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INTEGRATED APPROACH TO THE MANAGEMENT OF THE LANDSCAPE FOR THE IMPLEMENTATION OF THE DANUBE STRATEGY

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Abstract

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The EU Strategy for the Danube Region represents a new form of territorial cooperation. Its ambition is to establish a mechanism of joint responsibility of the countries in the Danube Region for the economic and social development respecting the preservation of natural and cultural heritage. The Strategy is built on four basic pillars: connectivity, building of prosperity, strengthening of the Danube Region and protection of the environment. The Strategy declares the necessity of interdisciplinarity and integrated approach to building a sustainable development of the Region. The scientific base of such an integrated management concerning the landscape and environment is in general the geosystem approach to the landscape, the managerial basement is the harmonisation of the development of the society with the natural, socio-economic and cultural-historical potential of landscape. The integration of both these bases needs a proper system of mutually complementary scientific methods and their implementation to the institutional tools convenient for the Danube Region. The goal of the article is to outline the possibilities for joining/implementation of scientific methods through legally supported tools to integrated landscape management and regional development.

Key words: macro-regional strategy, integrated landscape management, cross-cutting issues, sustainable development, Danube Region.

Introduction

The European Union dedicates much attention to regional cooperation for solving environmental problems, which overstep the local and regional boundaries such as the climate change, the biodiversity loss, desertification, natural risks and hazards, and so on. The Strategy for the Baltic Sea Region is one example of such complex regional strategies. That strategy was followed by the EU Strategy for the Danube Region (further on EUSDR) as the response to the Austrian-Rumanian initiative. Other examples are the strategies for Adriatic and Ionian Region, and for the Alpine Region (Fig. 1). These EU macro-regional strategies were

initiated and requested by the EU Member States (and in some cases, the non-EU countries) located in the same geographical area via the European Council. The macro-regional strategies are also accompanied by a rolling action plan to be regularly updated.



Fig. 1. European Union macro-regional strategies (EC, 2019b).

The EUSDR was approved at the session of the European Council on the 24th of November, 2011. Its ambition is to produce a mechanism of common responsibility of the countries in the Danube Region for their economic and social development, to raise the Danube Region to the 21st century level, that is, safe, attractive and self-assured, at the same time respecting conservation of natural and cultural heritage (EC, 2019a). Along with the support to the socio-economic development of the Region, the strategy also aimed to face the environmental challenges as water pollution, floods, droughts, soil erosion, loss of biodiversity and climate change.

The EUSDR defines four basic pillars, that express the core fields of action of the Strategy (Table 1). In terms of communication and indicating the direction of actions, as well as a reference to the Cohesion Policy Legislative Package 2021–2027 (EC, 2018), the four Pillars are labelled as:

1. Connecting the Danube Region – smart and sustainable.
2. Protecting the Environment – clean and green.
3. Building Prosperity – smart, social and innovative.
4. Strengthening the Danube Region – effective, sound and safe.

Each pillar specifies and describes its priority areas, main targets, the actions, projects and processes, where the macro-regional strategy can contribute to improvements. Each priority area is managed by two Priority Area Coordinators (PACs).

Following the EUSDR, an Action Plan for the implementation of the EUSDR was adopted, which specifies in detail the individual pillars, priorities and projects (EC, 2020).

T a b l e 1. Pillars and priority areas of the European Union Strategy for the Danube Region (EC, 2019a).

Pillars	**Priority Areas**	**Countries in charge of coordination**
1 Connecting the Danube Region – smart and sustainable	1A Waterways Mobility - "To improve mobility and intermodality of inland waterways"	Austria and Romania
	1B Rail-Road-Air Mobility - "To improve mobility and intermodality – rail, road and air"	Slovenia and Serbia
	02 Sustainable Energy - "To encourage more sustainable energy"	Hungary and the Czech Republic
	03 Culture & Tourism - "To promote culture and tourism, people to people contacts"	Bulgaria and Romania
2 Protecting the Environment – clean and green	04 Water Quality - "To restore and maintain the quality of waters"	Hungary and Slovakia
	05 Environmental Risks - "To manage environmental risks"	Hungary and Romania
	06 Biodiversity, Landscapes, Air & Soil Quality - "To preserve biodiversity, landscapes and the quality of air and soils	Land Bavaria (Germany) and Croatia
3 Building Prosperity – smart, social and innovative	07 Knowledge Society - "To develop the Knowledge Society (research, education and ICT)"	Slovakia and Serbia
	08 Competitiveness - "To support the competitiveness of enterprises"	Land Baden-Württemberg (Germany) and Croatia
	09 People & Skills - "To invest in people and skills"	Austria and Moldova
4 Strengthening the Danube Region – effective, sound and safe	10 Institutional Capacity & Cooperation - "To step up institutional capacity and cooperation"	City of Vienna (Austria) and Slovenia
	11 Security - "To work together to tackle security and organized crime"	Germany and Bulgaria

The EUSDR as well as an action plan declared the obvious necessity of the integrated approach to the solving of those problems. Nevertheless, this effort still remained at a theoretical level.

The necessity of the scientific and integrative approach for EUSDR were also pronounced on the 5th Annual Forum of the EU Strategy for the Danube Region on the 3rd and 4th of November, 2016, in Bratislava. The Forum was jointly organised by the Slovak Republic (current Presidency of the EUSDR), the European Commission (Directorate General for Regional and Urban Policy - DG REGIO, and first time together with the Directorate General of the Joint Research Center - DG JRC). The last, that is, the 8th Annual Forum of EUSDR was held on the 27th and the 28th of June, 2019, in Bucharest under the motto: 'Building cohesion for a shared prosperity in the Danube Region.' The 9th EUSDR Annual Forum, jointly organised

by the Republic of Croatia, the European Commission and the Danube Transnational Programme with the support of the Danube Strategy Point, will take place on 22nd of October, 2020, as a virtual event (due to the current COVID-19 pandemic).

For increasing the quality of living in the Danube Region, the Strategy needs to focus its activities on (strategic) objectives describing the strategic and long term changes, like:

- counteracting Climate Change,
- stimulating Sustainable Development,
- establishing and enforcing Knowledge Society, stimulating the Economy and fight Poverty.
- improving Mobility and Connectivity,
- enhancing Democracy, sound Administration and strong Involvement of Civil Society and Youth (EC, 2019a).

It is to state, that a real integrative approach to the whole scope of the agenda of EUSDR is too ambitious. Therefore, an inevitable early step for the application of the interdisciplinary and integrative principles is to find and develop mechanisms for partial steps, and, to publish the good practice achieved in countries. This paper presents a scientifically based approach to the principles of the integration of the knowledge of landscape ecology with the existing management/spatial planning tools. This kind of integration might be marked as the integrated landscape management. Such an approach might become as a recourse for the solution of environmental and ecological problems within the EUSDR. All the more, the tools that we included to the integration are available – although in slightly different forms – in all countries of the Danube Region, thereby they might be respected in broad context.

The paper focuses on the evaluation of the situation such as the principles of integrated landscape management included in the EUSDR and proposes a set of measures for the successful implementation of integrated management in real practice. The application of an integrated approach to management is necessary in terms of fulfilling the principles and objectives of sustainability and ensuring regional sustainable development of the territory. It will prevent the emergence of new ones, eliminate current environmental problems and also ensure the protection and efficient use of the area's resources and potentials.

The Danube Region: regional specifications

The Danube Region covered by the EUSDR is mainly the basin of the 2.857 km long Danube river, including also the parts of the mountain ranges where its tributaries originate (like the Alps or the Carpathians). It stretches from the Black Forest (Germany) to the Black Sea (Romania-Moldova-Ukraine). The Danube Region is the natural catchment area of the Danube river – including the catchment areas of the tributaries – stretching to 14 Danube countries with a total area of 801,463 km^2. The Danube Region is home to around 115 million inhabitants, where different cultures, ethnicities and religions meets. Different levels of historical development, socio-economic statuses and different legislations caused that their approach to protection, management and land use is different too (Wrbka et al., 2004; Wascher, 2005). Nine countries of this region, namely Germany, Austria, the Czech Republic, the Slovak Republic, Hungary, Slovenia, Bulgaria, Romania and Croatia are EU members, while five of them – Serbia, Bosnia and Herzegovina, Montenegro, Ukraine and Moldova – are not (Fig. 2).



Fig. 2. The Danube Region (Copyright © EUSDR 2019a).

The Danube Region comprises of remarkable variety of landscape structures, where lowlands with an important stock of water sources and top quality agricultural land alternate with mountain ranges of the Carpathians and the Alps with unique flora and fauna, down to the exclusive natural landscape in the Danube delta, which needs really a very comprehensive system of management (Bastian et al., 2006; Csorba, Szabó, 2009; Divíšek et al., 2014; Mezősi et al., 2016).

It represents diverse, specific and rare areas with unique natural and cultural/historical resources. The natural heritage of the Danube Region is of European importance, and is home to over 2,000 plant and over 5,000 animal species. It hosts over half of the European populations of bears, wolves and lynx as well as important bird sanctuaries for species like Dalmatian pelican. The delta of the Danube River is one of the world's largest wetlands featuring rare fauna and flora, as well as thirty different types of ecosystems. This rich natural heritage resulted in the creation of 2,860 Natura 2000 sites (including 230 sites along the Danube itself) (EC, 2020).

Regarding the interlinked landscape system of the Region though, the attitude to environmental protection in one country may affect environmental quality of all adjacent countries. Ecological phenomena do not know administrative boundaries and so many ecological phenomena and processes occurring in one country can either negatively or positively affect the ecological conditions in the surrounding countries. This is the base logical reason for integration and harmonisation of development activities of all countries in the Danube Region.

This unique natural asset is under growing pressure. The biodiversity and variety of ecosystems of the region are being gradually reduced – species and living spaces, wetlands and floodplain areas disappear. Additionally, deforestation, land and air pollution grow. Rural

areas suffer from depopulation and land abandonment. Much of this is due to the rapid industry, urban, transport and agriculture development and sprawl during recent years: natural resources are over exploited. The environment infrastructure necessary is not yet well developed. Land pollution is worsened by non-compliant municipal landfills and numerous contaminated sites. The public awareness about the ecological needs in the eastern part of the region is not sufficient, as well as the knowledge and use of best available practices (EC, 2020). At present, climate change also plays a significant role in threatening biodiversity as well as individual natural resources.

Material and methods

The base for integrated landscape management was already stated in Agenda 21 (1992). Chapter 10 of AGENDA 21, titled as *'Integrated approach to the management of land resources'* defined the basic theses of integrated landscape management, as follows:

- all activities may take place in the same landscape, but they are in conflicts, therefore they need an integrated approach,
- if an activity harms one component of the landscape, also the other components are endangered and so is the overall functioning, ecological balance and stability of the landscape. On other side, an optimal measure applied to protect the landscape as a whole may protect all other individual components.

AGENDA 21 defined the request for integrated management as follows: *'Government on appropriate level ... should: a) Adopt planning and management systems that facilitate the integration of environmental components such as air water, land and other natural resources, using landscape ecological planning (LANDEP) or other approaches that focus on, for example, ecosystem or a watershed.'(*Agenda 21, Chapter 10, para 1.0.7).

AGENDA 21 designated as the basic tool for such approach the physical planning, which should be the obligatory frame and basis for all other planning processes.

According to those theses, the concept of integrated landscape management today is generally recognized as the best frame for the management of natural resources, which accomplishes several environmental objectives such as reduction of soil degradation, conservation of biodiversity, keeping the water in the ecosystems, flood prevention, improvement of water quality and reduction of the factors accelerating the climate change. It is also considered an innovative way to mitigate the size, duration and rate of negative effects of humans on landscape (Stelfox, 2004), but also a frame for the achievement of economic and social targets, even as tool for minimising occasional prices and effects of communities (Hagmann et al., 2002; Crossman, Bryan, 2007).

The European Union shows a very strong effort towards the application of integrative tools towards the optimum utilization of natural resources. In particular the IPPC Directive, the NATURA 2000 and the Water Framework Directive should be mentioned in this respect. All the above mentioned intended to be supported by the INSPIRE Directive, which enforces the integrated spatial information system as the inevitable basement of integrated approach. The Water Framework Directive defines the integrated river basin management *as the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin.*

As other concepts of integrative character, the Europäische Raumordnungs Charta (1983), the Alpine Convention, the Carpathian Convention, the Danube River Protection Convention and the European Landscape Convention (2000) of the EEC might be mentioned, and naturally also, the EUSDR and other macro-regional strategies.

However, the integrated management also became a fashionable term. Laymen and specialists often use it referring to most different procedures and activities. In agreement with still valid theses of Agenda 21, the main principles of integrated landscape management for scientific, as well as for practical reasons, are defined as follows:

a. The management is a ruling device, it comprises the chain planning – organising – controlling, which harmonizes the demands of different sectors with respect to sustainable development.
b. Accordingly, the integrated management is not a concrete physical activity executed, for example, in watersheds, in nature conservation areas, in forestry, in agriculture and so on. Those, of course, may finally lead to the expected effects, but they are just physical, sectorial works, while the management is the policy, which rules and obliges the subjects to provide such works.

These principles are still valid and they have been supported by all successive conferences of Rio Summit ´92 and other international conferences. The present trends of the sustainable development are determined also by further integrative principles as (Izakovičová et al., 2018):

- Partnership and supra-sectorial approach, as a principle of cooperation between individual sectors and industries. It is the economic precondition of the integrated management, in particular pronounced since the Rio+10 World Summit of Sustainable Development in Johannesburg in 2002.
- Supra-regionality, as the principle of spatial cooperation. It is the spatial-political precondition of the integrated management, also one of the principle of EUSDR.
- Landscape-ecological complexity, as the principle of scientific/professional integration, the principle of the integrated approach towards the natural resources. It is the natural-scientific precondition of the integrated management.

The basic methodological procedure was analysis of documents and literature review, which focused on defining and evaluating the basic aspects of integrated landscape management and how these principles of integrated landscape management are implemented in the Danube Strategy and its application. As the results of this effort, the definitions of the basement terms in legal acts might be quoted.

We analysed the following documents:

- EUSDR,
- Action Plan for the Implementation of the Danube Strategy,
- literature sources defining the basic principles of integrated landscape management,
- international projects realised in the Danube Region.

Based on analysis of the diversity of such tools and approaches, the basic principles and criteria of integrated landscape management were defined, the analyses of the legal and planning tools that support integrated landscape management were devoted. Finally, the possible impact of such integrated landscape management on the Danube Region was defined.

The integrated landscape management and the landscape

The integrated landscape management is elaborated in different publications (Caims et al., 1994; Slocombe, 1998; Szaro et al., 1998; Siebert et al., 2004; Bezák, 2006; Izakovičová, Kozová, 2008). All these authors underlined that the integrated landscape management must be based on interdisciplinary, complex and balanced research in three areas, as in environmental, social and economical sphere (Tress, Tress, 2001). A special effort should be given to the research of the interconnections and interrelations between particular areas components, complexes and areas. In particular, the relation between environmental and social-economic area is of key importance, since in general, the businesses beside of high social and economic effects, have negative environmental impact on the landscape.

Coming out of the above mentioned principles of integrated management, the material basis for such a process must be a complex – integrated – material entity (Miklós et al., 2015). Integrated landscape management is based on understanding the landscape as geosystem – an integrated system of the space, georelief and all other natural, man-influenced and man-made components of the landscape – material resources in certain area – as geological, water, soil and biotic sources, climate, land-use, man-made objects (Naveh, Lieberman, 1993; Miklós, Izakovičová, 1997; Mezősi et al., 2016), non-material socio-economic phenomena in the landscape and their relations. The space is the integrating frame of particular natural sources in a given area. Every point of earth's surface presents specific homogeneous entity of mutual combination of listed sources – components, which through their attributes are capable to satisfy human needs, and as such in relation to human society, act as natural resources.

Results and discussion

As approved, the EUSDR rests on 4 basic pillars expressing the core fields of action of the Strategy (interlinking, promotion of prosperity, strengthening of the Danube Region and environmental protection) and 12 priority areas comprising thematic areas where the macro-regional strategy can contribute to improvements (Fig. 3). This structure fits the new challenges and objectives.

The Strategy encourages an integrated approach (e.g., environment, mobility, economic development, human resource development, etc.). It emphasizes that each priority area has

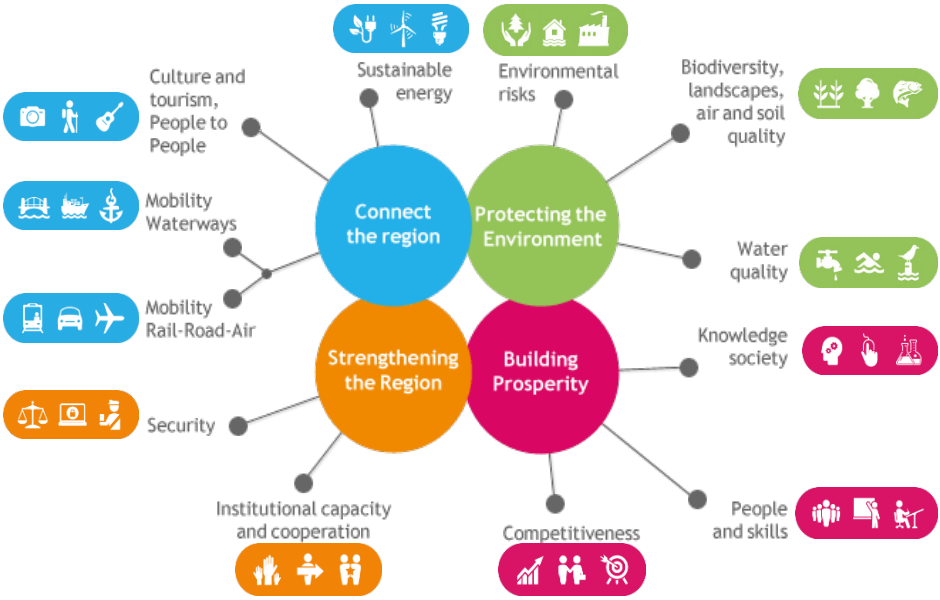


Fig. 3. The structure of the EUSDR: pillars and Priority Areas (source: EC, 2019a).

to be considered with other policy fields. For example, climate change mitigation and adaptation have an impact on transport, energy, tourism, research and so on. Policies whilst the latter also have an impact on climate change. Improving transport infrastructure has a positive impact on the business environment, on the attractiveness of cities and regions or on the mobility of citizens, it can also have negative impacts on landscapes, biodiversity, quality of air, soil and water. In the energy sector, it is desirable to increase the production of energy from renewable sources, but this cannot be done at the expense of biodiversity. All these matters need to be looked at together, with a view to the most sustainable (EC, 2019a).

Cooperation between Priority Areas is important on any issues concerning multiple priorities. These so-called 'Cross-cutting issues' are selected areas of cooperation, aiming at strengthening reciprocal coordination among Priority Areas. Cross-cutting issues are gaining importance due to the success of the EUSDR as a result of emerging new topics and policy fields and also because of integrated approach as the recommended method. The fact that the declared integrated approach to regional development remained in theory without being projected into concrete objective is still a problem.

Based on the evaluation, it can be stated that goals and principles of integrated landscape management were not implemented within the EUSDR application consistently. Cooperation and coordination in the Danube Region between individual countries is very weak, the overall impact of the Strategy is not very high. Macro-regions have a higher impact within sector policies than within Priority Areas that seek for local implementation and less national steering (Sielker, Mirtl, 2017; Roggeri, 2015). It shows that at EUSDR level, exchange of infor-

mation and joint strategies are predominant. At Priority Area level, joint working structures and joint pilot actions are established. At Pillar as well as on national level, cooperation is less developed and is mainly made up of exchange of information (EC, 2019a). However, this cooperation focuses on the preparation of documents and not on the implementation of joint projects.

The major concrete achievement is the set-up of cooperation structures and new partnerships. In the solution of joint projects, cross-border cooperation is relatively well developed, for example, INTERREG V-A Romania-Bulgaria 2014-2020 and INTERREG – IPA Bulgaria-Serbia 2014-2020, INTERREG V-A Slovakia-Austria /2016/01 No. Realisation of the of common strategic projects that are crucial for the Danube Region, was very poor.

The main gaps hindering a sound implementation are by far the current available funding framework and the lacking political commitment and ownership. Additionally, the lacking political commitment and ownership of local/regional/national governments, as well as on the macro-regional level is a second major gap hindering a sound implementation of the strategy.

The definition of horizontal priorities (cross-cutting topics) across the established Priority Areas, effective international cooperation at the level of participating countries and spatial planning at the level of the whole region is the basis for fulfilment of the EUSDR objectives and ensuring sustainable development of the region (EC, 2019a).

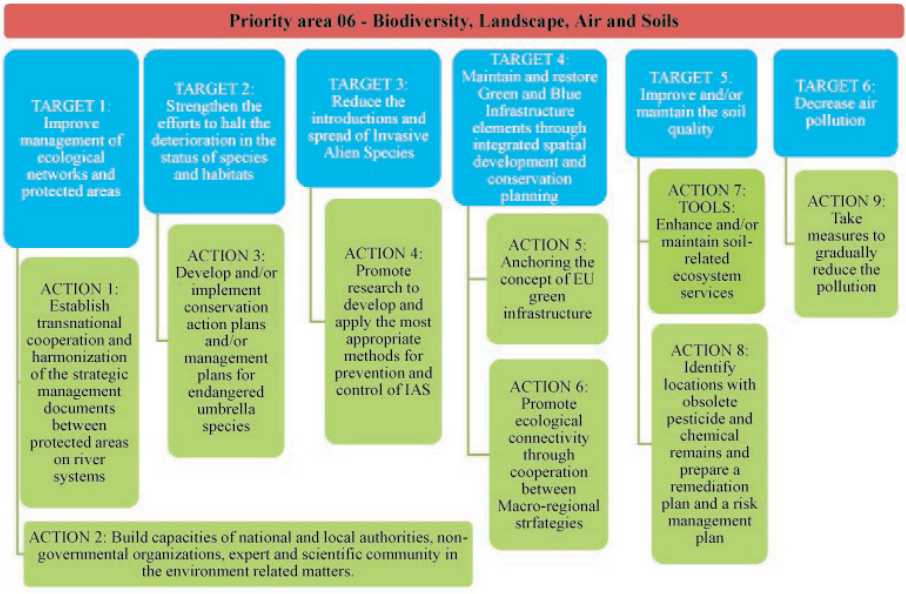


Fig. 4. Structure of Pillar 2, Priority Area 06: Biodiversity, Landscape, Air and Soils – Targets and Actions.

From the landscape-ecological point of view, the basic goal of the integrated landscape management is harmonisation of the localisation and functioning of all requested human activities with the natural, socio-economic and cultural-historical potential of a given region. Such a development is based on a synchronized balance of the supply, which is represented by the complex value of the given region and the demand, which represents the development requests of the society in this region (Bastian et al., 2020).

The principles of integrated landscape management are very well defined at the theoretical level within the Targets and Actions of individual Pillar. The problem, however, is their application in real practice. Coordination between Priority Areas and Pillars is essential. From the point of view of integrated landscape management, the most relevant is Pillar 2 'Protecting the Environment.' Based on the Targets and Actions of Pillar 2, Priority Area 06 'Biodiversity, Landscape, Air and Soils' (Fig. 4), the following basic principles has to be fulfilled to achieve ecologically optimum organisation and utilization of the landscape.

a) Maintenance of overall biodiversity and ecological stability of the landscape (Pillar 2: Protecting the environment, Priority Area 06: Biodiversity, landscapes, air and soils, Target 1/ Action 1, 2 and Target 4/ Action 5, 6) as the most general and basic condition for preservation of the gene pool, biological diversity, balance, flexibility and natural functioning ecosystems, which basically also means maintenance of landscape's natural production capacity. Overall ecological landscape stability is given by the proportion of areas in various stages of naturalness, their spatial distribution, way of use and level of protection (Fig. 5). The Danube river

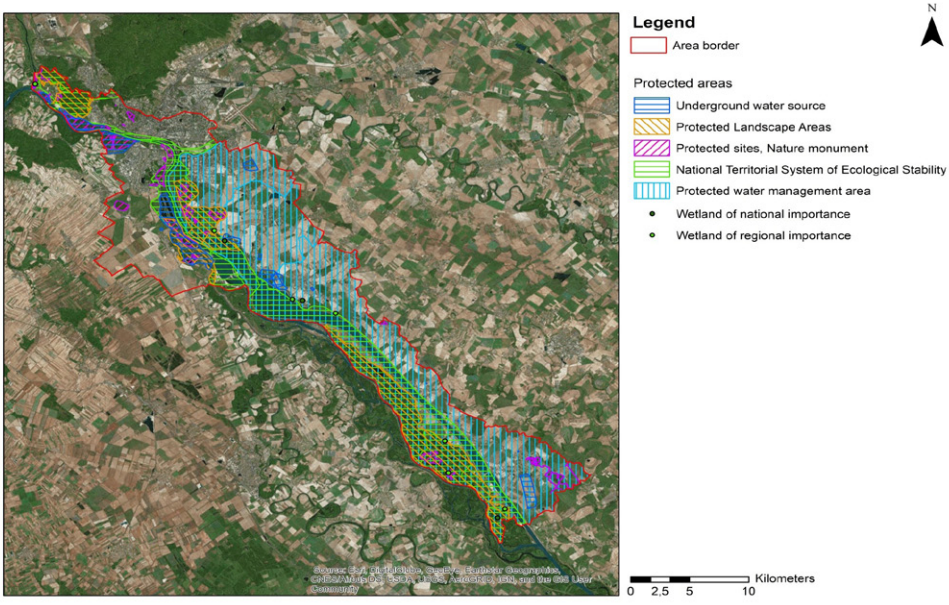


Fig. 5. Nature and Landscape Conservation of Danube Region in Podunajská nížina (Danubian lowland), on border line with Slovakia, Austria and Hungary.

itself represents a supraregional biocorridor with unique flora and fauna. Many of these rare ecosystems are threatened by pressures of uncoordinated territorial development, which occupies valuable biotopes, causes fragmentation, builds barriers to migration of biota, thus braking the continuity within the key part of the Pan-European ecological network (Jongman, 1995; Diviaková, 2011; Miklós et al., 2011) and the European Green Belt (Wrbka et al. , 2009). Risky in this sense is also the uncoordinated navigation on the Danube. Natural localities with abundant flora and fauna often become interesting for investors. It is indispensable to survey all representative geoecosystems of the concerned territory, to evaluate their ecosystem services and then propose the cross-border functional and interlinked ecological network, which is much more than the mere existence of set of protected areas or the NATURA 2000. Obviously, the provision for protection of the geoecological diversity as the indispensable condition for conservation of the biodiversity in the Danube Region is crucial. It would also be necessary to coordinate the management of protected areas within the Danube Region.

Preservation of ecological stability therefore proceeds first of all by ecological optimisation of the spatial structure and use of the landscape, that is, by appropriate spatial distribution of landscape element, the appropriate land-use and protection (Naveh, Lieberman, 1993; Jongman, 2003; Haber, 2008).

b) Protection and rational use of natural resources (Pillar 2: Protecting the environment, Priority Area 04: Water quality, Target 1/ Action 1,2,3, Target 2/ Action 4, Target 4/ Action 6; Priority Area 05: Water quality, Target 3/ Action 4; Priority Area 06: Biodiversity, landscapes, air and soils, Target 5/ Action 7,8, Target 6/ Action 9), namely air, water, soil, biotic resources, mineral sources. The status of natural resources is defined by their amount, health condition, production capacity (Fig. 6), and presence of foreign substances. The Danube Region avails itself of remarkable natural resources: water, agricultural land and forest. Reserves of mineral materials are equally important. However, these resources are often threatened and subsequently degraded. Water quality in the Danube has improved during the last decade, but further improvement is still needed. Most stretches of the Danube can be described as moderately polluted, but some tributaries and stretches of the lower Danube fail to achieve this status. As regards a general spatial distribution of key water quality parameters along the Danube river in 2017, the highest concentrations of biodegradable organic matter were observed in the middle and lower parts of the river. The concentration of nutrients and cadmium reached their highest concentration values in the middle and lower part of the Danube. In some areas, harmful substances from farmland and heavy industries pollute the rivers and severely undermine the quality of the water (ICPDR, 2017). Underground waters in farming areas of the Region display an increased presence of pesticides and heavy metals. Sources of pollution vary starting by the release of waste water produced by urbanisation and industries directly into the Danube river and its tributaries over the negative impact of chemicals applied in forest management, and ending by waste dumping in close vicinity of the stream, even direct dumping of waste in water. Industrial crashes, inherently a rapid and massive threat to water in the Region, also represent a great risk. Forests, apart from being confronted with important pressure in the form of recreation activities, are also indirectly threatened by the change of the ecologi-

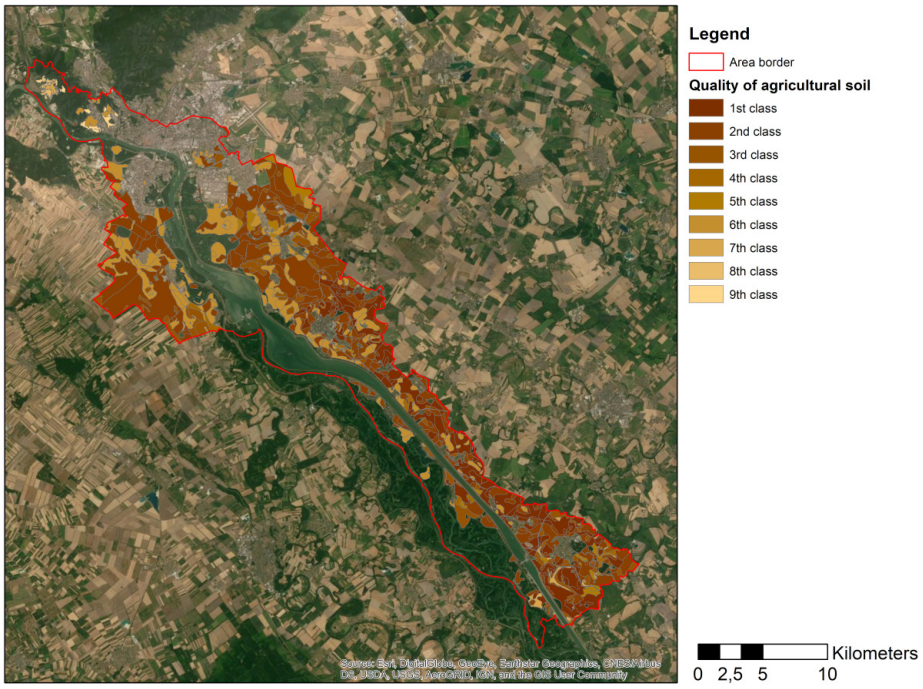


Fig. 6. Agricultural land protection – credit soil-ecological units (CSEU) of Danube Region in Podunajská nížina (Danubian lowland), on border line with Slovakia, Austria and Hungary.

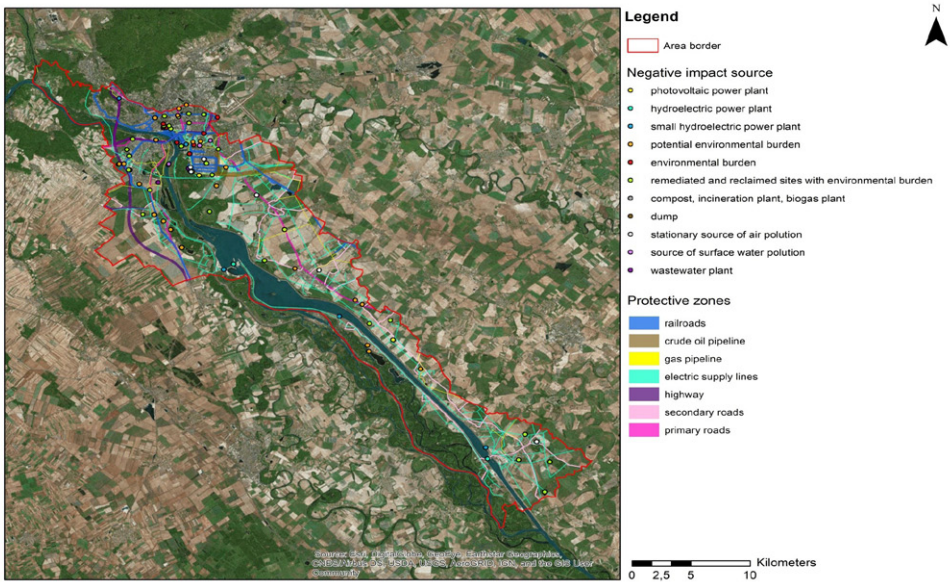


Fig. 7. Negative factors – Stress factors of Danube Region in Podunajská nížina (Danubian lowland), on border line with Slovakia, Austria and Hungary.

cal environmental factors (negative effects of contamination of individual environmental components, changed hydrological regime because of climate change or due to various investing activities, etc.). Likewise, users themselves threaten the soil particularly by incorrect husbandry practices and by negative effects of other sectors causing chemical or physical degradation of soils. Mining of minerals is also harmful to landscape by occupation of valuable ecosystems, generation of anthropogenic relief forms, and disturbed hydrological processes, contamination of components of ecosystems through air and soil pollution.

Their protection and rational use proceeds either based on optimal spatial arrangement of objects and activities, or by optimisation of technological processes applied by the industries and by regulation of their use (Haber, 2008).

c) Protection of the immediate environment of humans diversity (Pillar 2: Protecting the environment, Priority Area 05: Water quality, Target 3/ Action 4, Target 4/ Action 3; Priority Area 06: Biodiversity,landscapes, air and soils, Target 5/ Action 8, Target 6/ Action 9), means provision for good quality of environmental components and mitigation of unfavourable risk factors such as polluted air in residential areas, noise, radiation, vibrations, wastes, dust, or light effects (Fig. 7). They are also referred to as environmental stress factors (Izakovičová, 2000). The character of landscape and overall environmental aesthetics in many countries of the Danube Region is often affected by overall deterioration, illegal landfills, abandoned and neglected areas, abandoned buildings and structures. Deteriorated quality of the environment subsequently has a negative effect on the quality of life.

The protection against these adverse effects leans first of all on optimisation of technological processes of the producing industries, transport, services, as well as on spatial organisation of the landscape elements with different use.

d) Protection against occurrence and consequences of natural risks and hazards (Pillar 2: Protecting the environment, Priority Area 05: Water quality, Target 2/ Action 1, 5, Target 4/ Action 3) where flood defence, protection against draught connected with increased water discharge from a basin, protection against manifestations of geo-dynamic processes including landslides and the like belongs. The basic condition for ensuring this principle is suitable land use, which respects the limits, given by the abiotic status of the territory and implementation of technological measures, which mitigate manifestations of natural risks. Floods, erosion and accumulation processes have been recently perceived as very risky phenomena. On the other side, the ever more frequent draughts represent a considerable threat for farming and food production. Frequency of these extreme phenomena in the territory is not only determined by the climate change but also by the unsuitable management of the territory (Jakubcová et al., 2016).

This is where the need of optimisation of land use and implementation of eco-stabilizing measures mitigating manifestations of natural risks and hazard in our basin is truly necessary (Fig. 8).

To solve the presence of this complex of natural risk factors, other plans were adopted in 2015 by International Commission for the Protection of the Danube River (ICPDR). The Danube River Basin Management Plan - Update 2015 (DRBM Plan) and the 1st Danube Flood Risk Management Plan (DFRM Plan). These two plans set the water management priorities for the Danube River Basin until 2021. The DRBM Plan aims to further protect



Fig. 8. Natural risks - flood on Podunajská nížina lowland - Bratislava, part Devín (photo: Piscová, 2020).



Fig. 9. Positive environmental landscape at the Danube Region - settlement Jahodná (photo: Miklósová, 2020).

and enhance the status of all the waters, to prevent their deterioration and to ensure the sustainable, long-term use of water resources. It establishes and strengthens several integrative principles for river basin management, including economic approaches and integration with other sector policies like energy, transport and adaptation to climate change (ICPDR, 2015a).

The DFRM Plan represents sustainable flood risk management. It addresses all the aspects of flood risk management focusing on prevention, protection and preparedness, includes measures for achieving the established objectives (ICPDR, 2015b).

e) Provision for conservation of social and cultural diversity (Pillar 1: Connecting the region, Priority Area 3: Culture and Tourism, Target 3, Action 6, 7) based on respect for ethnic, religious and cultural and/or historical specificities of individual communities forming the given territory. Each ethnicity or religion is characterized by different customs and traditions, some are more sensitive others more aggressive to their environment and landscape where they live (Fig. 9). Many have created rare and precious biotopes and historically valuable landscape structures that stand out not only from the cultural point of view but also ecological (Bugár et al., 2020). The communities where the development is not always in harmony with the environmental protection must be addressed with utmost sensitivity, systemic education and edification, by presentation of positive examples to follow.

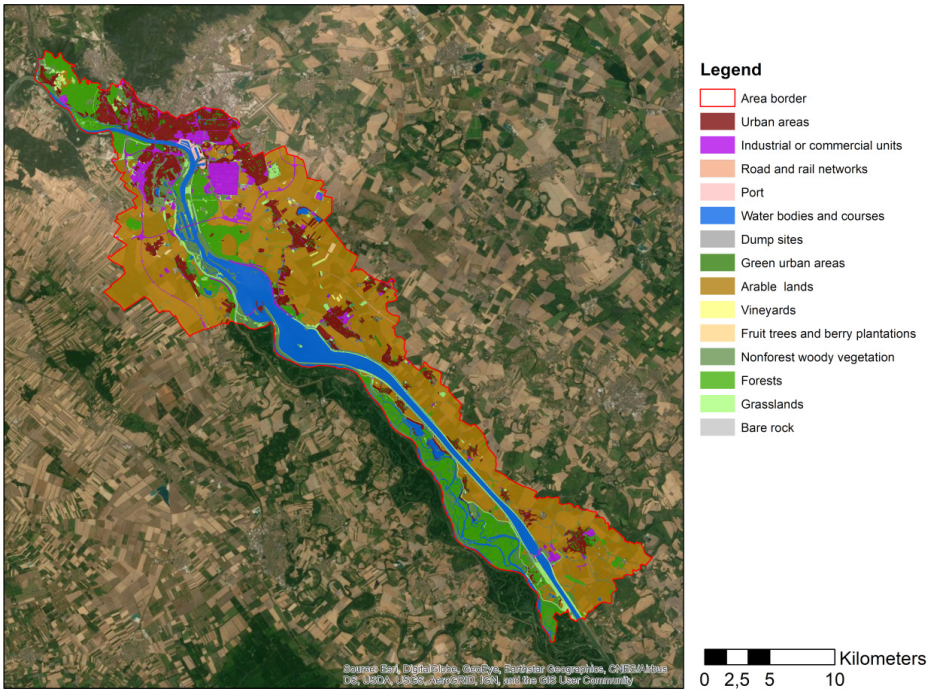


Fig. 10. Land cover - study area of Danube Region in Slovakia, in Podunajská nížina (Danubian lowland), on border line with Austria and Hungary.

This objective can be ensured like the preceding aims by ecologisation and humanisation of superstructure, coordination of economic, and legal tools and humanisation of the collective consciousness, but partly also with the means of optimisation of landscape structure and appropriate management of the historical structures of the country forcible methods would lead to a blind alley.

For summary, the basic tools for fulfilling the above mentioned basic principles are:

- ecological optimisation of the spatial structure of the landscape – optimal spatial arrangement of objects and activities,
- by optimisation of technological processes,
- coordination of economic and legal measures,
- effective education.

These sets of activities that must be interconnected in the sense of Agenda 21, can be comprehensively called integrated landscape management. The basis of the whole process should be the ecological optimization of land use. In Slovakia, this definition has been codified in the most integrative legal tool for landscape management – in *Act No. 50/1976 Zb., on territorial planning and building order, in the reading of the amendment Act No. 237/2000 Z.z.* as a base for all other spatial planning tools.

In the case of non-acceptance of these principles in the management of the landscape, various conflicts of interest in the use of the landscape and subsequently the emergence of various ecological and environmental problems resulting from these encounters of interests may occur (Izakovičová, 1995; Izakovičová et al., 2018). The evaluation of environmental and ecological problems resulting from the sectoral approach in the management and use of the landscape is presented on the example of a study area – a selected part of the Slovak Danube region.

T a b l e 2. Area of land cover types of the study area in ha.

Type of land cover	**area (ha)**	**% of total area**
Industrial or commercial units	2404.80	5.149
Grasslands	2666.74	5.710
Water bodies and courses	6046.72	12.947
Bare rock	2.71	0.006
Forest	5560.05	11.905
Non-forest woody vegetation	3768.14	8.068
Fruit trees and berry okabtatuibs	59.05	0.126
Vineyards	91.32	0.196
Arable land	19 799.15	42.394
Green urban areas	777.42	1.665
Dump sites	18.36	0.039
Port	97.21	0.208
Roads and railroads network	129.27	0.277
Urban areas	5281.95	11.31
TOTAL	46 702.86	100.000

T a b l e 3. Inter-sectoral issues.

Inter-sectoral issues
Agriculture – water management
- Endangerment of water resources due to intensive use of chemical compounds: runoff of chemicals into watercourses, seepage of foreign substances into groundwater, seepage of excrements into groundwater, seepage of fuels from mechanization - Limitation of use of the highest quality soils due to water resources protection zones: limitation of chemicals usage and machinery usage in agriculture, increased technical requirements for location and operation of animal farms
Agriculture – forestry
- Pressures to remove forest ecosystems in favour of agricultural production
Agriculture – industry
- Pressures on covering highest quality soils by building storage and production areas: construction of industrial areas, logistics centres, warehouses and so on - Endangerment of the highest quality soils due to industrial exhalations: Increased concentration of contaminants in soils - Limitation of agricultural production in the protection zones of industrial plants
Agriculture – transport
- Endangerment of the highest quality soils due to transportation exhalations: increased concentration of contaminants in soils
Agriculture – urbanization
- Pressures on highest quality soils coverage due to urban development: reducing the total area of the highest quality soils - Endangering the quality of the environment: increased noise, dust, odour
Agriculture – recreation
- Pressures on highest quality soils coverage due to development of recreational facilities: expansion of cottage built-up areas and recreational areas

T a b l e 4. Intra-sectoral issues.

Intra-sectoral issues
Agriculture - agriculture: endangerment of the own production source by the farmer himself
- Soil degradation by chemicals : pollution of the highest quality soils due to increased use of chemicals - Physical degradation of soil: compaction, erosion and other adverse effects due to inappropriate soil management

The study area is situated in Slovakia, at the south-western part of the Podunajská nížina (Danubian lowland), on border line with Austria and Hungary. The area is spanning from Bratislava city, following the Danube river and country border to cadastre of municipality Gabčíkovo with a total area of 46.702 ha. It includes continuous urban fabric of Bratislava city, rural land of small municipalities and natural aspects of Podunajská nížina (Danubian lowland). The area itself is comprised of 23 cadastral areas of municipalities and 10 districts of Bratislava city. Dominant land use form in the model area is agriculture (Fig. 10). The structure of land use elements is given in Table 2.

T a b l e 5. Supra-sectoral issues.

Supra-sectoral issues
Agriculture – nature conservation and biodiversity protection
- Endangerment of natural ecosystems due to expanding of agricultural production: their destruction and transformation into agroecosystems - Endangerment of plants and animals (biodiversity) due to the accompanying negative effects of agriculture (noise, light effects, chemicals usage and subsequent contamination of the environment) - Physical disturbance of natural ecosystems and their components due to intensive use of heavy machinery - Endangerment of wetlands due to changes in the hydrological regime of the area - Limitation of agricultural activities in protected areas and their protection zones
Agriculture - landscape protection
- Increasing anthropization of the area and endangering the spatial ecological stability of the area - Disruption of the traditional character of the rural landscape by the creation of large-scale arable land patches and the construction of residential areas
Agriculture – landscape aesthetics
- Creation of a monofunctional intensively used agricultural landscape without vegetation with low aesthetic value - Endangerment of the aesthetics of area by abandoned dilapidated livestock production objects

Some examples of environmental problems are presented as conflicts of interests in the agricultural sector, as agriculture is the dominant sector in the study area. The issues are integrated into different levels on the basis of interaction.

Inter-sectoral issues are reflected in conflicts of interests between the agriculture and other productive and non-productive sectors of the national economy (Table 3). Intra-sectoral issues are related to the agricultural development and endangering its productive resource, which is agricultural land (Table 4), while supra-sectoral issues are the relationship between the agricultural development and environmental protection (Table 5).

If we want to eliminate and also prevent the occurrence of new environmental and ecological problems in the Danube region, we must respect the following theses (Miklós et al., 2011; Izakovičová et al., 2019; Primmer, Furman, 2012; Bezák, 2006; Dick, 2011; Sielker, 2016):

- Principle of supra-regionality: For successful implementation, it is necessary to consider the model territory of the whole basin of the Danube River. The natural units have to be preferred to administrative units as the ecological or stress phenomena and processes do not respect administrative boundaries, they rather depend on natural conditions such as relief, climate, land use and so on. The space and position of the watersheds are the scene and factor of an integrity of individual natural resources in a given territory.
- Supra-sectorial principle: The frequently neglected environmental principles must be respected by all industries and sectors of the economic and social development. Pref-

erence of the economic development at the cost of environmental and social factors is inadmissible in the light of sustainability principles. All problems are normally interlinked: for instance, changes of land use greatly influence the territorial biodiversity and stability, pollution and overburdening of individual environmental components requires investments into mitigation of the resulting damage and implementation of new technologies, closure of operations with negative environmental impact is often connected with social problems including unemployment, increase of negative social phenomena and so on.

- Principle of landscape-ecological complexity: The optimum organisation and use of the territory must be considered in the light of a complete set of properties of the geosystem, it rests precisely on the confrontation of conditions provided by the geosystem with the requirements of society (Špinerová, 2010). Therefore, the geosystem approach in certain space must be applied (Miklós, Izakovičová, 1997).
- Principle of coordination and participation: All possible actors and stakeholders must be invited to participate in implementation of the Danube Strategy. Only such cooperation can ensure success. The importance of involving stakeholders in decision-making processes, particularly in the field of efficient use of ecosystem services, has been stressed upon by various authors (Martinez-Harms et al., 2015; Primmer, Furman, 2012; Fontaine et al., 2014; IPBES, 2015; Sielker, 2016).

Proper education will also be indispensable because only educated and well-informed population will be prepared to apply all the measures and recommendations in everyday practice.

As already mentioned, the integrated management of the landscape is not a single tool. Therefore, the complex procedure of harmonising the demands of all the sectors towards the landscape needs an extraordinary effort and consensus of stakeholders on different hierarchic levels.

Conclusion

There are significant differences between trends of regional development among regions along the common axis of the Danube river. The economic differences and their effect, while comparing different regions, are visible. These differences also influence the approach to the regional development and access to environmental protection. Regarding the interlinked landscape system of the Danube Region though, the attitude to environmental protection in one country may affect environmental quality of all the adjacent countries. This is the base logical reason for integration and harmonisation of development activities of all the countries in the Danube Region. The 1990s have seen a strong surge in the number of cross-border regions all over Western, Central and Eastern Europe. Many of these regions exhibit positive trends in the coordination of joint development (Perkmann, 2003; Johnson, 2009; Kuus, 2011; Bański, 2013; Szmigiel-Rawska, 2014). This experience can be an inspiration for all the countries of the Danube Region, so we highly appreciate the initiative and effort of the EUSDR to coordinate these activities.

On the other hand, one of the declared principles of the Strategy, particularly that of "not to create anything new," though acceptable from the practical point of view, is not altogether opportune. The Commission declares that no new legal regulations, new insti-

tutions and finances are necessary for the implementation of the Strategy. That very same principle underlines the necessity for increased endeavour to create at least new mechanisms and procedures for harmonization of corresponding existing legal tools to an integrated corpus. The realization of the above-mentioned goals is quite complex. However, almost in all countries of the Danube Region exist tools that might be harmonized and arranged in order to implement the above defined principles of the integrated management of the landscape. Those tools are the spatial planning procedures like the physical/territorial planning, the watershed management, the land arrangement and consolidation, and forestry planning. Other legal tools that should be included in the planning procedures are those that deal with the whole territory of Danube Region and with all human activities, such as the nature conservation, the flood management, as well as the not yet institutionalized, but very popular approaches of the landscaping and landscape architecture.

As the renewed EUSDR Action Plan (EC, 2020) will be approved just in the preparatory phase of the funding period 2021–2027, this period can be perfectly used for better integrating strategic actions of the EUSDR into programming processes relevant for the Danube Region. There is persistent importance of continuing to use macro-regional strategies as a strategic framework for promoting more coherent and synergic implementation of EU policies, programmes and funds.

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