passenger and cargo transport, significant noise levels can be expected. Aircrafts produce the greatest noise at take-off and landing. Airports are not only burdened by aircraft noise, but also the noise created by various vehicles, such as admission and transportation vehicles for passengers, cargo and aircrafts, and motor vehicles of passengers, employees and airport visitors. Since most of the major airports are located in industrial and urban areas, the population in these areas are affected by aircraft noise. Although air traffic contributes with only around 1% of noise higher than 65 dB, its impact is the most harmful to employees at the airport and the airport vicinity (Steiner, Božičević, Kaštela, 2003).

Aircraft emissions cause air pollution at the airport itself, but also in its surroundings. They refer to exhaust emissions from aircraft engines, aviation fuel systems, aircraft servicing motor vehicles and ground airport equipment.

Due to the aforementioned, it is not possible to exclude the possibility of a negative impact of air traffic on the health of residents in the vicinity of the airports.

7.2.4.12.4 Maritime transport

Development index, employment

Development of access traffic infrastructure (railway, road) in ports shall increase their interoperability and accessibility to European traffic routes. This shall lead to the integration of ports into the local transport system (passenger and cargo), increased competitiveness of Croatian ports due to faster and easier intake and flow of goods and services in port areas, as well as increased distribution of cargo transport on the Adriatic and coastal routes in favour of maritime transport.

Realization of measures M.8, M.9, M.10, M.11, M.12 and M.13 shall increase the efficiency of port operations, which shall potentially positively affect the economic activity in port cities, whereby Croatia shall achieve a more competitive position as the port, industrial, transport and distribution center of Southern Europe.

Extensions and construction of passenger terminals and ferry docks shall help reduce travel time, crowds and traffic congestion that hinders the intra-city mobility, especially during the tourist season. This shall make the maritime passenger transport system more reliable in the long-term, which contributes to the productivity of public transport and the economy in general. Activities planned under these measures have the potential to positively influence the direct and indirect employability (equipping public transport stations, ports and jetties with accompanying amenities and services generates indirect employment).

The transboundary impact of measure M.9 is reflected in the importance of the Port of Ploče for the economy of Bosnia and Herzegovina, whose transport infrastructure directly dictates the success of the Port of Ploče business.

Overall (general) population movement

The development of transit cargo seaports has the potential to, as a result of growth of their business, positively influence the new employment opportunities of residents or possible new immigration of people for work. The synergistic impact of these effects is, due to the development of port activities, reflected in the long-term sustainability of the maritime transport system in the port cities, which has the potential to indirectly influence the possible changes in demographic structures and the overall movement of the population of the port areas leading to population progression.

Human health risk

The impact of port complexes on human health is manifested mainly through the effects of noise, air emissions of harmful gases from traffic and emissions into the sea.

The most significant impact on the noise level at the port location shall have an increasing number of ships, which shall generate noise during their operation and docking in ports and an increased concentration of people in the port area. Traffic congestion in new passenger ports can be triggered by an increased number of cars and other vehicles waiting for boarding on ferries, especially during the tourist season.

The synergistic effect of local air pollution due to the emission of harmful gases and dust into the air from traffic is reflected in the increase of overall pollution, thereby reducing the quality of the air, i.e. increasing the risk of harmful effects on people and the environment.

In addition, potential seawater pollution in the port area can lead to local changes in sea quality, thus adversely affecting human health. In order to mitigate this potentially negative impact, protective measures have been prescribed in the environmental component Surface and Groundwater.

7.2.4.12.5 Inland waterway transport

Development index, employment

The revitalization of inland waterway traffic shall improve rational resource management, which means that the comparative advantages of inland waterways shall be more utilized. There is a great justification for the development of this mode of transport since it is more profitable and economically exploited, particularly in areas where there are more favourable conditions for sailing on rivers with more peaceful flows or canals. By modernizing waterways and river ports of the Republic of Croatia, it would be possible to divert large volumes of goods to river traffic. On the other hand, the development of inland navigation also facilitates the development of combined transport (Dundović, Vilke, 2009).

The development of ports on inland waterways shall have a positive effect on improving the efficiency of transport of goods and people on inland waterways and increasing the interoperability of the transport system in Croatia. By establishing an intermodal transport chain in cargo transport (measure I.4), the efficiency and reliability of inland navigation shall be achieved. Modernization of road and railway infrastructure links has the potential to influence the promotion of jobs, skills and knowledge related to waterway activities (e.g. tourism, public transport, production and economic activities in the hinterland).

The long-term impact of river transport development is reflected in increasing the competitiveness of river ports in Vukovar and Osijek as the main ports for cargo and passenger transport. This may indirectly affect the improvement of the development index through strengthening economic activity, GDP growth and employability of the local population, and reducing emigration in Osijek-Baranja and Vukovar-Srijem County, which may favourably affect the socio-economic trends.

The construction of the Danube - Sava multipurpose canal (measure I.7) shall create conditions for the relocation of certain traffic flows (e.g. road and railway cargo transport) to river traffic, which could further lead to overall economic development in Croatia. This would directly connect Croatian waterways to the European network of inland waterways and the multifunctional Rhine - Main – Danube canal, i.e. communication with important European economic and traffic centers would be realized. The construction of the canal and the construction of a new high - performance railway line Zagreb - Rijeka, along with the arrangement of the Sava River waterway, would result in an intermodal transport route between Vukovar and Rijeka, which would connect the Danube and Mediterranean countries via the Rijeka port. The transport integration of the Danube and the Adriatic, which would be the most favourable combined route from the Adriatic to Central Europe, along with the link between the Danube River and the Black Sea ports, would significantly strengthen the strategic position of the port of Vukovar. In addition to the main effect of the potential canal for the economic development of the Republic of Croatia, which consists of savings in cargo transport via the Podunavlje - Jadran corridor, the increase of agricultural production is highlighted as well, which would be achieved through irrigation of agricultural areas using drainage and irrigation systems, along with benefits for the food industry, flood protection and fish farming (Dundović, Vilke, 2009).

Furthermore, a positive transboundary impact of measures I.5 and I.6 is expected, through the realization of favourable bilateral and economic relations between Croatia and Bosnia and Herzegovina. Port of Slavonski Brod is located near the junction of the Vc and X corridors, which is why it has the potential for development into an important intermodal hub. With the development of the Sisak port, the industrial and commercial area of Zagreb with the Sava River and inland waterways would be well connected, with the broader port area being the distributive and logistics center.

Human health risk

Inland waterways traffic is characterized as being extremely safe in terms of navigation and its impact on the increase of pollutant emissions in the environment is considered the least harmful in relation to railway and road traffic. Due to the relatively low traffic density and low number of accidents, the safety of navigation in inland waterways is very high. Inland waterway navigation is the most acceptable mode of transport from the point of view of emissions into the environment, because water and air pollution and noise pollution produced by inland navigation vessels is insignificant compared to road and railway transport. Accordingly, the impact of the subject measures on the health of population is neutral.

7.3 Transboundary impacts

Transboundary impacts are the result of certain activities that may cause change in environmental components in countries bordering with the territory of the country where a particular activity takes place.

The Act on the Confirmation of the Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (OG 7/09) represents an international agreement which defines the cooperation with regard to the transboundary environmental impact. Parties shall assess the environmental impact of certain activities at an early stage of planning and communicate and consult each other in all major potential interventions which may have an impact on the environment across national borders.

The methods of testing and the criteria for determining the likely impact of the strategy, plan or programme on the environment include the identification of the characteristics/intensity of the impacts of the strategy, plan or programme, taking into account the transboundary nature of the impact.

The Republic of Croatia borders with the following countries for which the transboundary environmental impact[5] has been estimated: the Republic of Slovenia, the Republic of Hungary, Bosnia and Herzegovina, the Republic of Serbia, Montenegro and the Italian Republic.

The strategy defines the goals, whose realisation shall probably have transboundary impacts:

- SO1 Better coordinate traffic management with neighboring countries (BiH - Port of Ploče, road and rail links from BiH, Slovenia, Serbia, Italy, Montenegro and Hungary)
- SO4 Develop the potential of major logistics centers (port Rijeka, port Split, port Ploče, port Vukovar, port Osijek, Zagreb node)
- RT1 Improve the rail freight corridor from port Rijeka to the markets with the greatest potential for the port (Hungary, Bosnia and Herzegovina, Slovakia, Italy, South Poland and Serbia).
- RDT7 Increase connectivity with neighboring countries in order to raise co-operation and territorial integration to a higher level.
- RDT8 Increase the availability of areas in Croatia where the upper limit of motorway capacity has been reached and where there is no alternative road infrastructure (parallel motorways, etc.) - from Zagreb in the direction of Bjelovar and Varaždin in the direction of Koprivnica.
- RIT1 Increase the competitiveness of ports in Vukovar and Osijek as main river ports for freight traffic.
- RIT2 To cooperate with BiH in the development of the Slavonski Brod cargo port.

Measures which are connected with the subject goal, and may generate **negative** and **positive** impact on the neighboring countries are as follows:

Railway transport:

- R.1 Zagreb – state border with Slovenia towards Ljubljana (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor)
- R.6 Križevci – state border with Hungary towards Budapest (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor RH2)
- R.8 Novska – state border with Serbia (TEN-T core network/Pan-European Corridor RH1)

[5] Maps in the Study are informative and solely for the purpose of the subject document.

- R.9 State border with Hungary – Osijek – State border with Bosnia and Herzegovina (TEN-T core network/PanEuropean Corridor RH3).

Road transport:
- Ro.11 Dubrovnik – State border with Montenegro
- Ro.9 D2 from the state border with Slovenia to the state border with Serbia
- Ro.1 Connecting via the bridge near Gradiška
- Ro.2 A5 Osijek – state border with Hungary Pecs (TEN-T comprehensive network/Pan-European corridor RH3)
- Ro.3 A5 from A3 to the state border with Bosnia and Herzegovina (TEN-T comprehensive network/Pan-European corridor RH3)
- Ro.6 DC 10 Vrbovec – Križevci – Koprivnica – State border with Hungary towards Kaposvár
- Ro.7 DC 12 junction Vrbovec 2 – Ivanja Reka – Vrbovec – Bjelovar – Virovitica – State border with Hungary towards Barcs
- Ro.16 Preparations for accessibility of Dubrovnik after the accession of Croatia to Schengen (Peljesac Bridge), continuation of the Adriatic-Ionian Corridor

Maritime transport:
- M.2 Implementation of the "Motorways of the Sea" projects
- M.9 Specialisation of the Port of Ploče (container and bulk cargo).

Inland waterway transport:
- I.1 Improvement of waterway of Danube and Drava rivers to Osijek
- I.2 Improvement of the Sava River
- I.3 Development of the Port of Vukovar (TEN-T core network)
- I.4 Development of the Port of Osijek (TEN-T comprenhensive network)
- I.5 Development of the Port of Slavonski Brod (TEN-T core network)
- I.6 Development of the Port of Sisak (TEN-T comprehensive network)
- I.7 Construction of the Danube-Sava multipurpose canal.

7.3.1 Italy

The implementation of the Strategy could lead to negative impacts on the marine environment of the Republic of Italy, in the form of cumulative impacts due to increased maritime traffic and cargo transport lines.

The greatest pressure on the marine environment comes from economic maritime traffic, cruise ships and nautical tourism, including the construction of nautical ports and the discharge of untreated wastewater into the sea.

Measures that can adversely affect the marine environment (sea quality, biodiversity) of Italy are the implementation of the "Motorways of the Sea" projects and the development of seaports in the context of traffic intensification.

Impacts are related to sea pollution and increased noise levels in the sea. In addition, the most significant negative impacts on the marine environment can occur due to accidents, especially ships carrying dangerous cargo.

7.3.1.1 Impact of maritime transport

Measure:

- M.2 Implementation of project „Sea motorways“

Maps in the Study are informative and solely for the purpose of the subject document.

Potential pollution of the marine environment in the territory of the Italian Republic is possible due to the implementation of "Motorways of the Sea" projects and partly due to the development of ports. These projects, which at this stage of the Strategy are not yet clearly defined, lead to an increase in maritime traffic, i.e. maritime routes, which increases the risk of accidental situations that may lead to pollution of the marine environment. However, given that the Strategy plans to introduce systems to improve the safety in maritime navigation, the potential risks of accidents can be better controlled.

7.3.1.1.1 Accidental situations

Increased maritime traffic can also increase the risk of accidental situation, especially when it comes to ships carrying dangerous cargo. These are unpredictable situations that are difficult to prevent, but it is precisely for that reason that adequate intervention plans need to be in place to address potential accidental situations without significant consequences for the marine environment.

Pursuant to the provisions of the Intervention plan for sudden sea pollution (OG 92/08), reports on accidents are prepared and the public is informed through public media and other media about the actions taken. Also, the Subregional intervention plan for the prevention, readiness for and response to the large-scale sudden pollution of the Adriatic Sea (OG-IC 7/08) prescribes the obligation to notify the bodies of other states about the sea pollution.

If pollution by hazardous and harmful substances or exceptional natural event in the sea may endanger the marine environment, human health and economic use of the sea and may have consequences on two or more counties or when the amount of pollution by oil and/or oil mixture exceeds 2000 m^3, command action is implemented by the Staff for the implementation of the Intervention Plan, in cooperation with the County Operational Centers.

7.3.1.1.2 Noise

By increasing maritime traffic, as a result of the implementation of the "Sea Highway" measure, there will be increased noise emissions. Sound power levels and associated effects on marine ecosystems have increased over the past period, although there are few studies that can quantify these changes. Under water there is sound and no human influence. The main natural sources of sound are seismic (shaking, moving, etc.), meteorological (wind, rain, waves, etc.) and biological (many organisms in the sea produce sound). Many organisms use sound in communication, detecting prey, and invasion of the predator threat. Part of their natural environment is in a sound environment, and by entering anthropogenic noise this environment changes, becomes unnatural so that marine organisms can endure adverse effects. The input of sound energy occurs in a wide range both in space and time. Anthropogenic sounds can be short (impulsive) or long (continuous) duration. Impulse sounds can be repeated at longer or shorter intervals, but such repetition can be "deformed" with the distance from the source and the reverberation and become unrecognizable by continuous noise. More sound frequencies are worse in the marine environment while low frequencies can travel longer. The main source of continuous noise is ship traffic, and impulse underwater noise is the work of ultrasonic devices (sonar, geological and seismic research), explosion and underwater works. The problem of noise exposure is complex because it involves a wide range of anthropogenic sources in the marine environment, numerous species inhabiting this environment and overlapping in space and time with noise sources. Potential adverse effects of noise exposure range from negligible to significant.

ACCOBAMS (2013) has also defined categories into which negative impacts of noise on the marine mammals can be classified. The first group is physical trauma, i.e. temporary or permanent hearing loss, tissue injuries that do not lead to death and injuries that can potentially lead to the death of the organism in case of immediate exposure. There is also a group of impacts that lead to behavioural changes. Behavioural changes can be small, where the normal activity of the individual does not change, but can be more pronounced when the individuals stop performing their normal activities. The last category refers to noise below the level of the environment and does not affect the organisms.

7.3.2 Hungary

Potential transboundary impacts of the Strategy on the environment of the Republic of Hungary are possible due to the implementation of measures relating to the construction or reconstruction of roads.

7.3.2.1 Impact of railway and road transport

Railway transport:

- R.6 Križevci – State border with Hungary towards Budapest (TEN-T core network/TEN-T Mediterranean corridor/PanEuropean corridor Vb)
- R.9 State border with Hungary – Osijek – State border with Bosnia and Herzegovina (TEN-T comprehensive network/core network/Pan-European corridor Vc)

Road transport:

- Ro.2 A5 Osijek – State border with Hungary Pecs (TEN-T comprehensive network/Pan-European corridor RH3)
- Ro.6 DC 10 Vrbovec – Križevci – Koprivnica – State border with Hungary towards Kaposvár
- Ro.7 DC 12 junction Vrbovec 2 – Ivanja Reka – Vrbovec – Bjelovar – Virovitica – State border with Hungary towards Barcs

The impacts are manifested primarily in the form of air pollution due to increased traffic on the roads and potentially due to railway transport, if it shall be powered by diesel. The study assessed the impact of the Strategy on air quality as moderately negative. For the territory of the Republic of Hungary, a moderate impact of the implementation of these measures relating to road and railway transport on air quality was also assessed.

7.3.2.2 Impact of inland waterways transport

Measures:

- I.1 Improvement of inland waterway of Danube and Drava rivers to Osijek
- I.4 Development of the Port of Osijek (TEN-T comprenhensive network)

With the development of the measure I.1 Improvement of the waterway of the Danube River and Drava River to Osijek on the level of strategic assessment is not expected to have a significant negative impact on water bodies and protected areas as well as on the goals of conservation and integrity of the ecological network of the Republic of Hungary, the measure concerns the arrangement of the Drava River waterway from Danube to Osijek (distance more than 50 rkm from the border with the Republic of Hungary). On the intensity and duration of the possible negative impact, a project-level assessment will be carried out, including cross-border impacts in accordance with the Convention on Environmental Impact Assessment across State Boundaries (ESPO).

During the implementation of the measure I.4 Development of the Port of Osijek (TEN-T comprehensive network), since it is a spot site about 50 rkm from the border with the Republic of Hungary, no impact on the water bodies in the Republic of Hungary is expected at the level of strategic assessment. During the development of this measure, the environmental protection requirements applicable to the Water Framework Directive, the Protection of Sensitive Areas and Natura 2000 Areas will be applied, and in the phase of its implementation, a process of estimating the

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impact of an accurately defined environmental intervention will be implemented, regulations to evaluate cross-border impact.

7.3.2.2.1 Natura 2000 areas

Road transport:

- Ro.7 DC 12 junction Vrbovec 2 – Ivanja Reka – Vrbovec – Bjelovar – Virovitica – State border with Hungary towards Barcs

In addition to the aforementioned, the impact of roads on the Natura 2000 areas of the Republic of Hungary was also considered and it was concluded that DC 12 road junction Vrbovec 2 – Ivanja Reka – Vrbovec – Bjelovar – Virovitica – State border with Hungary towards Barcs could have potential impact (Figure 7.36).

Negative impact is largely possible during the construction and at the strategic level of assessment, it is not considered significant.

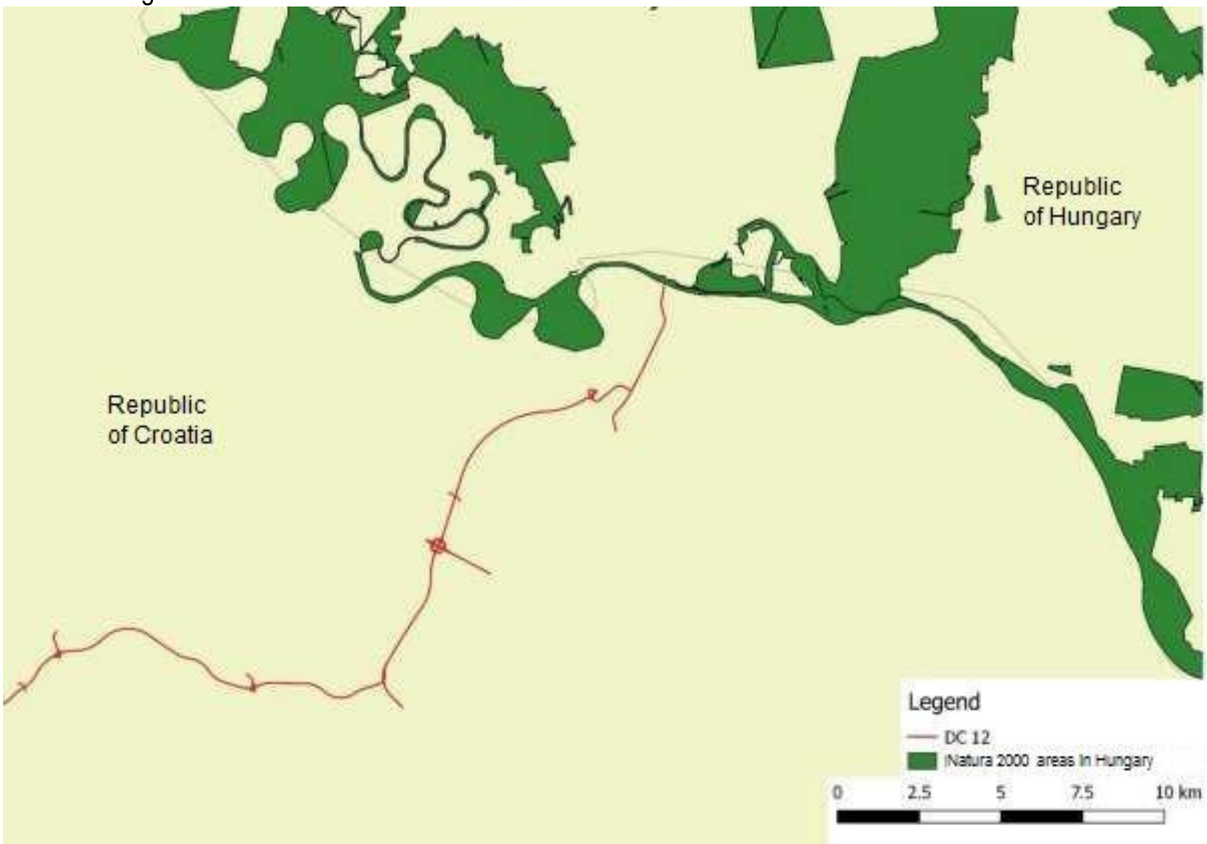

Figure 7.36 DC 12 junction Vrbovec 2 – Ivanja Reka – Vrbovec – Bjelovar – Virovitica – State border with Hungary towards Barcs in relation to Natura 2000 areas in Hungary

7.3.3 Bosnia and Herzegovina

7.3.3.1 Impact of railway and road transport

Railway transport:

Maps in the Study are informative and solely for the purpose of the subject document.

- R.9 State border with Hungary – Osijek – State border with Bosnia and Herzegovina (TEN-T comprehensive network/core network/Pan-European corridor (RH3)

Road transport:

- Ro.1 Connecting by the bridge near Gacka
- Ro.3 A5 from A3 to the state border with Bosnia and Herzegovina (TEN-T comprehensive network//Pan-European corridor RH3)
- Ro.16 Preparations for accessibility of Dubrovnik after the accession of Croatia to Schengen (Peljesac Bridge), continuation of the Adriatic-Ionian Corridor

Interventions that could potentially lead to air pollution in Bosnia and Herzegovina are related to road and railway infrastructure. Potential impacts are possible due to the use of roads (including bridges on the Sava river), that is, emissions of pollutants from vehicles. Since these are not entirely isolated areas, no significant impacts from road activities are expected at the strategic level, i.e. no exceedance of air pollutant concentrations is expected that could lead to a change in the category of air quality in the territory of neighbouring countries.

The impacts of the railway transport development relate to an increase in the volume of traffic on the existing sections. As already mentioned, negative impacts could be expected on wild species and habitats, primarily in the form of fragmentation of habitats and increased noise and vibration along the railway line. The impacts, on the other hand, are considered moderate because they can be mitigated by environmental protection measures during design.

As regards the road traffic, it is important to emphasise that the A5 motorway sections from A3 to the state border with Bosnia and Herzegovina are in different stages of construction (Figure 3.2). The section from Sredanci (A3 motorway) to the border with Bosnia and Herzegovina is currently under construction. This section also includes the bridge across the Sava River. The award of a contract on bridge construction is currently in the public procurement process. The extension of the section on the Bosnian-Herzegovinian side has already been constructed.

Maps in the Study are informative and solely for the purpose of the subject document.

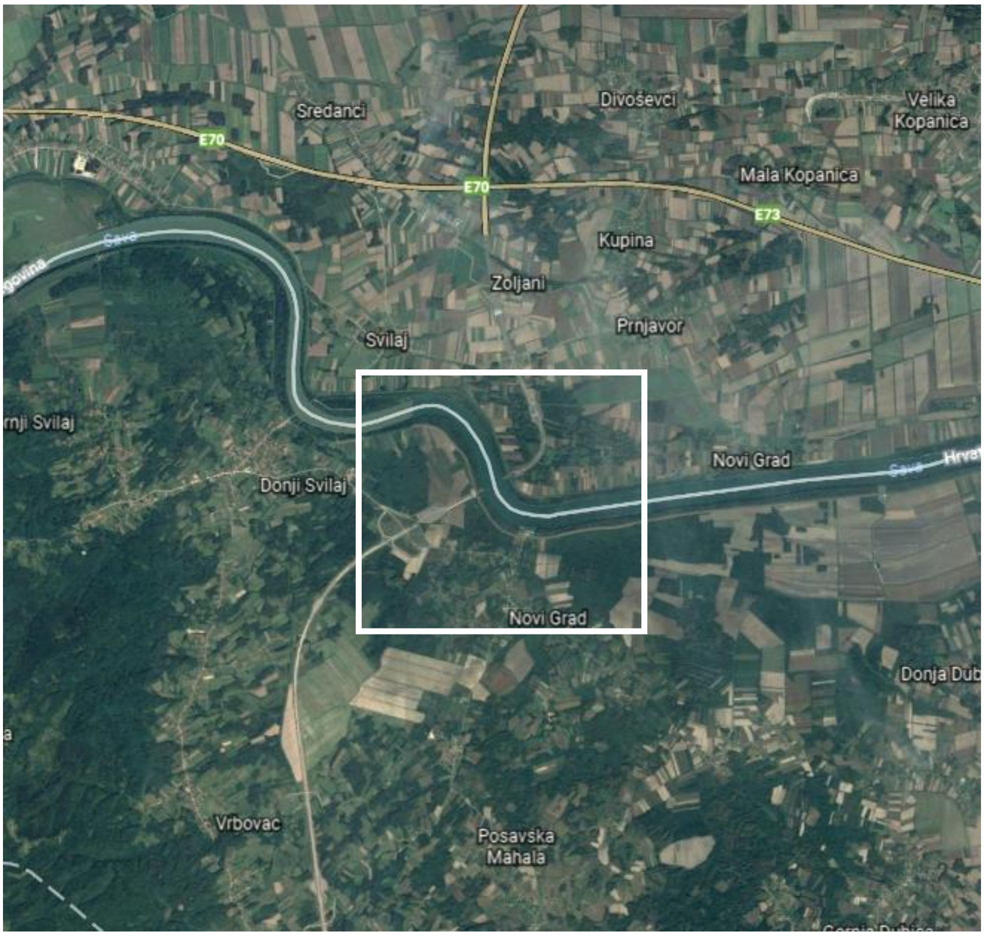

Figure 7.37 A5 from A3 to the state border with Bosnia and Herzegovina (TEN-T comprehensive network/Pan-European corridor Vc) (Svilaj bridge)

In addition to the above mentioned negative impacts, the development of roads leading to the connection of BH to European major corridors would have a positive impact on the socio-economic features within BiH that would be connected to the Republic of Croatia. This would enable BiH's territorial integration with Western Europe (highway A3), or Eastern and Northeast Europe (highway A5).

7.3.3.2 Impact of inland waterway transport

Measures:

- I.1 Improving the navigability of the Sava river
- I.7 Construction of the Danube-Sava multipurpose canal
- I.5 Development of the Port of Slavonski Brod (TEN-T core network)
- I.6 Development of the Port of Sisak (TEN-T comprehensive network)

The negative impacts of improving the navigability of the Sava River and the construction of the Danube - Sava multipurpose canal are possible due to pollution of freshwater from ships.

As stated in the previous chapters, the riskiest impact of ships on the surrounding waters is caused by hazardous substances discharged from ships. The harmful impact and the intensity of the environmentally harmful impact depend primarily on the type of the ship. Although all ships pollute water to a smaller extent due to leakage of

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lubricants and similar substances, dissolving of biocide coatings or disposing waste, the main impacts depend on the type of cargo being transported by the ship. The type and intensity of the negative impact on the condition of water bodies depend on whether the liquid cargo, dry bulk cargo or other types of load (including passengers) is transported.

Stimulating the use of inland waterways by the EU directly affects the growth of transport demand on the Danube, thus potentially increasing the risks of surface and groundwater pollution due to the transport of hazardous substances by inland waterways.

In addition, negative transboundary impacts are possible due to the improvement of the navigability of the Sava river, which can lead to hydromorphological changes that may indirectly affect water habitats and wild species within the borders of Bosnia and Herzegovina.

7.3.3.3 Impact of maritime transport

Measure:

- M.9 Specialization of the Port of Ploče (kontejnerski i rasuti teret)

Transboundary impact of the Ploče port specialization is reflected in the importance of the Ploče port for the economy of Bosnia and Herzegovina, whose transport infrastructure directly depends on the success of the port of Ploče.

7.3.4 Republic of Montenegro

7.3.4.1 Impacts of maritime transport

Measure:

- M.2 Implementation of the “Motorways of the Sea” projects

Potential pollution of the marine environment in the territory of the Montenegro is possible due to the implementation of "Motorways of the Sea" projects and partly due to the planned development of the sea ports. The subject projects, which at this stage of the Strategy are not yet clearly defined, can lead to an increase in maritime traffic, thus increasing the risk of accidental situations that can significantly pollute the marine environment.

7.3.4.1.1 Accidental situations

Increased maritime traffic can also increase the risk of accidental situation, especially when it comes to ships carrying dangerous cargo. These are unpredictable situations that are difficult to prevent, but it is precisely for that reason that adequate intervention plans need to be in place to address potential accidental situations without significant consequences for the marine environment.

Pursuant to the provisions of the Intervention plan for sudden sea pollution (OG 92/08), reports on accidents are prepared and the public is informed through public media and other media about the actions taken. Also, the Subregional intervention plan for the prevention, readiness for and response to the large-scale sudden pollution of the Adriatic Sea (OG-IC 7/08) prescribes the obligation to notify the bodies of other states about the sea pollution.

If pollution by hazardous and harmful substances or exceptional natural event in the sea may endanger the marine environment, human health and economic use of the sea and may have consequences on two or more counties

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or when the amount of pollution by oil and/or oil mixture exceeds 2000 m³, command action is implemented by the Staff for the implementation of the Intervention Plan, in cooperation with the County Operational Centers.

7.3.4.1.2 Noise

By increasing maritime traffic, as a result of the implementation of the measure "Motorways of the Sea", there shall be increased noise emissions. Sound levels and associated effects on marine ecosystems have increased over the past periods, though there are few studies that can quantify these changes. Under water there is sound even without human influence. The main natural sources of sound are seismic (earthquakes, shifts, etc.), meteorological (wind, rain, waves, etc.) and biological (many organisms in the sea produce sound). Many organisms use sound in communication, detecting prey, and threats from predators. Part of their natural environment is in a sound environment, and by placing anthropogenic noise this environment changes, becomes unnatural so that marine organisms can suffer adverse effects. The input of sound energy occurs in a wide range, both in space and time. Anthropogenic sounds can be of short (impulse) or long (continuous) duration. Impulse sounds can be repeated at longer or shorter intervals, but such repetition can be "decomposed" with the distance from the source and the reverberation and become unrecognizable from the continuous noise. Higher frequencies of sound poorly spread in the marine environment, while low frequencies can travel longer. The main source of continuous noise is ship traffic, and impulse underwater noise is caused by the operation of ultrasonic devices (sonars, geological and seismic research), explosions and underwater works. The problem of noise exposure is complex because it includes a wide range of anthropogenic sources in the marine environment, numerous species inhabiting the environment and overlapping in space and time with noise sources. Potential adverse effects of noise exposure range from negligible to significant.

ACCOBAMS (2013) has also defined categories into which negative impacts of noise on the marine mammals can be classified. The first group is physical trauma, i.e. temporary or permanent hearing loss, tissue injuries that do not lead to death and injuries that can potentially lead to the death of the organism in case of immediate exposure. There is also a group of impacts that lead to behavioural changes. Behavioural changes can be small, where the normal activity of the individual does not change, but can be more pronounced when the individuals stop performing their normal activities. The last category refers to noise below the level of the environment and does not affect the organisms.

7.3.4.2 Impacts of road traffic

Measure:

- Ro.11 Dubrovnik – State border with Montenegro

The impact is manifested in the form of air pollution due to increased traffic. Since these are not fully isolated areas of traffic activities, at the strategic level no significant impacts are expected, i.e. no exceedance of concentrations of pollutants in the air is expected, which may lead to changes in the air quality category on the territory of the Republic of Montenegro. At a strategic level, the impact of pollution caused by the new road traffic is assessed as moderately negative and no mitigation measures are prescribed, as the technical measures for mitigating local impact are defined when defining the project, i.e. using the environmental impact assessment.

7.3.5 Republic of Slovenia

7.3.5.1 Impacts of railway and road transport

Interventions which may potentially lead to air pollution in the Republic of Slovenia are related to road and railway infrastructure. Potential impacts are possible due to increased use of routes, i.e. emission of pollutants from the vehicles.

Railway transport:

Maps in the Study are informative and solely for the purpose of the subject document.

- R.1 Zagreb – state border with Slovenia towards Ljubljana (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor)

Road traffic:

- Ro.9 D2 from the state border with Slovenia to the state border with Serbia

The impact of measure R.1 has been rated as moderately negative, as these are not areas where there is no traffic infrastructure, i.e. new polluters. This measure implies improving the M101 track.

Road D2 is an existing corridor, but if new directions are defined, this shall be realized in the next steps of the Strategy implementation. Realization of the measure Ro. 9 is therefore also estimated as having a moderately negative impact on the strategic level.

7.3.5.2 Impacts of maritime transport

Measure:

- M.2 Implementation of the "Motorways of the Sea" projects

Potential pollution of the marine environment in the territory of the Republic of Slovenia is possible due to the implementation of "Motorways of the Sea" projects and partly due to the planned development of the sea ports. The subject projects, which at this stage of the Strategy are not yet clearly defined, can lead to an increase in maritime traffic, thus increasing the risk of accidental situations that can significantly pollute the marine environment. However, given that the Strategy plans to introduce systems to improve maritime safety, the potential risks of accidents can be controlled more successfully.

7.3.5.2.1 Accidental situations

Increased maritime traffic can also increase the risk of accidental situation, especially when it comes to ships carrying dangerous cargo. These are unpredictable situations that are difficult to prevent, but it is precisely for that reason that adequate intervention plans need to be in place to address potential accidental situations without significant consequences for the marine environment.

Pursuant to the provisions of the Intervention plan for sudden sea pollution (OG 92/08), reports on accidents are prepared and the public is informed through public media and other media about the actions taken. Also, the Subregional intervention plan for the prevention, readiness for and response to the large-scale sudden pollution of the Adriatic Sea (OG-IC 7/08) prescribes the obligation to notify the bodies of other states about the sea pollution.

If pollution by hazardous and harmful substances or exceptional natural event in the sea may endanger the marine environment, human health and economic use of the sea and may have consequences on two or more counties or when the amount of pollution by oil and/or oil mixture exceeds 2000 m^3, command action is implemented by the Staff for the implementation of the Intervention Plan, in cooperation with the County Operational Centers.

7.3.6 Republic of Serbia

7.3.6.1 Impact of railway and road transport

Measures that could potentially lead to transboundary pollution, i.e. local exhaust emission increases and pollution of surface and underground flows are as follows:

Maps in the Study are informative and solely for the purpose of the subject document.

Railway transport:

- R.8 Novska – state border with Serbia (TEN-T core network/Pan-European Corridor X)

Road traffic:

- Ro.9 D2 from the state border with Slovenia to the state border with Serbia

Increased concentrations of pollutants mostly occur the vicinity of the roads and their concentration, depending on weather conditions, decreases with distance. Also, concentrations of pollutants are greater by the roads with more heavy duty vehicles, as well as roads with higher speed limits.

7.3.6.2 Impacts of inland waterway transport

Measures:

- I.3 Development of the Port of Vukovar (TEN-T core network)
- I.7 Construction of the Danube-Sava multipurpose canal

The effects of the extension of the river ports are primarily related to the hydromorphological state of the surface waters, since the works shall change the natural appearance of the watercourse basin. The negative influence on the hydromorphological condition shall also affect the ecological state of the surface waters, as it is an integral part of the ecological condition.

Generally, the impact with the highest risk of ships on the surrounding water is caused by harmful substances discharged from ships. The manner of the harmful impact and the intensity of the environmentally harmful effects depend primarily on the type of vessel. Although all ships in a smaller quantity pollute water due to leakage of lubricants and similar substances, dissolving biocide coatings or rejecting waste, the main impacts depend on the type of cargo being transported by ship.

The construction of the Danube - Sava multipurpose canal shall divert a part of the Danube and Sava water, which shall affect the natural water regime of these watercourses, i.e. their water flow dynamics shall be changed. Water flow dynamics form an integral part of the hydromorphological state of surface water and, due to its modification, can lead to significant changes in the habitat conditions, thus making a negative impact on the biological state of surface water.

7.3.7 Conclusion

Estimated impacts of traffic pollution at strategic level have been assessed as moderately negative and local, and no mitigation measures have not been prescribed at strategic level. Measures to mitigate the local impacts of roads that are of technical character are prescribed at the level of environmental impact assessment.

The negative impacts of inland waterway traffic at a strategic level (including accidental situations) may cause significant consequences on the environment and nature. No mitigation measures have been prescribed at the strategic level since the intensity of impact can not be accurately defined without detailed information on the interventions.

In order for the planning of inland navigation not to have significant consequences for surface and ground water and biodiversity of the Danube region, transboundary cooperation has been established within the European Strategy for the Danube Region. The objective of joint management is to define guidance and instructions for decision-makers dealing with water management with the aim of environmentally acceptable planning of inland waterway navigation.

The implementation of the measures proposed by the Strategy shall have a positive impact on traffic connection between the Republic of Croatia and the neighboring countries. Graphic presentations in the study are for the purpose of analyzing the potential impacts and the subject document does not prejudice the boundaries.

Maps in the Study are informative and solely for the purpose of the subject document.

8 Environmental protection measures

8.1 Soil

1. If the intervention is planned in the area of moderate and high risk of erosion, agrotechnical mitigation measures shall be used in accordance with the Ordinance on Agrotechnical Measures.

8.2 Waters

2. When constructing railway lines, concrete sleepers shall be used as much as possible, i.e. wooden sleepers that need to be treated with chemicals before use shall be avoided.
3. During the design and construction of railway lines and roads, the road routes shall be defined in a manner that minimises the impact of changes in the existing river and lake basins to reduce the impact on their hydromorphological condition. When constructing roadways in vulnerable, sensitive or protected areas, at the level of the project, an analysis of potential pollution of the surrounding water bodies shall be conducted and appropriate protection measures shall be prescribed.
4. During the works on the expansion of airports, wastewater drainage system shall be constructed as well as wastewater treatment facilities of the appropriate category.
5. All line and point interventions shall be designed in such a manner as to avoid areas of special water protection - sanitary protection zones.
6. Each newly constructed port, before the preparation of the main design or before the start of use of the port, if the main design is not required, shall have a maritime study accepted and certified by the Port authority in accordance with Article 5 of the Regulation on Conditions to be met by the Ports (OG 110/04).
7. In planned ports, solid waste collection shall be organised and adequate infrastructure shall be provided for wastewater collection from ships.
8. New sea and river ports are planned at locations where the morphological condition of water bodies is rated as very good, i.e. at locations where there are no existing hydromorphological pressures.

8.3 Biodiversity

9. The development of the railway transport on the Karlovac-Rijeka section shell based on a variant solution that passes through the south of the Zlobin village in Primorje-Gorski Kotar County with the sanation of the existing railway line.
10. Motorways and other roads with a planned traffic density of more than 5000 vehicles per day are planned in a manner that shall enable the establishment of adequate capacity for wild species in the next stages of their realisation, taking into account existing transport infrastructure.
11. The transport infrastructure in areas that are evaluated as non-fragmented shall be planned primarily in habitats that are under higher anthropogenic influence with the use of the shortest possible sections through non-fragmented areas. The transport infrastructure shall be planned in a manner that enables the implementation of green infrastructure.
12. The improvement of the maritime transport shall be planned in such a manner as to avoid the areas inhabited by the species *Tursiops truncatus* (bottlenose dolphin) and fish hatches in the Adriatic.
13. The new eastern port on the Danube in Vukovar shall be planned completely outside the borders of the Special reserve of forest vegetation Vukovarske dunavske ade.
14. The section of the road that is planned within the boundaries of the Significant landscape Cetina – Donji tok, and is covered by the measure of Ro. 15 Reorganisation of the Split network, shall be constructed in such a way to avoid disturbing the features of this protected area.
15. The traffic corridor envisaged by measures R.11 Zagreb Node and Ro.8 Reorganization of the main Zagreb network, in which several types of parallel line transport infrastructure are planned to be implemented with a view to mitigate cumulative impacts, shall be constructed in cooperation of all the transport sectors involved, as well as the bodies competent for expert nature protection activities and

bodies competent for forest management in the given area, in order to enable adequate capacity for wild species through parallel roads with minimum disturbance of forest habitats.

8.4 Cultural and historical heritage

Protection of archaeological heritage

16. Prior to undertaking the interventions in the area that arise from spatially located measures, the archaeological field examination shall be conducted and, if necessary, test archaeological research on the positions of known and recorded archaeological sites, which shall determine the scope of protective archaeological research, documentation and conservation of the findings and sites. Archaeological field examination shall be conducted at the locations of potential archaeological sites with indicative names, toponyms and places where changes in relief caused by human action in history are evident.
17. If protective archaeological research results in significant findings that need to be preserved and presented, there is a possibility of relocating the infrastructure route and other planned structures on the locations of such sites.

Protection of cultural and historical units, historical structures and buildings

18. The protection measure system includes the exploration and documentation of the endangered cultural heritage with maximum preservation to mitigate the negative impact on the spatial and visual integrity of the architectural heritage.

Protection of historical cultural landscape

19. Measures for the protection of the historical cultural landscape shall be implemented during the project design stage by designing a landscaping design of the intervention zone area.
20. A landscape sensitivity study shall be prepared prior to the landscaping design.

8.5 Agriculture

21. In the area of Pannonian Croatia, the implementation of the measures that can generate conversion and fragmentation of P1 and P2 land capability class shall be planned to avoid by all means, except in exceptional circumstances, taking P1 and P2 land capability classes.
22. In the area of Dinarides, the measures that can generate conversion and fragmentation of P1 and P2 land capability class shall be implemented outside P1 and P2 land capability class.
23. Measures that can generate conversion and fragmentation of agricultural land shall be planned to maximise the use of existing infrastructure and avoid unnecessary conversion and fragmentation of agricultural land.

8.6 Landscape characteristics

24. The measures envisaged by the Strategy shall be incorporated into the landscape through green infrastructure projects, or projects of Landscaping by an expert (landscape architect).

8.7 Social and economic characteristics

25. When designing roads, the significance of impacts shall be assessed taking into account the estimated traffic increase and, if necessary, appropriate noise protection measures shall be implemented.

8.8 Climate changes

26. All infrastructure projects arising from the measures of the Strategy shall be planned taking into account the potential climate phenomena in the area of measure implementation. The project design shall be realised in accordance with non-formal guidelines: *„Non-paper Guidelines for Project Managers: making vulnerable investments climate resilient"* (European Commission, Directorate-General for Climate Action).

27. The measures envisaged by the Strategy are to be implemented in accordance with the National Policy Framework for the Establishment of Infrastructure and Development of Alternative Fuel Market (NFP) (OG 34/17) and strategic documents and incentives by local and regional self-government units related to the establishment of alternative fuels infrastructure are contained in the aforementioned National Framework

9 Alternative solutions

General, developmental and management and organizational measures of the Strategy do not offer alternative solutions to its activities, while for the spatially located measures are alternative solutions only to the extent of R.3 construction of the railway line from Karlovac to Rijeka (TEN-T basic network / TEN-T Mediterranean corridor / Pan-European Corridor Vb). It offers two variants of the railroad track in Zlobin - northern and southern. As the impact of spatially-located Strategy measures on the environment is thoroughly assessed in chapter 7.2.4 by environmental components, so is the impact of both alternative solutions of measure R.3 on the environment.

The impact of alternative solutions of measure R.3 on the environment has been identified and evaluated on the Biodiversity component of the environment. Given that the Strategy plans to develop the railway network from Zagreb to Rijeka, which includes new corridors through the area of distribution of all three large carnivores (Figure 7.7), the adverse impacts of measure R.3 on the status of their populations can not be ruled out, given the percentage of fatalities on the railway tracks, which especially applies to the bear population. Data analysis found that the new railway sections, covering both alternatives, are interfering the habitats of the three large carnivores less than the existing railway corridor, while a large part of the planned route spatially matches the existing ones. An overview of the alternative solutions suggested for railway construction under measure R.3 found potentially less disturbance of the habitat highly suitable for bears, but also for all three large carnivores, by using the alternatives that pass through the southern part of Zlobin (Primorje-Gorski Kotar County), than the alternative which passes through its northern part. When it comes to habitats, there is a smaller loss of forest habitat with the alternative that passes through the southern part of Zlobin (Primorje-Gorski Kotar County), than with the alternatives which passes through its northern part.

An analysis of the impact of the Zagreb - Rijeka railway network development on the environment identified a railway route which has a moderate impact on the area biodiversity and it was determined and recommended to develop the railway transport on the Karlovac - Rijeka section based on an alternative solution which passes south of the Zlobin settlement in Primorje – Gorski Kotar County, along with the renovation of the existing railway line.

In order to improve the current state, along with the strategic level, it is also necessary to include additional protection measures during the design of the railway to reduce the adverse impacts of railway transport to a lower level than the current one in the mountainous part of Croatia.

10 Environment monitoring

Implementation of the Strategy measures is planned through implementing activities that shall be further elaborated in terms of defining specific projects and the bodies which shall implement a particular project, so that the environmental monitoring obligations shall be defined more precisely.

For this level of defining the Strategy measures, no programme of environmental monitoring and the implementation of measures has been prescribed.

11 Appropriate assessment

11.1 Introduction

11.1.1 Data on the authorized entity and reasons for Study preparation

The developer of the Study of the *Main Acceptability Assessment of the Strategy for the Ecological Network* is the company IRES EKOLOGIJA d.o.o. with registered office in Zagreb, Prilaz baruna Filipovića 21. The copy of the authorization for performance of professional activities in the field of nature protection issued by the Ministry of Environment and Energy is in Chapter 14 of the Appendices.

On 13 July 2015, the Ministry of Environment and Energy issued a Decision (Class: UP/I 612-07/15-71/136, Reg. No.: 51707-2-1-15-4) that for the Transport Development Strategy of the Republic of Croatia for the period 2017-2030, the possibility of significant negative impacts on the conservation objectives and the integrity of the ecological network area shall not be ruled out and the implementation of the main acceptability assessment for the ecological network shall be mandatory for the subject Strategy. The Decision is attached as Appendix 14.3 pursuant to Article 26 of the *Nature Protection Act* (*OGof the Republic of Croatia 80/13*) for the strategies, plans and programmes subject to the strategic assessment, the Main assessment shall be conducted within the procedure for strategic environmental impact assessment of the strategy, plan and programme (SEA).

11.1.2 Description of the impact prediction method

Given that the scope of the Strategy covers the entire territory of the Republic of Croatia and therefore overlaps with the scope of the ecological network proclaimed by the Regulation on the Proclamation of Ecological Network (OGof the Republic of Croatia 124/2013, 105/15), the scope of the possible influence of the Strategy refers to the territory of the Republic of Croatia covered by ecological network.

For indicating the significance of the influence, the scale with five values is used, ranging from -2 (significant negative impact) to +2 (significant positive impact). Each target species and habitat type on which the intervention could have an impact is evaluated with one the values according to the following table (Table 11.1). Additionally, for strategic planning documents, the value "?" is added, where the impacts depend on the manner of implementing specific interventions.

Table 11.1 Applied scale for the intensity assessment of the impact of the planned intervention (Source: Manual for Acceptability Assessment of the Intervention for Ecological Network)

Value	Description	Explanation of description
-2	Significant negative impact (unacceptable adverse impact)	Significant disturbance or destroying impact on target types or species, significant changes in ecological conditions of habitats or species, significant impact on habitats or the natural development of species. Significant adverse impacts shall be reduced by applying mitigation measures to the level below the significance threshold.
-1	Moderate negative impact (adverse impact that is not significant)	Limited / moderate / negligible negative impact Moderately problematic impact on habitats or species population; moderate disturbance of ecological conditions of habitats or species; edge impact on habitats or the natural development of species. Elimination of impacts is possible by applying the proposed mitigation measures.
0	No impact	The Strategy has no visible impacts.
+1	Positive impact that is not significant	Moderate positive impact on habitats or populations; moderate improvement of ecological conditions of habitats or species; moderate positive impact on habitats or the natural development of species.
+2	Significant positive impact	Significant positive impact on habitats or populations; significant improvement of ecological conditions of habitats or species; significant positive impact on habitats or the natural development of species.
?	Impact significance assessment is not possible	For plans, programs, and strategies with a lack of localised elements (e.g. sector operational programmes) or documents with a low level of details, where the impact of their elements can range from -2 to +2, depending on the manner of implementation of specific interventions.

11.2 Ecological network data

11.2.1 Description of ecological network area which the Strategy may have an impact on

The scope of the Strategy covers the entire territory of the Republic of Croatia and therefore overlaps with the scope of the ecological network defined in the Regulation on Ecological Network (OG 124/2013, 105/15). The ecological network of the Republic of Croatia also represents the areas of the EU Natura 2000 ecological network. The ecological network of the Republic of Croatia are the conservation areas significant for birds - SPA (areas significant for conservation and achieving favourable conservation status of wild bird species of interest for the European Union, as well as their habitats, and areas significant for conservation of migratory bird species, in particular wetlands of international importance) and conservation areas significant for species and habitat types - SCI (areas significant for conservation and achieving favourable conservation status of other wild species and their habitats, as well as natural habitat types of interest for the European Union). Detailed data on the number and area of the ecological network areas in the Republic of Croatia are shown in the table (Table 11.2) and in the maps (Figure 11.1, Figure 11.2) below.

Table 11.2 Data on the number and area of ecological network areas in the Republic of Croatia (Source: HAOP, http://www.dzzp.hr/ekoloska-mreza/natura-2000)

Ecological network	RoC land area (%)	RoC land share (%)	Area of territorial sea and inland sea waters of the RoC (km^2)	Share of territorial sea and inland sea waters of the RoC (%)	Area outside the territorial sea and inland sea waters of the RoC (km^2)	Total RoC area (km^2)	Total RoC area share (%)	Number of ecological network area
SPA	16,104.92	28.46	4594.59	14.47	9.81	20,709.33	23.44	743
SAC	17,103.62	30.22	1045.44	3.29	-	18,149.06	20.54	38
TOTAL	**20,785.83**	**36.73**	**4896.34**	**15.42**	**9.81**	**25,691.98**	**29.08**	**781**

Figure 11.1 Conservation areas significant for birds (Source: Appendix IV of the Regulation on Ecological Network, OG 124/13, 105/15)

Figure 11.2 Conservation areas significant for species and habitat types (Source: Appendix IV of the Regulation on Ecological Network, OG 124/13, 105/15)

When considering the share of the ecological network in the total area of Croatia, account should be taken of the differences in shares in the continental Croatia and the karst area of Croatia. Namely, the continental part of Croatia, which is naturally similar to the countries of Central Europe, is also close to the aforementioned EU countries in the percentage of Natura 2000 network. However, the karst area of Croatia, which includes most of the Alpine and the entire Mediterranean region, is rich in biodiversity and is recognized as one of the most important areas of preserved nature in Europe (Figure 11.3). This area with its percentage of the Natura 2000 network differs from the European average, stemming from the fact that these areas were not under significant influence of glaciation and are therefore characterized by a large number of endemic species, particularly tertiary relics.

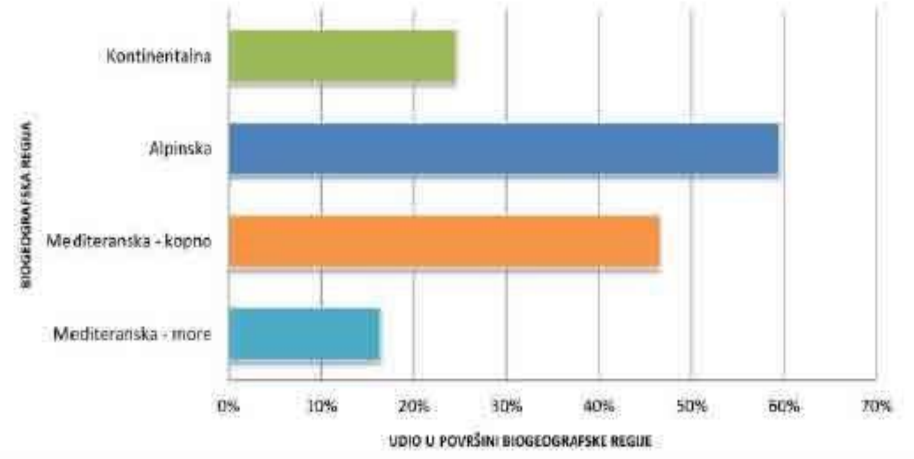


Figure 11.3 Ecological network share in RoC by particular biogeographical regions (Source: HAOP)

SCI areas are indicated for 74 habitat types (Topić i Vukelić 2009; Gottstein 2010, Bakran-Petricioli 2011) (Table 11.3) and 135 species (Table 11.4). Of these, 20 habitat types and nine species are of priority, and for their conservation the European Union is particularly responsible considering the extent of their natural areal and their endangerment.

SPA areas are indicated for 126 species of birds in which the species listed in Annex I of the Directive 2009/147/EC of the European Parliament and Council of 30 November 2009 on the conservation of wild birds are listed as well.

Table 11.3 Number of habitat types for 126 species of birds according to which the ecological network areas have been indicated (Source: Topić and Vukelić 2009; Gottstein 2010; Bakran-Petricioli 2011; Regulation on the Ecological Network, OG 124/13, 105/15)

Habitat type groups	Number of habitat types
Coastal and halophytic habitats	13
Coastal sand dunes and inland dunes	2
Freshwater habitats	9
Temperate heath and scrub	3
Sclerophyllous scrub	3
Natural and semi-natural grassland formations	16
Raised bogs and mires and fens	5
Rocky habitats and caves	5
Forests	18

Table 11.4 Number of species by groups according to which the ecological network areas have been indicated (Source: Regulation on Ecological Network, OG 124/13, 105/15)

Group	Number of species
Plants	20
Shellfish	2
Gastropods	3
Crustaceans	2
Insects	24
Fish	52
Amphibians	6
Reptiles	7
Birds	126
Mammals	19

Strategy implementation can affect all target habitats and target species of the ecological network of the Republic of Croatia due to its wide coverage and the relatively large number of impacts arising from its measures which contribute to increasing the quality of the transport system and the transport infrastructure of the Republic of Croatia.

In the table below (Table 11.6), the ecological network areas where transport and transport infrastructure are listed as pressures affecting these ecological network areas, pursuant to the Natura 2000 Standard form. The impacts of a certain defined pressure are associated with all human activities and natural processes which can positively or negatively affect the area conservation and management. Traffic and infrastructure are denoted by letter D in the valid reference list of hazards, pressures and activities (Table 11.5).

Table 11.5 List of threats in category D of Traffic and Infrastructure (Source: *Reference material for the reporting period 2007-2012 under the Article 17 of the Habitats Directive*)

D	Traffic and Infrastructure	
D01	Roads, paths and railway	D01.01 Paths, tracks, bicycle trails D01.02 Roads, motorways D01.03 Parking lots D01.04 Railway tracks D01.05 Bridges, viaducts D01.06 Tunnels
D02	Communal infrastructure	D02.01 Electrical lines and telephone lines D02.02 Pipelines D02.03 Communication poles and antennas D02.09 Other means of energy transport
D03	Ship lines, ports, maritime structures	D03.01 Port areas D03.02 Ship lines D03.03 Maritime structures
D04	Airports, air lines	D04.01 Airports D04.02 Heliports D04.03 Air lines
D05	Improved area accessibility	-
D06	Other means of transport and communication	-

Table 11.6 RoC ecological network areas for which the traffic has been indicated as negative pressure (Source: Natura 2000 Standard form)

Area code	Area name	Pressure code	Pressure description
HR1000040	Papuk	D	Transport and Infrastructure
HR2000573	Petrijevci	D	
HR2001389	Banićevac	D	
HR2001495	Jama kod Burići	D	
HR2000730	Bistrinci	D	
HR2001145	Izvor špilja pod Velim vrhom	D	
HR4000019	Paške stijene Velebitskog Kanala (Rt Deda - Rt Krištofer)	D01	Roads, paths and railway tracks
HR2001215	Boljunsko polje	D01	
HR4000018	Paške stijene Velebitskog Kanala (Rt Sv. Nikola – Rt Fortica – Rt Mrtva)	D01	
HR2000947	Gornji Majkovi - lokve	D01	
HR2001304	Žbevnica	D01	
HR2001115	Strahinjčica	D01	
HR5000031	Delta Neretve	D01	
HR2000911	Kolansko blato - Blato Rogoza	D01	
HR2000641	Zrmanja	D01	
HR2001415	Spačva JZ	D01	
HR2000876	Crni vrh kod Vrhovina	D01	
HR2001364	JI dio Pelješca	D01	
HR2001356	Zrinska gora	D01	
HR2001218	Benkovac	D01	
HR2001088	Mala Dubrava - Vučedol	D01	
HR3000163	Stonski kanal	D01	
HR2001485	Istra - Martinčići	D01	
HR2001058	Lička Plješivica	D01	
HR2000543	Vlažne livade uz potok Bračana (Žonti)	D01	
HR2001361	Ravni kotari	D01	

Area code	Area name	Pressure code	Pressure description
HR2001338	Područje oko špilje u uvali Pišćena, Hvar	D01	
HR2001343	Područje oko špilje Duboška pazuha	D01	
HR2001500	Stepska staništa kod Bapske	D01	
HR2001367	I dio Korčule	D01	
HR2000601	Park prirode Učka	D01	
HR2001430	Golubinjak	D01	
HR2001335	Jastrebarski lugovi	D01	
HR2001358	Otok Cres	D01	
HR2000444	Varoški Lug	D01	
HR2001323	Česma - šume	D01	
HR1000018	Učka i Ćićarija	D01	
HR1000033	Kvarnerski otoci	D01	
HR2000234	Draganićka šuma - Ješevica 1	D01	
HR2001486	Istra - Čepićko polje	D01	
HR2000589	Stupnički lug	D01	
HR2000616	Donji Kamenjak	D01	
HR2001432	Lug - Jasenak	D01	
HR3000431	Akvatorij J od uvale Pržina i S od uvale Bilin žal uz poluotok Ražnjić	D01	
HR2000488	Južni Dilj	D01	
HR2000629	Limski zaljev - kopno	D01	
HR2000623	Šume na Dilj gori	D01	
HR2000645	Bjelolasica	D01	
HR2000637	Motovunska šuma	D01	
HR2000703	Tarska uvala - Istra	D01	
HR2001319	Ris	D01	
HR2001416	Brezovica-Jelik	D01	
HR2000465	Žutica	D01	
HR5000037	Nacionalni park Mljet	D01	

Area code	Area name	Pressure code	Pressure description
HR3000433	Ušće Mirne	D01	
HR2000522	Luka Budava - Istra	D01	
HR2000555	Lokva u Prljevićima	D01	
HR2000570	Crni jarki	D01	
HR2000546	Vlažne livade uz Jugovski potok (Štrcaj)	D01	
HR2001350	Podbiokovlje	D01	
HR2001253	Poštak	D01	
HR2001353	Lokve-Sunger-Fužine	D01	
HR2000132	Područje oko špilje Škarin Samograd	D01	
HR2001363	Zaleđe Trogira	D01	
HR2000447	Nacionalni park Risnjak	D01	
HR5000022	Park prirode Velebit	D01	
HR5000020	Nacionalni park Plitvička jezera	D01	
HR2000937	Vidova gora	D01	
HR2001360	Šire rovinjsko područje	D01	
HR4000010	Saplunara	D01	
HR5000030	Biokovo	D01	
HR5000019	Gorski kotar i sjeverna Lika	D01	
HR2001337	Područje oko Rafove (Zatonske) špilje	D01	
HR2001484	Istra - Čački	D01	
HR3000450	Solana Pag	D01	
HR2000416	Lonjsko polje	D01	
HR2001357	Otok Krk	D01	
HR2001384	Solana Dinjiška	D01	
HR2001334	Poluotok Ubaš	D01	
HR2000580	Papuk	D01	
HR2001017	Lipa	D01	
HR1000029	Cetina	D01	

Area code	Area name	Pressure code	Pressure description
HR2000946	Snježnica i Konavosko polje	D01	
HR2000929	Rijeka Cetina - kanjonski dio	D01	
HR2001301	Podbilo	D01	
HR3000031	Sv. Juraj - otočić Lisac	D01	
HR2000782	Rečice	D01	
HR2001386	Pazinski potok	D01	
HR2000200	Zagorska peć kod Novog Vinodola	D01	
HR2001365	Pazinština	D01	
HR2000369	Vršni dio Ravne gore	D01.01	Paths, tracks nad bicycle trails
HR2000942	Otok Vis	D01.01	
HR2001298	Vejalnica i Krč	D01.01	
HR2000591	Klek	D01.01	
HR2000449	Ribnjaci Crna Mlaka	D01.01	
HR2001097	Biševo kopno	D01.01	
HR2001002	Čepelovačke livade	D01.02	Roads and motorways
HR2001388	Budava	D01.02	
HR5000025	Vransko jezero i Jasen	D01.02	
HR4000002	Park prirode Telašćica	D01.02	
HR1000025	Vransko jezero i Jasen	D01.02	
HR2000931	Jadro	D01.02	
HR2000171	Tabaina špilja	D01.02	
HR2001347	Donje Međimurje	D01.02	
HR2001046	Matica-Vrgoračko polje	D01.02	
HR2001255	Bulji	D01.02	
HR2000950	Slano - oleandri	D01.02	
HR2001321	Jasena ponor	D01.02	
HR1000035	NP Kornati i PP Telašćica	D01.02	
HR5000038	Park prirode Lastovsko otočje	D01.02	

Area code	Area name	Pressure code	Pressure description
HR2001294	Bruvno	D01.02	
HR2001367	I dio Korčule	D03	Ship lines, ports and maritime structures
HR3000172	Obalna linija od luke Gonoturska do rta Vratnički	D03	
HR2001343	Područje oko špilje Duboška pazuha	D03	
HR1000033	Kvarnerski otoci	D03	
HR3000161	Cres - Lošinj	D03	
HR2001358	Otok Cres	D03	
HR1000032	Akvatorij zapadne Istre	D03	
HR3000042	Košljunski zaljev	D03	
HR4000028	Elafiti	D03	
HR3000165	Uvala Slano	D03	
HR2001357	Otok Krk	D03	
HR3000431	Akvatorij J od uvale Pržina i S od uvale Bilin žal uz poluotok Ražnjić	D03	
HR2000629	Limski zaljev - kopno	D03	
HR3000170	Akvatorij uz Konavoske stijene	D03	
HR4000007	Badija i otoci oko Korčule	D03	
HR4000017	Lokrum	D03	
HR3000461	Uvala Modrić	D03	
HR2001260	Poluotok Molunat	D03	
HR3000031	Sv. Juraj - otočić Lisac	D03	
HR3000163	Stonski kanal	D03	
HR3000018	Podmorje otoka Unije	D03	
HR3000166	Sjeverna obala od rta Pusta u uvali Sobra do rta Stoba kod uvale Okuklje s otocima i akvatorijem	D03	
HR4000015	Malostonski zaljev	D03	
HR2001338	Područje oko špilje u uvali Pišćena, Hvar	D03	
HR3000153	Otok Korčula - od uvale Poplat do Vrhovnjaka	D03	
HR3000126	Ušće Cetine	D03	
HR3000150	Pelješac - od uvale Rasoka do rta Osičac	D03	

Area code	Area name	Pressure code	Pressure description
HR3000002	Plomin - Moščenička draga	D03.01	Port areas
HR3000001	Limski kanal - more	D03.01	
HR3000433	Ušće Mirne	D03.01	
HR3000017	Podmorje otoka Suska	D03.01	
HR2001388	Budava	D03.01	
HR3000003	Vrsarski otoci	D03.01	
HR3000014	Ilovik i Sv. Petar	D03.01	
HR3000004	Cres - rt Grota - Merag	D03.01	
HR3000053	Silba - podmorje	D03.01	
HR3000052	Olib - podmorje	D03.01	
HR3000063	Prolaz između Zapuntela i Ista	D03.01	
HR3000074	Rivanjski kanal sa Sestricama	D03.01	
HR3000067	Luka Soliščica; Dugi Otok	D03.01.02	Docks/tourist ports
HR3000044	Uvala Vlašići	D03.01.02	
HR3000445	Murterski kanal	D03.01.02	
HR3000457	Južna obala Hvara - od rta Nedjelja do uvale Česminica	D03.01.02	
HR1000023	SZ Dalmacija i Pag	D03.01.02	
HR3000415	Uvale Jaz; Soline i Sulinj na Krku	D03.01.02	
HR3000468	Podmorje poluotoka Lopar - Rab	D03.01.02	
HR3000417	Zaljev Sv. Eufemije na Rabu	D03.01.02	
HR3000095	Pakleni otoci	D03.01.02	
HR3000085	Otok Vrgada SI strana s o. Kozina	D03.01.02	
HR3000045	Uvala Dinjiška	D03.01.02	
HR3000024	Supetarska draga na Rabu	D03.01.02	
HR5000038	Park prirode Lastovsko otočje	D03.02	Ship lines
HR3000073	J rt o. Zverinac	D03.02	
HR3000419	J. Molat-Dugi-Kornat-Murter-Pašman-Ugljan-Rivanj-Sestrunj-Molat	D03.02	
HR3000463	Uvala Remac	D03.02	

Area code	Area name	Pressure code	Pressure description
HR4000002	Park prirode Telašćica	D03.02	
HR3000442	Kakanski kanal	D03.02	
HR3000074	Rivanjski kanal sa Sestricama	D03.02	
HR3000078	Otok Tukošćak i o. Mrtonjak	D03.02	
HR3000075	Otok Jidula do rt Ovčjak; prolaz V. Ždrelac	D03.02	
HR5000037	Nacionalni park Mljet	D03.02	
HR4000001	Nacionalni park Kornati	D03.02	
HR3000004	Cres - rt Grota - Merag	D03.02	
HR3000079	Otok Karantunić	D03.02	
HR3000002	Plomin - Mošćenička draga	D03.02	
HR3000469	Viški akvatorij	D03.02	
HR3000471	Uvala Škvaranska - Uvala Sv. Marina	D03.02	
HR3000433	Ušće Mirne	D03.02.01	Freight lines
HR3000430	Pantan	D03.03	Maritime structures
HR3000177	Zmajevo oko	D03.03	
HR3000001	Limski kanal - more	D03.03	
HR3000414	Zmajevo uho	D03.03	
HR3000003	Vrsarski otoci	D03.03	
HR4000004	Velo i Malo Blato	D04	Airports and air lines
HR2001357	Otok Krk	D04	
HR5000025	Vransko jezero i Jasen	D04	
HR1000033	Kvarnerski otoci	D04	
HR1000025	Vransko jezero i Jasen	D04	
HR5000037	Nacionalni park Mljet	D04.03	Air paths
HR4000001	Nacionalni park Kornati	D04.03	
HR5000037	Nacionalni park Mljet	D05	Improved area accessibility
HR2000580	Papuk	D05	
HR4000001	Nacionalni park Kornati	D05	

Area code	Area name	Pressure code	Pressure description
HR5000038	Park prirode Lastovsko otočje	D05	
HR4000002	Park prirode Telašćica	D05	
HR5000025	Vransko jezero i Jasen	D05	
HR1000025	Vransko jezero i Jasen	D05	
HR2000942	Otok Vis	D05	
HR2000447	Nacionalni park Risnjak	D06	Other means of transport and communication
HR2000601	Park prirode Učka	D06	

11.3 Description of the impacts of the Strategy on ecological network

The impacts of transport development on biodiversity, that is, the target species and target habitat types of the ecological network are manifested in several ways, depending on the type of transport that is divided into the following sectors in the subject Study: public transport, road transport, railway transport, air transport, maritime transport and inland waterways transport.

Primary impacts are related with the fragmentation of habitats, the interruption of migratory paths (especially for large carnivores, amphibians and reptiles), fatalities of species due to collisions with means of transport, environmental pollution (air, soil, underground, land and sea water), noise disturbance, vibration, light, spread of invasive species, etc.

In the case of waterways, the impacts relate to degradation of aquatic and wetland habitats, hydromorphological changes in river flow, water quality changes, continuous disturbance of species. In the case of air traffic, adverse effects may arise from bird disturbance, land use for the expansion of airports, collision of birds with airplanes and the like.

The major impacts expected in the sea transport are strongly linked to the impacts on sea quality, eutrophication in ports and the spread of invasive species. All these impacts are intensified with the already existing infrastructure and the existing impacts of various forms of traffic (cumulative impact).

By analysing the Main Objectives and Specific Objectives applicable to all traffic sectors, it is concluded that their impact is neutral for the ecological network and that only the specific measures that are spatially located have been separated and their impact on the ecological network is analysed below.

For the purposes of the environmental impact assessment, the measures defined by the Strategy are divided into four categories:

1. General measures
2. Development measures
3. Management and organisational measures
4. Spatially located measures

The first three categories contain all the measures pertaining to the organization and management of the traffic system or to the development and improvement of the traffic infrastructure without mentioning specific projects. For these measures, it has been assessed that they have neutral impact (0) or impact which can not be assessed (?), and they are listed below according to sectors. For the two measures which may potentially have an impact on the ecological network: I.1 Improving the waterway of Danube and Drava rivers to Osijek and I.2 Improvement of the Sava River, impact assessment has been performed.

Last category of measures includes specific spatial interventions, and the impact assessment of measures which belong to the category Spatially located measures is shown in subsection 11.3.1.

<u>General measures</u>

G.1 National concept for cargo logistics
G.2 Increasing access to international airports through public transport
G.3 Improving the safety of the transport system
G.4 Increasing intermodality in the passenger transport and development of passenger hubs
G.5 Maintenance concept for various traffic systems
G.6 Increasing energy efficiency of the traffic system
G.7 Reorganisation of the transport system for greater sustainability
G.8 Adjusting the legal framework and planning guidelines to relevant EU requirements and policies

G.9 Preparation and compliance with the requirements of the Schengen Agreement
G.10 Increasing administrative capacity/training
G.11 Improving the public perception of the traffic system in Croatia
G.12 Reduce negative environmental impacts of traffic
G.13 Adapting to climate changes and their mitigation
G.14 Improving the data collection process
G.15 Enhancing interoperability with neighbouring countries

Development measures

Urban, suburban and regional transport

U.2 Infrastructure development
U.3 Development of stops
U.4 Separating transport modes – identifying priorities in public transport, elimination of bottlenecks
U.6 Alternative fuelling stations

Railway transport

R.15 ETCS L1, L2 on other railway lines, GSM-R
R.16 Electrification of other railway lines
R.17 Restoration, upgrading of other railway lines
R.18 Regional transport except Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)
R.19 Improvements and new railway yards

Road transport

Ro.18 Reorganisation of toll collection system
Ro.20 Secondary and tertiary restoration of roads and connection
Ro.21 Developing the concept of rest stops for the road network with a high level of service
Ro.22 Traffic management and control, traffic counting and information system
Ro.23 Junction development plan

Air transport

A.10 Airport accessibility
A.11 Airport safety
A.13 Termination or change of the role/ownership of regional airports

Maritime transport

M.1 Increasing intermodality and accessibility
M.2 Implementation of the “Motorways of the Sea” projects
M.4 Fuel distribution facilities for gas-powered ships and eco-ships
M.5 Sea safety
M.6 Improving island accessibility, port development M.7 Development of other ports (e.g. Korčula, Pula)
M.14 Development of special-purpose ports (ports for shipbuilding, nautical tourism, military ports, industrial ports, fishing ports, sports ports)
M.16 Closure or change of the role/ownership of unused ports

Inland waterway transport

I.1 Improving the waterway of Danube and Drava rivers to Osijek
I.2 Improvement of the Sava River
I.11 Terminals for hazardous substances and waste management facilities

Management and organisational measures

Urban, suburban and regional transport

U.13 Ticketing and common ticket systems
U.14 Introduction of public transport services on-demand
U.15 Harmonisation of timetables (coordination)
U.16 Administrative capacity and training
U.17 Purchase of the new fleet
U.18 Transport reorganisation
U.19 Information platform
U.20 Support to non-profit organisations in the transport sector
U.21 Traffic and logistics management and information
U.22 Review/updating of local/regional Master Plans

Railway transport

R.26 Reorganisation of charging fees for the use of railway infrastructure
R.30 Improving the rolling stock for passenger transport
R.31 Improving the rolling stock for cargo transport
R.35 Liberalisation of passenger transport
R.36 Liberalisation of cargo transport
R.38 Business/timetable reorganisation

Road transport

Ro.34 Updating of legal regulations and planning guidelines
Ro.35 Implementation
Ro.36 Improving the data collection system

Air transport

A.15 Enhancing cooperation with competent regional bodies
A.16 Croatia Airlines restructuring
A.19 Cooperation with the aviation industry
A.20 Air traffic management, Single European Sky, SESAR
A.21 Raising awareness of customer satisfaction
A.22 Increasing financial viability of airports
A.23 Limiting environmental impacts
A.24 Revision/update of airport Master plans
A.25 Cooperation/agreements with other international airports

Maritime transport

M.17 Cooperation with the shipping industry
M.18 Strategic maritime definition

M.20 Operational plan improvement (ship routing etc.)
M.21 Traffic management using the IT system, VTMIS
M.28 Modernisation of vessels (safety, energy efficiency and environmental protection) M.29 Cooperation/agreements with other international ports

Inland waterway transport

I.16 Cooperation with Croatian ship owners
I.18 Support to companies for inland waterway transport
I.20 Increase the fleet of vessels for monitoring the safety of navigation and vessels for environmental protection
I.21 Cooperation/agreements with other international ports

Spatially located measures

Road traffic

Ro.1 Connecting via the bridge near Gradiška
Ro.2 A5 Osijek – state border with Hungary Pecs (TEN-T comprehensive network/Pan-European corridor RH3)
Ro.3 A5 from A3 to the state border with Bosnia and Herzegovina (TEN-T comprehensive network/Pan-European corridor RH3)
Ro.4 A7 Križišće – Žuta Lokva (TEN-T comprehensive network/Adriatic-Ionian direction)
Ro.5 A11 Lekenik – Sisak
Ro.6 DC 10 Vrbovec – Križevci – Koprivnica – State border with Hungary towards Kaposvár
Ro.7 DC 12 junction Vrbovec 2 – Ivanja Reka – Vrbovec – Bjelovar – Virovitica – State border with Hungary towards Barcs
Ro.8 Reorganisation of the main Zagreb network
Ro.9 D2 from the state border with Slovenia to the state border with Serbia
Ro.10 Reorganisation of the Rijeka network
Ro.11 Dubrovnik – State border with Montenegro
Ro.12 Capacity increase – dedicated lane for public transport between Zagreb and Karlovac
Ro.13 Capacity increase – dedicated lane for public transport on the Zagreb bypass
Ro.14 Improving access to the Port of Slavonski Brod
Ro.15 Reorganisation of the Split network
Ro.16 Preparations for the accessibility of Dubrovnik after Croatia joins the Schengen Area (Pelješac Bridge)

Railway transport

R.1 Zagreb – state border with Slovenia towards Ljubljana (TEN-T core network/TEN-T Mediterranean corridor / PanEuropean corridor)
R.2 Zagreb – Karlovac (TEN-T core network/TEN-T Mediterranean corridor/Pan-European corridor RH2)
R.3 Karlovac to Rijeka (TEN-T core network/TEN-T Mediterranean corridor/Pan-European corridor RH2)
R.4 Railway network around Rijeka
R.5 Zagreb – Križevci (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor RH2)
R.6 Križevci – state border with Hungary towards Budapest (TEN-T core network/TEN-T Mediterranean corridor / PanEuropean corridor RH2)
R.7 Zagreb – Novska (TEN-T core network/Pan-European Corridor RH1)
R.8 Novska – state border with Serbia (TEN-T core network/Pan-European Corridor RH1)

R.9 State border with Hungary – Osijek – State border with Bosnia and Herzegovina (TEN-T core network/Pan-European Corridor RH3)
R.10 Regional link Vinkovci – Vukovar (TEN-T core network/access to Pan-European Corridor RH1)
R.11 Zagreb node
R.14 Zagreb Central Station

Air transport

A.1 Dubrovnik Airport development (TEN-T comprehensive network)
A.2 Pula Airport development (TEN-T comprehensive network)
A.3 Brač Airport development
A.4 Mali Lošinj Airport development
A.5 Osijek Airport development (TEN-T comprehensive network)
A.6 Rijeka Airport development (TEN-T comprehensive network)
A.7 Split Airport development (TEN-T comprehensive network)
A.8 Zadar Airport development (TEN-T comprehensive network)
A.9 Franjo Tuđman Airport development (TEN-T comprehensive network)

Maritime transport

M.8 Specialization of the Port of Rijeka (container, liquid cargo transport and LNG terminal)
M.9 Specialization of the Port of Ploče (container and bulk cargo)
M.10 Specialization of the Port of Dubrovnik (cruise ships)
M.11 Specialization of the Port of Split (RO-RO, passenger and cruise traffic)
M.12 Specialization of the Port of Zadar (RO-RO, passenger and cruise traffic)
M.13 Specialization of the Port of Šibenik (smaller vessels and super yachts)

Inland waterway transport

I.3 Development of the Port of Vukovar (TEN-T core network)
I.4 Development of the Port of Osijek (TEN-T comprehensive network)
I.5 Development of the Port of Slavonski Brod (TEN-T core network)
I.6 Development of the Port of Sisak (TEN-T comprehensive network)
I.7 Construction of the Danube-Sava multipurpose canal

11.3.1 Possible individual impacts of the spatially located measures of the strategy

When it comes to the transport infrastructure, the interventions differ largely only in size and accordingly in the intensity of the impact. The size of the intervention ranges from constructing a new road to extending or reconstructing an already existing road by adding traffic lanes, intersections, crossings, etc. The impacts that traffic interventions can have on the target species and habitats of the ecological network are mostly of a similar nature. The impact assessment depends on the size and intervention design of a particular intervention.

According to the HAOP <*Croatian Agency for the Environment and Nature*> Expert Guidelines, the three major sources of intervention impact should be distinguished for the purpose of assessing the impact of traffic interventions on the ecological network. The first source of impact is the performance of construction works, the second is the facility itself, and the third is the traffic activity. Depending on the original source of impact, they differ in terms of intensity, coverage, duration, and characteristics. The impact is usually most pronounced during construction works. However, it is also of a limited duration depending on the size of the intervention. During the construction of large motorways, the works of different intensity may last several years. Once the works are completed, the construction stage impact is reduced, but it still remains present for a longer period of time. On the other hand, the impact of the traffic itself is usually increased over time and depends largely on the density and amount of vehicles.

The following impacts are possible **during construction**:

- Loss of land/area use: Temporary used areas (outside the location of the road, work belt), e.g. for storage purposes, work machines, etc.
- Change in the landscape layout (geomorphology): Visual changes are greatest during construction works, since construction often requires the transfer of large quantities of land. The underground parts of the structure itself need to be dug in, construction works require a larger space for e.g. storing and moving, than the road itself.
- Change in functional connection: the construction site hinders connectivity, especially in areas of intensive works.
- Noise: Construction sites are usually a source of great noise, which is continuous during the performance of works (e.g. machine operation, etc.), and the most noise is produced by works such as mining or drilling.
- Air pollution: Machines emit substances that pollute the air, dust is spread, mining causes great amount of dust
- Water pollution: Normal operation of work machines causes the release of substances that pollute the water, but also possible release of fuel, oil, etc.
- Vibrations: Construction works, trucks and large machines cause vibrations, which are most intense during mining or drilling.
- Changes in the hydrological regime (quality and quantity): Construction works can temporarily disrupt the hydrological regime, and it may be necessary to move underground and surface water flows.

Line facility with secondary structures may have the following impacts:

- Loss of land/area use: Permanent use of areas where the road is located, but also secondary structures such as auxiliary roads, structure for water source protection, etc.
- Asphalting: Mainly roads, but also secondary structures such as auxiliary roads
- Change in the landscape layout: Dams, bridges and crossings change the layout, but after the completion of the works, efforts are made to integrate the road into the surrounding landscape where possible (growing vegetation).
- Change in functional connection: Roads can interrupt connectivity (depending on the structure); if there are no mitigation measures, the connection is terminated permanently.
- Changes in the hydrological regime: The facility may permanently disturb the hydrological regime due to e.g. laying the foundations, which affects groundwater.

During the use, the transport infrastructure interventions may have the following impacts:

- Noise: Traffic emits the noise of different volume, intensity, characteristics, and frequencies depending on the traffic density, which may vary depending on the time of the day, but also the type of traffic, e.g. only cargo vehicles or only personal cars (the noise emitted by the railway has completely different characteristics than the noise emitted by car traffic).
- Air pollution: substances that pollute the air largely depend on the type of traffic, vehicles (e.g. trucks, cars), traffic density, speed limits, etc.
- Light: Roads of great importance usually do not have lighting, but vehicles in motion emit light.
- Water pollution: depends on the traffic density, accidents during the transport of dangerous cargo, etc.
- Vibrations after the start of using the infrastructure: Vibrations are mostly caused by the railway, while cars usually do not cause vibrations, but goods vehicles and trucks do cause vibrations, mostly in a relatively small range.
- Change in functional connection: Traffic density is often a key factor that conditions whether or not the connection shall be interrupted.

The construction and use of line facilities has different impacts on habitat types and plant and animal species. The impacts are different in the construction stage and in the stage of using the line object, whereby the impacts at the construction stage are mostly short-term while the impacts in the use stage last for much longer.

11.3.1.1 Road transport

<table>
<tr><th>Code and name of measure</th><th>Ro. 1 Connecting via the bridge near Gradiška</th></tr>
<tr><td>Description of the measure</td><td>The bridge near Gradiška over the Sava River is part of the road corridor Hungarian border - Virovitica Okučani - Bosnia and Herzegovina border (Stara Gradiška). This road is located on the corridor of the existing state road D5, and the bridge is an integral part of the international agreement between Croatia and Bosnia and Herzegovina. The Republic of Bosnia and Herzegovina has already completed the motorway from Banja Luka (Bosnia and Herzegovina) to Gradiška, however, a planned bridge shall be constructed to connect the motorway from Bosnia and Herzegovina with the existing Zagreb-Lipovac (A3) motorway. Border crossing Gradiška is one of the two largest border crossings between Croatia / EU and Bosnia and Herzegovina for all types of transport.</td></tr>
<tr><td>Areas of ecological network that may be impacted by the implementation of the measure</td><td>HR1000004 Donja Posavina
HR2001311 Sava downstream od Hrušćice
HR2000416 Lonjsko polje</td></tr>
<tr><td>Impact description</td><td>The planned bridge is about 220 m long and stretches over the Sava River, with only half of it being located within the areas of the ecological network HR2001311 Sava downstream od Hrušćice and HR1000004 Donja Posavina. On the west side, the edge of the bridge structure enters the area of the ecological network HR2000416 Lonjsko polje (Figure 11.4).

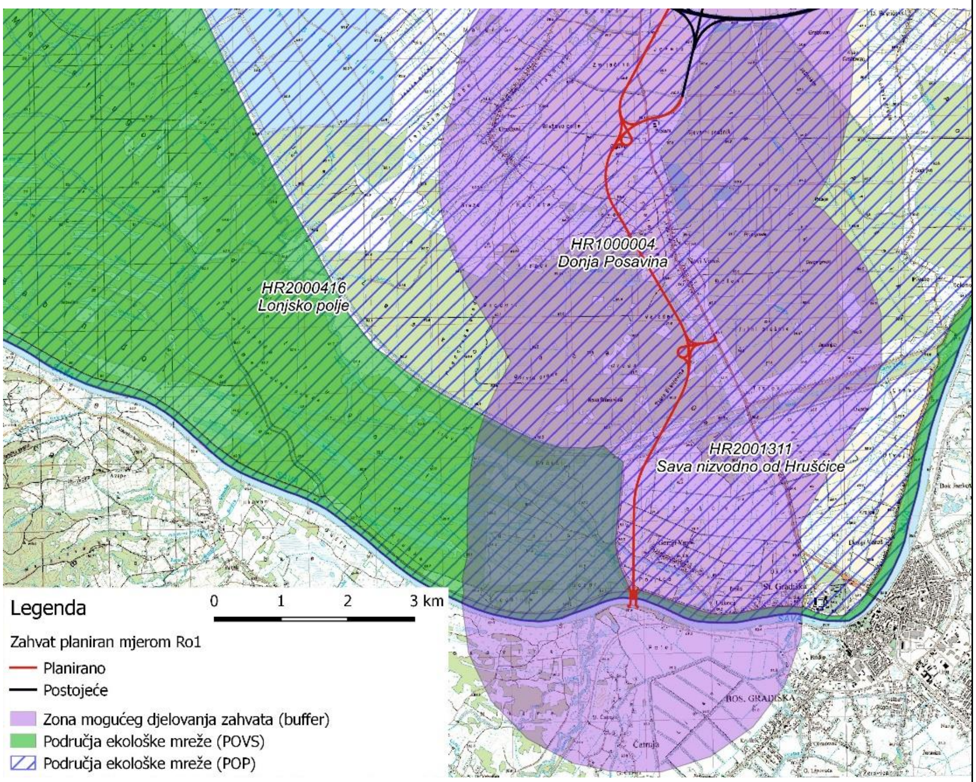


Figure 11.4 Areas of ecological network located in the area of the intervention planned by the Ro1 measure (prepared by: IRES EKOLOGIJA d.o.o.)

The construction of the bridge shall permanently convert a part of the target habitat types 3270 Rivers with muddy banks covered in Chenopodion rubri p.p. and Bidention p.p. and 91E0* Alluvial forests (Alno Padion, Alnion incanae, Salicion albae) of the area of the ecological network</td></tr>
</table>

	HR2001311 Sava downstream od Hrušćice in the approximate surface of 0.22 ha. During construction, target species of fish (asp - *Aspius aspius*, schraetzer - *Gymnocephalus schraetser*, common zingel - *Zingel zingel*, streber - Zingel streber, Vladykov's Lamprey - *Eudontomyzon vladykovi,* Balkan loach - *Cobitis elongata*, spined loach - *Cobitis elongatoides*, Danube whitefin gudgeon - *Romanogobio vladykovi*, cactus roach - *Rutilus virgo*) and bivalves (thick shelled river mussel - *Unio crassus*) may be disturbed. During the construction of the bridge and the section of the joint to the A3 motorway, a temporary negative impact of the construction (noise and conversion of a part of the habitat) on the target species of birds in the area of the ecological network HR1000004 Donja Posavina is expected. During the use of the same section, an additional negative impact can be expected in the form of bird fatalities and departure from the newly constructed section	
Impact significance assessment	HR1000004 Donja Posavina	-1
	HR2001311 Sava downstream od Hrušćice	-1
	HR2000416 Lonjsko polje	0

Code and name of measure	Ro. 2 A5 Osijek - State border with Hungary Pécs (TEN-T comprehensive network/Pan-European corridor RH3)
Description of the measure	The A5 motorway is part of the comprehensive TEN-T network and the Pan-European Corridor Vc. The total length of the A5 motorway is 86.8 km and extends from the border with Bosnia and Herzegovina via Osijek and Beli Manastir to the border with Hungary. Various sections of the motorway are in various stages of construction. The section from Osijek to Hungarian border, the section Osijek-Beli Manastir (24.6 km) and the section Beli Manastir – Hungarian border (5 km) are at the earliest stage of construction. Other sections, like the bridge over the Drava River (2.4 km long), are part of the planned corridor and construction is in progress. Through the concept of functional regions, the stages of completion and schedule for the remaining sections shall be analysed, as well as the technical parameters required, taking into account the expected demand and economic and ecological aspects, for example the planned section passing through parts of the Natura 2000 area.
	The competent Ministry has adopted the Decision on acceptability for the ecological network for the Ro2 measure, with the implementation of the legally prescribed and established measures to mitigate the negative impacts on the goals of the conservation and integrity of the ecological network area (CLASS: UP/I 612-07/13-60/63, FILE NO.: 517-07-1-1-2-14-12, 3 June 2014).

Code and name of measure	Ro. 3 A5 from A3 to the state border with Bosnia and Herzegovina (TEN-T comprehensive network/Pan-European corridor RH3)
Description of the measure	The A5 motorway is part of the comprehensive TEN-T network and the Pan-European corridor Vc, and Svilaj is listed as a border crossing of the EU core network. The total length of the A5 motorway is 86.8 km and extends from the border with Bosnia and Herzegovina via Osijek and Beli Manastir to the border with Hungary. Various sections of the motorway are in various stages of construction. The section from Sredanci (A3 motorway) to the border with Bosnia and Herzegovina is 3.5 km long and is under construction. This section also includes the bridge over the Sava River (660 m long). The award of the contract for bridge construction is currently in the public procurement process. The extension of the section on the side of Bosnia and Herzegovina has already been built.
	The competent Ministry has adopted the Decision on acceptability for the environment and ecological network for the Ro3 measure, with the implementation of the legally prescribed and established measures to mitigate the negative impacts on the goals of the conservation and integrity of the ecological network area (CLASS: UP/I 351-03/15-02/16, FILE NO.: 517-06-2-1-2-15-16, 2 November 2015).

Code and name of measure	Ro.4 A7 Križišće - Žuta Lokva (TEN-T comprehensive network/Adriatic–Ionian route)
Description of the measure	The results of the NPM show that there are certain perturbation shortcomings in the corridor, mainly during the tourist season and related to local / regional traffic (including short tourist trips). Due to this, certain interventions in the corridor may be necessary to increase the level of service. Through the concept of functional regions, problems will be identified and further special studies will determine the technical parameters, taking into account the expected demand and economic and ecological aspects, especially geographic features due to the very complex terrain of the coastal relief.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000019 Gorski kotar i sjeverna Lika HR1000022 Velebit HR1000033 Kvarnerski otoci HR2000131 Škabac špilja HR2000190 Vlaška peć HR2000200 Zagorska peć kod Novog Vinodolskog HR2001154 Orlovac špilja HR2001357 Otok Krk HR5000019 Gorski kotar i sjeverna Lika HR5000022 Park prirode Velebit
	From the start of the section from Križišće, the planned section passes at a distance of about 200 m from the area of the ecological network HR2000131 Škabac špilja, then passes through the area HR2000200 Zagorska peć kod Novog Vinodolskog in the length of about 4.5 km. In nearly its entire second part, the section passes through the area of the ecological network HR1000019 Gorski kotar i sjeverna Lika and HR5000019 Gorski kotar i sjeverna Lika in the length of about 22 km, and partly above Senj, along the areas of the ecological network HR1000022 Velebit and HR5000022 Park prirode Velebit (Figure 11.5)

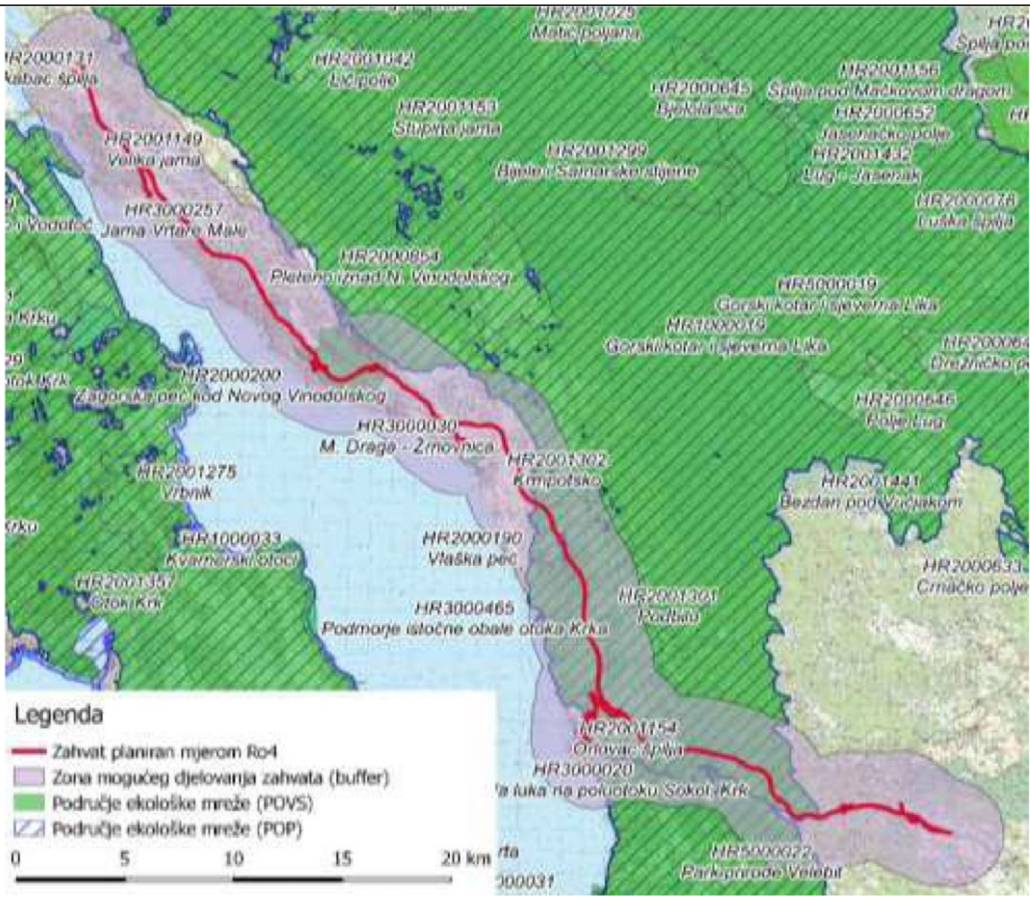


Figure 11.5 Areas of the ecological network located in the area of the intervention planned by the Ro4 measure (prepared by: IRES EKOLOGIJA d.o.o.)

The area of the ecological network HR2000131 Škabac špilja, a type locality for the species *Episinus cavernicola*, is located about 125 m west of the route planned by this measure. According to the topographic map (TM 1:25 000), the entrance to the cave is located about 280 m west of the planned route (Figure 11.6). Considering the relative proximity of this ecological network area, a moderately negative impact on the target habitat type 8310 Caves and pits closed to the public, cannot be completely excluded.

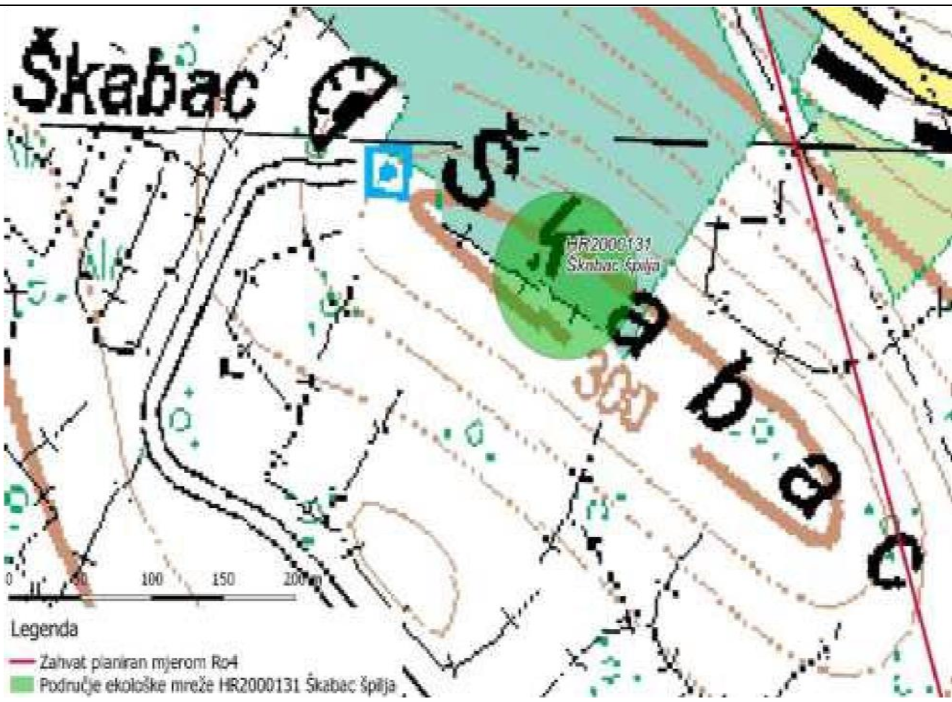


Figure 11.6 Overview of the intervention planned by the Ro4 measure in relation to the area of the ecological network HR2000131 Škabac špilja (prepared by: IRES EKOLOGIJA d.o.o., Source: Bioportal)

Since the speleological object Zagorska peć, within the area of the ecological network HR2000200 Zagorska peć, is located more than 1 km from the planned section, the negative impact on the target habitat type 8310 Caves and pits closed to the public can be excluded (Figure 11.7). However, since the area of the ecological network HR2000200 Zagorska peć kod Novog Vinodolskog is an internationally important underground habitat for the following species: *Rhinolophus ferrumequinum*, *Myotis blythii*, *Myotis capaccinii* and *Miniopterus schreibersii*, a moderately negative impact can be expected both during construction and during the use of the planned section

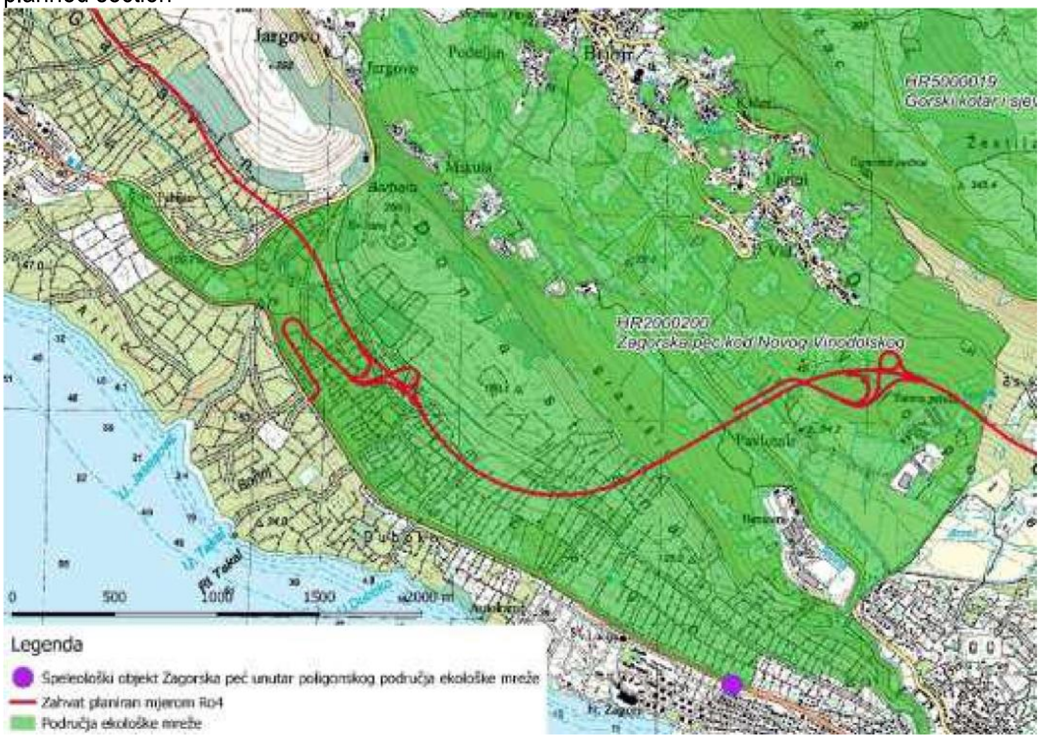
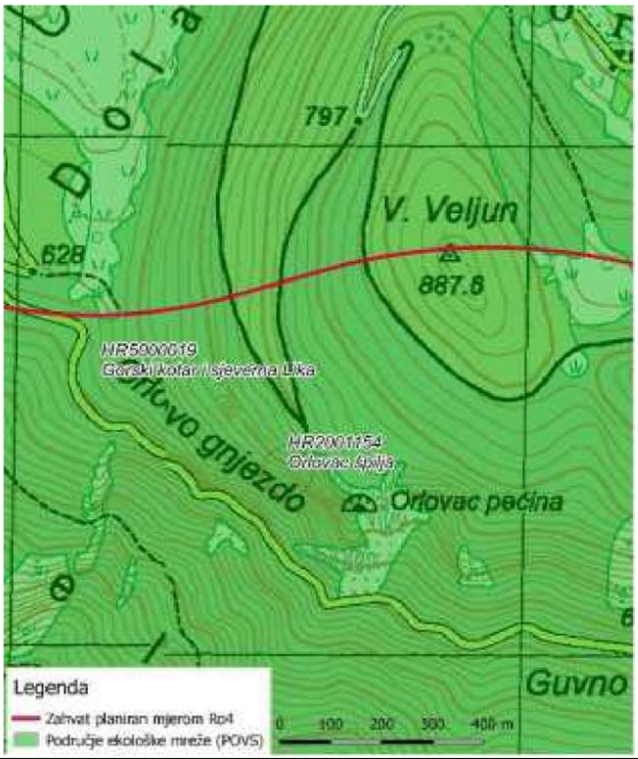


Figure 11.7 Speleological object Zagorska peć in relation to the planned section (prepared by: IRES EKOLOGIJAd.o.o., Source: Croatian Agency for the Environment and Nature, 2017)

Also, the area of the ecological network HR2000190 Vlaška peć, which is located about 2.1 km from the planned route, is home to the population of 12 individuals of the target species *Rhinolophus ferrumeguinum*. Due to the loss of a part of the habitat and noise disturbances, the possibility of fatalities of the target species of bats during use of the planned road cannot be excluded. The significance of the impact is assessed as moderately negative (-1).

Figure 11.8 Area of the ecological network HR2000190 Vlaška peć (prepared by: IRES EKOLOGIJA d.o.o., Source: Bioportal)

During construction, the area of the ecological network HR2001154 Orlovac špilja could be negatively affected due to the relative proximity of the objects to the planned work area (Figure 11.9).



<table>
<tr><td></td><td colspan="2">Figure 11.9 Area of the ecological network HR2001154 Orlovac špilja (prepared by: IRES EKOLOGIJA d.o.o., Source: Bioportal)

During the operation of the intervention in the part passing through the area of the ecological network HR1000019 Gorski kotar i sjeverna Lika and HR5000019 Gorski kotar i sjeverna Lika, a significant negative impact is possible in the form of fragmentation and interruption of the functional linkage of populations of target species of birds and, especially, large carnivores between the areas of the ecological network HR5000019 Gorski kotar i sjeverna Lika and HR5000022 Park prirode Velebit. The section passes through a highly suitable habitat for bears, wolves and lynxes, and if adequate mobility and population communication is not ensured, a significant negative impact on target species of large carnivores of the area of the ecological network HR5000019 Gorski kotar i sjeverna Lika can be expected.</td></tr>
<tr><td rowspan="10">Impact significance assessment</td><td>HR1000019 Gorski kotar i sjeverna Lika</td><td>-1</td></tr>
<tr><td>HR1000022 Velebit</td><td>-1</td></tr>
<tr><td>HR1000033 Kvarnerski otoci</td><td>0</td></tr>
<tr><td>HR2000131 Škabac špilja</td><td>-1</td></tr>
<tr><td>HR2000190 Vlaška peć</td><td>-1</td></tr>
<tr><td>HR2000200 Zagorska peć kod Novog Vinodolskog</td><td>-1</td></tr>
<tr><td>HR2001154 Orlovac špilja</td><td>-1</td></tr>
<tr><td>HR2001357 Otok Krk</td><td>0</td></tr>
<tr><td>HR5000019 Gorski kotar i sjeverna Lika</td><td>-1</td></tr>
<tr><td>HR5000022 Park prirode Velebit</td><td>-1</td></tr>
</table>

Code and name of measure	Ro. 5 A11 Lekenik - Sisak
Description of the measure	A11 motorway (Zagreb - Sisak) is under construction, with one section completed. The total length of the motorway between Zagreb and Sisak amounts to 48.1 km. The next planned section, Lekenik - Sisak, is 10.8 km long. The last section should be Sisak - Mošćenica, whose construction shall be considered after the completion of the previous sections. Further studies shall analyze the completion phases and the timetable of the remaining sections with regards to intermodality as well as the necessary technical parameters, taking into account the expected demand as well as the economic and environmental aspects.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000003 Turopolje HR2000415 Odransko polje HR2000642 Kupa
Impact description	The final section of the A11 motorway runs along the entire length of the areas of the ecological network HR1000003 Turopolje and HR2000415 Odransko polje (Figure 11.10). Planned connecting roads after the Sisak node enter the area of the ecological network HR2000642 Kupa.

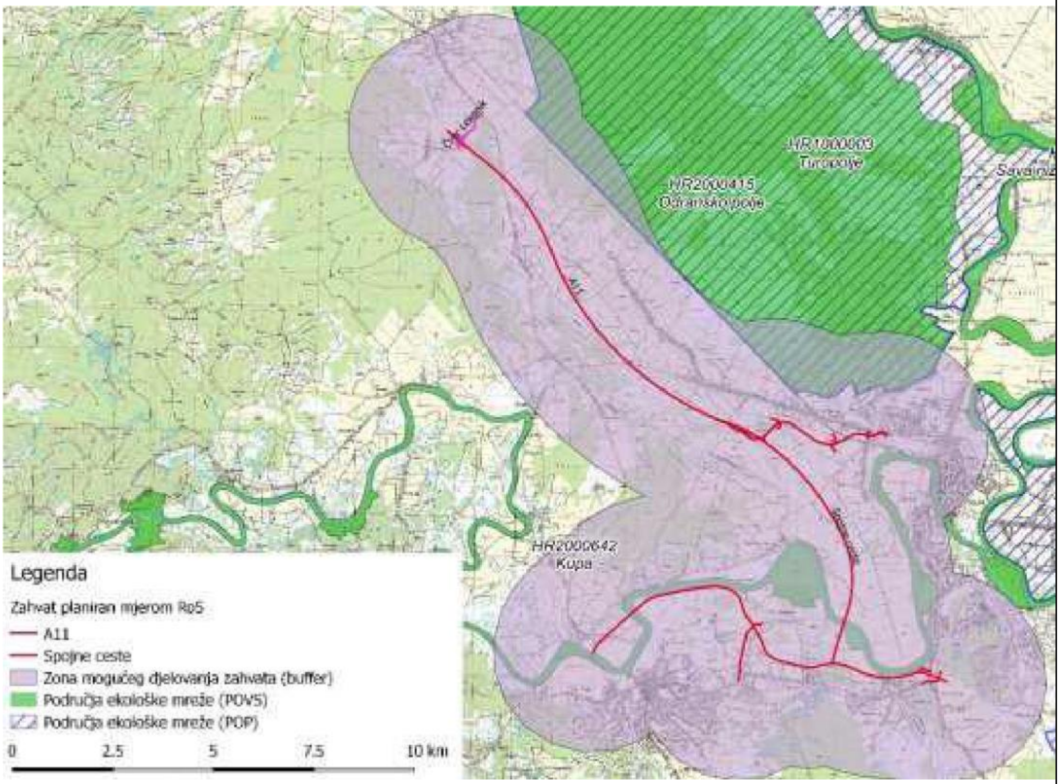


Figure 11.10 Areas of the ecological network located in the area of the intervention planned by the Ro5 measure (prepared by: IRES EKOLOGIJA d.o.o.)

A moderately negative impact can be expected during the use of the intervention on the target species in the area of the ecological network HR1000003 Turopolje in the form of noise disturbance and light pollution. During the construction of connecting roads that cross over or are located along the area of the ecological network HR2000642 Kupa, negative impacts of construction in the form of water contamination and loss of target habitats may occur.

The impact on the area of the ecological network HR2000415 Odransko polje can be considered neutral, due to the distance of the planned intervention from the ecological network area.

Impact significance assessment	HR1000003 Turopolje	-1
	HR2000415 Odransko polje	0
	HR2000642 Kupa	-1

Code and name of measure	**Ro. 6 DC 10 Vrbovec - Križevci - Koprivnica - State border with Hungary towards Kaposvár**	
Description of the measure	State road DC10 was previously categorised as the A12 motorway. The A12 motorway is a partly built motorway in the central Croatia, northeast of Zagreb, and extends towards the town of Vrbovec. The twolane 23 km long road is built between the A4 motorway and Sveta Helena. The state road DC12 is the western branch of the so-called "Podravski ipsilon", and it is planned that be DC12 shall be the eastern branch and shall finally connect Zagreb with the Hungarian border towards Kaposvár. The corridor is divided into several sections and the completion stage of the intervention documentation (intervention and permits) differs from section to section.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000008 Bilogora i Kalničko gorje HR1000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja) HR2001404 Glogovnica HR5000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja)	
Impact description	The planned section passes through the area of the ecological network HR1000008 Bilogora i Kalničko gorje in the length of 8 km, whereby it significantly fragments the area of the ecological network, the habitats used by birds are permanently being converted, and during the construction and use a negative impact on target species of birds is expected, in the form of noise disturbance and light pollution. Considering that the section between Križevci and Koprivnica, in the part that crosses the area of the ecological network HR1000008 Bilogora i Kalničko gorje up to Velika Mučna, is already in preparation, and considering that this track follows the existing traffic infrastructure (road and railroad), the impact of construction and use of the planned section is considered moderately negative. The terrain configuration enables for an extended route that is laid in lowland terrain with adequate crossings over existing watercourses, roads and railways. A negative impact on the areas of the ecological network HR1000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja), HR2001404 Glogovnica and HR5000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja), is possible during construction in the form of watercourse contamination. However, at the intervention level, for the purpose of preventing possible contamination of existing watercourses; throughout the section, protection measures with a closed drainage system and purification devices - separators and lagoons, have been envisaged.	
Impact significance assessment	HR1000008 Bilogora i Kalničko gorje	-1
	HR1000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja)	-1
	HR2001404 Glogovnica	0
	HR5000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja)	-1

Code and name of measure	Ro. 7 DC 12 Vrbovec 2 hub - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - State border with Hungary towards Barcs
Description of the measure	The state road DC12 is the eastern branch of the so-called "Podravski ipsilon", and it is planned that DC10 shall be the western branch and shall finally connect Zagreb with the Hungarian border towards Pecs. Currently, only the Vrbovec 2 junction and initial (western) section of the state road DC12 are completed. The rest of the corridor is divided into several sections, and the completion stage of the intervention documentation (intervention and permits) differs from section to section. Through the concept of functional regions, the completion stages and the schedule for the remaining sections as well as the required technical parameters shall be assessed, taking into account the expected demand and the economic and environmental aspects.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000008 Bilogora i Kalničko gorje HR1000012 Taložnice Virovitičke šećerane HR1000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja) HR1000009 Ribnjaci uz Česmu HR5000015 Srednji tok Drave (od Terezinog polja do Donjeg Miholjca) HR2001281 Bilogora HR2000441 Ribnjaci Narta

Impact description

The planned section of DC12 passes through the area of the ecological network important for bird conservation HR1000009 Ribnjaci uz Česmu in the length of 18 km, and through the area HR1000008 Bilogora i Kalničko gorje in the length of about 24 km (Figure 11.11). Areas HR1000012 Taložnice Virovitičke šećerane and HR1000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja) are located within the zone of the possible effect of the intervention, but due to the distance of the intervention, impact on their target species is not expected. In regards to the conservation areas of importance for species and habitats, the planned intervention passes through the area of ecological network HR2001281 Bilogora in the length of 9 km. Most of the planned route passes through the area marginally, but a negative impact of permanent conversion of target habitat types and/or loss of target species (*Bombina variegata* and *Euplagia guadripunctaria*) cannot be excluded.

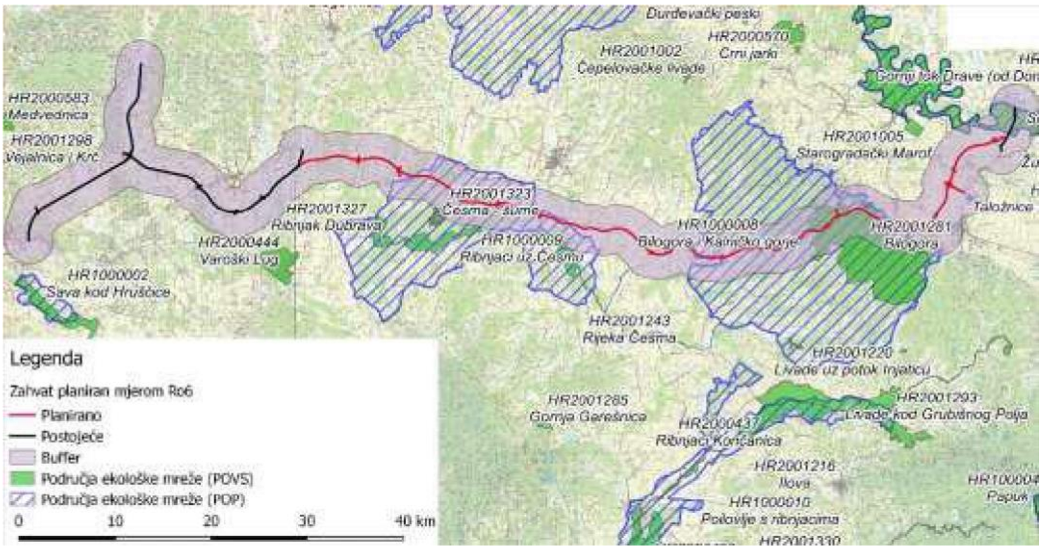


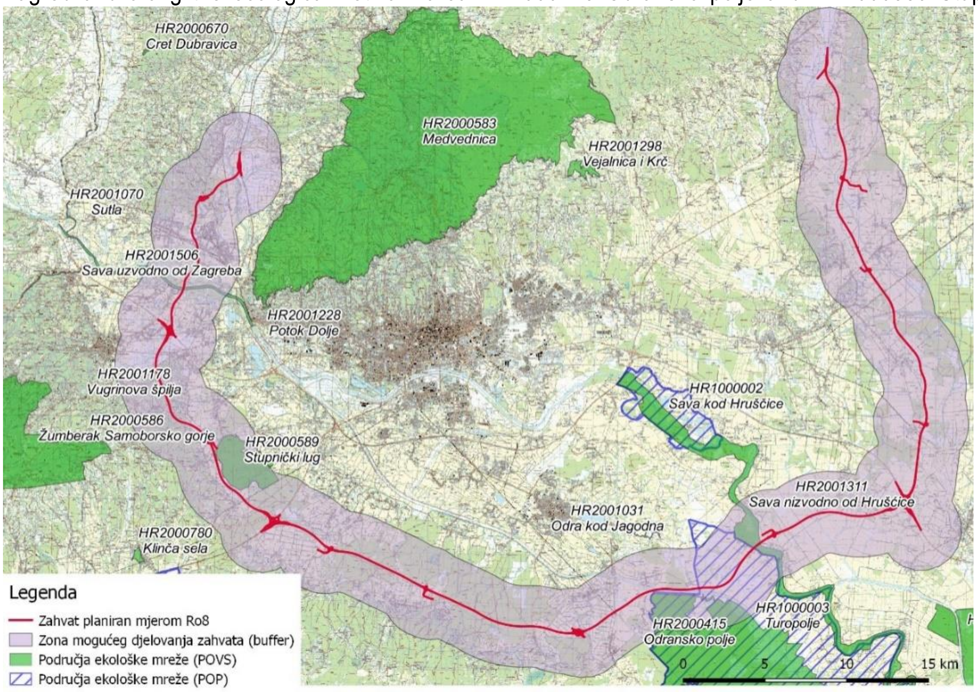
Figure 11.11 Areas of the ecological network located in the area of the intervention planned by the Ro6 measure

At the nearest point, the planned route passes about 1 km north of the area of the ecological network HR2000441 Ribnjaci Narta, and negative impacts of the pollution of the target habitat type 3130 Amphibious habitats of *Isoeto-Nanojuncetea* with the corresponding target species during the construction and use cannot be excluded.

A significantly negative impact can be assessed for target species of birds in the area of the ecological network HR1000009 Ribnjaci uz Česmu, due to the loss of part of the habitat, changes in the functional linkage of the area, possible pollution during use, noise disturbance and light pollution.

Impact significance assessment

HR1000008 Bilogora i Kalničko gorje	-1
HR1000012 Taložnice Virovitičke šećerane	0
HR1000014 Gornji tok Drave (od Donje Dubrave do Terezinog polja)	0
HR1000009 Ribnjaci uz Česmu	-1
HR2001281 Bilogora	-1
HR2000441 Ribnjaci Narta	-1
HR5000015 Srednji tok Drave (od Terezinog polja do Donjeg Miholjca)	0

Code and name of measure	**Ro. 8 Reorganization of the main Zagreb network**
Description of the measure	Zagreb is the capital of the Republic of Croatia and the junction of the main road corridors. Currently, all corridors of the highway are connected via the Zagreb Bypass, roads with the highest traffic loads in Croatia. The main road network within the city also needs to be reorganized, taking into account the effects calculated through the concept of functional regions.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000003 Turopolje HR2000415 Odransko polje HR2000589 Stupnički lug HR2001311 Sava downstream od Hrušćice HR2001506 Sava uzvodno od Zagreba
Impact description	The action planned for this measure goes through the ecological network area that is important for conserving the HR1000003 Turopolje bird, about 4.5 km long (Figure 11.12). Directly crosses the two areas of the ecological network on the Sava River: HR2001311 Sava downstream from Hrušćica and HR2001506 Sava upstream from Zagreb and along the ecological network area HR2000415 Odransko polje and HR2000589 Stupnički lug  Figure 11.12 Područja ekološke mreže na području zahvata planiranog mjerom Ro.8 (Izrađivač: IRES EKOLOGIJA d.o.o.) Negative impact on the area of the ecological network HR1000003 Turopolje is not considered to be significantly negative as the planned operation runs through the peripheral northern part of the ecological network area and can be alleviated by mitigation measures. Negative impact on target habitats and types of area HR2000415 The Odraan field can not be excluded during construction and during use, and in particular in the potential for pollution of water that are important for the maintenance of habitats and associated species. During the construction of part of the section passing through the area of the ecological network HR2000589 Stupnička lug it is possible to damage the target habitat and the target species of oak stripeburn (Cerambyx cerdo) within the working belt. During use, no negative impact is expected. During the construction of the transition to Sava

	can not exclude the negative impact of construction works for the HR2001311 Sava downstream of Hrušćica and HR2001506 Sava upstream of Zagreb.	
Impact significance assessment	HR1000003 Turopolje	-1
	HR2000415 Odransko polje	-1
	HR2000589 Stupnički lug	-1
	HR2001311 Sava downstream od Hrušćice	-1
	HR2001506 Sava uzvodno od Zagreba	-1

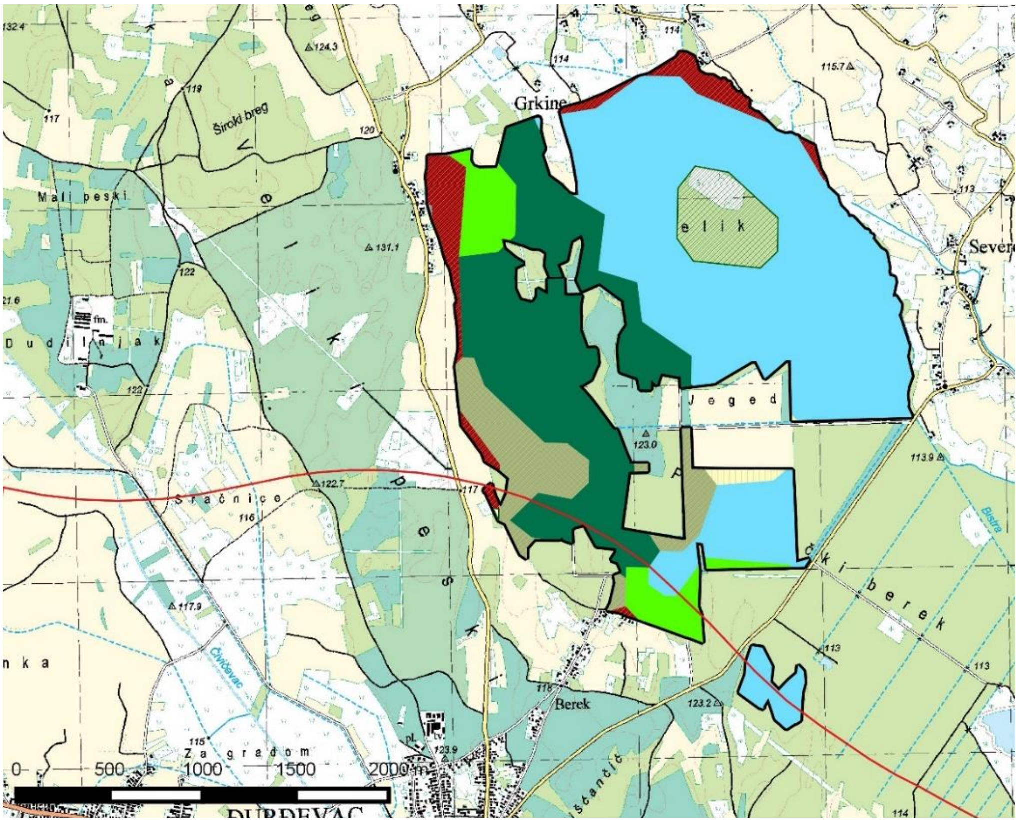
Code and name of measure	Ro. 9 D2 from the state border with Slovenia to the state border with Serbia
Description of the measure	D2 is an existing state road for transit traffic in the northern parts of Croatia. It stretches from the border crossing with Slovenia to Dubrava Križovljanska in the west, through Varaždin, Osijek, Vukovar, and ends at the Ilok - Bačka Palanka bridge at the border crossing with Serbia. Most of the D2 route is parallel to the Drava River (Podravska magistrala). Relevant intensity of very high volume of freight traffic affects the features of the existing route, thus evidently reducing the level of safety. A new corridor for the D2 is planned, but on the basis of the concept of functional regions, the completion phases and the timetable of the remaining sections, as well as the necessary technical parameters shall be analyzed, taking into account the expected demand as well as the economic and environmental aspects.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000011 Ribnjaci Grudnjak i Našice HR1000012 Taložnice Virovitičke šećerane HR1000013 Dravske akumulacije HR2000372 Dunav - Vukovar HR2000368 Peteranec HR2000570 Crni jarki HR2000571 Đurđevački peski HR2000572 Kloštarski (Kalinovački) peski HR2000672 Zovje HR2001005 Starogradački Marof HR2001088 Mala Dubrava - Vučedol HR2001307 Drava - akumulacije HR2001416 Brezovica - Jelik HR2001500 Stepska staništa kod Bapske HR2001501 Stepska staništa kod Opatovca HR2001502 Stepska staništa kod Šarengrada HR2001004 Stari Gradac - Lendava HR2001086 Breznički ribnjak (Ribnjak Našice) HR2001329 Potoci oko Papuka
Impact description	Part of the state road D2 that is planned from Ormoža to Varaždin passes along the area of the ecological network HR1000013 Drava Reservoir and HR2001307 Drava - accumulation and during its construction it can expect a potentially negative impact on noise, pollution and the like. These impacts are of temporary character and are considered moderately negative. Part of the planned route runs a length of 1,5 km through the area of the ecological network HR2001416 Brezovica-Jelik where a permanent loss of part of the target habitat type 91E0 * Alluvial forests (Alno-Padion, Alnion incanae, Salicion albae) can occur. By cross-section of the planned section passing through this area of the ecological network with the map of habitats (Figure 11.13) it was determined that by implementing this measure, a smaller part of the target habitat type (according to NKS on the map marked E.2.1.) In the length of about 350 m

Legenda

HR2001416 Brezovica-Jelik

Karta staništa

- C23/C22/E31, Mezofilne livade Srednje Europe / Vlažne livade Srednje Europe / Mješovite hrastovo-grabove i čiste grabove šume
- D12, Mezofilne živice i šikare kontinentalnih, izuzetno primorskih krajeva
- E21, Poplavne šume crne johe i poljskog jasena
- E31, Mješovite hrastovo-grabove i čiste grabove šume
- E92, Nasadi četinjača
- E93, Nasadi širokolisnog drveća
- I21, Mozaici kultiviranih površina
- I21/J11/I81, Mozaici kultiviranih površina / Aktivna seoska područja / Javne neproizvodne kultivirane zelene površine
- I31, Intenzivno obrađivane oranice na komasiranim površinama
- J11, Aktivna seoska područja
- Podravska brza cesta (Ro9)



Legenda

HR2001416 Brezovica-Jelik

Karta staništa

- C23/C22/E31, Mezofilne livade Srednje Europe / Vlažne livade Srednje Europe / Mješovite hrastovo-grabove i čiste grabove šume
- D12, Mezofilne živice i šikare kontinentalnih, izuzetno primorskih krajeva
- E21, Poplavne šume crne johe i poljskog jasena
- E31, Mješovite hrastovo-grabove i čiste grabove šume
- E92, Nasadi četinjača
- E93, Nasadi širokolisnog drveća
- I21, Mozaici kultiviranih površina
- I21/J11/I81, Mozaici kultiviranih površina / Aktivna seoska područja / Javne neproizvodne kultivirane zelene površine
- I31, Intenzivno obrađivane oranice na komasiranim površinama
- J11, Aktivna seoska područja
- Podravska brza cesta (Ro9)

Figure 11.13 Part of the route planned by the measure Ro9 passing through the area of the ecologic network HR2001416 Brezovica-Jelik (Izrađivač: IRES EKOLOGIJA d.o.o.)

A part of about 2 km of route passes along the ecological network of HR1000011 Ribnjake Grudnjak and Našice and HR2001086 Breznički pond (Pond Našice) where it is possible to have a negative impact on the target species of birds and vistas in the form of harassment during construction as well as noise and light pollution during use interventions. Both areas are about 200 m away from the axis of the planned road. Approximately 80m long, the planned route crosses the area of the ecological network HR2001329 Floods around Papuk, which is expected to have a negative impact due to possible contamination of the target habitat type and associated target species.

In the part of the route near Vukovar, the same passes directly to the area of the ecological network HR2001088 Mala Dubrava - Vučedol where there is a possibility of damaging the target habitat type 9160 Sub-Atlantic and Central European oak and oak-gravel forests of Carpinion betulus during the construction of the planned stock. Cross-sectioned by the Map of the Habitat of the Republic of Croatia (Figure 11.14) it was established that the stock in question is sufficiently far from the target habitat of this area of the ecological network and that the negative impact may be excluded.

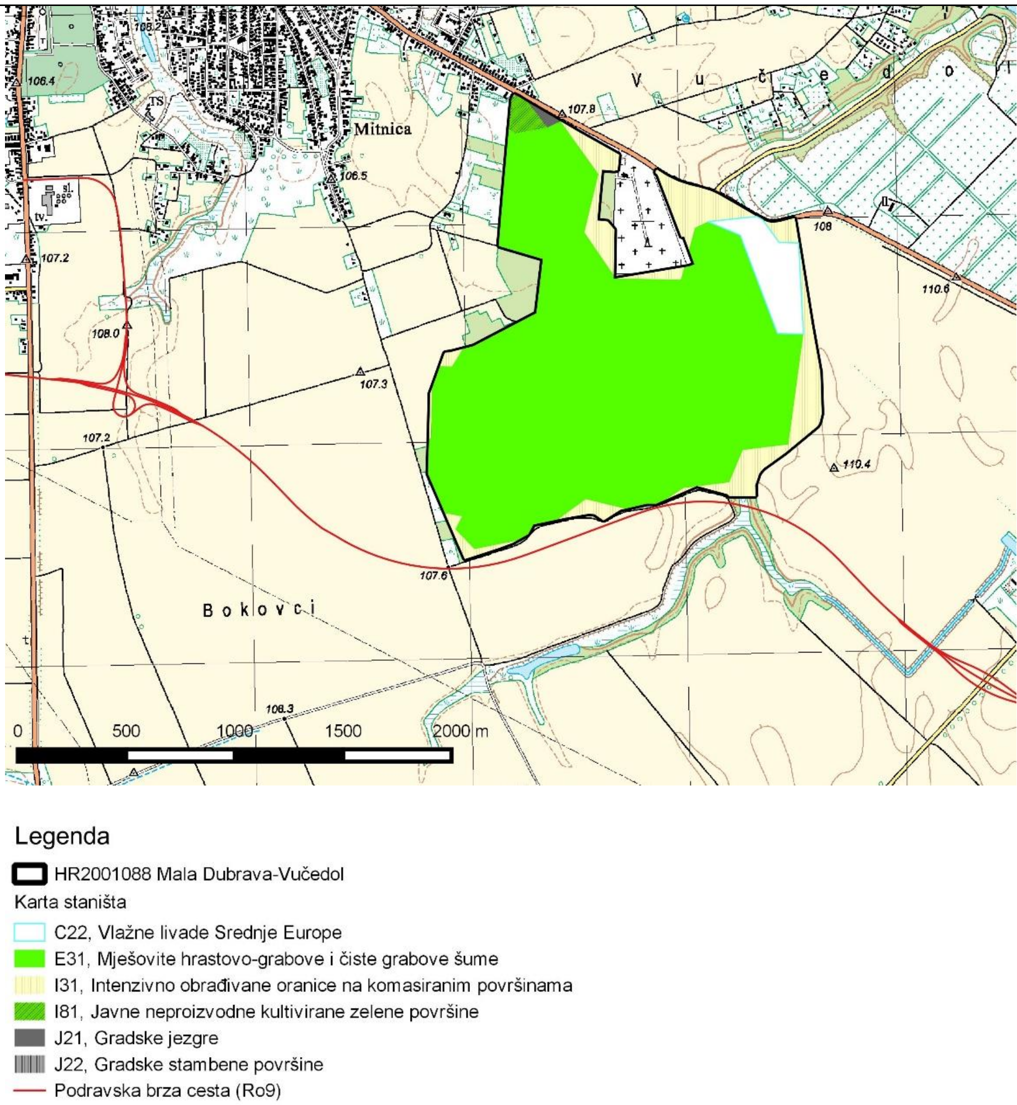


Figure 11.14 Part of the route planned by the measure Ro.9 passing through the area of the ecologic network HR2001088 Mala Dubrava - Vučedol (Izrađivač: IRES EKOLOGIJA d.o.o.)

With a length of about 220 m, the planned route passes through the area of the ecological network HR2001500 Steps habitat at Bapske, which would permanently transform part of the target and priority habitat type 6240 * Subpanonian steep grasslands (Festucion vallesiacae), which presents a significant negative impact (Figure 11.15). By changing the route or by setting the track to a higher altitude (viaduct) a significant negative impact would be reduced.

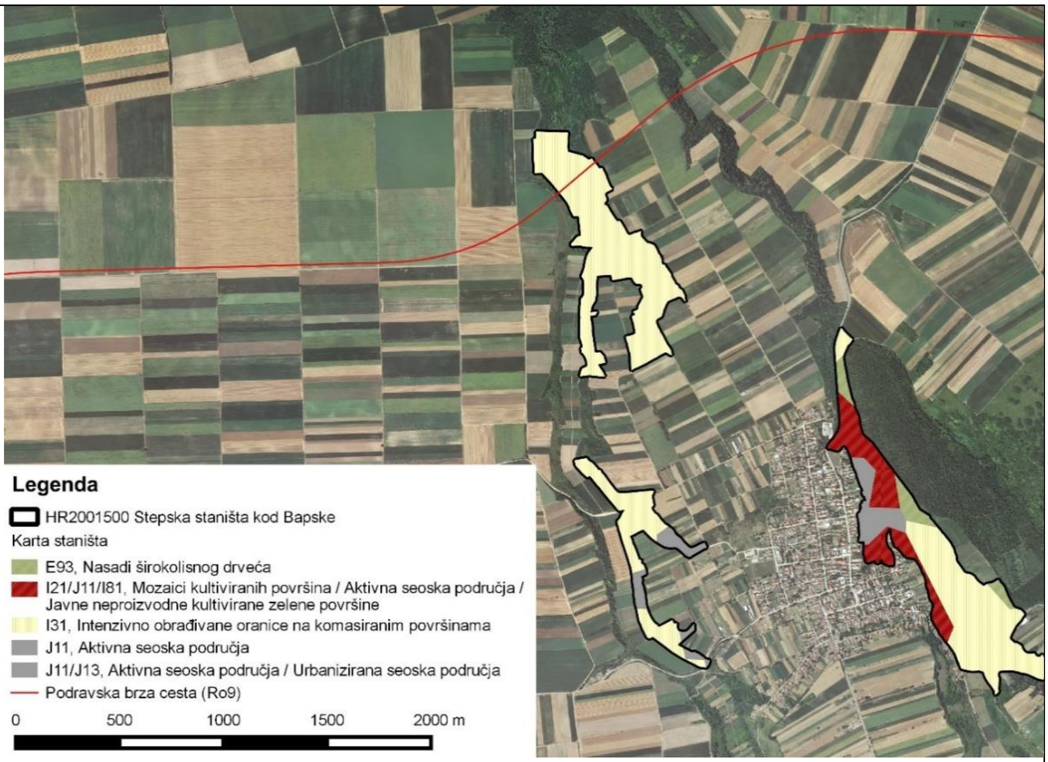


Figure 11.15 Part of the route planned by the Ro9 measure passing through the area of the ecologic network HR2001500 Stepska staništa kod Bapske (prepared by: IRES EKOLOGIJA d.o.o.)

The impact of the Ro.9 measure is considered neutral due to the fact that the following areas of the ecological network are sufficiently removed from the planned route (Figure 11.16): HR1000012 Taložnice Virovitičke šećerane, HR2000372 Dunav - Vukovar, HR2000368 Peteranec, HR2000570 Crni jarki, HR2000571 Đurđevački peski, HR2000572 Kloštarski (Kalinovački) peski, HR2000672 Zovje, HR2001005 Starogradački Marof, HR2001501 Stepska staništa kod Opatovca, HR2001502 Stepska staništa kod Šarengrada and HR2001004 Stari Gradac - Lendava.

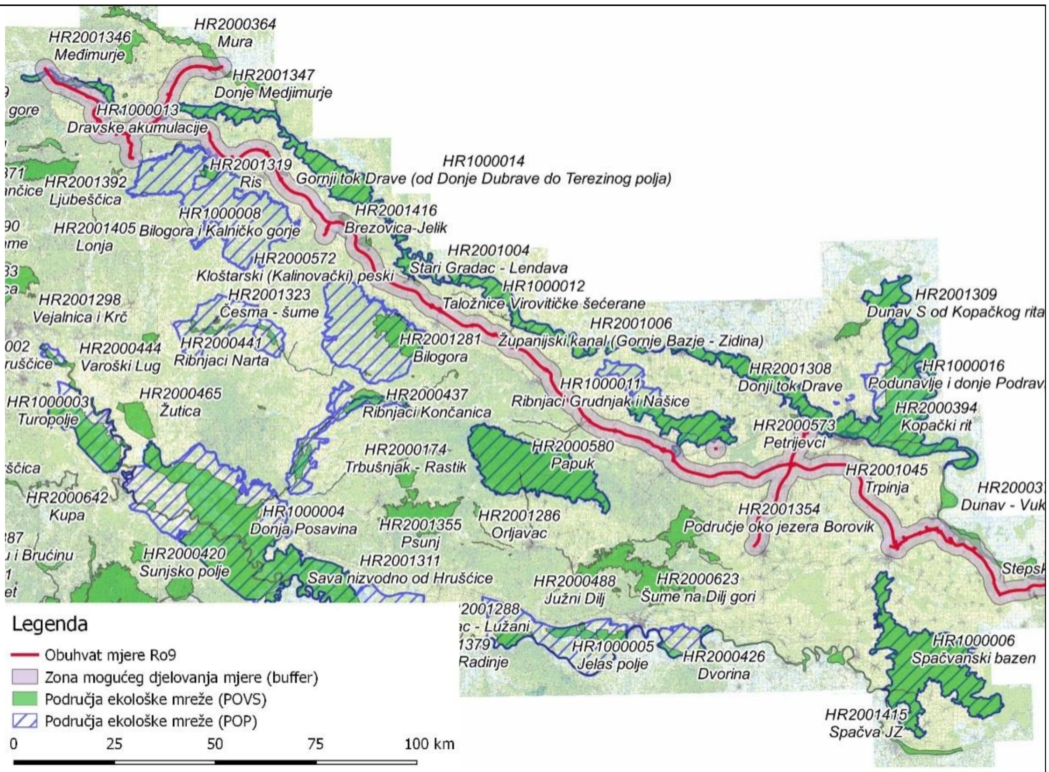


Figure 11.16 Ecological network on the area Područja ekološke mreže na području zahvata planiranog mjerom Ro.9 (Izrađivač: IRES EKOLOGIJA d.o.o.)

Impact significance assessment	HR1000011	Ribnjaci Grudnjak i Našice	-1
	HR1000012	Taložnice Virovitičke šećerane	0
	HR1000013	Dravske akumulacije	-1
	HR2000372	Dunav - Vukovar	0
	HR2000368	Peteranec	0
	HR2000570	Crni jarki	0
	HR2000571	Đurđevački peski	0
	HR2000572	Kloštarski (Kalinovački) peski	0
	HR2000672	Zovje	0
	HR2001005	Starogradački Marof	0
	HR2001088	Mala Dubrava - Vučedol	0
	HR2001307	Drava - akumulacije	-1
	HR2001416	Brezovica-Jelik	-1
	HR2001500	Stepska staništa kod Bapske	-2
	HR2001501	Stepska staništa kod Opatovca	0
	HR2001502	Stepska staništa kod Šarengrada	0
	HR2001004	Stari Gradac - Lendava	0
	HR2001086	Breznički ribnjak (Ribnjak Našice)	-1
	HR2001329	Potoci oko Papuka	-1

Code and name of measure	Ro10 Reorganization of the Rijeka network
Description of the measure	The Rijeka road junction is one of the main traffic hubs in Croatia and has an important role in connecting the Croatian motorway network: A7 motorway connects the A8 motorway (Istrian Y) and the A6 (Rijeka - Bosiljevo) motorway. Port of Rijeka is the most important Croatian port (the main port of the TEN-T network) and the development of the port must be harmonized with the road development. The planned western container terminal in Rijeka is connected to the planned D403 state road. The Rijeka Bypass is part of the A7 motorway and is one of the roads in Croatia with the highest traffic intensity. For the purpose of further improvement of the road network, a new corridor outside of the city is planned for the A7, on the Permani - Grobničko polje (A6) – Križišće section. The northern part of the island of Krk is planned as part of the potential further development of the Port of Rijeka. The construction of a new corridor of the D102 state road is also planned for the island of Krk, which includes a new bridge. All these measures need to be coordinated with the reorganization of Rijeka's internal road network, taking into account the need for public transport as well as cycling and walking, port development and other development plans of relevant stakeholders, such as railway companies. For these reasons, further analysis is needed on the basis of the concept of functional regions, in order to establish the final package of measures, as well as the necessary technical parameters, taking into account the expected demand as well as the economic and environmental aspects.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000018 Učka i Ćićarija HR1000019 Gorski kotar i sjeverna Lika HR2000131 Škabac špilja HR2000146 Velika špilja u Permanima HR2000601 Park prirode Učka HR2000643 Obruč HR2000658 Rječina HR2001487 Bakar - Meja HR5000019 Gorski kotar i sjeverna Lika

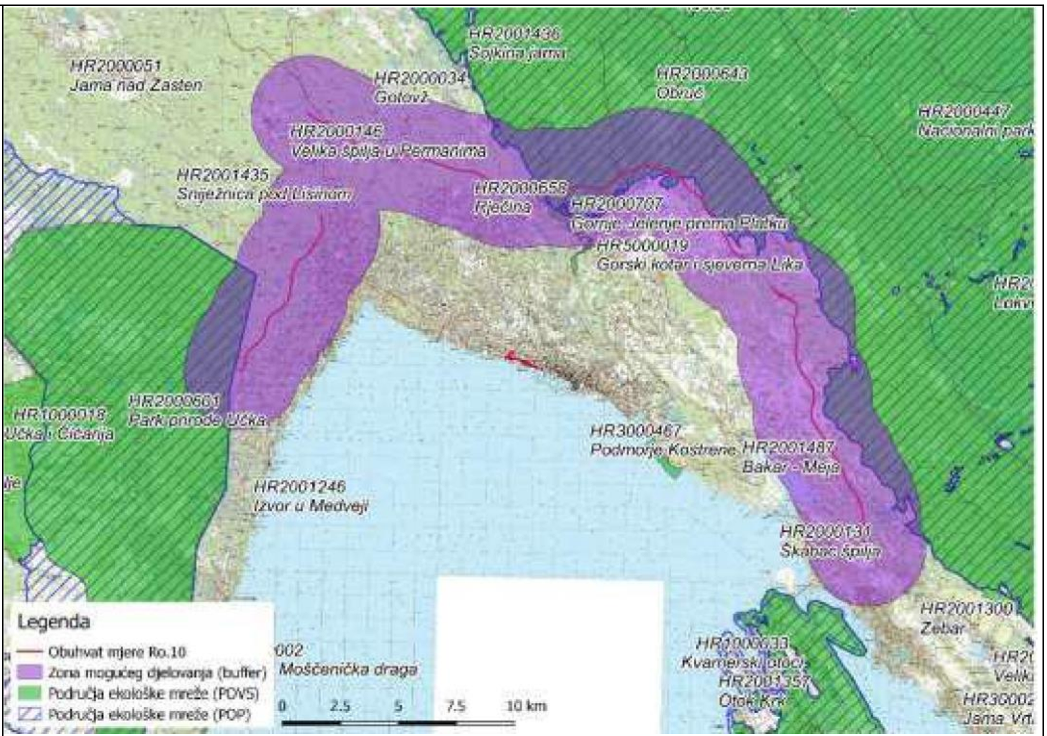
<table>
<tr><td rowspan="1">Impact description</td><td colspan="2">


Figure 11.17 Scope of the Ro10 measure (prepared by: IRES EKOLOGIJA d.o.o.)

A part of the Rijeka network marginally passes through the areas of the ecological network HR1000019 Gorski kotar i sjeverna Lika, HR2000643 Obruč, HR2000658 Rječina and HR5000019 Gorski kotar i sjeverna Lika, where a moderately negative impact on the target species and habitats of these areas is expected in the form of disturbances during construction and increased noise and possible animal fatalities during the use of the road. A negative impact is not expected for areas of the ecological network HR1000018 Učka i Ćićarija, HR2000131 Škabac špilja, HR2000146 Velika špilja u Permanima, HR2000601 Park prirode Učka and HR2001487 Bakar - Meja as they are sufficiently removed from the planned roads.
</td></tr>
<tr><td rowspan="9">Impact significance assessment</td><td>HR1000018 Učka i Ćićarija</td><td>0</td></tr>
<tr><td>HR1000019 Gorski kotar i sjeverna Lika</td><td>-1</td></tr>
<tr><td>HR2000131 Škabac špilja</td><td>0</td></tr>
<tr><td>HR2000146 Velika špilja u Permanima</td><td>0</td></tr>
<tr><td>HR2000601 Park prirode Učka</td><td>0</td></tr>
<tr><td>HR2000643 Obruč</td><td>-1</td></tr>
<tr><td>HR2000658 Rječina</td><td>-1</td></tr>
<tr><td>HR2001487 Bakar – Meja</td><td>0</td></tr>
<tr><td>HR5000019 Gorski kotar i sjeverna Lika</td><td>-1</td></tr>
</table>

<table>
<tr><th>Code and name of measure</th><th>Ro. 11 Dubrovnik - State border with Montenegro</th></tr>
<tr><td>Description of the measure</td><td>The corridor Dubrovnik – State border with Montenegro is in various stages of construction, depending on the section. By the construction of this corridor, the Dubrovnik Airport should be bypassed. Through the concept of functional regions, the completion stages and the schedule of construction as well as the technical parameters needed shall be assessed, taking into account the expected demand and the economic and environmental aspects.</td></tr>
<tr><td>Areas of ecological network that may be impacted by the implementation of the measure</td><td>HR2001010 Paleoombla - Ombla</td></tr>
<tr><td>Impact description</td><td>Approximately 9 km of the planned section passes through the area of the ecological network HR2001010 Paleoombla - Ombla (Figure 11.18).

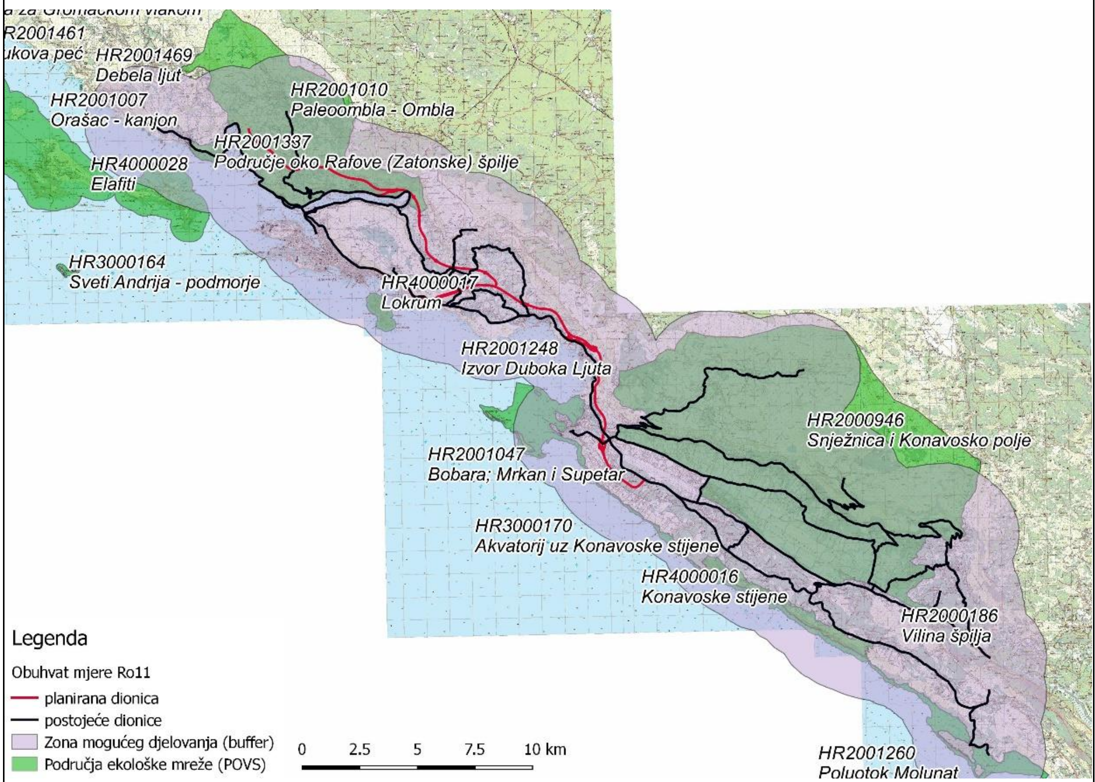


Figure 11.18 Scope of the Ro.11 measure (prepared by: IRES EKOLOGIJA d.o.o.)

Negative impacts can be expected during construction in the form of disturbance of the habitat conditions of the target species of bats, especially in the part passing near caves classified as important habitats for the target species of bats (Vilina Cave and Močiljska Cave). Caves categorized as the target habitat type 8310 Caves and pits closed to the public within the area of the ecological network HR2001010 Paleoombla - Ombla, Vilina Cave and Močiljska Cave are also in the vicinity of the planned section (Figure 11.19). Močiljska Cave is located approximately 320 m east of the planned section, and Vilina Cave is located approximately 220 m northeast of the route. Due to the distance of cave objects, the impact on the habitat type 8310 can be excluded.</td></tr>
</table>

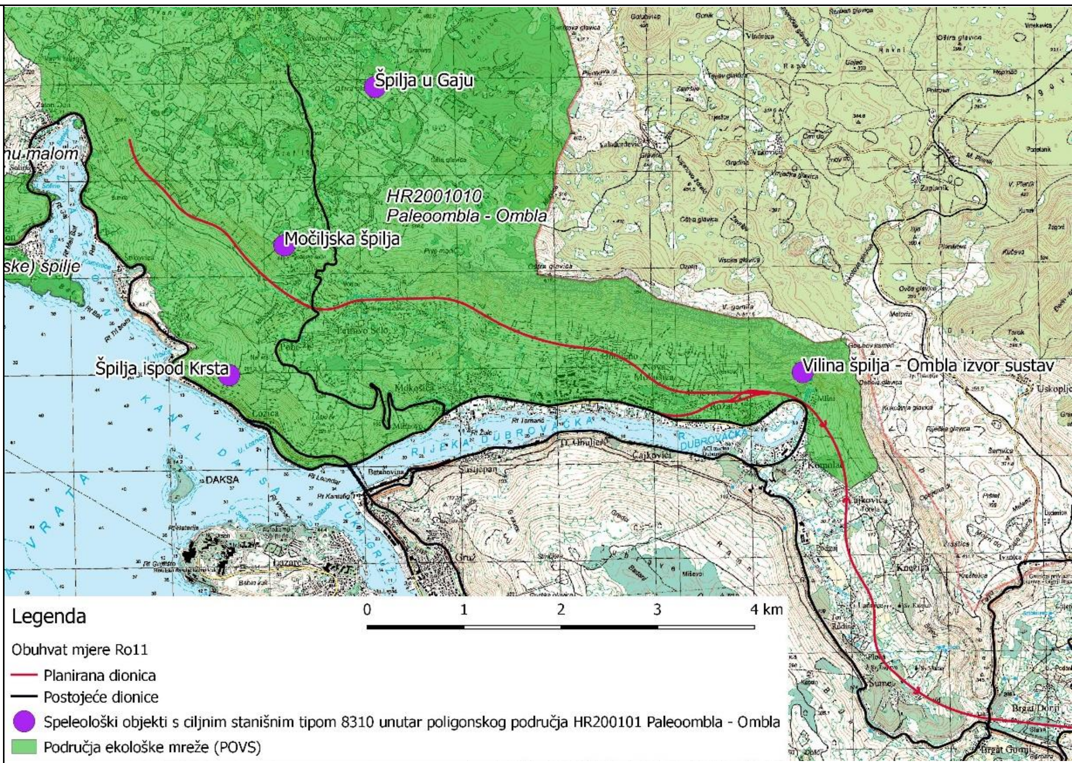


Figure 11.19 Speleological objects of the area of the ecological network HR2001010 Paleoombla - Ombla classified as a habitat type 8310 Caves and pits closed to the public in relation to the planned section covered by the Ro11 measure (prepared by: IRES EKOLOGIJA d.o.o., Source: Croatian Agency for the Environment and Nature, 2017)

During the use of the route, negative impact on target bat species may be expected in the form of fatalities, noise and light pollution, which is why the impact of the subject measure on the ecological network area HR2001010 Paleoombla-Ombla is rated as moderately negative.

Impact significance assessment	HR200101 Paleoomla – Ombla	-1

Code and name	Ro. 12 Capacity increase - A dedicated lane for public transport between Zagreb and Karlovac	
Description of the measure	The road corridor from Zagreb to Karlovac is covered by the European core network due to the international and regional importance of traffic coming from the direction of Rijeka towards the interior. The Zagreb - Karlovac section is one of the oldest sections of the motorway network in Croatia with poor ecological standards. According to the feasibility study, the limitations of of the capacity are caused by the existing toll collection system. The potential to change the toll collection system (see Measure Ro.17) would have a clear impact on this section of the highway. If the significant increase in the number of vehicles on this section continues, consideration should be given to the option of building a third track. Specific interventions to increase safety and environmental standards on this section are also justified. Further analysis and studies will show the character and justification of capacity expansion in line with the indicators and conclusions of the Transport Infrastructure Development Master Plan on the Zagreb-Karlovac highway, which serves as the basis for sustainable development of the stock. At this point, there is no justification for building a dedicated public transport lantern, as at the same time it is planning to invest in the reconstruction of the strip on the Croatian Leskovac-Karlovac part, and it is also the meaning of marking this measure as red.	
Areas of the ecological network that may be impacted by the implementation of the measure	HR1000001 Pokupski bazen HR2001335 Jastrebarski lugovi HR2000450 Ribnjaci Draganići	
Impact description	During the construction of the dedicated public transport lane, a moderately negative impact on target. Impact species found on the areas of the ecological network HR1000001 Pokupski bazen, HR2001335 description Jastrebarski lugovi and **HR2000450** Ribnjaci Draganići can be expected.	
Impact significance assessment	HR1000001 Pokupski bazen	-1
	HR2001335 Jastrebarski lugovi	-1
	HR2000450 Ribnjaci Draganići	-1

Code and name of measure	Ro. 13 Capacity increase - A dedicated lane for public transport on the Zagreb bypass
Description of the measure	Zagreb bypass is the busiest route in Croatia and the traffic level is constantly increasing. Some sections of the Zagreb bypass need to be extended with a new public transport lane. Through the concept of functional regions, the existing options for capacity increase shall be analysed, the stages and schedule of construction shall be assessed as well as the necessary technical parameters, taking into account the expected demand and economic, social and environmental aspects, as well as the development planned for other means of transport.

Areas of ecological network that may be impacted by the implementation of the measure	HR2001311 Sava downstream od Hrušćice	
Impact description	Given that this is an upgrade of an existing road, no significant impacts are expected on the area of the ecological network HR2001311 Sava downstream od Hrušćice at the strategic assessment level.	
Impact significance assessment	HR2001311 Sava downstream od Hrušćice	0

Code and name of measure	**Ro. 14 Improving access to the Port of Slavonski Brod**	
Description of the measure	Slavonski Brod, as the main port on the Sava River, is the only port of inland waterways in Croatia on the Sava River, which is an integral part of the core TEN-T network. The development of the port and the additional business zone needs to be coordinated with the improvements of other transport infrastructure, especially the road. The NPM points to the good accessibility of the Port of Slavonski Brod.	
Areas of ecological network that may be impacted by the implementation of the measure	HR2001311 Sava downstream od Hrušćice	
Impact description	The planned road is located approximately 700 m north of the area of the ecological network HR2001311 Sava downstream od Hrušćice, which means that no negative impacts on the ecological network are expected due to the implementation of the Ro.14 measure.	
Impact significance assessment	HR2001311 Sava downstream od Hrušćice	0

Code and name of measure	**Ro. 15 Reorganisation of the Split network**
Description of the measure	Split is one of the main tourist centers in Croatia. Tourism related to cruise trips is particularly important for the road network because it creates large seasonal loads on the road network. The road network in Split shall be reorganised, taking into account the public transport system and the planned development of the city, the port and other transport systems such as the railway. One of the potential measures is the Split bypass: Trogir - Split - Omiš, which is planned for regional and local traffic, and different sections are in different stages of construction: the Split-Trogir section has already been completed, while the access road from Split to A1 motorway is under construction. Through the concept of functional regions, a final package of measures shall be set as well as the required technical parameters, taking into account the expected demand and the economic and environmental aspects.

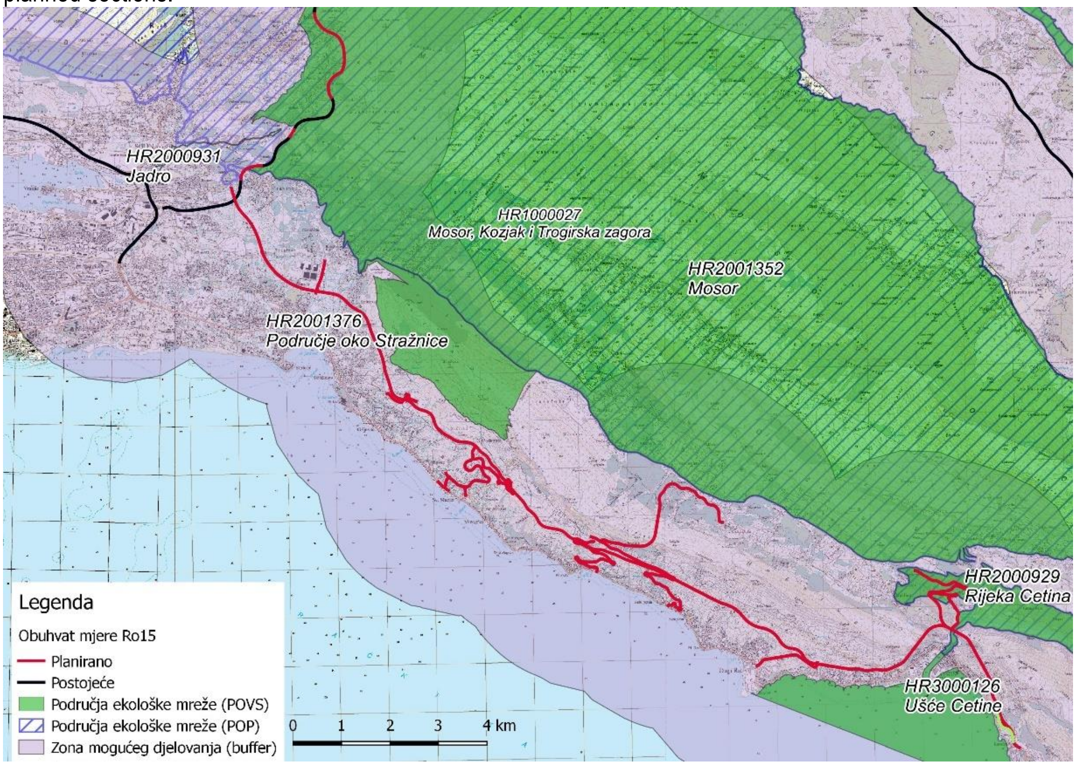
<table>
<tr><td>Areas of ecological network that may be impacted by the implementation of the measure</td><td colspan="2">HR1000027 Mosor, Kozjak i Trogirska zagora
HR1000029 Cetina
HR2001352 Mosor
HR2000929 Rijeka Cetina - kanjonski dio
HR2001376 Područje oko Stražnice
HR3000126 Ušće Cetine</td></tr>
<tr><td>Impact description</td><td colspan="2">Potential impacts on target species of birds in the area of the ecological network HR1000027 Mosor, Kozjak i Trogirska zagora and target species in the area HR2001376 Područje oko Stražnice: lesser mouse-eared bat - Myotis blythii, are possible due to fragmentation and changes in habitat conditions due to the construction of the planned sections.


Figure 11.20 Scope of the Ro.15 measure (prepared by: IRES EKOLOGIJA d.o.o.)
As the route passes through the area of the ecological network HR2000929 Rijeka Cetina - kanjonski dio, a negative impact is possible on the target habitat type 8210 Carbonate rocks with hazmophytic vegetation</td></tr>
<tr><td rowspan="6">Impact significance assessment</td><td>HR1000027 Mosor, Kozjak i Trogirska zagora</td><td>-1</td></tr>
<tr><td>HR1000029 Cetina</td><td>-1</td></tr>
<tr><td>HR2001352 Mosor</td><td>0</td></tr>
<tr><td>HR2000929 Rijeka Cetina - kanjonski dio</td><td>-1</td></tr>
<tr><td>HR2001376 Područje oko Stražnice</td><td>-1</td></tr>
<tr><td>HR3000126 Ušće Cetine</td><td>0</td></tr>
</table>

Code and name	**Ro. 16 Preparations for Dubrovnik's accessibility after Croatia's accession to Schengen (Pelješac Bridge – Adriatic Ionian corridor)**	
Description of the measure	The long-distance accessibility in mid-term scenario is of course the Dubrovnik airport. For the further development of the road infrastructure it is necessary to build the "Peljesac" bridge, in combination with the road network on Peljesac and the Ston bypass. The continuation of the construction of the Adriatic - Ionian Corridor from Ploče to the state border with the Black Mountain and its course will be determined after the studies have been conducted and taking into account the European transport corridors.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000036 HR1000031 HR2001364 HR3000163 HR3000167 HR4000015 HR5000031	Srednjedalmatinski otoci i Pelješac Delta Neretve JI dio Pelješca Stonski kanal Solana Ston Malostonski zaljev Delta Neretve
Impact description	Potential impacts resulting from the implementation of the intervention planned by this measure can be expected during construction, and later in the usage phase, in the form of potential contamination of the marine areas of the ecological network HR4000015 Malostonski zaljev, HR3000163 Stonski kanal, HR3000167 Solana Ston. The use of intervention may have a negative impact on target species of birds in the areas of the ecological network HR100003 Srednjedalmatinski otoci i Pelješac and HR1000031 Delta Neretve. By selecting adequate techniques for the implementation of the intervention and later solving the problems of rainwater, the impact would be moderate for the areas HR4000015 Malostonski zaljev, HR3000163 Stonski kanal, HR3000167 Solana Ston. The full coverage of the Ro.16 measure shall Impact contribute to the negative impact of fragmentation of the habitat and increased traffic pressure, in the form description of noise disturbance, light pollution and animal fatalities in the areas of the ecological network HR1000036 Srednjedalmatinski otoci i Pelješac and HR2001364 JI dio Pelješca. For the planned intervention provided for in this Land - Pelješac Bridge with access road measure, the competent Ministry has adopted the Decision on acceptability for the environment and ecological network, with the implementation of the legally prescribed and established mitigation measures for the goals of the conservation and integrity of the ecological network area (CLASS: UP/I 351-03/15-02/59, FILE NO.: 51706-2-1-2-15-15, 30 October 2015). The Decision on acceptability for the environment and ecological network (CLASS: UP/I 351-03/15-02/76, FILE NO.: 517-06-2-1-2-16-13, 26 April 2016) was also adopted for the Sparagovići - Doli section of the state road.	

Impact significance assessment	HR1000036	Srednjedalmatinski otoci i Pelješac	-1
	HR1000031	Delta Neretve	-1
	HR2001364	JI dio Pelješca	-1
	HR3000163	Stonski kanal	-1
	HR3000167	Solana Ston	-1
	HR4000015	Malostonski zaljev	-1
	HR5000031	Delta Neretve	0

11.3.1.2 Railway transport

In railway transport, the defined measures mainly relate to the improvement of the existing railway corridors, so impacts during the usage of the interventions, i.e. railways, were analyzed, in line with the expected increase in traffic. Negative impacts recognized as possible effects are mainly noise, vibration, pollution caused by accidents, target species fatalities and light pollution.

Code and name of measure	**R1. Zagreb - State border with Slovenia towards Ljubljana (TEN-T basic network/TEN-T Mediterranean corridor/ Pan-European corridor)**
Description of the measure	The M101 railway is part of the TEN-T core network and RH1 corridor and is one of the major international connections towards Zagreb and the only urban node of the core railway TEN-T network in Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger transport. Future scenarios such as the entry of Croatia into the Schengen area shall increase the volume of traffic on this Description of the railway line. Although some activities are being developed to improve this railway line, the fact is that some measure parts of the M101 railway currently have a speed limit of up to 60 km/ h. Through the concept of functional regions, the technical requirements to be met in terms of capacity and allowed speed shall be assessed taking into account economic and environmental aspects. Since the subject railway line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t/a; usable length of railway tracks for reception and dispatch 750 m, ERTMS
Code and name of measure	**R.2 Zagreb - Karlovac (TEN-T basic network/TEN-T Mediterranean corridor/ Pan-European corridor RH2)**
Description of the measure	The corridor connecting Zagreb and Rijeka is primarily important for cargo transport and partly for suburban passenger transport. The analysis shows that suburban passenger transport primarily takes place on the section from Zagreb to Karlovac. Currently, this part of the M202 railway is mostly single-track, which limits the potential to increase capacity. It is expected that the importance of this railway line for cargo transport shall increase in the medium to long term, given that Rijeka is defined as the main Croatian port within the TEN-T network. Further studies shall analyse planned speed and capacity needs, taking into account economic and ecological aspects. In addition to the capacity increase, cargo transport requires that the railway line meet the following technical criteria: axle load (mass per axle) 22.5 t/a; ERTMS; usable length of railway tracks for reception and dispatch depending on the logistic concept.
Code and name of measure	**R.3 Karlovac + to Rijeka (TEN-T basic network/TEN-T Mediterranean corridor/ Pan-European corridor RH2)**
Description of the measure	The analysis shows that this part of the corridor connecting Zagreb and Rijeka is mainly used for cargo transport. Currently, this part of the M202 railway is mostly single-track and electrified, with some parts having a speed limit of 50 km / h. Rijeka is defined as the main Croatian port within the TEN-T network and Description of the therefore it is expected that the importance of this f railway line for cargo transport shall increase in the medium to long term. This section should therefore meet the following technical criteria: axle load (mass per axle) 22.5 t/a; usable length of railway tracks for reception and dispatch depending on the logistic concept, ERTMS. According to feasibility studies, the best variant of the strip was chosen, "Low-lane", bearing in mind the possible construction of a container terminal on Krk and a connection to the Dalmatian railway, the planned speed and capacity needs, taking into account economic and ecological aspects.
Code and name of measure	**R.4 Railway network around Rijeka**
Description of the measure	According to current preliminary analyses, there might be potential for the reorganisation of the Rijeka railway node with the introduction of suburban lines, giving priority to the modal shift from the use of Description of the personal cars. Additional analyses should explore the capacity of the railway, taking into account the measure logistics concept and capacity of the Port of

	Rijeka terminals. The remaining capacity can be utilised for transport. Improvement of the connection with Slovenia shall be harmonised with measures R.2 and R.3
Code and name of measure	**R.5 Zagreb - Križevci (TEN-T basic network/TEN-T Mediterranean corridor/ Pan-European corridor RH2)**
Description of the measure	The corridor connecting Zagreb and Rijeka with Eastern Europe via Hungary is primarily important for cargo transport and partly for suburban transport. The analysis shows that suburban travels in this part of the corridor are mostly related to Dugo Selo (15 568 passenger trains in 2012) and Križevci (11 516 passenger trains in 2012). Currently, this part of the M201 railway line is double-track to Dugo Selo singe-track to Križevci. This fact limits the potential to increase capacity, especially if it is taken into account that the importance of this railway line for cargo transport shall increase in the medium to long term given that Rijeka is defined as the main Croatian port within the TEN-T network. Since this line is important for cargo transport, in addition to increasing capacity, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
Code and name of measure	**R.6. Križevci - State border with Hungary towards Budapest (TEN-T basic network/TEN-T measure Mediterranean corridor/ Pan-European corridor RH2)**
Description of the measure	The analysis shows that this part of the corridor connecting Zagreb and Rijeka with Eastern Europe via Hungary is most important for cargo transport and partly for suburban transport. Hungary is currently working on the further development of this corridor (development of Gysev and Szekesfehervar network - the development of the Boba railway line). Currently, this part of the M201 railway is mainly single-track Description of the and electrified, with some parts having a speed limit of 80 km / h. Rijeka is defined as the main Croatian measure port within the TEN-T network and therefore, it is expected that the importance of this railway line for cargo transport shall increase in the medium to long term. For this reason and taking into account that this section is a part of the core network and TEN-T corridor, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
Code and name of measure	**R.7 Zagreb - Novska (TEN-T basic network/Pan-European corridor RH1)**
Description of the measure	The railway lines M102 and M103 are part of the core TEN-T network and RH1 corridor and are one of the major international connections towards Zagreb, the only urban node of the core railway TEN-T network in Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger transport (over 59,000 passenger trains between Zagreb and Dugo Selo in 2012). Future scenarios such Description of the as the entry of Croatia into the Schengen area shall increase the volume of traffic on this railway line. Although some activities are being developed to improve the railway line from Dugo Selo to Novska, the fact is that currently some parts of both lines have a speed limit of up to 50 km / h. Further studies shall analyse planned speed and capacity needs, taking into account economic and ecological aspects. Since this line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
Code and name of measure	**R.8 Novska - State border with Serbia (TEN-T basic network/Pan-European corridor RH1)**
Description of the measure	The M105 railway is part of the core TEN-T network and RH1 corridor and one of the major international connections towards Zagreb. RH1 has historically been the most important corridor in terms of longdistance passenger transport. Future scenarios such as the entry of Croatia into the Schengen area or the entry of neighbouring countries like Serbia into the European Union shall increase the volume of traffic on Description of the this line. At present, the M105 railway line is double-track between Novska and Tovarnik, which was measure constructed as a border crossing between Croatia and Serbia on the core rail network. Further studies shall assess the technical requirements to be met, taking into account both the economic and environmental aspects. Since this line is also important for cargo transport, it shall meet the following minimum

	technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
Code and name of measure	**R.9 State border with Hungary – Osijek - State border with Bosnia and Herzegovina (TEN-T comprehensive network/basic network/Pan-European corridor RH3)**
Description of the measure	The M303 railway is part of the core TEN-T network in Croatia, and Slavonski Šamac is the border crossing of the core railway network with Bosnia and Herzegovina. The railway lines M301 and M302 are Description of the part of a comprehensive network, but serve as a link between Bosnia and Herzegovina - Croatia - Hungary, measure following the Pan-European Corridor Vc. The NPM shows that there is currently no traffic need. The potential of this international corridor shall increase if the Schengen borders move in relation to their current position.
Code and name of measure	**R.10 Regional link Vinkovci - Vukovar (TEN-T basic network/Pan-European corridor RH1)**
Description of the measure	The railway line M601 Vinkovci - Vukovar shall serve as a railway connecting RH1 and the only Croatian port of internal waters of the core TEN-T network on the Danube, Vukovar. Future scenarios related to Vukovar port development shall increase the importance of cargo transport on this line in the medium to of the long-term perspective. Further studies shall assess the technical requirements to be met, taking into account both the economic and environmental aspects. Since this line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
Code and name of measure	**R.11 Zagreb Node**
Description of the measure	Current configuration of the Croatian railway network and the fact that Zagreb is the only urban node of the TEN-T core network demonstrate the importance of the Croatian capital in the entire transport system. In order to increase the importance of the role of the railway in the regional connection and the urban transport system, further studies shall analyse specific conditions to be met.
Code and name of measure	**R.14 Zagreb Central Station**
Description of the measure	Zagreb Central Station shall play a key role not only in long-distance transport but also in local and regional transport. It shall probably be necessary to adapt the existing access and platforms and the organisation of the movement of passengers inside and outside the station in favour of the modal hub. Specific technical requirements shall be the result of further studies that shall take into account economic, social and ecological aspects.

Measures R1, R2, R3, R4, R5, R8, R9, R10 and R11 relate to the increase in the volume of traffic on the already existing sections. As already mentioned above, negative impacts can affect target species of the ecological network, primarily in the form of additional animal fatalities caused by collision with locomotives, increased noise and vibration along the railway and potential environmental pollution due to accidents. These impacts can be mitigated by mitigation measures for the ecological network and are considered moderately negative (-1).

For the R11 measure - Zagreb Node, a possible negative impact on the area of the ecological network HR2000589 Stupnički lug has been identified, if the measure involves the construction of new railway sections.

The procedure of Assessment of acceptability for the ecological network was implemented for measures R6 and R7 and the competent Ministry has issued the Decision that the intended intervention was acceptable to the environment and the ecological network with the application of mitigation measures for the goals of ecological network conservation (CLASS: UP/I 351-03/14-02/59, FILE NO.: 517-06-2-1-1-15-09, 16 March 2015 and CLASS: UP/I 351-03/18-02/27, FILE NO.: 51706-2-1-217-23, 23 February 2017).

As part of the R.14 measure - Zagreb Central Station, interventions are planned which, due to their distance, shall not have an impact on the ecological network (0).

11.3.1.3 Air transport

Measures of the Strategy do not provide for the construction of new airports which would have a negative impact on the goals of the conservation and integrity of the ecological network. However, most of the measures plan to extend the existing traffic capacity and/or upgrade certain elements (access light signaling system and the like).

Code and name of measure	**A.1 Development of the Dubrovnik Airport (TEN-T comprehensive network)**	
Description of the measure	Dubrovnik is one of the main destinations on the Adriatic coast. The main problem of this airport are bottlenecks that occur at the peak of the tourist season. Given the characteristics and geographic position of the surrounding area that forms the enclave, it is necessary to maintain and improve the traffic connections to ensure good connectivity. Planned measures include the expansion of the existing transport/infrastructure capacities to maintain existing quality levels of service, the reduction/removal of bottlenecks, the rehabilitation of the existing and construction of new road structures and facilities that are required for safe and unobstructed airport operations, the implementation of environmental protection measures, the implementation of measures to increase energy efficiency and the supply of necessary equipment and devices.	
Areas of ecological network that may be impacted by the implementation of the measure	HR2000946 Snježnica i Konavosko polje	
Impact description	The implementation of this measure could have a negative impact on the target species of bats (greater horseshoe bat - *Rhinolophus ferrumequinum,* Mediterranean horseshoe bat - *Rhinolophus euryale,* lesser mouse-eared bat - *Myotis blythii,* common bent-wing bat *Miniopterus schreibersii,* Geoffroy's bat - *Myotis emarginatus)* in the area of the ecological network due to the fact that the Dubrovnik Airport borders with the area of the ecological network HR2000946 Snježnica i Konavosko polje. Additional negative impact of extending existing traffic capacities can be expected in the form of light pollution to which bats are sensitive, increased noise sources and direct collision with aircrafts.	
Impact significance assessment	HR2000946 Snježnica i Konavosko polje	-1

Code and name of measure	**A.2 Development of the Pula Airport (TEN-T comprehensive network)**	
Description of the measure	The Pula Airport is important for the accessibility of this region from remote locations. Airport traffic is seasonal, which can cause bottlenecks due to limited infrastructure. Two important operational aspects need to be considered, including: 1) Quality of service, primarily due to the competitiveness of neighboring international airports, and 2) Balance between security and operational capacity. These aspects, among other things, stress the need to increase the capacity of this airport by upgrading certain elements: the access light signaling system, runway, apron, terminal, and access points. On the basis of the concept of functional regions, the feasibility of these measures and the order of priority shall be established, taking into account the environmental requirements and the real needs, as well as the potential in regards to the expected demand.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000032 Akvatorij zapadne Istre HR2000522 Luka Budava - Istra	
Impact description	Increasing the capacity of the Pula Airport can potentially have a negative impact on the target species of birds in the area of the ecological network HR1000032 Akvatorij zapadne Istre, but this impact can be considered acceptable due to the distance of the area (about 4 km). The negative impact on target habitat 9340 Evergreen oak forests (*Quercus ilex*) in the area of the ecological network HR2000522 Luka Budava Istra, can also be considered acceptable due to the fact that no activities in that area of the ecological network were planned.	
Impact significance assessment	HR1000032 Akvatorij zapadne Istre	0
	HR2000522 Luka Budava - Istra	0

Code and name of measure	**A.3 Development of the Brač Airport**
Description of the measure	The development of the Brač Airport is planned to improve the connectivity of the island of Brač with remote locations and thus the connectivity of Central Dalmatia, in line with various security requirements and traffic demand. The analyzes show the need for the ICAO 3C code and compliance with ICAO, EASA and national standards. On the basis of the concept of functional regions, feasible measures and order according to priorities shall be established, taking into account the environmental requirements and the real needs, as well as the potential in regards to the expected demand. The Evaluation procedure for the assessment of the impact of the extension of the runway was performed and the decision was made that the intervention was acceptable to the ecological network.
	The measure provides for no interventions that could impact the ecological network.

Code and name of measure	**A.4 Development of the Mali Lošinj Airport**	
Description of the measure	The development of the Mali Lošinj Airport is planned to improve the connectivity of Mali Lošinj with remote locations and thus the connectivity of Northern Dalmatia, in line with various security requirements and traffic demand. The analyzes show a potential need for expansion of the runway, apron and terminals. On the basis of the concept of functional regions, the feasibility of these measures and the order of priority shall be established, taking into account the environmental requirements and the real needs, as well as the potential in regards to the expected demand.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000033 Kvarnerski otoci	
Impact description	With the expansion of the runway, apron and terminals of the Mali Lošinj Airport, a moderately negative impact on the target species of birds in the area of the ecological network HR1000033 Kvarnerski otoci is expected, primarily in the form of bird fatalities resulting from direct collisions with aircrafts, light pollution and an additional source of noise. Given that the intervention planned by this measure requires a location permit with included environmental and nature protection conditions, the impact of this measure can be considered moderately negative for the ecological network. The increase in air traffic in the Mali Lošinj area can have a negative effect on the target types of birds of prey that use higher airspace: *Aquila chrysaetos* - golden eagle, *Bubo bubo* - eurasian eagle-owl, *Circaetus gallicus* - short-toed snake eagle, *Circus cyaneus* - hen harrier, *Falco columbarius* - merlin, *Falco naumanni* - lesser kestrel, *Falco peregrinus* - peregrine falcon, *Falco vespertinus* - red-footed falcon and *Pernis apivorus* - European honey buzzard. Air traffic may also have an adverse impact on the prey population of the common crane (*Grus grus*).	
Impact significance assessment	HR1000033 Kvarnerski otoci	-1

Code and name of measure	A.5 Development of the Osijek Airport (TEN-T comprehensive network)	
Description of the measure	Regional connectivity and connectivity to remote locations, along with national cohesion, are the main reasons for expansion of the Osijek Airport, taking into account freight traffic due to synergy with other means of transport. On the basis of the concept of functional regions, feasible measures and order according to priorities shall be established, taking into account the environmental requirements and the real needs, as well as the potential in regards to the expected demand.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000016 Podunavlje i donje Podravlje	
Impact description	The planned expansion of the Osijek Airport shall have no impact on the area of the ecological network HR1000016 Podunavlje i donje Podravlje nor its target species of birds, due to the fact that it is more than 8 km removed from it.	
Impact significance assessment	HR1000016 Podunavlje i donje Podravlje	0

Code and name of measure	A.6 Development of the Rijeka Airport (TEN-T comprehensive network)	
Description of the measure	Rijeka Airport shows a big increase in passenger traffic and has additional potential for freight traffic due to synergy with the Port of Rijeka. Remediation/expansion/replacement of the apron and operational equipment and the control tower equipment is currently underway. This is part of the airport's plan for development and harmonization with ICAO, EASA and national standards. For the purpose of achieving energy efficiency and environmental protection, interventions are planned for solar power plant, the facade of the passenger terminal building and wastewater treatment. On the basis of the concept of functional regions, the feasibility of these measures and the order of priority shall be established, taking into account the environmental requirements and the real needs, as well as the potential in regards to the expected demand.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000033 Kvarnerski otoci HR2001357 Otok Krk	
Impact description	With the development of the Rijeka Airport, it is possible that the pressure on the target species of birds in the area of the ecological network HR1000033 Kvarnerski otoci and target species of bats in the area HR2001357 Otok Krk shall increase. The negative impact would manifest in the increasing intensity of light pollution, target species fatalities and intensified noise during use.	
Impact significance assessment	HR1000033 Kvarnerski otoci	-1
	HR2001357 Otok Krk	-1

Code and name of measure	A.7 Development of the Split Airport (TEN-T comprehensive network)	
Description of the measure	With similar traffic levels as the Dubrovnik Airport, Split is the second most important access point on the Dalmatian coast in regards to passenger traffic. The main problem of this airport are bottlenecks that occur at the peak of the season. The problems of seasonality and quality of service shall be solved by expanding the land and air facilities, which is currently underway.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000027 Mosor, Kozjak i Trogirska zagora HR2001363 Zaleđe Trogira	
Impact description	The expansion of the land and air facilities in the Split Airport may have a moderately negative impact on the target species of birds in the area of the ecological network HR1000027 Mosor, Kozjak i Trogirska zagora as well as the target species in the area of the ecological network HR2001363 Zaleđe Trogira greater horseshoe bat *(Rhinolophus ferrumequinum).* The negative impact would manifest in the increasing intensity of light pollution, target species fatalities and intensified noise during use.	
Impact significance assessment	HR1000027 Mosor, Kozjak i Trogirska zagora	-1
	HR2001363 Zaleđe Trogira	-1

Code and name of measure	A.8 Development of the Zadar Airport (TEN-T comprehensive network)	
Description of the measure	The connectivity of the Central Dalmatia to remote locations is the main reason for expanding this airport. Analyses show that investments need to be directed at improving the traffic and infrastructure capacity of the airport for airplanes in accordance with the ICAO 4E code. On the basis of the concept of functional regions, feasible measures and order according to priorities shall be established, taking into account the environmental requirements and the real needs, as well as the potential in regards to the expected demand.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000024 Ravni kotari HR2001361 Ravni kotari	
Impact description	Zadar Airport is located about 300 m west of the area of the ecological network HR1000024 Ravni kotari and about 3.5 km north of the area of the ecological network HR2001361 Ravni kotari, which is why a negative impact on the target species of birds and bats in these areas of the ecological network cannot be excluded. Given that this is an existing pressure, the impact was assessed as moderately negative, with the prescribed mitigation measures.	
Impact significance assessment	HR1000024 Ravni kotari	-1
	HR2001361 Ravni kotari	-1

Code and name of measure	A.9 Development of the Franjo Tuđman Airport (TEN-T basic network)
Description of the measure	Franjo Tuđman Airport is the main entry point to Croatia and operates as the hub for domestic and international traffic. The airport is currently operated by a concessionaire who founded a new company, Međunarodna zračna luka Zagreb d.d., and whose investment plan is periodically revised by the Ministry of Maritime Affairs, Transport and Infrastructure. Company Zračna luka Zagreb d.o.o. is still active and now has the role of mediator between the Government of the Republic of Croatia and the concessionaire with the goal of further developing the infrastructure and all the transport segments that are not the object of the concession contract. If the concessionaire withdraws from the intervention and the management of the airport, Zračna luka Zagreb d.o.o. shall immediately take over the airport from the concessionaire to ensure the continuous and uninterrupted operation of the Zagreb Airport. The development plans for the airport include the construction of a new terminal to increase capacity.
Impact description	The measure has already been implemented.

11.3.1.4 Maritime transport

The impact of maritime traffic on the marine ecosystems is manifested mainly through pollution of the marine environment, especially in port areas, by taking over parts of submarine habitats during the expansion of port areas, underwater noise and increased risk of invasive species. The measures proposed by the Strategy within the Maritime Traffic sector relate to the expansion, improvement and specialization of existing ports

Code and name of measure	M.8 Specialization of the Port of Rijeka (container, liquid cargo transport and LNG terminal)
Description of the measure	The Port of Rijeka is classified as the only TEN-T basic Croatian sea port. It is a port open for public transport of particular (international) economic interest to the Republic of Croatia. This is the largest port in the Republic of Croatia whose advantage is the existence of the deepest natural channel on the Adriatic. Much of the traffic is transit freight to the wider hinterland of central Europe, with regard to volume, dominated by liquid and bulk cargo, followed by container and cargo. Further development of the port will be focused on the specialization of container and cargo traffic. For the port's success, it is necessary to ensure the interoperability and accessibility of the port and to complement the development of the port with the necessary development of road and rail infrastructure and logistic areas. At this time, a number of projects on the island of Krk, such as the LNG terminal and the container terminal, are planned, and according to further projects, adequate infrastructure needs to be planned in terms of accessibility (road, rail) to the island of Krk. Further analysis will identify the projects needed to realize this specialty and set priorities, taking into account environmental requirements and real needs as well as the potential for the expected demand. An emphasis will be put on improving warehouse facilities and better connectivity with the hinterland. If there is a significant increase in transport demand, it is necessary to analyze the possibility of using the locations on the island of Krk.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000033 Kvarnerski otoci HR2001357 Otok Krk HR2000891 Jezero Njivice na Krku HR3000029 Obala između rta Šilo i Vodotoč HR3000472 Podmorje oko rta Ćuf na Krku
Impact description	The aforementioned areas are separated for the potential impact of the LNG terminal project on Krk. Given that the environmental impact assessment at the project level under the Study is not going to be further evaluated.

Code and name of measure	M.9 Specialization of the Port of Ploče (container and bulk cargo)	
Description of the measure	The Port of Ploče is classified as a TEN-T comprehensive port in Croatia, which is of particular importance for Bosnia and Herzegovina. Further development of the port shall be focused on the specialization of the container and bulk cargo transport. According to development plans, the focus shall be on the construction of a new terminal for dry and bulk cargo, a container terminal and the modernization of existing infrastructure and new logistics space. Although it is outside of the scope of this strategy, it should be noted that the success of this port is directly linked to the development of road and rail infrastructure in the Republic of Bosnia and Herzegovina. Further analysis shall determine the feasibility of these measures and determine their priority, taking into account environmental requirements, real needs and potential in regards to the expected demand.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000031 Delta Neretve HR5000031 Delta Neretve	
Impact description	The construction of a new terminal for dry and bulk cargo and a container terminal, if they are planned in the area of the ecological network, may have a negative impact on the target species and habitats in the areas of the ecological network HR1000031 Delta Neretve and HR5000031 Delta Neretve, in the form of a permanent transformation of a part of the habitat.	
Impact significance assessment	HR1000031 Delta Neretve	-1
	HR5000031 Delta Neretve	-1

Code and name of measure	M.10 Specialization of the Port of Dubrovnik (cruise ships)
Description of the measure	The Port of Dubrovnik is classified as a TEN-T comprehensive port in Croatia. It is a port open for public transport of particular (international) economic interest to the Republic of Croatia. In recent years, the Port of Dubrovnik has become one of the most popular destinations for cruises in Europe, and its development is focused on passenger traffic on cruise ships. The planned development includes the modernization and reconstruction of the passenger terminal and the expansion of the facilities for ferry traffic. Further analysis shall determine the feasibility of these measures and determine their priority, taking into account environmental requirements, real needs and potential in regards to the expected demand.
Areas of ecological network that may be impacted by the implementation of the measure	/
Impact description	Expansion of the facilities for ferry traffic and reconstruction of the passenger terminal are localized within the Port of Gruž, and no direct negative impact on the areas of the ecological network are expected.

Code and name of measure	**M.11 Specialization of the Port of Split (RO-RO, passenger and cruise traffic)**
Description of the measure	The Port of Split is classified as a TEN-T comprehensive port in Croatia. It is a port open for public transport of particular (international) economic interest to the Republic of Croatia. The Port of Split is also called the gate to the islands. This is the largest passenger port in Croatia and therefore its development is focused on passenger traffic and cruise travel. The planned development shall be aimed at building new space for ferry anchorage, road and rail traffic, and cruise ships on cruise travels, including the expansion of passenger piers. Further analysis shall determine the feasibility of these measures and determine their priority, taking into account environmental requirements, real needs and the potential in regards to the expected demand.
Areas of ecological network that may be impacted by the implementation of the measure	/
Impact description	The construction of new space for ferry anchorage and the expansion of passenger piers are planned within the existing Port of Split and no additional negative impacts on the ecological network are expected.

Code and name of measure	**M.12 Specialization of the Port of Zadar (RO-RO, passenger and cruise traffic)**
Description of the measure	Construction of a new passenger port outside the center of the old town in Gaženica is in progress. The new port shall enable the expansion of capacity for berthing major international ferries and modern cruise ships (“home port”), and the international standard for passenger and vehicle docking facilities. Further analysis shall identify the necessary interventions in order to achieve this specialization and establish priorities, taking into account environmental real needs and the potential in regards to the expected demand.
Areas of ecological network that may be impacted by the implementation of the measure	/
Impact description	Activities planned for in this measure are located in the scope of Luke Gaženica, which is not located outside of the area of the ecological network.

Code and name of measure	M.13 Specialization of the Port of Šibenik (smaller vessels and super yachts)
Description of the measure	The Port of Šibenik is classified as a TEN-T comprehensive port in Croatia. It is a port open for public transport of particular (international) economic interest to the Republic of Croatia. Further development of the port shall focus on the specialization of passenger traffic as a port for the exclusive navigation of smaller capacity vessels (boutique boats) and super yachts. Further analysis shall establish the necessary interventions for the achievement of the specialization and determining priority, taking into account environmental requirements, real needs and the potential in regards to the expected demand.
Areas of ecological network that may be impacted by the implementation of the measure	HR3000171 Ušće Krke
Impact description	This measure envisages the specialization of passenger traffic to the exclusive navigation of smaller capacity vessels and super yachts, which shall not negatively impact the area of the ecological network HR3000171 Ušće Krke and its associated target species and habitats.

11.3.1.5 Inland waterway transport

Code and name of measure	I.3 Development of the Port of Vukovar (TEN-T basic network)
Description of the measure	The Port of Vukovar is located on the Danube River and is classified as a basic TEN-T port. Vukovar is an inland port that can accommodate class 5 vessels. It has been assigned the VIc class of navigability. Passenger and goods traffic of the port is increasing. It was established that the following measures should be implemented for the purpose of development and upgrading the Port of Vukovar: the modernization and construction of new facilities to increase the capacity of the existing port, the development and construction of the new eastern port, the modernization of connections with road and rail infrastructure, the construction of an industrial pier in Ilok, the development of facilities in the ports for passengers. Further analysis shall determine the feasibility of these measures and their order of priority, taking into account the environmental requirements and real needs, as well as the potential in regards to the expected demand.
Areas of ecological network that may be impacted by the implementation of the measure	HR2000372 Dunav - Vukovar
Impact description	Activities provided for in this measure may have a negative impact on the target species and habitats in the area of the ecological network, primarily due to the permanent conversion of target habitat types 3270 Rivers with muddy banks covered in *Chenopodion rubri* p.p. and *Bidention* p.p., and 91E0* Alluvial forests *(Alno-Padion, Alnion incanae, Salicion albae)*, as well as due to the disturbance of the target species of fish (asp *Aspius aspius,* schraetzer *Gymnocephalus schraetser,* common zingel *Zingel zingel,* sichel *Pelecus cultratus* and Balon's ruffe *Gymnocephalus baloni).*

Impact significance assessment	HR2000372 Dunav - Vukovar	-1

Code and name of measure	**I.4 Development of the Port of Osijek (TEN-T comprehensive network)**	
Description of the measure	The Port of Osijek is located on the Drava River and is classified as a TEN-T comprehensive port. Passenger and goods traffic of the port is increasing. The Port of Osijek has a great opportunity to become an intermodal logistics center thanks to its size and excellent potential due to the road and rail connection to the hinterland. It was established that the following measures should be implemented for the purpose of development and upgrading the Port of Osijek: the construction of a port basin and business zone development, the construction of bulk cargo reloading terminals, the construction and remediation of the existing coastline, the modernization of basic river infrastructure and security systems. Further analysis shall determine the feasibility of these measures and their order of priority, taking into account the environmental requirements and real needs, as well as the potential in regards to the expected demand.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000016 Podunavlje i donje Podravlje HR2001308 Donji tok Drave	
Impact description	The construction of the port basin in the Port of Osijek can temporarily negatively affect the target species of fish in the area of the ecological network HR2001308 Donji tok Drave and on the target species in the area HR1000016 Podunavlje i donje Podravlje. Other activities are limited to the land part of the existing Port and no additional negative impact on the ecological network is expected from the implementation of these activities.	
Impact significance assessment	HR1000016 Podunavlje i donje Podravlje	-1
	HR2001308 Donji tok Drave	-1

Code and name of measure	**I.5 Development of the Port of Slavonski Brod (TEN-T basic network)**
Description of the measure	The Port of Slavonski Brod is located on the Drava River and is classified as a TEN-T basic port. The potential of Slavonski Brod, which is of particular importance to Bosnia and Herzegovina, largely depends on the development of the navigability of the Sava River in Bosnia and Herzegovina and Serbia and on the construction of the Danube-Sava canal through Slavonia. Reliability and safety of navigation on the Sava River are key factors affecting the attractiveness of the port. Most of the freight traffic consists of crude oil and item cargo transshipment. Further development of the port depends on the logistics concept.
Impact significance assessment	The competent Ministry issued the confirmation that the planned intervention shall not have a significant impact on the area of the ecological network (CLASS: 612-07/09-01/554, FILE NO.: 532-0802-1/2-09-4, 9 February 2009).

Code and name of measure	**I.6 Development of the Port of Sisak (TEN-T comprehensive network)**	
Description of the measure	The Port of Sisak is located on the Sava River and is classified as a TEN-T comprehensive port. Reliability and safety of navigation on the Sava River are key factors affecting the attractiveness of the port. These factors are located in three locations: in the town of Sisak on the Kupa River, near the town of Crnac on the Sava River and in Galdovo on the Sava River. The potential of Sisak greatly depends on the development of the Sava River navigability in the border area with Bosnia and Herzegovina and Serbia and/or the construction of the Danube-Sava canal through Slavonia. The construction of the new Port of Sisak to the south of the town of Crnac is planned. Freight traffic is mostly related to the Sisak oil refinery, i.e. the transportation of crude oil. Further development of the port depends on the logistics concept.	
Areas of ecological network that may be impacted by the implementation of the measure	HR1000004 Donja Posavina HR2001311 Sava nizvodno od Hrušćice	
Impact description	The planned construction of the new Port of Sisak south of the town of Crnac may have a negative impact on target species of birds in the area of the ecological network HR1000004 Donja Posavina during the construction, in the form of disturbance and noise emission. Negative impact on target species of fish and habitats in the area of ecological network HR2001311 Sava nizvodno od Hrušćice is expected in the case of conversion of target habitats and temporary disturbance of target species and fish.	
Impact significance assessment	HR1000004 Donja Posavina	-1
	HR2001311 Sava nizvodno od Hrušćice	-1

Code and name of measure	**I.7 Construction pf the Danube-Sava multipurpose canal**
Description of the measure	It is planned that the Danube-Sava multipurpose canal shall have four equally important functions navigation, tourism, irrigation and drainage. Due to its multiple functions, the canal shall have an important impact on the Croatian economy. From a traffic perspective, the canal is part of the 560 kilometer long intermodal traffic corridor of the Danube River basin – Adriatic, which includes the Sava River's waterway and a railway link with the Port of Rijeka. The acceptability of the canal construction shall be assessed through the results of the Canal feasinility study.
Areas of ecological network that may be impacted by the implementation of the measure	HR1000006 Spačvanski bazen HR2000372 Dunav - Vukovar HR2001311 Sava nizvodno od Hrušćice HR2001414 Spačvanski bazen

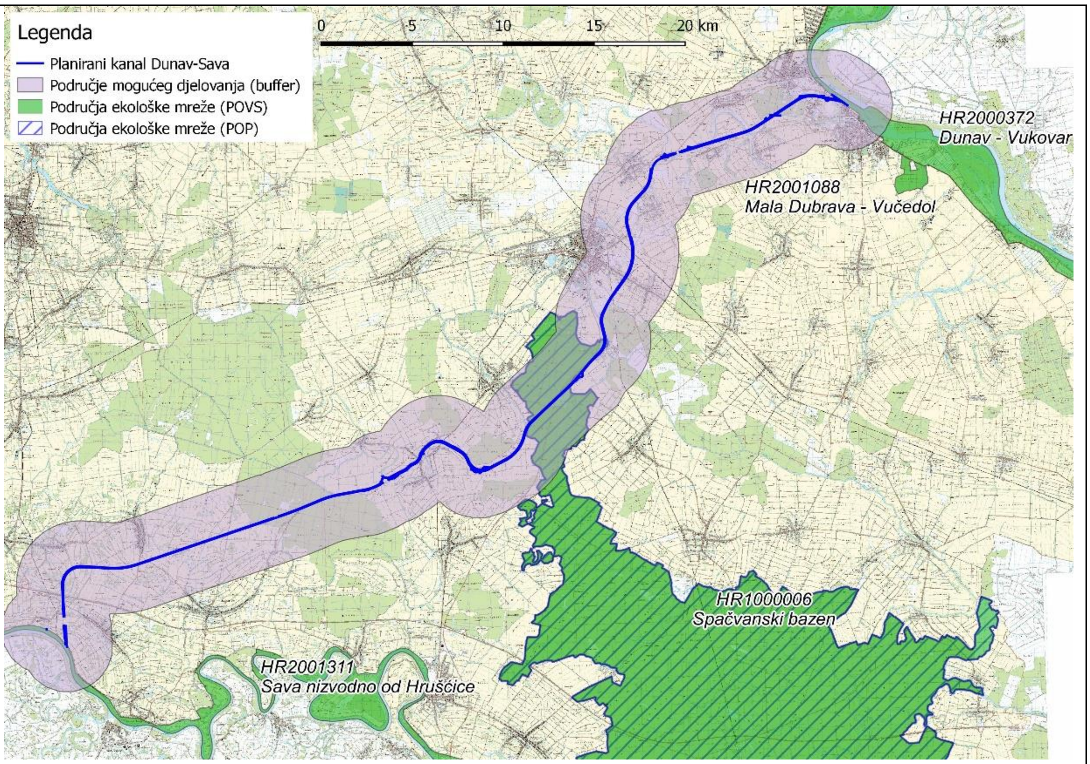
<table>
<tr><td rowspan="2">Impact description</td><td colspan="2">

Figure 11.21 Područje obuhvata mjere I.7. (Izrađivač: IRES EKOLOGIJA)</td></tr>
<tr><td colspan="2">A high negative impact of canaling and water flow deviations, as well as of changing hydrographic functions has already been identified for the areas of the ecological network HR1000006 Spačvanski bazen and HR2001414 Spačvanski bazen. The construction of the Danube-Sava canal would significantly change the groundwater regime which is essential for the survival of the target and priority habitat type 91E0* Alluvial forests (Alno-Padion, Alnion incanae, Salicion albae), but especially of the habitat type 91F0 Riparian mixed forests of Quercus robur, Ulmus laevis, Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia due to the sensitivity of pedunculate oak to the alteration of the hydrological regime of groundwaters. Significantly negative impact on the habitat types shall indirectly
be negatively reflected on the target species in the area of the ecological network HR2001414 Spačvanski bazen (primarily great capricorn beetle - Cerambyx cerdo and stag beetle Lucanus cervus), as well as on the target species of birds in the area HR1000006 Spačvanski bazen. Considering the above, a significantly negative impact on the ecological network during the realization can be expected.

A moderately negative impact can be expected on the areas of the ecological network HR2000372 Dunav - Vukovar and HR2001311 Sava nizvodno od Hrušćice in the form of temporary disturbance and possible pollution during construction</td></tr>
<tr><td rowspan="4">Impact significance assessment</td><td>HR1000006 Spačvanski bazen</td><td>-2</td></tr>
<tr><td>HR2000372 Dunav - Vukovar</td><td>-1</td></tr>
<tr><td>HR2001311 Sava nizvodno od Hrušćice</td><td>-1</td></tr>
<tr><td>HR2001414 Spačvanski bazen</td><td>-2</td></tr>
</table>

11.3.1.6 Development measures (I.1. and I.2.)

By implementing the I.1. measure which includes the improvement of the waterway to Osijek, a negative impact in the areas of ecological network HR2001308 Donji tok Drave and HR1000016 Podunavlje i donje Podravlje is possible. This development measure needs to be planned in cooperation with the professional bodies for nature protection (Croatian Environment and Nature Agency and the Public Institution - Natural Resources Management Agency in the Osijek-Baranja County).

By implementing the I.2. Improvement of Sava measure, i.e. the intervention that would improve the level of navigability of the Sava River, negative impacts are possible in areas of the ecological network (Sava downstream od Hrušćice (HR2001311), Lonjsko polje (HR2000416), Sunjsko polje (HR2000420), Dolina Une (HR2000463), Vlakanac - Radinje (HR2001379), Jelas polje s ribnjacima (HR2001326), Dvorina (HR2000426), Gajna (HR2000427), Sava-Štitar (HR2000431), Spačvanski bazen (HR2001414), Sava kod Hruščice (HR1000002), Donja Posavina (HR1000004), Jelas polje (HR1000005), Spačvanski bazen (HR1000006)). When defining the activities for the implementation of the measure, it is necessary to consult the expert bodies for nature protection (the Croatian Environment and Nature Agency and the competent County public institutions for the management of the protected natural values) in order to consider, at the planning level, the impacts and risks that could arise due to the implementation of the measure. For the intervention that is functionally related to the implementation of the I.2. measure ("Reconstruction of the Sava River waterway and establishment of the control line of the Sava River from Račinovci to Sisak"), the Ministry of Environmental Protection, Spatial planning and Construction of the Republic of Croatia adopted the Decision (Class: UP/I-351-03/09-02/98, File no.: 531-14-1-1-02-10-42 of 3 November 2010) that this intervention is acceptable for the environment, with the application of environmental protection measures and monitoring the state of environment.

11.3.2 Possible cumulative impact of the intervention

The analysis of the measures proposed by the Strategy and their potential cumulative impact on the ecological network identified the areas of ecological network for which cumulative pressure of traffic development was assessed, taking into account the existing pressure caused by the development of transport infrastructure (code D, Table 11.6):

<table>
<tr><th>Area code</th><th>Area name</th><th>Pressure code</th><th>Cumulative impact description</th></tr>
<tr><td>HR1000032</td><td>Akvatorij zapadne Istre</td><td>D03</td><td>The area of the ecological network is endangered due to the development of maritime traffic (ports, shipping lines, etc.). The strategy provides for an extension of the airport, which shall not contribute to cumulative pressure on this area of the ecological network.</td></tr>
<tr><td>HR1000033</td><td>Kvarnerski otoci</td><td>D01</td><td rowspan="3">The area of the ecological network

HR1000033 Kvarnerski otoci is endangered by road, maritime and air traffic, therefore the A.4 and A.6 measures related to the development of airports shall contribute to the negative cumulative impact on the target species of birds in this area of the ecological network.</td></tr>
<tr><td>HR1000033</td><td>Kvarnerski otoci</td><td>D03</td></tr>
<tr><td>HR1000033</td><td>Kvarnerski otoci</td><td>D04</td></tr>
</table>

HR2000200	Zagorska peć kod Novog Vinodola	D01	The Ro.4 measure shall contribute to the cumulative negative impact of road traffic on the target species in this area of the ecological network.
HR2000416	Lonjsko polje	D01	The Ro.1 measure provides for the construction of a bridge along the southeastern border of this area of the ecological network, and no additional negative impact of the Ro1 measure is expected.
HR2000570	Crni jarki	D01	The section provided for by the Ro.9 measure is sufficiently removed from this area of the ecological network and no additional negative impact is expected.
HR2000589	Stupnički lug	D01	The implementation of the Ro.8 measure shall not contribute to the negative cumulative impact on this area of the ecological network, with the application of the proposed mitigation measures.
HR2001357	Otok Krk	D01	The A.6 measure may contribute to the cumulative negative impact of road traffic on the target species of bats in this area of the ecological network.
HR2001357	Otok Krk	D03	
HR2001357	Otok Krk	D04	
HR2001361	Ravni kotari	D01	With the proposed mitigation measure to avoid the expansion of the Zadar Airport to this area of the ecological network, it is believed that the implementation of the A.8 measure shall not contribute to the negative impact of traffic on this area of the ecological network.
HR2001363	Zaleđe Trogira	D01	The implementation of the A.7 measure shall contribute to the cumulative negative impact of traffic on this area of the ecological network.
HR2001364	JI dio Pelješca	D01	In addition to the existing traffic pressure on this area of the ecological network, the opening of the new corridor provided for in the Ro.16 measure shall contribute to the negative impact of the roads on target species and habitats in this area of the ecological network.

HR2001416	Brezovica - Jelik	D01	An additional negative impact provided for in the Ro.9 measure has been identified in the form of taking over an additional part of this area of the ecological network, but considering that this includes a minimal taking over of the target habitat type, the impact can be considered moderately negative.
HR2001500	Stepska staništa kod Bapske	D01	With the implementation of the mitigation measure for the Ro.9 measure of the Strategy, no additional negative impact of traffic on this area of the ecological network is expected.
HR5000019	Gorski kotar i sjeverna Lika	D01	With the implementation of the mitigation measure for the Ro.4 measure, the significantly negative cumulative impact on this area of the ecological network would be reduced.
HR5000022	Park prirode Velebit	D01	
HR5000031	Delta Neretve	D01	The implementation of Ro.16 and M.9 measures marginally enters this area of the ecological network, but with the implementation of the proposed mitigation measures, the additional negative impact of traffic on this area of the ecological network may be excluded.

Although not identified as being endangered by traffic and development of the traffic sector, by analyzing the pressures and negative impacts identified by this Study, the area of the ecological network HR2001311 Sava downstream od Hrušćice has been isolated as an area with great additional traffic pressure. This is manifested in the implementation of measures involving the construction of bridges on the Sava River, the development and maintenance of the Sava waterway (which includes a measure involving the development of the Port of Sisak) and the potential construction of the Danube-Sava canal.

EN area	Measures that have an impact	Cumulative impacts on the EN area
HR1000033 Kvarnerski otoci	A.4 Development of the Mali Lošinj Airport A.6 Development of the Rijeka Airport	The area of the ecological network HR1000033 Kvarnerski otoci is endangered by road, maritime and air traffic, therefore the A.4 and A.6 measures related to the development of airports shall contribute to the negative cumulative impact on the target species of birds in this area of the ecological network.
HR2000200 Zagorska peć kod Novog Vinodola	Ro. 4 A7 Križišće - Žuta Lokva	The Ro.4 measure shall contribute to the cumulative negative impact of road traffic on the target species in this area of the ecological network.

HR2000589 Stupnički lug	Ro. 8 Reorganization of the main Zagreb network Ro.11 Zagreb Node	The Ro 8 measure provides for the construction of a line facility near the area of the ecological network HR2000589 Stupnički lug, while the R11 measure potentially includes planning a railway line through the area of the ecological network, which would contribute to the cumulative negative impact on this area of the ecological network.
HR2001357 Otok Krk	A.6 Development of the Rijeka Airport	The A.6 measure may contribute to the cumulative negative impact of road traffic on the target species of bats in this area of the ecological network.
HR2001363 Zaleđe Trogira	A.7 Development of the Split Airport	The implementation of the A.7 measure shall contribute to the cumulative negative impact of traffic on this area of the ecological network, primarily on the target species *Rhinolophus ferrumequinum*.
HR2001364 JI dio Pelješca	Ro. 16 Preparations for Dubrovnik's accessibility after Croatia's accession to Schengen (Pelješac Bridge)	In addition to the existing traffic pressure on this area of the ecological network, the opening of the new corridor provided for in the Ro.16 measure shall contribute to the negative impact of the roads on target species and habitats in this area of the ecological network.

11.4 Measures to mitigate the negative impacts of the intervention on conservation goals and the integrity of the ecological network area

Spatially located measures

Road traffic

1. During the intervention preparation for the Ro.1 Connection with the bridge near Gradišta measure, the construction time and planning of usage have to be adapted, with the objectives of conservation of the area of the ecological network HR1000004 Donja Posavina and avoidance of the construction of the bridge during the period of the highest activity of the target species of fish in the area of the ecological network HR2001311 Sava nizvodno od Hrušćice.
2. For the Ro.4 A7 Križišće - Žuta Lokva measure, the possibility of mitigating significantly negative impacts on the target species of the area of the ecological network HR2000200 Zagorska peć kod Novog Vinodolskog has to be considered, by implementing adequate mitigation measures for target species of bats (e.g. routing the species that follow vegetation during flight to a higher level by using structures that allow bats to fly over (hop-over) the road by using structures that overhang the road (closed screen).
3. When determining the work area, it is necessary to exclude any activity near the area of the ecological network HR2000131 Škabac špilja and HR2001154 Orlovac špilja.
4. When planning the part of the route passing through the area of the ecological network HR5000019 Gorski kotar i sjeverna Lika, which passes through a highly suitable habitat for target species of large carnivores (bear, wolf and lynx), adequate mobility across the road has to be ensured by building green infrastructure elements.
5. During the implementation of the Ro.5 A11 Lekenik - Sisak measure, noise protection towards the area of the ecological network HR1000003 Turopolje has to be planned on the intervention level in cooperation with an expert – ornithologist, and during the construction of the connecting roads over the river Kupa, entering priority target habitat types 91E0* Alluvial forests *(Alno-Padion, Alnion incanae, Salicion albae)* and 7220* Springs next to which tuff deposits *(Cratoneurion)* - dotted or ribbed formations dominated by moss of the species *Cratoneurion commutati* has to be avoided.
6. When implementing the Ro.6 DC 10 Vrbovec - Križevci - Koprivnica - State border with Hungary towards Kaposvár measure, additional mitigation measures such as building opaque noise reducing fences alongside the road have to be considered.
7. The route provided for in the Ro.7 DC 12 Vrbovec 2 hub - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - State border with Hungary towards Barcs measure needs to be moved so it does not cross the area of the ecological network HR1000009 Ribnjaci uz Česmu.
8. Alongside the section provided for in the Ro.8. Reorganization of the main Zagreb network measure, which passes through the area of the ecological network HR1000003 Turopolje, opaque noise reducing fences have to be integrated. In the part of the section passing next to the area of the ecological network HR2000589 Stupnički lug, damage to the surrounding trees of the target habitat type 9160 Sub-Atlantic and Central European oak and oakhornbeam forests *Carpinion betuli* has to be avoided.
9. The section provided for in the Ro.9. D2 from the state border with Slovenia to the state border with Serbia measure, which passes through the area of the ecological network HR2001500 Stepska staništa kod Bapske, has to be moved or arched over by a viaduct in order to prevent the conversion of the target habitat type 6240* SubPannonian steppe grasslands (*Festucion vallesiacae*).
10. During the construction of the part of the section under the Ro.15 Reorganization of the Split network: Split - Omiš measure, attention has to be paid to the part that passes next to the area of the ecological network

HR2001376 Područje oko Stražnice and the construction time has to be adapted to the ecology of the target species lesser mouse-eared bat - *Myotis blythii.* During the usage of the section, mitigation measures for bats (enabling bats to fly-over the road (hop-over) have to be planned and light pollution has to be reduced.

Railway transport

11. When improving the railway lines provided for by measures R1, R2, R3, R4, R5, R8, R9, R10 and R11, mitigate measures to alleviate target species fatalities (especially large carnivores) over and under the planned roads have to be planned.

Air traffic

12. When implementing the A.8. Development of the Zadar Airport measure, the expansion of the airport into the areas of the ecological network HR1000024 Ravni kotari and HR2001361 Ravni kotari has to be avoided.

Maritime traffic

13. During the construction of the new terminal provided for in the M9 Specialization of the Port of Ploče (container and bulk cargo) measure, taking over the habitats in the area of the ecological network HR1000031 Delta Neretve i HR5000031 Delta Neretve has to be avoided.

Cumulative impacts

14. Due to the identified negative cumulative impact on the area of the ecological network HR2001311 Sava nizvodno od Hrušćice, it is necessary to temporally separate the construction of bridges and reconstruction works of the river ports on Sava.

15. If the R11 measure plans to build new railway lines, it is necessary to harmonize them with the Ro8 Reorganization of the main Zagreb network measure, so that it follows the road infrastructure and does not occupy parts of areas of the ecological network (especially the area of the ecological network HR2000589 Stupnički lug).

Monitoring of mitigation measures is essential for determining their effectiveness. Sometimes only minor changes are enough to significantly increase their functionality. Also, based on the data collected through monitoring, future interventions and mitigation measures can be better planned. Monitoring should be anticipated during the mitigation measures planning in the intervention approval procedure.

11.5 Conclusion

The following was established by analyzing the potential impacts of the Ecological Network Strategy:

- The strategy contains general, development and management-organizational measures that have a neutral impact or impact that cannot be estimated.
- The analysis of spatially located measures showed that one measure has a significant negative impact on the ecological network.
- It was identified that the implementation of the Strategy measures shall have negative impacts during the construction of certain interventions provided for by the measures as well as during usage.
- Given that some parts of the measures (i.e. some sections within the scope of a measure) have already been built or are currently in construction (according to the most recent digital orthophoto data), the environmental impact assessment focuses on the period of usage of the scope of measures. Measures that have not yet been implemented, but may have an impact on the ecological network, can be made acceptable for the ecological network by implementing ecological network acceptability assessments within lower-level implementation programs.

The table below shows the areas of the ecological network for which the possibility of a significant negative impact has been established, the proposed mitigation measure and the final significance following the implementation of the mitigation measure.

Strategy measure	Impacted EN area	Impact assessment	Impact mitigation measure	Final impact assessment
Ro. 9 D2 from the state border with Slovenia to the state border with Serbia	HR2001500 Stepska staništa kod Bapske	-2	7. The section provided for in the Ro.9. D2 from the state border with Slovenia to the state border with Serbia measure, which passes through the area of the ecological network HR2001500 Stepska staništa kod Bapske, has to be moved or arched over by a viaduct in order to prevent the conversion of the target habitat type 6240* Sub-Pannonian steppe grasslands (*Festucion vallesiacae*).	-1
I.7 Construction of the Danube-Sava multipurpose canal	HR1000006 Spačvanski bazen	-2	The measure includes the construction of the Danube-Sava multipurpose canal. Given the level of intervention definition, it is not possible to determine the measures for reducing, avoiding and mitigating the negative impact.	-2 (??)
	HR2001414 Spačvanski bazen	-2		-2 (??)

* Within the area of the ecological network HR2001414 Spasical pool, oak tree is particularly sensitive to changing the hydrological regime of groundwater and therefore continuous measurements are required to obtain reliable results. By using the methodology applied in the analysis, it was concluded that a significantly negative impact cannot be excluded for the I.7 Construction of the Danube - Sava multipurpose canal measure, given that there are no adequate reduction, avoidance and mitigation measures that could be implemented into the Strategy, but the possibility of defining them when assessing the impact on the environment at later stages of intervention development still exists.

12 Conclusion

Based on an analysis of the existing environmental situation and existing environmental problems, a set of measures defined in the Strategy related to all traffic sectors was analyzed in the Study.

Additional environmental burdens are expected due to the implementation of the Strategy's measures, primarily in the emissions of pollutants into the air, greenhouse gas emissions, noise emissions, ballast and wastewater emergence and possible accident situations. The measures suggest activities that are related to improving the infrastructure of different traffic systems, but also to operational and organizational aspects. Also, the Strategy defines measures that are largely related to improving safety and environmental protection. General measures as well as management-organizational measures at the traffic level as a whole define the concepts of traffic development, capacity enhancement, improvement, process improvement and other, and as such at a strategic level do not generate environmental impacts and may positively affect the environmental components in the long run.

In the future, a part of the development measures shall result in spatially defined activities (e.g. implementation of the "Sea motorway" interventions, port development, etc.), and at this stage, apart from positive or neutral impacts,it can be expected they shall generate negative environmental impacts. For all of the above types of measures, their impact on the environment and health was assessed on the basis of their description. Spatially defined measures formulate the planned activities and their impact assessment was performed at the environmental components level, which has resulted in proposing measures to mitigate adverse environmental impacts.

Due to the lack of systematic research and data and the lack of specific data for measure I.7 The construction of the Danube - Sava multipurpose canal can not be confirmed with certainty the significant negative impact of this environmental measure. The intensity and significance of possible impacts will be assessed at the level of the project when project data is available and a feasibility study is carried out and an environmental impact assessment procedure is carried out.

At the strategic level of assessment, when we exclude specific impacts that are either constrained by legal regulation or are considered at the level of environmental impact assessment, the Strategy has potentially positive and negative impacts on environmental components. To mitigate the identified negative impacts, the Study prescribes measures for environmental protection, i.e. the mitigation of the potential impacts of the Strategy.

During the environmental impact assessment of the Strategy, potential transboundary impacts mainly related to air and water pollution and noise pollution were identified, but positive impacts have also been identified in terms of improving economic and socio-economic image of neighboring countries (traffic connections with European corridors).

Within the process of strategic assessment of the environmental impact of the Strategy, a process of assessing the acceptability of the Strategy for the ecological network was performed. Potential negative impacts of the Strategy on the ecological network were identified and mitigation measures were defined.

For the impacts of the Strategy that were assessed as significantly negative, adequate protection measures have been prescribed, i.e. measures to mitigate negative impacts. By implementing defined environmental protection measures stipulated in the Study, the Strategy is acceptable for the environment and the ecological network of the Republic of Croatia.

13 Summary

13.1 Introduction

The designer of the Transport Development Strategy of the Republic of Croatia for the period 2017-2030 (hereinafter: the Strategy) is the Ministry of Maritime Affairs, Transport and Infrastructure[6] (hereinafter: the Ministry of Sea, Transport and Infrastructure). The SEIA procedure started on 21 July 2015 with the adoption of the *Decision on the implementation of the procedure for Strategic Environmental Impact Assessment for the "Transport Development Strategy of the Republic of Croatia for the period 2017-2030*" (Class: 340-03/15-10/03, Reg. No.: 530-08-2-3-2-15-4).

The SEIA procedure for the Strategy is implemented on the basis of the provisions of the Environmental Protection Act, the Regulation on the Strategic Environmental Impact Assessment of the Strategy, Plan and Programme (OGof the Republic of Croatia 64/08)[7] and the Regulation on Information and Participation of the Public and Interested Public in Environmental Issues (OGof the Republic of Croatia 64/08). This procedure assesses the likely significant impacts on the environment and human health that may arise from the implementation of the Strategy.

The Strategic Environmental Impact Study (hereinafter: the Study) is developed in the SEIA procedure, a professional background attached to the Strategy and includes all the necessary data, explanations and descriptions in textual and graphic form. The study identifies, describes and assesses the likely significant impacts on the environment and human health that may arise from the implementation of the Strategy. It is intended to ensure that the consequences on the environment and human health are assessed during the preparation of the Strategy, prior to the final proposal and referral to the procedure for its adoption.

13.2 Preliminary environmental impact analysis of the Strategy

Air quality and climate features

At a strategic assessment level, when we exclude specific impacts that are either limited by legal regulations or are considered at the level of environmental impact, the Strategy has potentially positive and negative impact on air quality and climate features. Using the newly constructed transport infrastructure and increasing the number of vehicles shall increase the amount of harmful exhaust and greenhouse gases, which negatively affects the air quality. The implementation of the measures that contribute to the reduction of greenhouse gas emissions and the introduction of an intermodal system based on ecological and innovative solutions shall have a positive impact on the air quality and climate features.

Geodiversity

By analysing the locations of protected geoheritage sites and interventions planned in the Strategy, it has been established that there are no conflicts in the area, i.e. that the intervention shall not devastate the protected geoheritage sites.

Biodiversity

In the implementation of the Strategy, there are possible impacts on biodiversity, which are primarily reflected in additional fragmentation of rare and endangered habitats, disturbing species and reducing the stability of important ecosystems. Significant impacts are possible due to changes in hydromorphological conditions of water bodies, which

[6] The Ministry of Maritime Affairs, Transport and Infrastructure changed its name to Ministry of Sea, Transport and Infrastructure, October 2016.

[7] From January 2017, a new Regulation on the Strategic Environmental Impact Assessment of the Strategy, Plan and Programme (Official Gazette of the Republic of Croatia 3/17) is effective.

may lead to changes in habitat conditions. In addition, new roads significantly reduce habitats by causing edge effects and barrier effects.

Landscape characteristics

Large transport infrastructure projects and associated infrastructure generate negative impact on the landscape. The impact intensity depends on the area through which it passes or its characteristics. The characteristics of each area are manifested through natural, anthropogenic (cultural) and visual experiential qualities. Given the number and types of projects, that is, the type of transport, the most significant impact of the Strategy is expected in the landscape region of the Lowland areas of northern Croatia.

Soil

The construction of railway tracks and roads shall lead to a negative impact on the soil in the form of soil contamination with pollutants which occur due to transport by trains and road vehicles and potential soil degradation due to erosion or soil displacement. Since the impacts on the soil are largely related to the narrow area around the roads themselves, significant impacts on the soil during the implementation of the Strategy are not expected.

Water

Due to the implementation of the Strategy, negative impacts are expected due to potential pollution of water bodies and water for human consumption, as well as impacts on the hydromorphological condition of water bodies. However, it is estimated that these impacts shall not be significant if the existing legal regulations and water protection measures prescribed by the subject Study shall be applied.

Cultural and historical heritage

Due to the implementation of the Strategy, negative impacts are possible on the architectural heritage (individual buildings, cultural and historical units) and the cultural landscape, as well as the archeological zones and sites. Nevertheless, the preliminary analysis of the Strategy implementation does not show significant impacts, given that due to the character of the impact it is possible to implement protection measures for the conflict areas.

Agriculture

Realising the measures in the road and rail transport sector and inland waterway transport may result in the conversion and fragmentation of agricultural land P1 and P2. Given the presence of P1 and P2 land, the influence of the conversion of P1 and P2 land can be significant in the Dinarides.

Forestry

Significant impacts may be expected in the implementation of planned measures in the area of endangered lowland forests, in particular common oak forests that are regularly flooded. The construction of roads and railway tracks shall lead to fragmentation of forest areas, and the construction of the Danube - Sava canal to significant changes in the water regime, which shall have a significant impact on the stability of the lowland forest ecosystem.

Wild game and hunting

The main impacts that may arise from the implementation of the Strategy are the fragmentation of hunting areas, disturbance and fatalities of wild game on the roads.

Tourism

Transport capability to meet tourism needs is determined by the size and condition of the transport infrastructure and transport capacities as well as their ability to meet demand requirements with their services. The importance of tourism for Croatian economy is great and therefore the transport system appears as a factor for improving or limiting the development of tourism. The development and equipping of passenger terminals and accompanying facilities, a systematic improvement of infrastructure and transport service and the uniform development of all transport modes within the traffic system shall positively influence the accessibility of tourist destinations, the comfort, speed and safety of travel and the mobility of tourists within destinations, which shall synergistically affect the increase in the indicators of the tourism intensity and the possibilities of improving or creating new tourist products.

Social and economic characteristics

Today, a harmonised economic development and valorisation of economic and natural resources is inconceivable without the adequate development of the entire transport infrastructure complex. It is even more important considering the attractiveness of the coastline and islands in our country and the primacy of the most developed tourist area where most of the country's GDP is generated. The wide offer of different means of transport, infrastructure and various transport systems has a major role to play in raising the quality of life of citizens by improving accessibility and increasing travel speeds. This strengthens the mobility of the population, ensures sufficient and rapid supply of remote parts of Croatia, which leads to the intensification of the business of economic entities, strengthening of tourism activities, increase in the number of employees and the growth of the general and economic well-being of the society. The synergistic impact of these effects is reflected in the slow economic emigration of the population from the emigration areas in Croatia, which directly affects the stable overall (general) movement of the population.

13.3 Impact assessment methodology

The impact assessment is based on a strategic level that excludes individual interventions and a specific intervention-related environmental impact assessment. In line with the methodological recommendations for the development of strategic studies that analyse the strategies, plans and programmes proposed under the IPA 2010 intervention "Strengthening Capacities for Strategic Environmental Impact Assessment (SEIA) at Regional and Local Level" from 2014, the impact assessment was conducted through the selection of the strategic goal of the Study. The strategic goal of assessing the impact is "**Compliance of the Strategy measures with the environmental and nature requirements**". It is evident from the selection of the goal that the main methodological guideline for assessing the impact is an analysis of the acceptability of the measures proposed by the Strategy in relation to the relevant environmental topics with their components.

When assessing the impacts, four impact categories are used:

- ***Positive impact*** - describes the assessment that, due to the implementation of the measure, the state of the environmental elements in relation to the present situation shall be improved. This can be the result of solving some of the existing environmental problems, or due to the change in the existing negative trend.
- ***Neutral impact*** – the assessment has shown that there are no impacts on the environmental component.
- ***Moderate negative impact*** - describes the assessment that, due to the implementation of the measure, the state of the environmental elements in relation to the present situation shall slightly deteriorate, but not to the extent that it could lead to significant and persistent disturbance of the environment or nature. In this category, there are impacts involving the release of pollutants within the limits prescribed by legal regulations, taking of smaller parts of numerous or less valuable habitats, the risk of fatalities of a smaller number of individuals belonging to the species that are not in the protection regime etc.
- ***Significantly negative impact*** – describes the assessment that there is a risk that, due to the implementation of the measure, the state of the environmental elements shall deteriorate to the extent that it could lead to a significant disturbance of the environment or nature. A measure that would bring a significant impact to the level of moderate or eliminate it shall be prescribed for this impact.

In addition to the analysis of the Strategy measures, their justification in relation to the environmental and nature requirements is assessed, as well as possible direct, indirect, short-term, medium-term, permanent, cumulative and transboundary environmental impacts.

When describing the impacts of the proposed measures on the environment and nature, the following terms are used to provide a more detailed definition of the type and scope of individual impacts:

- *Direct impact* – if the measure is a direct source of the impact described

- *Indirect impact* – of the measure generates a change that is the source of the impact described (future)
- *Short*-term impact – if the impact on the environment/nature ceases within 5 years
- *Medium-term impact* – if the impact on the environment/nature ceases between 5th and 10th year from the beginning of the impact development
- *Permanent impact* – of the impact has permanent consequences on the environment/nature and does not cease even after 10 years
- *Cumulative impact* – if several measures from the Strategy generate equal impacts on the environmental component, their joint impact on this component is cumulative
- *Synergetic impact* - if several measures from the Strategy generate different impacts that jointly affect the environmental component in a manner that joint impact is stronger than the sum of individual impacts on the subject component, this impact is called synergetic
- *Transboundary impact* – if the measure can affect the environment/nature of other countries.

13.3.1 Environmental impact assessment of the Strategy

For the purposes of the environmental impact assessment, the measures defined by the Strategy are divided into four categories:

1. General measures
2. Development measures
3. Management and organisational measures
4. Spatially located measures

At the strategic level of assessment, when we exclude specific impacts that are either constrained by legal regulation or are considered at the level of environmental impact assessment, the Strategy has potentially positive and negative impacts on environmental components. Usage of the newly constructed traffic infrastructure and the increase in the number of vehicles shall increase the amount of harmful exhaust and greenhouse gases, but the implementation of measures that contribute to the reduction of greenhouse gas emissions and the introduction of an intermodal system based on ecological and innovative solutions shall reduce the negative impact on the environment.

Impacts on biodiversity are primarily reflected in the additional fragmentation of rare and endangered habitats, disturbance of species and reduction of the stability of important ecosystems. Significant impacts are possible due to changes in hydromorphological conditions of water-bodies, which may lead to changes in habitat conditions. In addition, new roads significantly reduce habitats by causing edge and barrier effects. Through the analysis of the development of the railway network Zagreb - Rijeka, a variant solution was considered, i.e. a track line that has a moderate impact on biodiversity has been identified.

Given the landscape features, the most significant impact of the Strategy is expected in the landscape region Lowland areas of northern Croatia. As a result of the implementation of the Strategy, an increase in water and soil pollution sources is also expected, however, it was estimated that these impacts shall not be significant if the existing legal regulations and water protection measures prescribed by this Study are implemented.

Significant impacts on forestry can be expected during the implementation of planned measures in the area of endangered lowland forests, in particular riparian pedunculate oak forests (construction of the Danube - Sava canal). It was assessed that the construction of the Danube - Sava canal shall have a significant impact without any mitigation measures or alternative solutions.

On the other hand, the Strategy is positively reflected on the overall socio-economic picture of the Republic of Croatia. A wide offer of different means of transport, infrastructure and various traffic systems has a major role in raising the quality of citizens' life by improving accessibility and increasing travel speeds. This increases the mobility of the population, ensures sufficient and rapid supply of remote parts of Croatia, which in turn leads to intensification of the business operations of business entities, the strengthening of tourism activities, the increase of the number of employees and the growth of the general and economic well-being of the society.

The strategy sets out objectives whose realization is expected to have transboundary impacts. This primarily refers to the specific objective that includes all traffic sectors in terms of better alignment of traffic management with neighboring countries (Bosnia and Herzegovina - Port of Ploče, road and rail connections with Bosnia and Herzegovina, Slovenia, Serbia, Italy, Montenegro and Hungary), but also on other goals, such as the realization of cooperation with Bosnia and Herzegovina in the development of the cargo port Slavonski Brod and the development of the potential for navigation on inland waterways in the segment of tourism and public transport, since a part of these routes often constitutes the borders with the neighboring countries. As the Strategy shall be the starting point for spatial planning of smaller spatial units, i.e. the development of master plans for functional regions, possible transboundary impacts for each activity shall be possible to be closely identified during further phases.

13.4 Environmental protection measures

13.4.1 Soil

1. If the intervention is planned in the area of moderate and high risk of erosion, agrotechnical mitigation measures shall be used in accordance with the Ordinance on Agrotechnical Measures.

13.4.2 Waters

2. When constructing railway lines, concrete sleepers shall be used as much as possible, i.e. wooden sleepers that need to be treated with chemicals before use shall be avoided.
3. During the design and construction of railway lines and roads, the road routes shall be defined in a manner that minimises the impact of changes in the existing river and lake basins to reduce the impact on their hydromorphological condition. When constructing roadways in vulnerable, sensitive or protected areas, at the level of the project, an analysis of potential pollution of the surrounding water bodies shall be conducted and appropriate protection measures shall be prescribed.
4. During the works on the expansion of airports, wastewater drainage system shall be constructed as well as wastewater treatment facilities of the appropriate category.
5. All line and point interventions shall be designed in such a manner as to avoid areas of special water protection - sanitary protection zones.
6. Each newly constructed port, before the preparation of the main design or before the start of use of the port, if the main design is not required, shall have a maritime study accepted and certified by the Port authority in accordance with Article 5 of the Regulation on Conditions to be met by the Ports (OG 110/04).
7. In planned ports, solid waste collection shall be organised and adequate infrastructure shall be provided for wastewater collection from ships.
8. New sea and river ports are planned at locations where the morphological condition of water bodies is rated as very good, i.e. at locations where there are no existing hydromorphological pressures.

13.4.3 Biodiversity

9. The development of the railway transport on the Karlovac-Rijeka section shell based on a variant solution that passes through the south of the Zlobin village in Primorje-Gorski Kotar County with the sanation of the existing railway line.
10. Motorways and other roads with a planned traffic density of more than 5000 vehicles per day are planned in a manner that shall enable the establishment of adequate capacity for wild species in the next stages of their realisation, taking into account existing transport infrastructure.
11. The transport infrastructure in areas that are evaluated as non-fragmented shall be planned primarily in habitats that are under higher anthropogenic influence with the use of the shortest possible sections through non-fragmented areas. The transport infrastructure shall be planned in a manner that enables the implementation of green infrastructure.
12. The improvement of the maritime transport shall be planned in such a manner as to avoid the areas inhabited by the species *Tursiops truncatus* (bottlenose dolphin) and fish hatches in the Adriatic.

13. The new eastern port on the Danube in Vukovar shall be planned completely outside the borders of the Special reserve of forest vegetation Vukovarske dunavkse ade.
14. The section of the road that is planned within the boundaries of the Significant landscape Cetina – Donji tok, and is covered by the measure of Ro. 15 Reorganisation of the Split network, shall be constructed in such a way to avoid disturbing the features of this protected area.
15. The traffic corridor envisaged by measures R.11 Zagreb Node and Ro.8 Reorganization of the main Zagreb network, in which several types of parallel line transport infrastructure are planned to be implemented with a view to mitigate cumulative impacts, shall be constructed in cooperation of all the transport sectors involved, as well as the bodies competent for expert nature protection activities and bodies competent for forest management in the given area, in order to enable adequate capacity for wild species through parallel roads with minimum disturbance of forest habitats.

13.4.4 Cultural and historical heritage

Protection of archaeological heritage

16. Prior to undertaking the interventions in the area that arise from spatially located measures, the archaeological field examination shall be conducted and, if necessary, test archaeological research on the positions of known and recorded archaeological sites, which shall determine the scope of protective archaeological research, documentation and conservation of the findings and sites. Archaeological field examination shall be conducted at the locations of potential archaeological sites with indicative names, toponyms and places where changes in relief caused by human action in history are evident.
17. If protective archaeological research results in significant findings that need to be preserved and presented, there is a possibility of relocating the infrastructure route and other planned structures on the locations of such sites.

Protection of cultural and historical units, historical structures and buildings

18. The protection measure system includes the exploration and documentation of the endangered cultural heritage with maximum preservation to mitigate the negative impact on the spatial and visual integrity of the architectural heritage.

Protection of historical cultural landscape

19. Measures for the protection of the historical cultural landscape shall be implemented during the project design stage by designing a landscaping design of the intervention zone area.
20. A landscape sensitivity study shall be prepared prior to the landscaping design.

13.4.5 Agriculture

21. In the area of Pannonian Croatia, the implementation of the measures that can generate conversion and fragmentation of P1 and P2 land capability class shall be planned to avoid by all means, except in exceptional circumstances, taking P1 and P2 land capability classes.
22. In the area of Dinarides, the measures that can generate conversion and fragmentation of P1 and P2 land capability class shall be implemented outside P1 and P2 land capability class.
23. Measures that can generate conversion and fragmentation of agricultural land shall be planned to maximise the use of existing infrastructure and avoid unnecessary conversion and fragmentation of agricultural land.

13.4.6 Landscape characteristics

24. The measures envisaged by the Strategy shall be incorporated into the landscape through green infrastructure interventions, or interventions of Landscaping by an expert (landscape architect).

13.4.7 Social and economic characteristics

25. When designing roads, the significance of impacts shall be assessed taking into account the estimated traffic increase and, if necessary, appropriate noise protection measures shall be implemented.

13.4.8 Climate changes

26. All infrastructure interventions arising from the measures of the Strategy shall be planned taking into account the potential climate phenomena in the area of measure implementation. The intervention design shall be realised in accordance with non-formal guidelines: „Non-paper Guidelines for Intervention Managers: making vulnerable investments climate resilient“ (European Commission, Directorate-General for Climate Action).
27. The measures envisaged by the Strategy are to be implemented in accordance with the National Policy Framework for the Establishment of Infrastructure and Development of Alternative Fuel Market (NFP) (OG 34/17) and strategic documents and incentives by local and regional self-government units related to the establishment of alternative fuels infrastructure are contained in the aforementioned National Framework

Due to the lack of systematic research and data and the lack of specific data for measure I.7 The construction of the Danube - Sava multipurpose canal can not be confirmed with certainty the significant negative impact of this environmental measure. The intensity and significance of possible impacts will be assessed at the level of the project when project data is available and a feasibility study is carried out and an environmental impact assessment procedure is carried out.

13.5 Appropriate assessment

The scope of the Strategy covers the entire territory of the Republic of Croatia and therefore overlaps with the scope of the ecological network defined in the Regulation on Ecological Network (OG 124/2013, 105/15). The ecological network of the Republic of Croatia also represents the areas of the EU Natura 2000 ecological network. The ecological network of the Republic of Croatia are the conservation areas significant for birds - SPA (areas significant for conservation and achieving favourable conservation status of wild bird species of interest for the European Union, as well as their habitats, and areas significant for conservation of migratory bird species, in particular wetlands of international importance) and conservation areas significant for species and habitat types - SAC (areas significant for conservation and achieving favourable conservation status of other wild species and their habitats, as well as natural habitat types of interest for the European Union).

13.5.1 Impacts of the Strategy on the Ecological Network

When it comes to the transport infrastructure, the interventions differ largely only in size and accordingly in the intensity of the impact. The size of the intervention ranges from constructing a new road to extending or reconstructing an already existing road by adding traffic lanes, intersections, crossings, etc. The impacts that traffic interventions can have on the target species and habitats of the ecological network are mostly of a similar nature. The impact assessment depends on the size and intervention design of a particular intervention.

According to the HAOP <*Croatian Agency for the Environment and Nature*> Expert Guidelines, the three major sources of intervention impact should be distinguished for the purpose of assessing the impact of traffic interventions on the ecological network. The first source of impact is the performance of construction works, the second is the facility itself, and the third is the traffic activity. Depending on the original source of impact, they differ in terms of intensity, coverage, duration, and characteristics. The impact is usually most pronounced during construction works. However, it is also of a limited duration depending on the size of the intervention. During the construction of large motorways, the works of different intensity may last several years. Once the works are completed, the construction stage impact is reduced, but it still remains present for a longer period of time. On the other hand, the impact of the traffic itself is usually increased over time and depends largely on the density and amount of vehicles.

The following impacts are possible **during construction**:

- Loss of land/area use: Temporary used areas (outside the location of the road, work belt), e.g. for storage purposes, work machines, etc.
- Change in the landscape layout (geomorphology): Visual changes are greatest during construction works, since construction often requires the transfer of large quantities of land. The underground parts of the structure itself need to be dug in, construction works require a larger space for e.g. storing and moving, than the road itself.
- Change in functional connection: the construction site hinders connectivity, especially in areas of intensive works.
- Noise: Construction sites are usually a source of great noise, which is continuous during the performance of works (e.g. machine operation, etc.), and the most noise is produced by works such as mining or drilling.
- Air pollution: Machines emit substances that pollute the air, dust is spread, mining causes great amount of dust
- Water pollution: Normal operation of work machines causes the release of substances that pollute the water, but also possible release of fuel, oil, etc.
- Vibrations: Construction works, trucks and large machines cause vibrations, which are most intense during mining or drilling.
- Changes in the hydrological regime (quality and quantity): Construction works can temporarily disrupt the hydrological regime, and it may be necessary to move underground and surface water flows.

Line facility with secondary structures may have the following impacts:

- Loss of land/area use: Permanent use of areas where the road is located, but also secondary structures such as auxiliary roads, structure for water source protection, etc.
- Asphalting: Mainly roads, but also secondary structures such as auxiliary roads
- Change in the landscape layout: Dams, bridges and crossings change the layout, but after the completion of the works, efforts are made to integrate the road into the surrounding landscape where possible (growing vegetation).
- Change in functional connection: Roads can interrupt connectivity (depending on the structure); if there are no mitigation measures, the connection is terminated permanently.
- Changes in the hydrological regime: The facility may permanently disturb the hydrological regime due to e.g. laying the foundations, which affects groundwater.

During the use, the transport infrastructure interventions may have the following impacts:

- Noise: Traffic emits the noise of different volume, intensity, characteristics, and frequencies depending on the traffic density, which may vary depending on the time of the day, but also the type of traffic, e.g. only cargo vehicles or only personal cars (the noise emitted by the railway has completely different characteristics than the noise emitted by car traffic).
- Air pollution: substances that pollute the air largely depend on the type of traffic, vehicles (e.g. trucks, cars), traffic density, speed limits, etc.
- Light: Roads of great importance usually do not have lighting, but vehicles in motion emit light.
- Water pollution: depends on the traffic density, accidents during the transport of dangerous cargo, etc.
- Vibrations after the start of using the infrastructure: Vibrations are mostly caused by the railway, while cars usually do not cause vibrations, but goods vehicles and trucks do cause vibrations, mostly in a relatively small range.
- Change in functional connection: Traffic density is often a key factor that conditions whether or not the connection shall be interrupted.

The construction and use of line facilities has different impacts on habitat types and plant and animal species. The impacts are different in the construction stage and in the stage of using the line object, whereby the impacts at the construction stage are mostly short-term while the impacts in the use stage last for much longer.

13.5.2 Measures to mitigate the negative impacts of the intervention on conservation goals and the integrity of the ecological network area

Spatially located measures

Road traffic

1. During the intervention preparation for the Ro.1 Connection with the bridge near Gradišta measure, the construction time and planning of usage have to be adapted, with the objectives of conservation of the area of the ecological network HR1000004 Donja Posavina and avoidance of the construction of the bridge during the period of the highest activity of the target species of fish in the area of the ecological network HR2001311 Sava downstream od Hrušćice.
2. For the Ro.4 A7 Križišće - Žuta Lokva measure, the possibility of mitigating significantly negative impacts on the target species of the area of the ecological network HR2000200 Zagorska peć kod Novog Vinodolskog has to be considered, by implementing adequate mitigation measures for target species of bats (e.g. routing the species that follow vegetation during flight to a higher level by using structures that allow bats to fly over (hop-over) the road by using structures that overhang the road (closed screen).
3. When determining the work area, it is necessary to exclude any activity near the area of the ecological network HR2000131 Škabac špilja and HR2001154 Orlovac špilja.
4. When planning the part of the route passing through the area of the ecological network HR5000019 Gorski kotar i sjeverna Lika, which passes through a highly suitable habitat for target species of large carnivores (bear, wolf and lynx), adequate mobility across the road has to be ensured by building green infrastructure elements.
5. During the implementation of the Ro.5 A11 Lekenik - Sisak measure, noise protection towards the area of the ecological network HR1000003 Turopolje has to be planned on the intervention level in cooperation with an expert – ornithologist, and during the construction of the connecting roads over the river Kupa, entering priority target habitat types 91E0* Alluvial forests *(Alno-Padion, Alnion incanae, Salicion albae)* and 7220* Springs next to which tuff deposits *(Cratoneurion)* - dotted or ribbed formations dominated by moss of the species *Cratoneurion commutati* has to be avoided.
6. When implementing the Ro.6 DC 10 Vrbovec - Križevci - Koprivnica - State border with Hungary towards Kaposvár measure, additional mitigation measures such as building opaque noise reducing fences alongside the road have to be considered.
7. The route provided for in the Ro.7 DC 12 Vrbovec 2 hub - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - State border with Hungary towards Barcs measure needs to be moved so it does not cross the area of the ecological network HR1000009 Ribnjaci uz Česmu.
8. Alongside the section provided for in the Ro.8. Reorganization of the main Zagreb network measure, which passes through the area of the ecological network HR1000003 Turopolje, opaque noise reducing fences have to be integrated. In the part of the section passing next to the area of the ecological network HR2000589 Stupnički lug, damage to the surrounding trees of the target habitat type 9160 Sub-Atlantic and Central European oak and oakhornbeam forests *Carpinion betuli* has to be avoided.
9. The section provided for in the Ro.9. D2 from the state border with Slovenia to the state border with Serbia measure, which passes through the area of the ecological network HR2001500 Stepska staništa kod

Bapske, has to be moved or arched over by a viaduct in order to prevent the conversion of the target habitat type 6240* SubPannonian steppe grasslands (*Festucion vallesiacae*).

10. During the construction of the part of the section under the Ro.15 Reorganization of the Split network: Split - Omiš measure, attention has to be paid to the part that passes next to the area of the ecological network HR2001376 Područje oko Stražnice and the construction time has to be adapted to the ecology of the target species lesser mouse-eared bat - *Myotis blythii.* During the usage of the section, mitigation measures for bats (enabling bats to fly-over the road (hop-over) have to be planned and light pollution has to be reduced.

Railway transport

11. When improving the railway lines provided for by measures R1, R2, R3, R4, R5, R8, R9, R10 and R11, mitigate measures to alleviate target species fatalities (especially large carnivores) over and under the planned roads have to be planned.

Air traffic

12. When implementing the A.8. Development of the Zadar Airport measure, the expansion of the airport into the areas of the ecological network HR1000024 Ravni kotari and HR2001361 Ravni kotari has to be avoided.

Maritime traffic

13. During the construction of the new terminal provided for in the M9 Specialization of the Port of Ploče (container and bulk cargo) measure, taking over the habitats in the area of the ecological network HR1000031 Delta Neretve i HR5000031 Delta Neretve has to be avoided.

Cumulative impacts

14. Due to the identified negative cumulative impact on the area of the ecological network HR2001311 Sava downstream od Hrušćice, it is necessary to temporally separate the construction of bridges and reconstruction works of the river ports on Sava.

15. If the R11 measure plans to build new railway lines, it is necessary to harmonize them with the Ro8 Reorganization of the main Zagreb network measure, so that it follows the road infrastructure and does not occupy parts of areas of the ecological network (especially the area of the ecological network HR2000589 Stupnički lug).

Monitoring of mitigation measures is essential to determine their effectiveness. Sometimes only minor changes are sufficient to significantly increase their functionality. Furthermore, based on the data collected through monitoring, future interventions and mitigation measures can be better planned. Monitoring should be anticipated during the planning of mitigation measures in the intervention approval procedure.

13.5.3 Conclusion

The table below shows the areas of the ecological network for which the possibility of a significant negative impact has been established, the proposed mitigation measure and the final significance following the implementation of the mitigation measure.

Strategy measure	Impacted EN area	Impact assessment	Impact mitigation measure	Final impact assessment
Ro. 9 D2 from the state border with Slovenia to the state border with Serbia	HR2001500 Stepska staništa kod Bapske	-2	7. The section provided for in the Ro.9. D2 from the state border with Slovenia to the state border with Serbia measure, which passes through the area of the ecological network HR2001500 Stepska staništa kod Bapske, has to be moved or arched over by a viaduct in order to prevent the conversion of the target habitat type 6240* Sub-Pannonian steppe grasslands (*Festucion vallesiacae*).	-1
I.7 Construction of the Danube-Sava multipurpose canal	HR1000006 Spačvanski bazen	-2	The measure includes the construction of the Danube-Sava multipurpose canal. Given the level of intervention definition, it is not possible to determine the measures for reducing, avoiding and mitigating the negative impact.	-2 (??)
	HR2001414 Spačvanski bazen	-2		-2 (??)

* Within the area of the ecological network HR2001414 Spasical pool, oak tree is particularly sensitive to changing the hydrological regime of groundwater and therefore continuous measurements are required to obtain reliable results.By using the methodology applied in the analysis, it was concluded that a significantly negative impact cannot be excluded for the I.7 Construction of the Danube - Sava multipurpose canal measure, given that there are no adequate reduction, avoidance and mitigation measures that could be implemented into the Strategy, but the possibility of defining them when assessing the impact on the environment at later stages of intervention development still exists.

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14.4 Directives, Conventions, Charters, Agreements and Protocols

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14.5 Publications

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15 Appendices

15.1 Approval for the performance of expert environmental protection activities

REPUBLIKA HRVATSKA
MINISTARSTVO ZAŠTITE OKOLIŠA
I PRIRODE
10000 Zagreb, Radnička cesta 80
Tel: 01 / 3717 111 fax: 01 / 3717 149

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URBROJ: 517-06-2-1-1-15-3
Zagreb, 25. siječnja 2015.

Ministarstvo zaštite okoliša i prirode na temelju odredbe članka 40. stavka 5. i u svezi s odredbom članka 271. Zakona o zaštiti okoliša („Narodne novine“, brojevi 80/13, 153/13 i 78/15) te članka 22. stavka 1. Pravilnika o uvjetima za izdavanje suglasnosti pravnim osobama za obavljanje stručnih poslova zaštite okoliša („Narodne novine“, broj 57/10), povodom zahtjeva tvrtke IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, zastupane po osobi ovlaštenoj za zastupanje sukladno zakonu, radi izdavanja suglasnosti za obavljanje stručnih poslova zaštite okoliša, donosi

R J E Š E N J E

I. Tvrtki IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, izdaje se suglasnost za obavljanje stručnih poslova zaštite okoliša:

1. Izrada studija o značajnom utjecaju strategije, plana ili programa na okoliš (strateška studija) uključujući i dokumentaciju potrebnu za ocjenu o potrebi strateške procjene te dokumentaciju za određivanje sadržaja strateške studije;
2. Izrada studija o utjecaju zahvata na okoliš, uključujući i dokumentaciju za provedbu postupka ocjene o potrebi procjene utjecaja zahvata na okoliš te dokumentacije za određivanje sadržaja studije utjecaja na okoliš;
3. Izrada programa zaštite okoliša;
4. Izrada izvješća o stanju okoliša;
5. Izrada elaborata o zaštiti okoliša koji se odnose na zahvate za koje nije propisana obveza procjene utjecaja na okoliš;
6. Obavljanje stručnih poslova za potrebe Registra onečišćavanja okoliša;
7. Izrada elaborata o usklađenosti proizvoda s mjerilima u postupku ishođenja znaka zaštite okoliša „Prijatelj okoliša“ i znaka EU Ecolabel;
8. Izrada podloga za ishođenje znaka zaštite okoliša „Prijatelj okoliša“.

II. Suglasnost iz točke I. ove izreke prestaje važiti u roku od godine dana od dana stupanja na snagu propisa iz članka 40. stavka 12. Zakona o zaštiti okoliša.

III. Ovo rješenje upisuje se u očevidnik izdanih suglasnosti za obavljanje stručnih poslova zaštite okoliša koji vodi Ministarstvo zaštite okoliša i prirode.

Stranica 1 od 3

IV. Uz ovo rješenje prileži popis zaposlenika ovlaštenika: voditelja stručnih poslova u zaštiti okoliša i stručnjaka slijedom kojih su ispunjeni propisani uvjeti glede zaposlenih stručnjaka za izdavanje suglasnosti iz točke I. ove izreke.

O b r a z l o ž e nj e

Tvrtka IRES EKOLOGIJA d.o.o. iz Zagreba (u daljnjem tekstu: ovlaštenik) podnijela je ovom Ministarstvu zahtjev za izdavanje suglasnosti za obavljanje stručnih poslova zaštite okoliša: Izrada studija o značajnom utjecaju strategije, plana ili programa na okoliš (strateška studija) uključujući i dokumentaciju potrebnu za ocjenu o potrebi strateške procjene te dokumentaciju za određivanje sadržaja strateške studije; Izrada studija o utjecaju zahvata na okoliš, uključujući i dokumentaciju za provedbu postupka ocjene o potrebi procjene utjecaja zahvata na okoliš te dokumentacije za određivanje sadržaja studije o utjecaju na okoliš; Izrada dokumentacije vezano za postupak izdavanja okolišne dozvole uključujući izradu Temeljnog izvješća; Izrada programa zaštite okoliša; Izrada izvješća o stanju okoliša; Izrada izvješća o sigurnosti; Izrada elaborata o zaštiti okoliša koji se odnose na zahvate za koje nije propisana obveza procjene utjecaja na okoliš; Praćenje stanja okoliša; Obavljanje stručnih poslova za potrebe Registra onečišćavanja okoliša; Izrada elaborata o usklađenosti proizvoda s mjerilima u postupku ishođenja znaka zaštite okoliša „Prijatelj okoliša" i znaka EU Ecolabel; Izrada podloga za ishođenje znaka zaštite okoliša „Prijatelj okoliša".

Ovlaštenik je uz zahtjev za izdavanje suglasnosti priložio odgovarajuće dokaze prema zahtjevima propisanim odredbama članka 5. i 20. Pravilnika o uvjetima za izdavanje suglasnosti pravnim osobama za obavljanje stručnih poslova zaštite okoliša (u daljnjem tekstu: Pravilnik), koji je donesen temeljem Zakona o zaštiti okoliša („Narodne novine", broj 110/07), a odgovarajuće se primjenjuje u predmetnom postupku slijedom odredbe članka 271. stavka 2. točke 21. Zakona o zaštiti okoliša („Narodne novine", brojevi 80/13, 153/13 i 78/15) kojom je ostavljen na snazi u dijelu u kojem nije suprotan tom Zakonu.

Ovlaštenik je naveo činjenice i podnio dokaze na podlozi kojih se moglo utvrditi pravo stanje stvari. U postupku je obavljen uvid u zahtjev i priloženu dokumentaciju te je utvrđeno da su ispunjeni svi propisani uvjeti i da je zahtjev za obavljanje stručnih poslova zaštite okoliša iz točke I. izreke ovog rješenja osnovan.

U dijelu koji se odnosi na izdavanje suglasnosti za obavljanje stručnih poslova: Izrada dokumentacije vezano za postupak izdavanja okolišne dozvole uključujući izradu Temeljnog izvješća i Praćenje stanja okoliša, ovlaštenik ne ispunjava uvjete jer nema zaposlene stručnjake odgovarajuće stručne osposobljenosti za obavljanje tih poslova. Ove činjenice utvrđene su uvidom u dostavljenu dokumentaciju vezano za stručnjake i vezano za stručne radove u kojima su sudjelovali ti stručnjaci: popis radova i naslovne stranice, a koje pravna osoba navodi kao relevantne i kojima potkrepljuje svoje navode da raspolaže stručnjacima odgovarajuće stručne osposobljenosti za obavljanje navedenih poslova. Naime, ovlaštenik uz svoj zahtjev nije dostavio dokaze iz kojih je očito da su zaposlenici sudjelovali kao voditelji ili odgovorne osobe u izradi najmanje tri odgovarajuće stručne podloge, dokumentacije vezane za postupak izdavanja okolišne dozvole uključujući izradu Temeljnog izvješća, odnosno odgovarajuće stručno iskustvo u izradi bilo kojeg drugog dokumenta s tim u svezi. Nadalje, uvidom u dostavljenu dokumentaciju utvrđeno je da ovlaštenik nije dostavio potvrdu Hrvatske akreditacijske agencije o stručnoj i tehničkoj osposobljenosti u svrhu obavljanja stručnih poslova praćenja stanja okoliša.

Slijedom naprijed navedenog, zbog odgovarajuće primjene Pravilnika, ovu suglasnost potrebno je uskladiti s odredbama propisa iz članka 40. stavka 3. Zakona o zaštiti okoliša, nakon njegova donošenja. Stoga se suglasnost izdaje s rokom važnosti kako stoji u točci II.

izreke ovoga rješenja. Točka III. izreke ovoga rješenja utemeljena je na odredbi članka 40. stavka 9. Zakona o zaštiti okoliša. Točka IV. izreke ovoga rješenja temelji se na naprijed izloženim utvrđenom činjeničnom stanju.

Temeljem svega naprijed navedenoga valjalo je riješiti kao u izreci ovoga rješenja.

UPUTA O PRAVNOM LIJEKU:
Ovo rješenje je izvršno u upravnom postupku i protiv njega se ne može izjaviti žalba, ali se može pokrenuti upravni spor. Upravni spor pokreće se tužbom Upravnom sudu u Zagrebu, Avenija Dubrovnik 6, u roku 30 dana od dana dostave ovog rješenja. Tužba se predaje navedenom upravnom sudu neposredno u pisanom obliku, usmeno na zapisnik ili se šalje poštom, odnosno dostavlja elektronički.

Upravna pristojba za zahtjev i ovo Rješenje propisno je naplaćena državnim biljezima u ukupnom iznosu od 70,00 kuna prema Tar. br. 1. i 2. Tarife upravnih pristojbi, Zakona o upravnim pristojbama („Narodne novine", brojevi 8/96, 77/96, 131/97, 68/98, 66/99, 145/99, 30/00, 116/00, 163/03, 17/04, 110/04, 141/04, 150/05, 153/05, 129/06, 117/07, 60/08, 20/10, 69/10, 126/11, 112/12, 19/13, 80/13, 40/14, 69/14, 87/14 i 94/14).

Privitak: Popis zaposlenika kao u točki IV. izreke rješenja.

REPUBLIKA HRVATSKA 6 MINISTARSTVO ZAŠTITE OKOLIŠA I PRIRODE ZAGREB

VODITELJICA ODJELA
Zrinka Valetić

Dostaviti:
1. IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb (**R! s povratnicom**)
2. Uprava za inspekcijske poslove, ovdje
3. Očevidnik, ovdje
4. Spis predmeta, ovdje

Stranica 3 od 3

REPUBLIKA HRVATSKA
MINISTARSTVO ZAŠTITE OKOLIŠA
I ENERGETIKE
10000 Zagreb, Radnička cesta 80
tel: +385 1 3717 111, faks: +385 1 3717 149
Uprava za procjenu utjecaja na okoliš i
održivo gospodarenje otpadom
Sektor za procjenu utjecaja na okoliš
i industrijsko onečišćenje
KLASA: UP/I 351-02/15-08/100
URBROJ: 517-06-2-1-1-17-4
Zagreb, 9. veljače 2017.

Ministarstvo zaštite okoliša i energetike, na temelju odredbe članka 43. Zakona o zaštiti okoliša („Narodne novine", brojevi 80/13, 153/13 i 78/15) rješavajući povodom zahtjeva ovlaštenika IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, radi utvrđivanja promjena u popisu zaposlenika ovlaštenika, temeljem odredbe članka 96. stavka 1. Zakona o općem upravnom postupku („Narodne novine", broj 47/09), donosi:

RJEŠENJE

I. Utvrđuje se da je kod ovlaštenika IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, nastupila promjena zaposlenih stručnjaka za obavljanje stručnih poslova zaštite okoliša u odnosu na zaposlenike temeljem kojih je ovlaštenik ishodio suglasnost za obavljanje stručnih poslova zaštite okoliša (KLASA: UP/I 351-02/15-08/100; URBROJ: 517-06-2-1-1-16-3 od 25. siječnja 2016.).

II. Utvrđuje se da je kod ovlaštenika IRES EKOLOGIJA d.o.o. iz točke I. ove izreke zaposlenik Edin Lugić, dipl.ing.biol. stekao uvjete za voditelja, a Mario Mesarić, mag.ing.agr. za stručnjaka za obavljanje stručnih poslova zaštite okoliša.

III. Utvrđuje se da kod ovlaštenika IRES EKOLOGIJA d.o.o. iz točke I. ove izreke više nije zaposlena Jelena Likić, prof.biol.

IV. Popis zaposlenika ovlaštenika priložen rješenjima iz točke I. izreke zamjenjuje se novim popisom koji je sastavni dio ovog rješenja.

Obrazloženje

IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb (u daljnjem tekstu: ovlaštenik), podnio je zahtjev za promjenom podataka u Rješenju (KLASA: UP/I 351-02/15-08/100; URBROJ: 517-06-2-1-1-16-3 od 25. siječnja 2016.) Ministarstva zaštite okoliša i prirode, a vezano za popis zaposlenika ovlaštenika koji prileži uz navedeno rješenje. Promjene se odnose na voditelje stručnih poslova i zaposlene stručnjake kako je navedeno u točkama II. i III.

U provedenom postupku Ministarstvo zaštite okoliša i energetike izvršilo je uvid u zahtjev za promjenom podataka, podatke i dokumente dostavljene uz zahtjev, a osobito u popis stručnih podloga, diplomu i potvrdu Hrvatskog zavoda za mirovinsko osiguranje navedenog stručnjaka, te službenu evidenciju ovog Ministarstva i utvrdilo da su navodi iz zahtjeva utemeljeni.

Slijedom navedenoga, utvrđeno je kao u točkama od I. do IV. izreke ovoga rješenja.

S obzirom da se pravomoćno i izvršno rješenje za obavljanje stručnih poslova zaštite okoliša (KLASA: UP/I 351-02/15-08/100; URBROJ: 517-06-2-1-1-16-3 od 25. siječnja 2016.) u svom sadržaju ne može mijenjati, ovo rješenje kojim su utvrđene gore navedene promjene priložit će se spisu predmeta navedene suglasnosti za obavljanje stručnih poslova zaštite okoliša.

UPUTA O PRAVNOM LIJEKU:
Ovo rješenje je izvršno u upravnom postupku i protiv njega se ne može izjaviti žalba, ali se može pokrenuti upravni spor. Upravni spor pokreće se tužbom Upravnom sudu u Zagrebu, Avenija Dubrovnik 6, u roku 30 dana od dana dostave ovog rješenja. Tužba se predaje navedenom upravnom sudu neposredno u pisanom obliku, usmeno na zapisnik ili se šalje poštom, odnosno dostavlja elektronički.

Upravna pristojba na zahtjev i ovo rješenje naplaćena je državnim biljezima u iznosu od 70,00 kuna sukladno članku 32. Zakona o upravnim pristojbama („Narodne novine", broj 115/16), a u vezi s Tarifom br. 1. i 2. Zakona o upravnim pristojbama („Narodne novine", brojevi 8/96, 77/96, 131/97, 68/98, 66/99, 145/99, 30/00, 116/00, 163/03, 17/04, 110/04, 141/04, 150/05, 153/05, 129/06, 117/07, 60/08, 20/10, 69/10, 126/11, 112/12, 19/13, 80/13, 40/14, 69/14, 87/14 i 94/14).

VODITELJICA SLUŽBE
Jadranka Matić

J. Matić

REPUBLIKA HRVATSKA
MINISTARSTVO ZAŠTITE OKOLIŠA I ENERGETIKE
ZAGREB

DOSTAVITI:
1. IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, (**R!, s povratnicom!**)
2. Uprava za inspekcijske poslove, ovdje
3. Evidencija, ovdje
4. Pismohrana u predmetu, ovdje

Stranica 2 od 2

POPIS

zaposlenika ovlaštenika: IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, slijedom kojih je ovlaštenik ispunio propisane uvjete za izdavanje suglasnosti za obavljanje stručnih poslova zaštite okoliša sukladno rješenju Ministarstva KLASA: UP/I 351-02/15-08/100, URBROJ: 517-06-2-1-1-16-3 od 25. siječnja 2016., mijenja se novim popisom KLASA: UP/I 351-02/15-08/100, URBROJ: 517-06-2-1-1-17-4 od 9. veljače 2017.

STRUČNI POSLOVI ZAŠTITE OKOLIŠA	*VODITELJI STRUČNIH POSLOVA*	*STRUČNJACI*
1. Izrada studija o značajnom utjecaju strategije, plana ili programa na okoliš (strateška studija) uključujući i dokumentaciju potrebnu za ocjenu o potrebi strateške procjene te dokumentaciju za određivanje sadržaja strateške studije	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak
2. Izrada studija o utjecaju zahvata na okoliš, uključujući i dokumentaciju za provedbu postupka ocjene o potrebi procjene utjecaja zahvata na okoliš te dokumentacije za određivanje sadržaja studije utjecaja na okoliš	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak
3. Izrada programa zaštite okoliša	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak
4. Izrada izvješća o stanju okoliša	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak
5. Izrada elaborata o zaštiti okoliša koji se odnose na zahvate za koje nije propisana obveza procjene utjecaja na okoliš	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak
6. Obavljanje stručnih poslova za potrebe Registra onečišćavanja okoliša	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak
7. Izrada elaborata o usklađenosti proizvoda s mjerilima u postupku ishođenja znaka zaštite okoliša "Prijatelj okoliša" i znaka EU Ecolabel	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak
8. Izrada podloga za ishođenje znaka zaštite okoliša „Prijatelj okoliša“	Mirko Mesarić, dipl.ing.biol. Edin Lugić, dipl.ing.biol.	Mario Mesarić, mag.ing.agr. dr.sc. Maja Kljenak

15.2 Approval for the performance of expert environmental protection activities

REPUBLIKA HRVATSKA
MINISTARSTVO ZAŠTITE OKOLIŠA I PRIRODE
10000 Zagreb, Radnička cesta 80
Tel: 01 / 3717 111 fax: 01 / 3717 149

KLASA: UP/I 351-02/16-08/25
URBROJ: 517-06-2-1-1-16-3
Zagreb, 31. svibnja 2016.

Ministarstvo zaštite okoliša i prirode na temelju odredbe članka 40. stavka 5. i u svezi s odredbom članka 271. Zakona o zaštiti okoliša („Narodne novine“, brojevi 80/13, 153/13 i 78/15) te članka 22. stavaka 1. i 5. Pravilnika o uvjetima za izdavanje suglasnosti pravnim osobama za obavljanje stručnih poslova zaštite okoliša („Narodne novine“, broj 57/10), povodom zahtjeva tvrtke IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, zastupane po osobi ovlaštenoj za zastupanje sukladno zakonu, radi izdavanja suglasnosti za obavljanje stručnih poslova iz područja zaštite prirode, donosi

RJEŠENJE

I. Tvrtki IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, izdaje se suglasnost za obavljanje poslova iz područja zaštite prirode koji se odnose na stručne poslove:

1. Izrada poglavlja i studija ocjene prihvatljivosti strategija, plana, programa ili zahvata za ekološku mrežu,
2. Priprema i izrada dokumentacije za postupak utvrđivanja prevladavajućeg javnog interesa s prijedlogom kompenzacijskih uvjeta,
3. Izrada studija procjene rizika uvođenja i ponovnog uvođenja i uzgoja divljih vrsta.

II. Suglasnost iz točke I. ove izreke prestaje važiti u roku od godine dana od dana stupanja na snagu propisa iz članka 40. stavka 12. Zakona o zaštiti okoliša.

III. Ovo rješenje upisuje se u očevidnik izdanih suglasnosti za obavljanje stručnih poslova zaštite okoliša koji vodi Ministarstvo zaštite okoliša i prirode.

IV. Uz ovo rješenje prileži popis zaposlenika ovlaštenika: voditelja stručnih poslova u zaštiti okoliša i stručnjaka slijedom kojih su ispunjeni propisani uvjeti glede zaposlenih stručnjaka za izdavanje suglasnosti iz točke I. ove izreke.

Obrazloženje

Tvrtka IRES EKOLOGIJA d.o.o. (u daljnjem tekstu: ovlaštenik) podnijela je ovom Ministarstvu zahtjev za izdavanje suglasnosti za obavljanje stručnih poslova iz područja zaštite prirode: Izrada poglavlja i studija ocjene prihvatljivosti strategija, plana, programa ili zahvata za ekološku mrežu; Priprema i izrada dokumentacije za postupak utvrđivanja prevladavajućeg javnog interesa s prijedlogom kompenzacijskih uvjeta; Izrada studija procjene rizika uvođenja i ponovnog uvođenja i uzgoja divljih vrsta.

Stranica 1 od 3

S obzirom na to da se zahtjev odnosi na izdavanje suglasnosti za stručne poslove iz područja zaštite prirode, Uprava za procjenu utjecaja na okoliš i održivo gospodarenje otpadom zatražila je mišljenje Uprave za zaštitu prirode o predmetnom zahtjevu. U zaprimljenom mišljenju Uprave za zaštitu prirode (KLASA: 612-07/16-69/07; URBROJ: 517-07-2-1-1-16-2 od 25. svibnja 2016.) navodi se sljedeće: *sukladno članku 7. stavak 1. točka 2., člancima 11. i 14. Pravilnika pravna osoba koja može obavljati stručne poslove iz područja zaštite prirode za koje je zatražena suglasnost mora imati voditelja stručnih poslova odgovarajuće prirodne ili biotehničke znanosti odnosno struke s pet godina radnog iskustva na stručnim poslovima zaštite prirode, jednog stručnjaka iz područja prirodne ili biotehničke znanosti odnosno struke s najmanje tri godine radnog iskustva na poslovima zaštite prirode te jednog stručnjaka iz područja prirodne, tehničke ili biotehničke znanosti odnosno struke s najmanje tri godine radnog iskustva na poslovima u struci.*

Tvrtka IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb predložila je zaposlenike za obavljanje poslova voditelja stručnih poslova zaštite prirode i stručnjake odgovarajuće struke za obavljanje mogućih stručnih poslova zaštite prirode.
Uvidom u dostavljenu dokumentaciju utvrđeno je da predloženi zaposlenici tvrtke IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb ispunjavaju uvjete propisane člancima 7., 11. i 14. Pravilnika za obavljanje stručnih poslova izrade poglavlja i studija ocjene prihvatljivosti strategija, plana, programa ili zahvata za ekološku mrežu, priprema i izrada dokumentacije za postupak utvrđivanja prevladavajućeg javnog interesa s prijedlogom kompenzacijskih uvjeta i izrada studija procjene rizika uvođenja i ponovnog uvođenja i uzgoja divljih vrsta. kako slijedi:

- *Mirko Mesarić, dipl.ing. biol., voditelj,*
- *Jelena Likić, prof. biol., voditeljica,*
- *dr.sc. Maja Kljenjak, mag.ing. prosp.arch., stručnjak,*
- *Edin Lugić, dipl.ing.biol., stručnjak.*

Sukladno navedenom ova Uprava je mišljenja da se tvrtci IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb izda suglasnost za obavljanje stručnih poslova zaštite prirode- izrada poglavlja i studija ocjene prihvatljivosti strategija, plana, programa ili zahvata za ekološku mrežu, priprema i izrada dokumentacije za postupak utvrđivanja prevladavajućeg javnog interesa s prijedlogom kompenzacijskih uvjeta i izrada studija procjene rizika uvođenja i ponovnog uvođenja i uzgoja divljih vrsta.

Ovlaštenik je uz zahtjev za izdavanje suglasnosti za poslove iz točke I. izreke ovog rješenja priložio odgovarajuće dokaze prema zahtjevima propisanim odredbama članaka 5. i 20. Pravilnika o uvjetima za izdavanje suglasnosti pravnim osobama za obavljanje stručnih poslova zaštite okoliša (u daljnjem tekstu: Pravilnik), koji je donesen temeljem Zakona o zaštiti okoliša („Narodne novine", broj 110/07), a odgovarajuće se primjenjuje u predmetnom postupku slijedom odredbe članka 271. stavka 2. točke 21. Zakona o zaštiti okoliša („Narodne novine", broj 80/13) kojom je ostavljen na snazi u dijelu u kojem nije suprotan tom Zakonu.

Ovlaštenik je naveo činjenice i podnio dokaze na podlozi kojih se moglo utvrditi pravo stanje stvari.

U postupku je obavljen uvid u zahtjev i priloženu dokumentaciju te je utvrđeno da su ispunjeni propisani uvjeti u dijelu koji se odnosi na izdane suglasnosti i da je zahtjev za obavljanje stručnih poslova zaštite okoliša iz točke I. izreke ovog rješenja osnovan.

Slijedom naprijed navedenog zbog odgovarajuće primjene Pravilnika ovu suglasnost potrebno je uskladiti s odredbama propisa iz članka 40. stavka 3. Zakona o zaštiti okoliša („Narodne

Stranica 2 od 3

novine", brojevi 80/13, 153/13 i 78/15), nakon njegova donošenja. Stoga se suglasnost izdaje s rokom važnosti kako stoji u točci II. izreke ovoga rješenja. Točka III. izreke ovoga rješenja utemeljena je na odredbi članka 40. stavka 9. Zakona o zaštiti okoliša. Točka IV. izreke ovoga rješenja temelji se na naprijed izloženim utvrđenom činjeničnom stanju.

Temeljem svega naprijed navedenoga valjalo je riješiti kao u izreci ovoga rješenja.

UPUTA O PRAVNOM LIJEKU:
Ovo rješenje je izvršno u upravnom postupku i protiv njega se ne može izjaviti žalba, ali se može pokrenuti upravni spor. Upravni spor pokreće se tužbom Upravnom sudu u Zagrebu, Avenija Dubrovnik 6, u roku 30 dana od dana dostave ovog rješenja. Tužba se predaje navedenom upravnom sudu neposredno u pisanom obliku, usmeno na zapisnik ili se šalje poštom, odnosno dostavlja elektronički.

Upravna pristojba za zahtjev i ovo Rješenje propisno je naplaćena državnim biljezima u ukupnom iznosu od 70,00 kuna prema Tar. br. 1. i 2. Tarife upravnih pristojbi, Zakona o upravnim pristojbama („Narodne novine", brojevi 8/96, 77/96, 95/97, 131/97, 68/98, 66/99, 145/99, 30/00, 116/00, 163/03, 17/04, 110/04, 141/04, 150/05, 153/05, 129/06, 117/07, 25/08, 60/08, 20/10, 69/10, 49/11, 126/11, 112/12, 19/13, 80/13, 40/14, 69/14, 87/14 i 94/14).

Privitak: Popis zaposlenika kao u točki IV. izreke rješenja.

REPUBLIKA HRVATSKA 6 MINISTARSTVO ZAŠTITE OKOLIŠA I PRIRODE ZAGREB

VODITELJICA ODJELA
Zrinka Valetić

Dostaviti:
1. IRES EKOLOGIJA d.o.o., Prilaz baruna Filipovića 21, Zagreb, **R s povratnicom!**
2. Ministarstvo zaštite okoliša i prirode, Uprava za zaštitu prirode, ovdje
3. Uprava za inspekcijske poslove, ovdje
4. Očevidnik, ovdje
5. Spis predmeta, ovdje

Stranica 3 od 3

15.3 Decision of the Ministry of Environment and Energy on the obligation to implement the Main Assessment of Acceptability for the Ecological Network

REPUBLIKA HRVATSKA
MINISTARSTVO ZAŠTITE OKOLIŠA I PRIRODE
10000 Zagreb, Radnička cesta 80
Tel: 01 / 3717 111 fax: 01 / 4866 100

Republika Hrvatska
530 – MPPI

Primljeno	21.7.2015.	
Klasifikacijska oznaka	Org. jed.	
340-03/15-10/03	08-2-2-1	
Urudžbeni broj	Pril.	Vrij.
517-15-3	0	0,00

P / 2 6 0 6 0 6 3

KLASA: UP/I 612-07/15-71/136
URBROJ: 517-07-2-1-15-4
Zagreb, 13. srpnja 2015.

Ministarstvo zaštite okoliša i prirode na temelju članka 48. stavak 6. vezano uz članak 26. stavak 2. i članak 46. Zakona o zaštiti prirode (Narodne novine, broj 80/2013), povodom zahtjeva nositelja izrade strategije Ministarstva pomorstva, prometa i infrastrukture iz Zagreba, Prisavlje 14, za prethodnu ocjenu prihvatljivosti za ekološku mrežu Strategije prometnog razvoja Republike Hrvatske za razdoblje od 2016.-2030. godine, nakon provedenog postupka, donosi

RJEŠENJE

Za Strategiju prometnog razvoja Republike Hrvatske za razdoblje od 2016.–2030. godine, nositelja izrade strategije Ministarstva pomorstva, prometa i infrastrukture iz Zagreba, Prisavlje 14, ne može se isključiti mogućnost značajnih negativnih utjecaja na ciljeve očuvanja i cjelovitost područja ekološke mreže te je za istu obvezna provedba glavne ocjene prihvatljivosti za ekološku mrežu.

Obrazloženje

Nositelj izrade strategije, Ministarstvo pomorstva, prometa i infrastrukture iz Zagreba, Prisavlje 14, podnio je 2. lipnja 2015. godine, zahtjev za provedbu postupka prethodne ocjene prihvatljivosti za ekološku mrežu Strategije prometnog razvoja Republike Hrvatske za razdoblje od 2016.-2030. godine (u daljnjem tekstu: Strategija). U zahtjevu su u bitnome navedeni osnovni podaci sukladno odredbama članka. 48. stavka. 2. Zakona o zaštiti prirode (u daljnjem tekstu: Zakon).

Po zaprimljenom zahtjevu sukladno odredbama članka. 48. stavka. 3. Zakona, Ministarstvo zaštite okoliša i prirode (u daljnjem tekstu: Ministarstvo), je od Državnog zavoda za zaštitu prirode zatražilo mišljenje (KLASA: UP/I 612-07/15-71/136, URBROJ: 517-07-2-1-15-2 od 15. lipnja 2015. godine) o mogućnosti značajnih negativnih utjecaja Strategije na ciljeve očuvanja i cjelovitost područja ekološke mreže. Državni zavod za zaštitu prirode, 6. srpnja 2015. godine dostavio je mišljenje (KLASA: 612-07/15-42/21, URBROJ: 366-07-3-15-2) u kojem navodi da se prethodnom ocjenom ne može isključiti mogućnost značajnih negativnih utjecaja Strategije na ciljeve očuvanja i cjelovitost područja ekološke mreže te da je potrebno provesti glavnu ocjenu prihvatljivosti za ekološku mrežu.

U provedbi postupka ovo Ministarstvo je razmotrilo predmetni zahtjev, polazišta, ciljeve i obuhvat Strategije i mišljenje Državnog zavoda za zaštitu prirode te je utvrdilo sljedeće.

Ministarstvo pomorstva, prometa i infrastrukture 2014. godine izradilo je Strategiju prometnog razvoja Republike Hrvatske za razdoblje od 2014.-2030. godine te je za nju izrađena i Strateška studija utjecaja na okoliš s glavnom ocjenom za ekološku mrežu. Prvi ciklus izrade nacionalne Strategije završio je 30. listopada 2014. godine donošenjem Strategije prometnog razvoja Republike Hrvatske za razdoblje od 2014. do 2030. godine od strane Vlade Republike Hrvatske. Strategija iz 2014. godine smatra se prvom fazom izrade Strategije prometnog razvoja Republike Hrvatske, obzirom da u vrijeme njene izrade Republika Hrvatska nije imala Prometni model, odnosno alat koji bi generirao relevantne podatke koji bi omogućavali kvalitetnu analizu i planiranje prometnog sektora. Izrada konačnog modela postojećeg prometnog sustava Republike Hrvatske završiti će zaključno s II kvartalom 2015.

Stranica 1 od 3

godine. S razvijenim prometnim modelom postojećeg prometnog sustava Republike Hrvatske, započeti će tzv. druga faza izrade Strategije, odnosno izrada Strategije prometnog razvoja Republike Hrvatske za razdoblje 2016.-2030. godine koja će se uputiti u postupak usvajanja od strane Hrvatskog Sabora.

Obuhvat Strategije odnosi se na cjelokupno područje Republike Hrvatske te se stoga preklapa sa obuhvatom ekološke mreže proglašene Uredbom o ekološkoj mreži (Narodne novine, broj 124/2013) koja čini 36,67% površine kopna RH i 16,39% površine obalnog mora RH.

Utjecaji prometnog razvoja na bioraznolikost, odnosno ciljne vrste i ciljne stanišne tipove ekološke mreže očituju se na više načina, ovisno o vrsti prometa. Prvenstveni utjecaji odnose se na fragmentaciju staništa, prekidanje migracijskih putova (osobito za velike zvijeri, vodozemce i gmazove), stradavanje vrsta uslijed kolizija s prijevoznim sredstvima, onečišćenje okoliša (zraka, tla, podzemnih, kopnenih i morskih voda), uznemiravanje bukom, vibracijama, svjetlom, širenje invazivnih vrsta. U slučaju plovnih putova utjecaji se odnose na - degradaciju vodenih i močvarnih staništa, hidromorfološke promjene riječnog toka, promjene kvalitete vode, kontinuirano uznemiravanje vrsta. U slučaju razvoja zračnog prometa negativni učinci mogu proizaći od ometanja ptica, korištenjem zemljišta za proširenje zračnih luka, sudara ptica sa zrakoplovima. Glavni utjecaji koji se očekuju u morskom prijevozu snažno su povezani s utjecajima na kvalitetu mora, eutrofikaciju u lukama te širenje invazivnih vrsta. Svi ovi utjecaji se intenziviraju s već postojećom infrastrukturom i postojećim utjecajima raznih vidova prometa (kumulativni utjecaj).

Razmatrajući predmetni zahtjev, nakon provedene analize mogućih negativni utjecaja Strategije na ciljeve očuvanja i cjelovitost područja ekološke mreže s obzirom na ciljeve i programska polazišta Strategije te činjenicu da je obuhvat Strategije cjelokupno područje Republike Hrvatske, ovo Ministarstvo nalazi da nije moguće isključiti mogućnost značajnih negativni utjecaj Strategije na ciljeve očuvanja i cjelovitost područja ekološke mreže te je stoga riješeno kao u izreci.

U sklopu Glavne ocjene potrebno je sagledati utjecaj na ekološku mrežu svih elemenata Strategije i ukoliko je potrebno predvidjeti alternativna rješenja (primjerice, alternativu razvoju unutarnje plovidbe). Alternativna rješenja bi trebala biti dio same Strategije i Glavne ocjene (ukoliko se kao što je zakonski propisano ova dva dokumenta izrađuju paralelno). Također, u Glavnoj ocjeni i samoj Strategiji treba istaknuti potrebu provedbe ocjene prihvatljivosti za ekološku mrežu u okviru provedbenih programa nižeg reda.

Glavna ocjena u okviru strateške studije utjecaja na okoliš treba biti izrađena u skladu sa Smjernicama za ocjenu prihvatljivosti za ekološku mrežu koje su prilog Općim metodološkim preporukama za izradu strateških studija i preporuka za provedbu ocjene prihvatljivosti strategija, planova i programa za ekološku mrežu. Smjernice su izrađene u okviru projekta SPUO Hrvatska IPA 2010 „Jačanje kapaciteta za provedbu strateške procjene utjecaja na okoliš na regionalnoj i lokalnoj razini„ i dostupne su na internetskim stranicama Ministarstva (http://mzoip.evolare.host25.com/doc/prilog_i_smjernice_za_ocjenu_prihvatljivosti_za_ekolosku_mrezu.pdf).

Pri ocjeni utjecaja i definiranju mjera ublažavanja u Glavnoj ocjeni treba koristiti postojeću praksu, smjernice i priručnike Europske komisije za Natura 2000 područja (npr. za morske luke i plovne puteve - Inland waterway transport and Natura 2000; The implementation of the Birds and Habitats Directives in estuaries and coastal zones with particular attention to port development and dredging
(http://ec.europa.eu/transport/modes/maritime/doc/guidance_doc.pdf)
te ostale priručnike za očuvanje bioraznolikosti Europske unije (npr. za prometnu infrastrukturu - Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions)
(http://www.iene.info/wp-content/uploads/COST341_Handbook.pdf).

Sukladno odredbama članka 26. stavka 2. Zakona, za strategije, planove i programe za koje je posebnim propisom kojim se uređuje zaštita okoliša određena obveza strateške procjene, prethodna ocjena obavlja se prije pokretanja postupka strateške procjene utjecaja strategije, plana i programa na okoliš.

Člankom 46. Zakona, propisano je da za strategije, planove i programe za koje je posebnim propisom kojim se uređuje zaštita okoliša određena obveza strateške procjene ili ocjene o potrebi strateške procjene, Ocjenu prihvatljivosti provodi Ministarstvo u skladu s člankom 26. Zakona.

Ako Ministarstvo ne isključi mogućnost značajnih negativnih utjecaja strategije, plana i programa na ciljeve očuvanja i cjelovitost područja ekološke mreže, sukladno odredbama članka 48. stavka 6. Zakona, donosi rješenje da je za strategiju, plan ili program obvezna Glavna ocjena.

U skladu s odredbama članka 51. stavka 3. Zakona, ovo Rješenje objavljuje se na internetskoj stranici Ministarstva.

Podnositelj zahtjeva oslobođen je plaćanja upravne pristojbe temeljem članka 6. stavka 1. Zakona o upravnim pristojbama (Narodne novine, br. 8/96, 77/96, 95/97, 131/97, 68/98, 66/99, 145/99, 30/2000, 116/2000, 163/2003, 17/2004, 110/2004, 141/2004, 150/2005, 153/2005, 129/2006, 117/2007, 25/2008, 60/2008, 20/2010, 69/2010, 126/2011, 112/2012, 19/2013, 80/2013, 40/2014, 69/2014, 87/2014 i 94/2014).

UPUTA O PRAVNOM LIJEKU

Ovo je Rješenje izvršno u upravnom postupku te se protiv njega ne može izjaviti žalba, ali se može pokrenuti upravni spor pred upravnim sudom na području kojeg tužitelj ima prebivalište, odnosno sjedište. Upravni spor pokreće se tužbom koja se podnosi u roku od 30 dana od dana dostave ovog Rješenja. Tužba se predaje nadležnom upravnom sudu neposredno u pisanom obliku, usmeno na zapisnik ili se šalje poštom, odnosno dostavlja elektronički.

VODITELJICA SLUŽBE

dr. sc. Loris Elez

REPUBLIKA HRVATSKA
MINISTARSTVO ZAŠTITE OKOLIŠA I PRIRODE
ZAGREB

Dostaviti:

1. **Ministarstvo pomorstva, prometa i infrastrukture, Prisavlje 14, 10000 Zagreb** *(R s povratnicom)*,
2. **U spis predmeta, ovdje**

Stranica 3 od 3

15.4 Decision on the content of the Study

P / 2 6 6 4 2 5 2

REPUBLIKA HRVATSKA
MINISTARSTVO POMORSTVA, PROMETA I INFRASTRUKTURE

KLASA: 340-03/15-10/03
URBROJ: 530-08-2-3-2-15-32
Zagreb, 23. rujna 2015. godine

Ministarstvo pomorstva, prometa i infrastrukture na temelju članka 68. stavka 3. Zakona o zaštiti okoliša („Narodne novine", broj 80/13, 153/13, 78/15) i članka 10. Uredbe o strateškoj procjeni utjecaja plana i programa na okoliš („Narodne novine", broj 64/08), donosi

ODLUKU

o sadržaju strateške studije za

Strategiju prometnog razvoja Republike Hrvatske za razdoblje 2016.-2030.

I.

Programska polazišta, obuhvat i ciljevi

Ministarstvo pomorstva prometa i infrastrukture je 2014. godine izradilo Strategiju prometnog razvoja Republike Hrvatske za razdoblje od 2014.-2030. godine (Narodne novine, broj 131/44), (dalje tu tekstu: Strategija). Paralelno s procesom izrade Strategije započeo je i proces izrade Strateške studije utjecaja na okoliš s glavnom ocjenom za ekološku mrežu, s ciljem konstantne interakcije i usklađenja oba dokumenta, a koji je rezultirao procjenom utjecaja na okoliš ciljeva i mjera Strategije.

Prvi ciklus izrade nacionalne Strategije završio je 30. listopada 2014. godine donošenjem Strategije prometnog razvoja Republike Hrvatske za razdoblje od 2014. do 2030. godine od strane Vlade Republike Hrvatske, osiguravajući ulazne podatke iz domene prometa za izradu programskih dokumenata za razdoblje 2014.-2020. godine (Operativni program „Konkurentnost i kohezija").

Strategija iz 2014. godine smatra se prvom fazom izrade Strategije prometnog razvoja Republike Hrvatske, obzirom da u vrijeme njene izrade Republika Hrvatska nije imala Prometni model, odnosno alat koji bi generirao relevantne podatke koji bi omogućavali kvalitetnu analizu i planiranje prometnog sektora.

Izrada konačnog modela postojećeg prometnog sustava Republike Hrvatske završiti će zaključno s II kvartalom 2015. godine (lipanj). Model će sadržavati relevantne fizičke komponente za sve vidove putovanja putnika i roba (kao što su broj vozila na promatranim dionicama, tehničke karakteristike tih dionica, karakteristična vozila, značaj tipa državna/lokalna i sl.) u cestovnom, željezničkom, javnom gradsko-prigradskom, pomorskom, riječnom i zračnom prometnom sustavu Republike Hrvatske s projekcijama u 2020., 2030. i 2040. godini.

S razvijenim prometnim modelom postojećeg prometnog sustava Republike Hrvatske, započeti će tzv. druga faza izrade Strategije, odnosno izrada Strategije prometnog razvoja Republike Hrvatske za razdoblje 2016-2030. godine koja će se uputiti u postupak usvajanja od strane Hrvatskog Sabora.

II.

Strateška studija utjecaja na okoliš za Strategiju prometnog razvoja Republike Hrvatske će sadržavati poglavlja koja će dati:

- kratki pregled sadržaja i glavnih ciljeva Strategije i odnosa s drugim odgovarajućim strategijama, planovima i programima;
- podatke o postojećem stanju okoliša i mogući razvoj okoliša bez provedbe Strategije;
- okolišne značajke područja na koja provedba Strategije može značajno utjecati;
- postojeće okolišne probleme koji su važni za Strategiju, posebno uključujući one koji se odnose na područja posebnog ekološkog značaja, primjerice područja određena u skladu s posebnim propisima o zaštiti prirode;
- ciljeve zaštite okoliša uspostavljene po zaključivanju međunarodnih ugovora i sporazuma, koji se odnose na Strategiju, te način na koji su ti ciljevi i druga pitanja zaštite okoliša uzeti u obzir tijekom izrade Strategije;
- vjerojatno značajne utjecaje (sekundarne, kumulativne, sinergijske, kratkoročne, srednjoročne i dugoročne, stalne i privremene, pozitivne i negativne) na okoliš, uključujući biološku raznolikost, zaštićena područja temeljem Zakona o zaštiti prirode, ljude, biljni i životinjski svijet, tlo, vodu, zrak, klimu, materijalnu imovinu, kulturno-povijesnu baštinu, krajobraz, uzimajući u obzir njihove međuodnose;
- utjecaje klimatskih promjena na prometnu infrastrukturu i pripadne mjere prilagodbe na klimatske promjene
- mjere zaštite okoliša uključujući mjere sprječavanja, smanjenja, ublažavanja i kompenzacije nepovoljnih utjecaja provedbe Strategije na okoliš;
- kratki prikaz razloga za odabir razmotrenih varijantnih rješenja, obrazloženje najprihvatljivijeg varijantnog rješenja Strategije na okoliš i opis provedene procjene, uključujući i poteškoće (primjerice tehničke nedostatke ili nedostatke znanja i iskustva) pri prikupljanju potrebnih podataka;
- opis predviđenih mjera praćenja;

III.

Rješenjem tijela nadležnog za zaštitu prirode ocjenjeno je da se u postupku provedbe strateške procjene utjecaja na okoliš, a sukladno članku 49. Zakona o zaštiti prirode, treba provesti postupak Glavne ocjene prihvatljivosti Strategije za ekološku mrežu sa sadržajem propisanim Prilogom II. Pravilnika o ocjeni prihvatljivosti plana, programa i zahvata za ekološku mrežu („Narodne novine“, broj 118/09)

IV.

Popis tijela i/ili osoba određenih posebnim propisima, koja su sudjelovala u postupku:

1. Ministarstvo pomorstva, prometa i infrastrukture,
2. Ministarstvo turizma,
3. Ministarstvo kulture, Uprava za zaštitu kulturne baštine,
4. Ministarstvo zdravlja, Uprava za sanitarnu inspekciju,
5. Ministarstvo graditeljstva i prostornog uređenja,
   - Uprava za graditeljstvo, stanovanje i komunalno gospodarstvo,
   - Uprava za prostorno uređenje,
6. Ministarstvo zaštite okoliša i prirode,
   - Uprava za zaštitu prirode,
   - Uprava za procjenu utjecaja na okoliš i održivo gospodarenje otpadom,
8. Ministarstvo poljoprivrede,
   - Uprava šumarstva, lovstva i drvne industrije,
   - Uprava poljoprivrede i prehrambene industrije,
   - Uprava vodnog gospodarstva,
12. Zadarska županija, Upravni odjel za prostorno uređenje, zaštitu okoliša i komunalne poslove,
13. Karlovačka županija, Upravni odjel za prostorno uređenje, građenje i zaštitu okoliša,
14. Varaždinska županija, Upravni odjel za poljoprivredu i zaštitu okoliša,
15. Dubrovačko-neretvanska županija, Upravni odjel za prostorno uređenje, gradnju i zaštitu okoliša,
16. Brodsko-posavska županija, Upravni odjel za komunalno gospodarstvo i zaštitu okoliša,
17. Bjelovarsko-bilogorska županija Upravni odjel za graditeljstvo i komunalnu infrastrukturu,
18. Šibensko-kninska županija, Upravni odjel za zaštitu okoliša i komunalne poslove,
19. Požeško-slavonska županija, Upravni odjel za gospodarstvo i graditeljstvo,
20. Međimurska županija, Upravni odjel za zaštitu okoliša i komunalno gospodarstvo,
21. Krapinsko-zagorska županija, Upravni odjel za prostorno uređenje, gradnju i zaštitu okoliša,
22. Primorsko-goranska županija, Upravni odjel za prostorno uređenje, graditeljstvo i zaštitu okoliša,

23. Virovitičko-podravska županija, Upravni odjel za prostorno uređenje, graditeljstvo, komunalne poslove i zaštitu okoliša,
24. Zagrebačka županija, Upravni odjel za prostorno uređenje, gradnju i zaštitu okoliša-Odsjek za zaštitu okoliša,
25. Grad Zagreb, Gradski ured za energetiku, zaštitu okoliša i održivi razvoj,
26. Vukovarsko-srijemska županija,Upravni odjel za prostorno uređenje, gradnju i zaštitu okoliša,
27. Istarska županija,Upravni odjel za održivi razvoj,
28. Koprivničko-križevačka županija, Upravni odjel za prostorno uređenje, gradnju i zaštitu okoliša,
29. Ličko-senjska županija, Upravni odjel za graditeljstvo, zaštitu okoliša i prirode te komunalno gospodarstvo,
30. Osječko-baranjska županija, Upravni odjel za prostorno uređenje, graditeljstvo i zaštitu okoliša,
31. Sisačko-moslavačka županija, Upravni odjel za zaštitu okoliša i prirode,
32. Splitsko-dalmatinska županija, Upravni odjel za graditeljstvo, komunalne poslove, infrastrukturu i zaštitu okoliša,
33. Hrvatska zajednica županija,
34. Udruga općina u Republici Hrvatskoj,
35. Udruga gradova u Republici Hrvatskoj,

Na sadržaj su se očitovala slijedeća tijela:

1. Ministarstvo pomorstva, prometa i infrastrukture,
    - Uprava sigurnosti plovidbe
    - Sektor željezničkog prometa i žičara
2. Ministarstvo zaštite okoliša i prirode, Uprava za zaštitu prirode
3. Ministarstvo poljoprivrede
4. Ministarstvo kulture, uprava za zaštitu kulturne baštine
5. Grad Zagreb
6. Krapinsko zagorska županija, Upravni odjel za prostorno uređenje, gradnju i zaštitu okoliš
7. Javna ustanova zavod za prostorno uređenje Splitsko dalmatinske županije
8. Požeško-slavonska županija
9. Međimurska županija, Upravni odjel za prostorno uređenje, gradnju i zaštitu okoliša, Odsjek za zaštitu okoliša i prirode
10. Zadarska županija, Općina Tkon,

11. Zadarska županija, Upravni odjel za prostorno uređenje, zaštitu okoliša i komunalne poslove
12. Zavod za prostorno uređenje Zadarske županije
13. Bjelovarsko-bilogorska županija
14. Varaždinska županija, upravni odjel za poljoprivredu i zaštitu okoliša
15. Dubrovačko - neretvanska županija , upravni odjel za zaštitu okoliša i prirode
16. Hrvatska zajednica županija

Osnovni podaci o izrađivaču Strategije:

Izrađivač Strategije je Ministarstvo pomorstva, prometa i infrastrukture, Prisavlje 14, 10 000 Zagreb

Studiju mora izraditi pravna osoba koja ima suglasnost Ministarstva zaštite okoliša i prirode, za obavljanje stručnih poslova zaštite okoliša - izradu studija o značajnom utjecaju plana i programa na okoliš sukladno Pravilniku o uvjetima za izdavanje suglasnosti pravnim osobama za obavljanje stručnih poslova zaštite okoliša („Narodne novine" br. 57/10).

VI.

Ova Odluka se na propisani način objavljuje na internetskoj stranici Ministarstva u svrhu informiranja javnosti (www.mppi.hr).

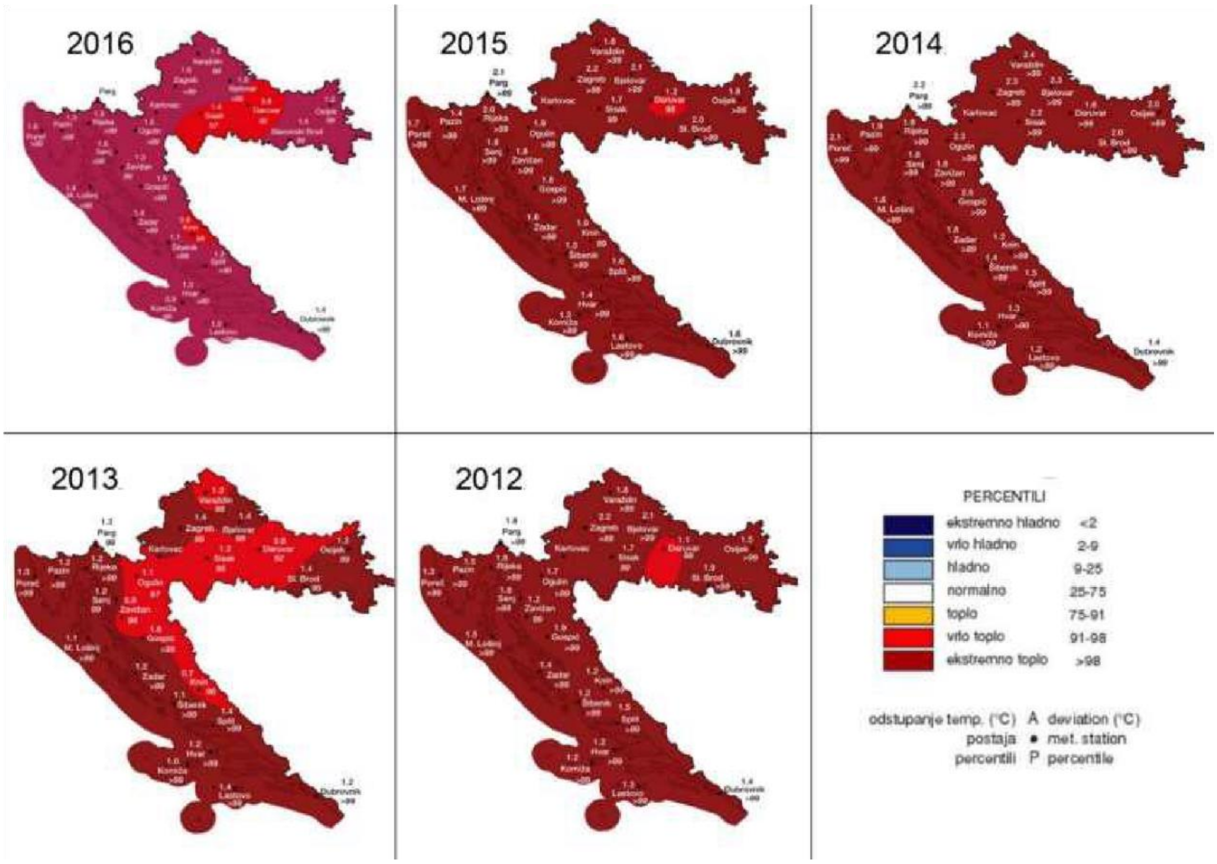
VII.

Ova Odluka stupa na snagu danom donošenja.

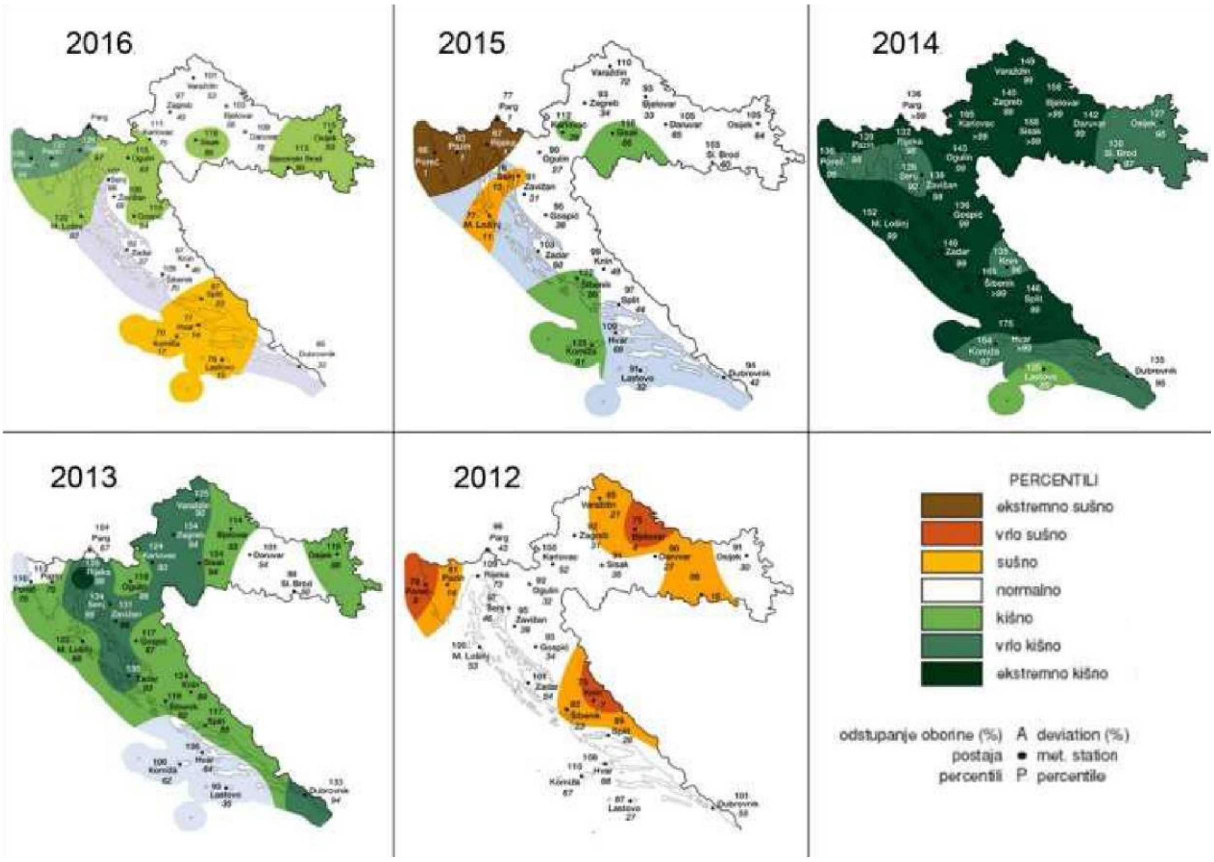
MINISTAR

dr. sc. Siniša Hajdaš Dončić

15.5 Deviation of mean air temperature in the period from 2012 to 2016



15.6 Deviation of rainfall in the period from 2012 to 2016



15.7 Types of general population movements

Type	Characteristic	Trend
E_1	Positive natural change Positive movement established by the census Natural change rate is higher than the increase rate established by the census	Emigration
E_2	Positive natural change Negative movement established by the census Natural change rate is higher than the decrease rate established by the census	Depopulation
E_3	Positive natural change Negative movement established by the census Natural change rate is lower than the decrease rate established by the census	Significant depopulation
E_4	Negative natural change Negative movement established by the census Natural change (decrease) rate is lower than the decrease rate established by the census	Extinction
I1	Positive natural change Positive movement established by the census Census established increase rate is higher than the natural change rate (increase)	Increase due to immigration
I2	Negative natural change Positive movement established by the census Census established increase rate is higher than the natural change rate (decrease)	Recovery due to immigration
I3	Negative natural change Positive movement established by the census Census established increase rate is lower than the natural change rate (decrease)	Low recovery due to immigration
I4	Negative natural change Negative movement established by the census Census established decrease rate is lower than the natural change rate (decrease)	Very low recovery due to immigration

15.8 Age indicators, structure and population density by counties in Croatia in 2011

County name	Surface area in km²	Density	Number of cities	Number of municipalities	Number of towns	Intercensal change index 11./01.	Ageing index (60+/0-19)	Ageing index (65+/0-14)	Average age	Age coefficient (65+), %	Total age dependence coefficient, %	Working age population (15-64 years of age)
Republic of Croatia	**56,594**	**75.71**	**127**	**429**	**6756**	**96.56**	**115**	**116.28**	**41.7**	**17.7**	**49.10**	**2,873,828**
Zagreb	3060	103.79	9	25	694	102.55	100.1	97.08	40.6	15.9	47.44	215,411
Krapina-Zagorje	1229	108.13	7	25	422	93.30	112.6	117.37	41.7	17.6	48.41	89,545
Sisak-Moslavina	4468	38.59	7	12	455	93.02	131.1	134.63	43.0	19.5	51.59	113,750
Karlovac	3626	35.55	5	17	649	90.91	149	157.01	44.0	21.1	52.80	84,359
Varaždin	1262	139.42	6	22	302	95.23	107.3	109.24	41.2	16.8	47.60	119,212
Koprivnica-Križevci	1748	66.12	3	22	264	92.86	110.5	112.92	41.6	17.7	50.23	76,937
Bjelovar-Bilogora	2640	45.37	5	18	323	89.99	114.9	119.37	42.0	18.4	51.01	79,310
Primorje-Gorski Kotar	3588	82.55	14	22	510	96.95	155.3	151.50	43.9	18.9	45.75	203,224
Lika-Senj	5353	9.51	4	8	258	94.88	166	181.57	45.3	24.7	62.04	31,428
Virovitica-Podravina	2024	41.92	3	13	188	90.84	103.3	107.82	41.2	17.1	49.37	56,797
Požega-Slavonia	1823	42.81	5	5	277	90.92	99.2	106.53	40.9	17.9	53.33	50,892
Brod-Posavina	2030	78.12	2	26	185	89.71	96.5	102.89	40.6	17.6	52.96	103,668
Zadar	3646	46.63	6	28	229	104.92	117.4	117.48	41.9	18.5	52.27	111,652
Osijek-Baranja	4155	73.41	7	35	263	92.29	106.3	110.10	41.2	16.9	47.58	206,692
Šibenik-Knin	2984	36.65	5	15	199	96.89	146.1	154.54	44.1	21.8	56.14	70,048
Vukovar-Srijem	2454	73.15	5	26	85	87.67	98.3	100.78	40.6	17.1	51.65	118,382
Split-Dalmatia	4540	100.18	16	39	368	98.09	102.3	101.37	40.8	16.6	49.16	304,915
Istria	2813	73.96	10	31	655	100.83	136.8	134.67	43.0	18.0	45.72	142,780
Dubrovnik-Neretva	1781	68.82	5	17	230	99.75	109.4	109.67	41.5	17.8	51.69	80,804
Međimurje	729	156.11	3	22	131	96.10	91.8	92.34	40.0	15.6	48.12	76,834
City of Zagreb	641	1232.48	1	-	70	101.40	118.9	117.85	41.6	17.3	47.07	537,188

15.9 The rate of total population changes between the 1991, 2001 and 2011 censuses and the interventions for 2020 and 2030, by counties

County name	1991	2001 / 1991	2001	2011 / 2001	2011	2020 / 2011	2020 (projection)	2030 / 2020	2030 (projection)
Republic of Croatia	4.784.265	-7,2%	4.437.460	-3,4%	4.284.889	-3,4%	4.139.098	-5,3%	3.918.127
Zagreb	282.989	+9,4%	309.696	+2,6%	317.606	-0,0%	317.499	-1,8%	311.666
Krapina-Zagorje	148.779	-4,3%	142.432	-6,7%	132.892	-5,9%	125.078	-7,6%	115.613
Sisak-Moslavina	251.332	-26,2%	185.387	-7,0%	172.439	-15,3%	146.123	-21,7%	114.467
Karlovac	184.577	-23,2%	141.787	-9,1%	128.899	-10,6%	115.248	-14,0%	99.090
Varaždin	187.853	-1,6%	184.769	-4,8%	175.951	-4,5%	167.984	-6,6%	156.842
Koprivnica-Križevci	129.397	-3,8%	124.467	-7,1%	115.584	-4,2%	110.728	-5,5%	104.607
Bjelovar-Bilogora	144.042	-7,6%	133.084	-10,0%	119.764	-9,8%	108.003	-12,2%	94.792
Primorje-Gorski Kotar	323.130	-5,5%	305.505	-3,0%	296.195	-2,9%	287.647	-5,6%	271.511
Lika-Senj	85.135	-37,0%	53.677	-5,1%	50.927	-10,3%	45.706	-10,4%	40.961
Virovitica-Podravina	104.625	-10,7%	93.389	-9,2%	84.836	-8,5%	77.613	-10,6%	69.370
Požega-Slavonia	99.334	-13,6%	85.831	-9,1%	78.034	-8,8%	71.141	-9,5%	64.352
Brod-Posavina	174.998	+1,0%	176.765	-10,3%	158.575	-8,8%	144.581	-12,1%	127.027
Zadar	214.777	-24,6%	162.045	+4,9%	170.017	+1,5%	172.610	-0,3%	172.130
Osijek-Baranja	367.193	-10,0%	330.506	-7,7%	305.032	-6,4%	285.494	-9,0%	259.708
Šibenik-Knin	152.477	-26,0%	112.891	-3,1%	109.375	-9,6%	98.838	-11,8%	87.180
Vukovar-Srijem	231.241	-11,4%	204.768	-12,3%	179.521	-10,7%	160.389	-15,2%	136.083
Split-Dalmatia	474.019	-2,2%	463.676	-1,9%	454.798	+0,0%	454.893	-1,0%	450.490
Istria	204.346	+1,0%	206.344	+0,8%	208.055	+0,1%	208.243	-1,6%	204.955
Dubrovnik-Neretva	126.329	-2,7%	122.870	-0,2%	122.568	-1,7%	120.471	-3,6%	116.185
Međimurje	119.866	-1,2%	118.426	-3,9%	113.804	-2,4%	111.128	-4,3%	106.392
City of Zagreb	777.826	+0,2%	779.145	+1,4%	790.017	+2,5%	809.681	+0,6%	814.706

15.10 Natural change, migration balance and types of general population movements from 2001 to 2011

County	Population		Total change		Natural change 2001 - 2010		Migration balance		Type of general population movement
	2001	2011	aps.	%	aps.	%	aps.	%	
	P1	P 2	D	r	PP	rPP	Ms	ms	
Zagreb	309,696	317,606	7,910	2.55	-3231	-1.04	11,141	3.60	I_2
Krapina-Zagorje	142,432	132,892	-9,540	-6.70	-7413	-5.20	-2,127	-1.49	E_4
Sisak-Moslavina	185,387	172,439	-12,948	-6.98	-10315	-5.56	-2,633	-1.42	E_4
Karlovac	141,787	128,899	-12,888	-9.09	-9521	-6.72	-3,367	-2.37	E_4
Varaždin	184,769	175,951	-8,818	-4.77	-5455	-2.95	-3,363	-1.82	E_4
Koprivnica-Križevci	124,467	115,584	-8,883	-7.14	-5437	-4.37	-3,446	-2.77	E_4
Bjelovar-Bilogora	133,084	119,764	-13,320	-10,01	-6681	-5.02	-6,639	-4.99	E_4
Primorje-Gorski Kotar	305,505	296,195	-9,310	-3.05	-10238	-3.35	928	0.30	I_4
Lika-Senj	53,677	50,927	-2,750	-5.12	-4308	-8.03	1,558	2.90	I_4
Virovitica-Podravina	93,389	84,836	-8,553	-9.16	-3867	-4.14	-4,686	-5.02	E_4
Požega-Slavonia	85,831	78,034	-7,797	-9.08	-2135	-2.49	-5,662	-6.60	E_4
Brod-Posavina	176,765	158,575	-18,190	-10.29	-3130	-1.77	-15,060	-8.52	E_4
Zadar	162,045	170,017	7,972	4.92	-175	-0,11	8,147	5.03	I_2
Osijek-Baranja	330,506	305,032	-25,474	-7.71	-9787	-2.96	-15,687	-4.75	E_4
Šibenik-Knin	112,891	109,375	-3,516	-3.11	-4908	-4.35	1,392	1.23	I_4
Vukovar-Srijem	204,768	179,521	-25,247	-12.33	-3106	-1.52	-22,141	-10.81	E_4
Split-Dalmatia	463,676	454,798	-8,878	-1.91	3975	0.86	-12,853	-2.77	E_3
Istria	206,344	208,055	1,711	0.83	-4150	-2,01	5,861	2.84	I3
Dubrovnik-Neretva	122,870	122,568	-302	-0.25	563	0.46	-865	-0.70	E_2
Međimurje	118,426	113,804	-4,622	-3.90	-18	-0,02	-4,604	-3.89	E_4
City of Zagreb	779,145	790,017	10,872	1.40	-5710	-0.73	16,582	2.13	I_2
Republic of Croatia	**4,437,460**	**4,284,889**	**-152,571**	**-3.44**	**-95047**	**-2.14**	**-57,524**	**-1.30**	E_4

15.11 Share of reported vacancies in the total number of registered unemployed persons, in %

County	2011	2012	2013	2014	2015	2016
ZAGREB	30	30	28	33	54	81
KRAPINA-ZAGORJE	39	37	44	55	84	127
SISAK-MOSLAVINA	23	22	21	20	29	36
KARLOVAC	26	27	30	29	43	57
VARAŽDIN	63	56	49	83	133	198
KOPRIVNICA-KRIŽEVCI	55	42	40	42	79	107
BJELOVAR-BILOGORA	32	31	29	27	39	54
PRIMORJE-GORSKI KOTAR	59	63	58	64	108	168
LIKA-SENJ	62	58	66	53	73	89
VIROVITICA-PODRAVINA	40	37	28	21	37	38
POŽEGA-SLAVONIA	34	32	34	34	52	72
BROD-POSAVINA	25	26	24	28	45	68
ZADAR	46	46	54	63	100	144
OSIJEK-BARANJA	31	30	37	29	50	59
ŠIBENIK-KNIN	56	75	63	71	85	110
VUKOVAR-SRIJEM	31	26	22	26	43	48
SPLIT-DALMATIA	32	30	30	35	55	70
ISTRIA	101	102	114	150	224	334
DUBROVNIK-NERETVA	65	67	55	59	86	123
MEĐIMURJE	77	58	57	78	110	150
CITY OF ZAGREB	48	54	61	74	105	143
Total	**41**	**41**	**42**	**47**	**71**	**96**