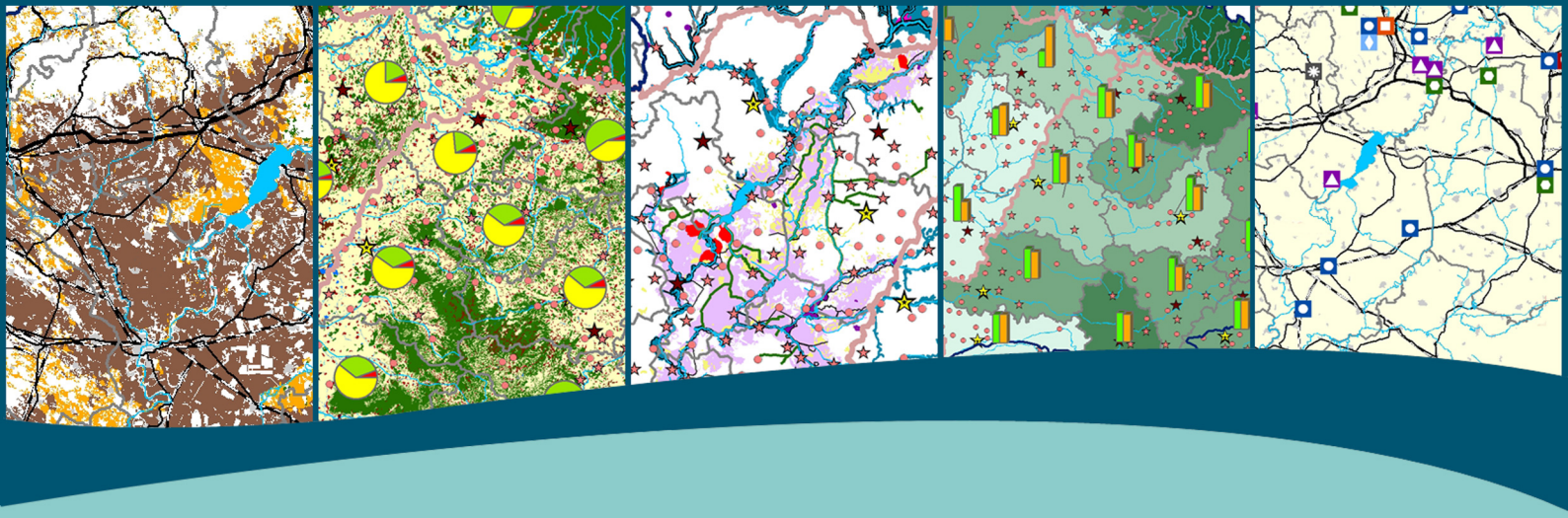

Tisa Catchment Area Development

Synthesis of the National Analyses

Jointly for our common future

TICAD

SOUTH EAST EUROPE
Transnational Cooperation Programme

TICAD
TISA CATCHMENT AREA DEVELOPMENT

Programme co-funded by the EUROPEAN UNION

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The docment synthetises the territorial analyses prepared by the five countries concerned, targeting the Tisa catchment area of Ukraine, Romania, Slovak repoblik, Hungary and Serbia.

The synthesis is prepared by the VÁTI Hungarian Nonprofit Limited Liability Company for Regional Development and Town Planning with the contribution of the project partners responsible for the analyses of the catchment area of their own country.

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CONTENT

INTRODUCTION

The Tisa Catchment Area stretches to the eastern half of the Carpathian Basin and is flanked by the interior ranges of the Carpathian Mountains. The territory of 157 thousand square kilometres is rich in natural resources; water, both surface and sub-surface: rivers and lakes as well as drink-water, thermal and mineral water supplies; abundant mineral deposits: coal, oil, gas and a broad range of minerals; fertile soil, excellent climatic conditions for farming; woodlands, groves, meadows and pastures of great expanse; consolidated settlement network; precious architectural, artistic and natural monuments; rich historic traditions; peoples of cultural, ethnic, national diversity; assiduous and talented workforce.

This same area, however, tormented by natural and technological disasters (floods, forest fires, draught, wind-storms and industrial explosions, toxic pollutions) as well as by wars and animosities has suffered tremendous losses too. The deposits of mines are gradually exhausted. Within five years, from 1995 to 2000 the woodland decreased by no less than 16 % (from 46,572 km^2 to 39,181 km^2). Large stretches of land have become unproductive because of subsequent draughts and floods, pollutions; wastewater has contaminated the waters, neglect and un-thoughtful developments resulted the decay and even the vanishing of historic monuments; the obtrusive and by now often derelict manufacturing, mining and infrastructure developments have devoured most beautiful landscapes. And the territory is losing from its most precious resource, people too.

In March 2001, after two significant waves of pollution that arrived from Romania and spread along the Tisa River and certain streams in its catchment area and caused ecological disaster, the decision of the Ministerial Committee of the European Council asked the concerned states (Hungary, Romania, Serbia and Montenegro, Slovakia and Ukraine) to cooperate in order to prevent cases similar to the disasters affecting the Tisa and Someş rivers, including the potential elaboration of an agreement under the auspices of the European Council.

The five countries situated in the Tisa River Basin agreed with the appeal and undertook cooperation in this issue. With the active participation of the European Council, the “Expert Group” of experts delegated by the above countries as well as other international organisations concerned prepared the basic document of cooperation entitled “Initiative on Sustainable Spatial Development of the Tisa River Basin”, which the five countries concerned adopted unanimously.

With signing the “Initiative”, a joint work started. For the coordinated continuation and extension of the work the responsible ministries and planning institutes of the partner states submitted a successful application to the **South-East Europe Trans-national Cooperation Programme**. In June 2009 the implementation of the Tisa Catchment Area (TICAD) project started with a kick-off meeting, with the participation of 14 organisations from the five affected countries and the Tisa Group of the International Commission for the Protection of the Danube River (ICPDR).

The **aim of the Tisa Catchment Area Development** – TICAD – **trans-national project** is to contribute to the harmonisation of the integrated territorial developments implemented in the river basin, to facilitate the creation of a sustainable economic structure, the optimal utilisation of natural and cultural resources, the development of areas of competitive growth and to promote the establishment of the internal and external functional interdependencies of the network of settlements.

Within the framework of the project the partners elaborate a common methodology and data base, on the basis of which they prepare the analysis of territorial processes on national level and following that on catchment level, develop trans-national complex development strategy and formulate common policy resolutions. In the course of this work they create a forum for international cooperation for planners and decision-makers as well as ensure publicity.

The present document is the **territorial analysis of the catchment area,** elaborated on the basis of a unified and accepted methodology and the five national assessments.

I. INTERNATIONAL DEVELOPMENT TRENDS AND MAIN RELEVANT EU POLICIES

I.1. EUROPEAN SPATIAL DEVELOPMENT DIRECTIVES

The 1990's represented a period of development, growth and prosperity in the life of the European Union. Economic development, strengthening integration and territorial enlargement resulted in the reassessment of development policy and foregrounding the need for *territorial cohesion*.

European Spatial Development Perspective (ESDP)
The ESDP is a common document of the ministers responsible for spatial development of the member states and the Directorate General for Regional Policy of the European Commission, which contains jointly formulated and approved recommendations. Its approach and orientation, which is of decisive importance for European spatial planning and the development policy of the EU, can be summarised as follows:
The *value system of the ESDP* is based on the principle of *sustainable development*. Its determining factors are *understanding and managing responsible foresight and territorial interdependencies.*
Characteristics:

- Integrated (harmonising the aspects of environment, society and economy)
- Strategic (defines interlinked actions)
- Indicative (its implementation is the responsibility of member states and regions)

The topics of the sixty development policy recommendations formulated in the course of consultations and the exchange of opinions are the following:

- Polycentric spatial development and a new urban-rural relationship (balanced urban network, urban-rural relations)
- Parity of access to infrastructure and knowledge (transport, IT development)
- Wise management of the natural and cultural heritage (protection and utilisation of natural and cultural values)

CEMAT Guiding Principles
Following the development of the ESDP, the material entitled **"Guiding Principles for Sustainable Spatial Development of the European Continent" (CEMAT Guiding Principles**) was prepared and adopted at the *European Council Conference of Ministers Responsible of Spatial Development (CEMAT)* held in Hanover in 2000, which brought together representatives of the 47 member states. It agrees with the ESDP in its approach, orientation and the system of its objectives. It takes a step forward with the designation types of *geographical areas* "requiring special treatment".
It highlights the following types of regions:

- cultural landscapes,
- urban areas,
- rural areas,
- coastal and island regions,
- mountains,
- floodplains and alluvial valleys,
- Euro corridors,
- redundant industrial sites, deteriorated industrial areas
- border regions.

Both the ESDP and the CEMAT Guiding Principles outline the tasks which serve the practical enforcement of the formulated principles, and record the need for analyses which explore the territorial processes and the enforcement of the formulated spatial development principles.
A series of other work processes and materials affecting the future of the region were elaborated on the basis of the two main European documents containing spatial development principles.

Vision Planet
One of the series of works following the system of values of the ESDP – CEMAT principles is the Vision Planet project of 1998-2002, which belongs to the INTERREG II C CADSES (for Central Europe, Adriatic, Danubian and South Eastern Space, surrounded by Germany, Austria, Northern Italy and Greece) programme. The substantive aim of the project for elaborating the integrated spatial development strategy of the CADSES region was to initiate cooperation and joint work between the spatial planning and research experts of the former socialist countries and the EU member states, and to explore and analyse the fundamental territorial characteristics and qualities of the region.
The importance of the work is indicated by the fact that the CADSES region includes the entire territory of 13 European countries (Albania, Bosnia and Herzegovina, Bulgaria, the Czech Republic, Greece, Croatia, Yugoslavia, Hungary, Macedonia, Moldova, Romania, Slovakia and Slovenia), as well as part of the territory of five countries (Austria, Poland, Germany, Italy and Ukraine), including regions regarding which the European Union had only minimal knowledge. The situation report resulted in really useful information, and the joint work meant the start of actual professional cooperation.

Carpathian Euroregion VASICA
The *Carpathian Euroregion* was formed in 1993 with the participation of Poland, Hungary, Slovakia and Ukraine, and Romania joined the association in 1997. The status of Euroregion initially provided a framework only for occasional bi- or trilateral cooperation along the border. Strategy development work on a regular basis evolved in the course of the INTERREG III B CADSES programme in 2000-2006. The aim of the Carpathians project was the sustainable development of the region based on the rich natural and cultural heritage, with the cooperation of 18 institutions from ten countries. Besides detailed and synthesised analyses and spatial development recommendations, a collection of maps and a four-language manual were prepared for local governments and investors. The summary document entitled *VASICA (Visions and Strategies for the Carpathian Area* was presented and discussed in 2008 at the Vienna conference on the strategy for the Carpathian region.
In May 2003 in Kiev the *Czech, Hungarian, Polish, Romanian, Serbian, Slovakian and Ukrainian ministers responsible for spatial development* signed a *Framework Agreement* on the protection and sustainable development of the values of the region.

Sustainable development of the Tisa Region
The creation of the CEMAT Initiative is discussed in the Introduction.
The agreement entitled Sustainable Spatial Development of the Tisa Region was presented at the 13th Session of the CEMAT.
The spatial development cooperation agreement set the following objectives:
- balanced social and economic development, improved competitiveness, promoting territorial cohesion;
- development generated by urban functions, the relationship between the town and the countryside;
- promoting accessibility;
- reducing environmental damage;
- enhancing and protecting natural resources and the natural heritage;
- enhancing the cultural heritage as a factor for development;

- developing energy resources, maintaining safety;
- encouraging high quality, sustainable tourism;
- limitation of the impact of natural disasters by preventive measures.

The following were set as basic conditions within the framework of the strategy to be developed:

- the protection of the landscape and fragile ecosystems,
  - water systems management in the course of spatial planning, the conservation of streams and lakes, limitation of the areas which can be occupied by urban expansion and intensive agriculture, flood protection;
- promoting territorial cohesion
  - (balanced territorial management, urban functions, urban-rural relationship, accessibility and access to information and knowledge), conservation of the natural and cultural heritage, encouraging high quality and sustainable tourism, the development of energy resources while maintaining safety;
- identifying the most efficient instruments of funding the programmes and projects for the sustainable development of the Tisa River basin, especially by involving international organisations and funds.

Bilateral cooperation started on the basis of the CEMAT initiative, and the present TICAD project is an expansion and synthesised continuation of these.

Interlude

The millennium brought a new perspective as well as new considerations and tasks for the European Union. These did not evolve as a result of a new turn, but manifested themselves following known antecedents, with an increased emphasis.

The message of the 1992 UN World Conference, the principle of sustainable development and the Agenda 21 predominated the development policy of the European Union in the 1990's in a perceptible manner. However, during the preparation for the new World Conference of 2002, it seemed advisable to publish an own sustainable development document for the EU. This is the so-called **Gothenburg Strategy of 2000** on the sustainable development of the EU.
The other emphatic topic, which also influenced the preparation of the UN World Conference, was *globalisation,* and the need for the *international – global – competitiveness* of the EU. The European Union's answer to this is elaborated in the **Lisbon Strategy**, also adopted in 2000**.** The document sets the daring and categorical objective of that the European Union *should become the leading knowledge-based economy in the world, outstanding in the field of productivity, research – development – innovation and full employment*.

The Territorial Agenda of the EU

With the accession of ten, then another two new member states (and thus with increasing disparities in territorial development) and as a result of the change in circumstances and research due to other factors (climate change, an ageing population, globalisation, etc.), improved and better-founded knowledge of the situation of the European Union offered reasons and opportunities for the rethinking and complementation of the spatial development principles set in the ESDP, and the elaboration of new European spatial development directives based on the principles of the ESDP.
Two significant spatial development documents were discussed and adopted at the consultation of the ministers responsible for spatial development of the European Union and the representatives of the European Commission, held in Leipzig in May 2007. One background material which offers an extended analysis of the present situation and an exploration of the expected future is entitled

"Territorial State and Perspectives of the European Union". The other is the **Territorial Agenda of the European Union.**

The document records the *main challenges* facing the European Union. Due to the change in the situation the scope of these is larger and the tension is more acute then at the time of development of the ESDP in the 1990's.

The challenges recorded by the material are the following:

- the geographical concentration of the population and the economy, the falling behind of internal and external peripheral areas,
- ageing and migration
- climate change
- loss of biodiversity
- increasing environmental and technological risks
- the scarcity of energy resources, rising energy prices
- increasing global competition.

As an answer to the challenges for the implementation of the principles of sustainable development, competitiveness and territorial cohesion, the material defines strategic objectives grouped in the following categories:

- polycentric development of urban areas and urban networks
- strengthening the urban – rural partnership
- development of trans-national competitive and innovative regional clusters (international territorial cooperation in the creation and operation of interconnected, competitive, innovative research – education – production – commercial units)
- strengthening of trans-European technological (transport, communication, information technology, energy) networks
- trans-European risk management (prevention of technological and natural disasters within the framework of international cooperation)
- the protection and utilisation of ecological structures and cultural resources.

The directives lay an even greater emphasis than before on the following:

- the aspects of globalisation (advantages, disadvantages, requirements)
- the disparities of the expanded territory of the European Union
- the priority of developing a knowledge-based economy.

During the formulation of the priorities of the Territorial Agenda the designation of types of geographical regions was also carried out (*integrated development of coastal zones, maritime and river basins and mountainous areas). In this way, the Territorial Agenda of the European Union also provides a framework for the integrated territorial strategy of the Tisa region*. The TICAD project and its continuation can be joined with the current development process of the EU Strategy for the Danube Region.

I.2. DIRECTIVES FOR THE PROTECTION OF NATURAL RESOURCES

The so-called principle of sustainable development, which ensures the preservation of natural resources for the future generations, requires the integration of environmental protection in the field of water management as well. The principle of sustainable water management means that it is important to create a balance between satisfying social needs and demands and preserving the quality and quantity of water as an environmental value.

I.2.1. Water management

Water Framework Directive

European legislation regarding water has been continuous since 1975. More than a dozen different directives had been developed by 1995 in order to prevent water pollution. In spite of the fact that in some cases the quality of water has improved, a lot of problems and tasks to be solved have arisen, which prompted the rethinking of the regulations. In 1997 agreement was born regarding the need to create a new regulation providing a framework for the earlier legal norms, in order to ensure the consistency and appropriateness of the water policy of the Community. This led to the creation of the new water policy of the European Union and the ***Water Framework Directive*** 2000/60/EC *"establishing a framework for Community action in the field of water policy"*, which serves its implementation. The exact date of its adoption is 23 October 2000, and it came into force on 22 December 2000. The Water Framework Directive (WFD) is the most important instrument for enforcing the new water policy of the EC. According to its provisions, the condition of all surface and underground waters has to be improved in the member states of the European Union by 2015, and the sustainability of this improved condition has to be ensured.

The Framework Directive covers all water bodies of the Community (inland surface waters, transitional waters, coastal waters and groundwater), its aim is the improvement of water quality and achieving the good condition of all waters by 2015.

In the case of surface waters (e.g. rivers, lakes, etc.) good condition means both the ecological and chemical status of the water. Ecological status depends on the condition of the ecosystem of the water, while chemical water quality is determined by the concentration of certain pollutants. A surface water body can be considered of good condition if the above parameters show only slight divergence compared to the natural condition. In the case of groundwater the monitoring of certain parameters (oxygen, pH, conductivity, and nitrates) is compulsory. The quantity of groundwater is also very important: it has to be known how much water can be extracted from a given source, and how long it takes for the water base to recharge in natural conditions. Thus the good condition of groundwater means that neither the extent of water extraction nor the level of pollution causes a problem.

If the concentration of a pollutant resulting from human activity significantly and continuously rises, the member state concerned is obliged to take steps in order to arrest and reverse the process. As a result of the above and the strict monitoring regulations, the directive will presumably have a beneficial effect on wetlands and other types of habitats in the case of both surface waters and groundwater.

Floods Directive

Directive 2007/60/EC of the European Parliament and of the Council *on the assessment and management of flood risks* aims to reduce and manage the risks floods pose to human health, the environment, infrastructure and property. The directive requires that the management of flood risks be discussed across national borders, and promotes commitment to improving transparency and involving the citizens. The directive prescribes the execution of four tasks for the member states (as well as those countries which adopt and wish to implement the considerations of the directive):

- preliminary flood risk assessment by 2011,
- the preparation of flood hazard maps and
- flood risk maps by 2013, as well as
- flood risk management plans by 2015.

The directive obliges member states to harmonise their activities with those member states and countries outside the Union with which they share a river basin, and requires them not to implement any measures which could increase flood risk outside their territory, except if agreements with the countries concerned are in place regarding these measures.

ICPDR International Commission for the Protection of the Danube River

The **International Commission for the Protection of the Danube River** was established by 13 countries (Germany; Austria; the Czech Republic; Slovakia; Hungary; Slovenia; Croatia; Serbia-Montenegro; Bosnia and Herzegovina, Bulgaria; Romania; Moldova and Ukraine) and the European Union as contracting parties, with its headquarters in Vienna, in order to coordinate the implementation of the **Danube River Protection Convention**. The **Danube River Protection Convention**, signed in 1994 by representatives of the eleven countries along the Danube, came into force in 1998. Its aim is the protection of the Danube River and its entire river basin against pollution and damaging effects, and its sustainable utilisation. The task of the Commission is to support the creation of a river basin management plan covering the entire basin and meeting the requirements of the EU Water Framework Directive.

Besides the examination, assessment and planning tasks related to the Danube river basin, the ICPDR also assumes an active role in the sub-territories (Tisa, Drava, Sava basins, Danube Delta).

At the meeting of the ministers of the ICPDR countries in December 2004, the ministers and the high-ranking representatives of the Tisa countries signed a memorandum on preparing the Tisa River Basin management plan ensuring the sustainable development of the region. The ICPDR established the **Tisa Group** to coordinate the task, whose main responsibility connected to the international, national and regional activities affecting the Tisa River Basin is the strengthening of coordination and the exchange of information, in order to ensure the harmonisation and efficiency of these activities. The countries of the Tisa Group agreed to prepare by 2009 the Tisa River Basin management plan, which integrates the issues related to water quality, water quantity, landscape and water management, flood protection and droughts. By 2007 the situation report of the Tisa River Basin was prepared, which analyses the main environmental and water management problems in the context of water quality and quantity.

I.2.2. Nature protection

Natura 2000

The network of **Natura 2000** sites was created by the European Union for the protection of the biological diversity, the remaining natural habitats and the wild species of animals and plants of the member states.

The Natura 2000 network of the European Union is formed by two types of interconnected protected areas:

Special Protection Areas – SPA

These are designated by the member states on the basis of the provisions of the Birds Directive (79/409/EEC), adopted in the countries of the European Union in 1979. This group of protected areas was created for the protection of rare and endangered species of wild birds and their habitats. The member states designate the areas on the basis of the incidence of species listed in Annex I of the Birds Directive, requiring the implementation of special measures, as well as of migratory species.

Special Areas of Conservation – SAC

These are constituted by areas designated on the basis of the Habitats Directive (92/43/ECC) of the European Union, adopted in 1992, which the Union considers worthy of protection. The Habitats

Directive serves the protection of all species of animals and plants occurring in natural conditions on the territory of the member states, with the exception of bird species, as well as the protection of their natural habitats. Special Areas of Conservation are designated on the basis of Annexes I (Natural habitat types of Community interest) and II (Animal and plant species of Community interest) of the Habitats Directive. The Habitats Directive clearly states that the designation of Natura 2000 areas does not aim to arrest economic development or to create closed reservations. The designation of an area as part of the Natura 2000 network does not mean the restriction of human activities if they are sustainable from an environmental point of view and do not endanger the area, the unity of the habitats found in the area, or the species protection objectives regarding the area.
Member states are obliged to create management plans for the protection of the Natura 2000 areas, and to implement the measures contained therein.
Tasks in the Natura 2000 network areas:

- Preparation of a management plan for the purposes of environmental protection.
- To ensure the continuous supervision (monitoring) of the condition of Natura 2000 areas and the natural values of the areas
- The basic data of Natura 2000 areas have to be stored in a computer database, and information services based on this have to be provided to interested professionals and the general public.
- The authorities and population of the designated areas have to be widely informed about the opportunities, benefits and obligations resulting from the designation.
- The objectives of the Natura 2000 network have to be included in education.
- Special attention has to be accorded to the presentation of Natura 2000 sites
- Regional development plans and programmes have to be subjected to strategic impact assessment (SIA) in order to ensure the opportunity to prevent negative impacts and include environmental aspects in the early stages of planning.
- Environmental impact assessment (EIA) has to be prepared in order to reveal the possible impacts on the environment of all future activities planned in the Natura 2000 areas or their immediate surroundings.

European Landscape Convention

The document, which was created in 2000 after long preparation, was/is individually ratified by the parliaments of the countries of the European Council (Hungary signed, then ratified it in 2005.) The European Landscape Convention laid the foundations of the unified examination, assessment, qualification and protection system of European landscapes.
The Landscape Convention represents a paradigm shift compared to the traditional reservation approach to protection. The scope of the adopted convention covers “landscapes that might be considered outstanding as well as everyday or degraded landscapes”. It “applies to the entire territory of the parties, and covers natural, rural, urban and peri-urban areas”. It does not treat and interpret landscape separately by sectors, but in its complex unity.
One of its most important observations is that landscapes are “an essential component of people’s surroundings, an expression of the diversity of their shared cultural and natural heritage, and a foundation of their identity”. The entire document focuses on the determining effect on landscape of the cultural and natural heritage, and on the trinity of protection, management and planning.
The designated tasks of the signatory member states include increasing the awareness of society of the issue, the training of professionals specialised in assessing and operating the landscapes, the identification of landscapes, taking notes of the changes in landscapes, analysing the characteristics of landscapes, the preparation of landscape character assessments, the integration of the concept of landscape in regional and town planning policies, as well as in cultural, environmental, agricultural, social and other economic programmes and plans.

II. GEOGRAPHICAL SCOPE OF THE ANALYSIS

II.1. TERRITORY

When **delimiting the target area of the project,** the natural border of the Tisa catchment area was determinative. An agreement was accepted by the partners in shaping the common methodology, stating that the territorial unit of the assessment will be level NUTS3. Ukraine and Serbia NUTS categories are not yet in use[1], therefore we are using the corresponding Serbian "oblast" and the Ukrainian "regions" (districts), though the latter are smaller than the NUTS3 categories.

Based on those mentioned above, the planning area concerns 45 NUTS3 regions in five countries. The whole territory is 175,818 km^2, which is divided as follows:

- Ukraine: 12,752 km^2
- Romania: 82,712 km^2
- Slovakia: 15.361 km^2
- Hungary: 51,212 km^2
- Serbia: 13,783 km^2

The smallest area unit is the City of Uzgorod in Ukraine, 31 km^2. The largest NUTS3 territories are in Romania: Timiş County (8,701 km^2) Arad and Bihor Counties.

The administrative divisions in the Tisa Catchment Area

Country	NUTS2	NUTS3	Size of territorial units 2007 (km^2)	Population number 2007 (person)
Ukraine	Zakarpatska Oblast		12 752	1 242 606
		Uzhorod	31	116 331
		Berehivskyi Region	654	77 246
		Velykobereznyanskyi Region	809	26 684
		Vynogradivskyi Region	696	117 554
		Voloveckyi Region	543	24 374
		Irshavskyi Region	944	98 621
		Mighirskyi Region	1 165	48 630
		Mukachivskyi Region	1 025	182 981
		Perechynskyi Region	631	30 987
		Rahivskyi Region	1 892	90 232
		Svalyavskyi Region	673	54 246
		Tyachivskyi Region	1 817	171 854
		Uzhorodskyi Region	869	76 004
		Hustskyi Region	996	126 862

[1] Serbia has officialy adopted NUTS categories in December 2009, after the TICAD workshop where this issue was decided. "Oblast" equals to NUTS 3 level.

Country	NUTS2	NUTS3	Size of territorial units 2007 (km^2)	Population number 2007 (person)
mania	North-West Development Region		34 161	2 725 563
		Bihor County	7 557	594 131
		Bistriţa-Năsăud County	5 352	316 689
		Cluj County	6 671	692 316
		Maramureş County	6 303	513 000
		Sălaj County	3 864	243 157
		Satu Mare County	4 414	366 270
	West Development Region		23 513	1 596 863
		Arad County	7 747	457 713
		Hunedoara County	7 065	472 284
		Timiş County	8 701	666 866
	Central Development Region		25 038	1 706 612
		Alba County	6 244	376 086
		Harghita County	6 648	325 611
		Mures County	6 713	581 759
		Sibiu County	5 433	423 156
Slovakia		Banská Bystrica Region	2 201	123 050
		Prešov Region	6 405	578 953
		Košice Region	6 754	774 103
Hungary	Northern Hungary		13 427	1 269 066
		Borsod-Abaúj-Zemplén County	7 245	732 022
		Heves County	3 637	322 605
		Nógrád County	2 545	214 439
	Northern Great Plain		17 723	1 552 704
		Hajdú-Bihar County	6 207	555 592
		Jász-Nagykun-Szolnok County	5 579	409 995
		Szabolcs-Szatmár-Bereg County	5 937	587 117
	Southern Great Plain		16 503	1 354 879
		Bács-Kiskun County	6 613	544 429
		Békés County	5 629	384 672
		Csongrád County	4 261	425 778

Country	NUTS2	NUTS3	Size of territorial units 2007 (km^2)	Population number 2007 (person)
	Central Hungary		3 559	1 196 903
		Pest County	3 559	1 196 903
Serbia		Juznibačka Oblast	4 011	605 720
		Severnobanatska Oblast	2 319	155 387
		Srednjebanatska Oblast	3 253	195 190
		Severnobacka Oblast	1 785	194 573
		Zapadnobačka Oblast	2 414	197 974
Tisa Catchment area			**175 818**	**15 470 146**

II.2. SETTLEMENT STRUCTURE OF THE AREA

Size structure of the settlement system was analyzed according to the number of inhabitants living in each urban or rural territorial administrative unit. The size of the settlements depends on demographic and functional features, and also on the country's territorial organization.
The total population of the target area, 15.5 million people, live in 3,572 settlements. Over 40 % of the settlements (with a population of 22.64% of the total) are of the category of 1000-5000 inhabitants. In Romania 75 % of the settlements are of this category. These 753 settlements comprise 33 % of the population of the Romanian catchment area.
In Slovakia and Hungary a substantial ratio (80% and 40 % respectively) of settlement are microvillages with less than 1,000 inhabitants. The highest ratio of population living in micro settlements (24 %) is in Slovakia. 6 % of the total population of the Tisa catchment area live in micro villages.
The cities of over 150,000 inhabitants are Sibiu, Arad, Oradea, Timisoara, Cluj-Napoca in Romania, Košice in Slovakia, Szeged, Miskolc, Debrecen in Hungary and Novi Sad in Serbia. These cities concentrate 13 % of the total population of the catchment area. It is an indicator of the urbanisation process that over 50 % of the total population lives in settlements of more than 10,000 inhabitants making up 10% of the number of settlements.

Size structure of the settlement system

Population category	Country	Number of settlements	Number of settlements in total %	Resident population (people)	Resident population in total %
0-1 000	Ukraine	2	6.7 %	2 615	0.6%
	Romania	41	4.11%	29 186	0.48%
	Slovakia	920	80.8%	364 428	24.68%
	Hungary	522	40.6%	284 885	5.41%
	Serbia	3	2.47%	2 737	0.3%
	TICAD territory	1 488	26.94%	5 352	6.29%
1 000-5 000	Ukraine	5	16.7%	17 742	3.8%
	Romania	753	75.45%	1 994 108	33.08%
	Slovakia	191	16.76%	356 581	24.15%
	Hungary	604	47.1 %	1 513 018	28.74%
	Serbia	81	66.94%	211 558	23.44%
	TICAD territory	1 634	44.59%	229 300	22.64%
5 000-10 000	Ukraine	16	53.3 %	131 075	28.4 %
	Romania	133	13.33%	876 149	14.53%
	Slovakia	12	1.1%	98 958	6.7%
	Hungary	83	6.5%	713 795	13.56%
	Serbia	20	16.5%	132 308	14.66%
	TICAD territory	264	18.15%	263 383	15.57%

10 000-50 000	Ukraine	5	16.7 %	110 685	24.0 %
	Romania	56	5.61%	1 122 548	18.62%
	Slovakia	14	1.22%	330 404	22.38%
	Hungary	67	5.2%	1 718 485	32.64%
	Serbia	15	12.39%	284 425	31.52%
	TICAD territory	157	8.22%	395 110	25.83%
50 000-150 000	Ukraine	2	6.6%	199 324	43.2%
	Romania	10	1.00%	862 684	14.31%
	Slovakia	1	0.09%	91 498	6.19%
	Hungary	5	0.4%	488 792	9.28%
	Serbia	1	0.8%	79 773	8.84%
	TICAD territory	19	1.78%	1 722 071	16.36%
150 000-	Ukraine	0	0%	0	0%
	Romania	5	0.50%	1 144 363	18.98%
	Slovakia	1	0.09%	234 237	15.86%
	Hungary	3	0.2%	545 489	10.36%
	Serbia	1	0.8%	191 405	21.21%
	TICAD territory	10	0.32%	971 131	13.28%

In **Ukraine** without regard for Uzhorod, where 100 % of urban population lives, the highest urban saturation is in Mukachivskyi Region (51.4 %), and the lowest one is in Irshavskyi Region (9.3 %).
The settlement structure of the region is represented by 30 urban (11 towns and 19 urban-type villages) and 579 rural settlements.
The greatest saturation by settlements is observed on the plain part of the region, within the limits of the Middle-Danube (Zakarpatian) lowland, the lowest saturation does in the mountain part.
Among the categories of urban-type villages, the settlements with a population from 5 to 10 thousand persons (53.3 %) are predominate. With regard to the quantity of the population, approximately an identical part is composed by the urban-type villages with a population from 5 to 10 thousand persons (28.4 %), from 10 to 50 thousand persons (24 %) and over 100 thousand persons (25.2 %).

In **Romania** there are a lot of small settlements, with less than 5,000 inhabitants, representing 79.6% of all settlements. Of these, only nine are urban, usually resorts (Ocna Sibiului, Miercurea Sibiului, Borsec, Băile Tuşnad).
The urban settlements network includes 83 small towns, 21 medium towns and 15 cities.
The analysis of the distribution of population based on settlements size classes indicates that 33.3% of the population live in 15 cities, while 33% live in rural areas with less than 5,000 inhabitants. From this point of view, it can be considered, that the settlements network in the studied area is relatively balanced.
Regarding the territorial distribution, the eastern and central parts of the studied area have a higher density of small and medium towns, and also an urban centre with over 300,000 inhabitants. In the western part of the studied area, except the four cities (Timişoara, Oradea, Arad, Satu Mare) which concentrate most of the human resources and investment, all the towns are small, being settlements whose polarization role is insufficiently stated.

The present settlement structre of the catchment area in **Slovakia** is characterized by low level of urbanisation - low share of urban settlements (2.5 %) and high share (80.8 %) of small settlements (with population less than 1,000 inhabitants). In 2001 48.7 % of inhabitants lived in rural settlements.

The **Hungarian** part of the Tisa River Basin, approximately 40% of the settlements are included in the population size category under 1,000 people, while only 5.4% of the population lives in such settlements. Nearly one-third of the population lives in settlements with 1,000 to 5,000 people, which represent almost half of the settlements. A good indicator of urban concentration is the fact that half of the population lives in cities with a population over 10,000. At the same time, smaller cities predominate, with a population of 10,000 to 50,000 people, which represents a proportion of 29% of the population, while their percentage by number covers 6.5% of all settlements. The percentage by number of settlements with over 50,000 people does not reach 1%, but 21.8% of the population lives in such cities.

In **Serbia** the concentration of population, considered by the settlement size category is relatively balanced: the greatest concentration of population (13,85 %) is in cities with the population over 100,000 inhabitants (Novi Sad); the settlements size category from 1,001-5,000 inhabitants is the second one with 26,95 %. The category from 0 to 1,000 accounts for 1,97 % of total area population. There is three settlement, with the popoulation of 16,73 % in the 50,000 – 10,000 category (Subotica, Sombor, Zrenjanin).

Urban areas (predominantly urban and intermediate settlements)

In **Ukraine** the settlement system with its centre Uzhorod covers the entire Zakarpatian Oblast, the area of which is equal to Tisa Catchment Area within Ukraine.
Four inter-regional settlement systems are distinguished:

- Uzhgorodskyi inter-regional settlement system with the centre in Uzhorod, covers Uzhgorodskyi, Rechinskyi and Velikoberezneanskyi Regions.
- Mukachivskyi inter-regional settlement system with the centre in Mukachevo, covers Mukachivskyi, Berehivskyi, Svalyavskyi, Irshavskyi Regions.
- Hustskyi inter-regional system with the centre in Hust, covers Hustskyi, Vinogradivskyi, Mighirskyi Regions.
- Rahivskyi inter-regional system with the centre in Rahiv, covers Rahivskyi and Tyachivskyi Regions.

With regard to the functional type, the agroindustrial centres with primary processing of agricultural production among human settlements, as well as the health-improving recreational centres (Svaliava, Golubine, Kobiletska Poliana) predominate. Koroliovo, Batiovo, Chop belong to the transport centres. Uzhorod and Mukacheve are the multifunctional centres.

In the **Romanian** catchment area there are 119 urban settlements (cities and towns), part of them are development centres with an important role for the positive evolution of the studied area.
Timişoara, Cluj-Napoca and Oradea are cities of national importance, with potential influence on European level; they are economic and cultural development centres situated on major transportation axes, with a geographical position that is beneficial for the development and improvement of relations between them and the territory, being situated inside open geographical areas – plain or plateau. Also, the proximity to the border for two of the cities, with traditional cross-

border bounds, impelled their development. The cities of Timişoara and Cluj-Napoca represent centres of high demographic convergence (over 300,000 inhabitants), both for the immediate vicinity and on macro-territorial level, being important domains like industry, universities, financial, IT potential, health utilities. Oradea is also an important attraction pole which constituted a metropolitan area.
The cities of Arad, Baia Mare, Satu Mare and Târgu Mureş are important through their demographical dimensions and the economical development level, being industrial and cultural centres with their own identity, offering specialized services.
Most of the cities balance the whole urban network, assuring the functionality of all the settlements through the possibilities of adjustment and control that they have; an important role being played by county residences (like Alba Iulia, Deva, Bistriţa, Zalău) and representative historical centers (like the cites of Hunedoara, Mediaş, Turda).
The towns with importance on county or local level, with balancing role in the settlement network or with serving role in their immediate vicinity are situated mainly on the western and north-western part of the studied area, in the counties of Arad, Timiş, Bihor, Maramureş. These towns don't always have an important economical potential. Their development took place mainly due to industry, which has an important role in their economy; there are towns specialized in a particular industrial branch or towns that have intensive agriculture as a complementary branch.

Settlements and settlement structures of the **Slovakian** catchment area are mutually interdependent by the most important population centres.
In Košice region there are 17 towns. They are diversified according to the size, importance and development potential. The City of Košice (240,000 inhabitants) is dominant as a settlement centre with concentration of inhabitants as well as economic activities and settlement centre (together with Prešov) with its international importance. District towns such as Micahlovce, Spišská Nová Ves, Rožňava, Trebišov are significantly smaller (22,000 – 40,000 inhabitants) and they have regional and national importance. Other towns have less than 10,000 inhabitants and their importance is either of regional, sub regional or local importance.
In Prešov region there are 23 towns, 15 of them are situated within the target area. In terms of size, importance and developing potential they are heterogeneous. Prešov is the settlement centre (with more than 90,000 inhabitants) together with Košice it has international importance. There are much smaller district towns such as Bardejov, Humenne, Vranov and Topľou (from 22,000 to 40,000 inhabitants), with regional as well as national importance. Towns such as Levoča, Sabinov, Snina, Stropkov, and Svidník have regional and local importance (10,000 – 22,000 inhabitants).
In Banská Bystrica region, there are six towns. In terms of the size, importance and developing potential they are homogeneous. Banská Bystrica region has 13 districts and 24 towns. Rimavská Sobota is the dominant town in the target area (with 25,000 inhabitants) with concentration of economic activities . It is a settlement centre (together with Lučenec) of international importance (connection with Hungary). District town Revúca is significantly smaller (14,000 inhabitants) and it has a regional importance.

In **Hungary** the historical roles of industrial and mining cities in the north, trade cities at the foot of the mountain and the market towns has somewhat changed, or their functions appear in a mixed form with other roles. Today, the role of a city is determined by its place in the network of settlements.
Based on the institutional coverage and the analysis of the quantitative and qualitative combination of basic urban functions, in the urban hierarchy of the Tisa Region there are two advanced regional centers Debrecen and Szeged. Miskolc can be considered as a regional centre with incomplete roles. Eger, Nyíregyháza, Szolnok, Kecskemét and Békéscsaba are advanced county centres.

Hungary's urban development policy is focused on counterbalancing the concentration in Budapest and the central urban region by promoting the development of the so-called pole cities, regional centres, and their territory and twin towns. The logistic, economic and knowledge centres will gradually evolve as a result of the development of the national infrastructure (transport, energy, IT), the central and regional aid schemes and local, social and corporate initiatives, which are expected to contribute to establish and develop transborder relations. A typical tendency is to improve the interior conditions and the knowledge base concentrated in pole cities and the region around them with a special profile. Thus, Szeged and its region focus on biotechnology, Debrecen on agriculture development and nuclear research, and Miskolc on mechatronics, while they are also striving to provide the conditions of sustainable development and social services for their region (catchment area).

In the **Serbian catchment area** the Provincial capital and the largest urban agglomeration is Novi Sad. There are four urban centres Zrenjanin, Kikinda, Sombor and Subotica. In general the area is characterized by exaggerated influence of regional and municipal centers. As a special feature of the settlement network there are four cross-river twin cities (Kanjiža-Novi Kneževac, Senta-Coka, Ada-Padej, Bečej-Novi Bečej) that are elaborating joit development strategies.

Rural areas

External peripheries: border areas

The border areas of the catchment area are mainly underdeveloped rural areas with low social and economic status that can be ascribed to historical reasons. By the end of the 19th century, a series of regional development areas started to form, which could have become real regions in time in case of unhindered development. Although the spatial structure of the area had been dramatically changed the consequences of the rebordering is the requalification of urban centers and appearance of new economic units. New settlement network reality accelerated development of some other urban centers. In addition to the new state borders, a significant lack of urban centres appeared on the Hungarian side, in comparison to which Budapest became an "overweight" centre in the network of settlements. The previous central functions were substituted in part by other cities, requalification of urban centres and new economic units have developed, but the disrupted rural-urban relations have not recovered since then in some regions. As a result of the extension of the European Union in 2007, the role of the border region is re-evaluated, and the economic relations with the former urban centres are strengthening, and the border can represent a possibility of breakthrough. In this process, development of the cross-border network of highways and cross roads, and improvement of public transportation and the creation of a "seamless Europe" play an important role. Furthermore, the cross-border relations, joint tourist, cultural and environmental protection programs and institutional cooperation are also important.

Internal peripheries

The so-called internal peripheries (isolated crisis areas, far from urban and other regional centres) are characterized by long term economic recession, employment crisis, poor infrastructure, difficult access, migration, depopulation, poverty and concentration of Roma communities.

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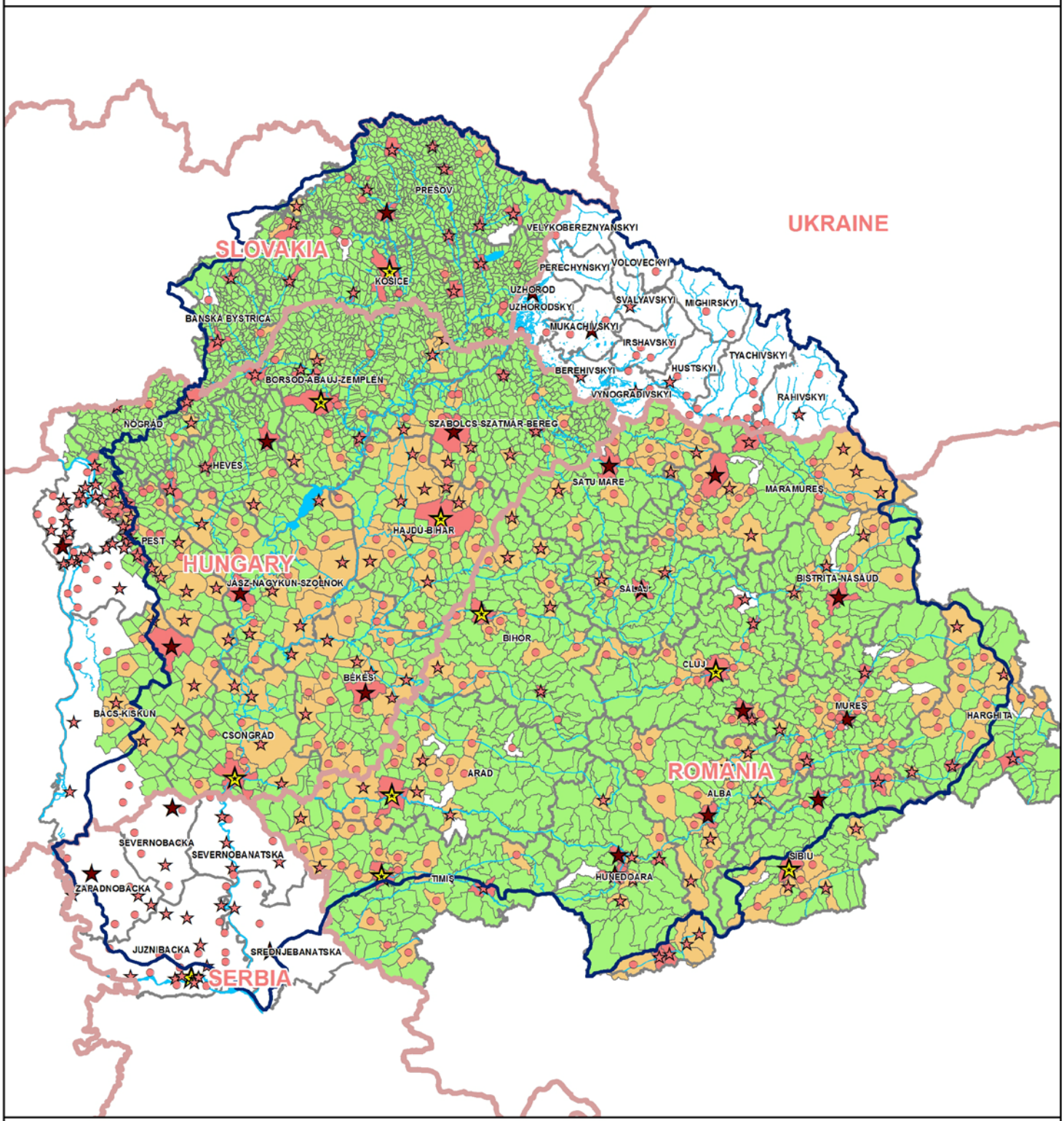
TICAD
SETTLEMENT STRUCTURE



Tisa Basin
Country border
County border
Major Water

Settlement structure
predominantly urban
intermediate
predopminantly rural

Municipality structure
5004 - 10000
10001 - 50000
50001 - 150000
150001 -

SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistical Office of the SR / Geologic Cartographic Institutin Bratislava
Hungary: TEiR
Serbia: Statistical Office of the Republic of Serbia

III. TERRITORIAL ANALYSIS OF THE REGION

III.1. SURVEY OF THE REGION'S SOCIAL SITUATION

III.1.1. Demographic situation

The total number of inhabitants living in the Tisa Catchment Area is around 15.5 million (2007). Romania has the greatest share both in terms of area size and the number of population.
At the level of NUTS 3 regions the largest numbers of population are in the areas of big cities Timis, Kosice, Borsod Abauj Zemplen, Cluj, and the lowest numbers of population are in the rural, more peripheral districts (e.g. Nográd, Zapadno and Severno-Bačka, Severno-Banatska, the Zakarpatska area).

The density of population of the comprised NUTS3 area units ranges between 40 – 140 people / km². The lowest densities are in the mountainous areas (Harghita, Bistriţa, eastern section of Banská Bystrica Region) and the peripheral rural areas (eastern part of Srednje-Banatski). The highest densities are in areas dominated by large, growing urban centres: the eastern part of Pest County in the shadow of Budapest, Košice Region, Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg Counties in Hungary. The district of Cluj is obviously dominated by the city of Cluj. Similar is the situation in County Csongrád in Hungary and also in the southern part of Južno-Bački Oblast of Serbia with Novi Sad.
Population density in 2007 was clearly the highest in the more urbanised regions (Uzhorodskyi, Pest, Južno-Bački, Cluj).

Density of the population within the **Ukrainian** part of the Tisa River region is 97.1 persons / km², which exceeds the average state index (77 persons / km²). The highest population density is observed in Uzhorod, Mukachivskyi and Uzhorodskyi Regions, and the lowest – in the mountainous Velykobereznianskyi, Volovetskyi, Mizhhirskyi, Perechynskyi and Rakhivskyi Regions.

In **Slovakian** districts population density was 261 persons / km². The highest value of population density was in Košice region (114.64 persons / km²), lower was in Prešov region (90.42 persons / km²). Population density in the target area of Banska Bystrica region was only 55.9 persons / km², which is nearly half of the average Slovak population density.

Density in the **Romanian** Tisa Catchment Area was of 73 persons / km² in 2007, less than the national average value of the same year – 90.3 persons / km². During 2002-2007, the population density decreased steadily from year to year.

In the **Hungarian** counties the population – beyond the national average – constantly decreases. Only the population of Pest County increased between 2002 and 2007, while the population of Békés County suffered the highest population decrease. On a national level these values represent two extremes.

In the **Serbian** districts the average population density is slightly higher than the average for Vojvodina. Južno-Bački County has the highest population density rate (151) while other regions have densities under the average. High density in Južno-Bački is the consequence of accelerated urban development of provincial capital Novi Sad in the last decade. Comparing to previous periods, there is decrease in population densities in Severno–Banatski and Srednje-Banatski Counties.

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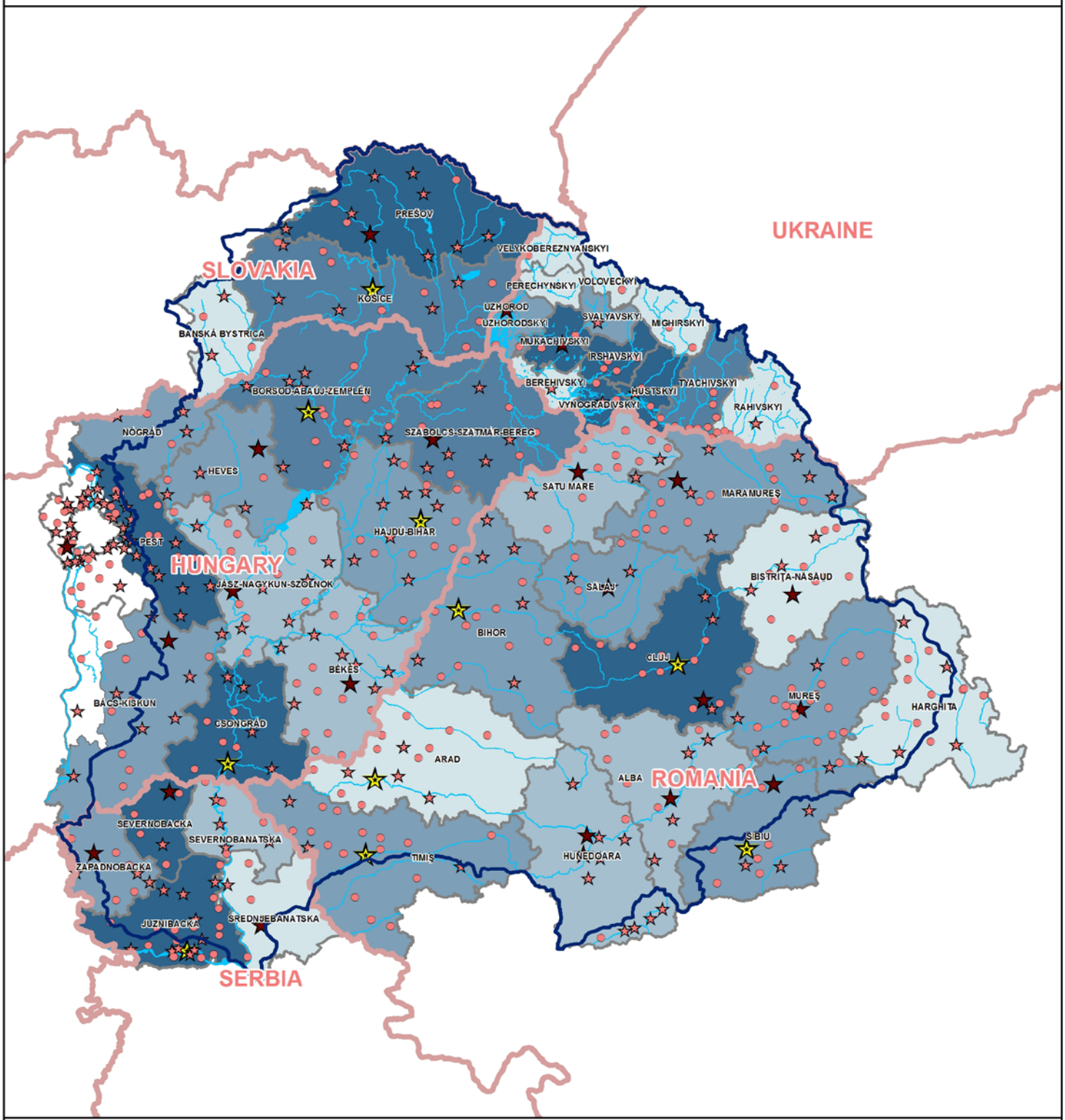
TICAD
SOCIAL SITUATION - POPULATION DENSITY



Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

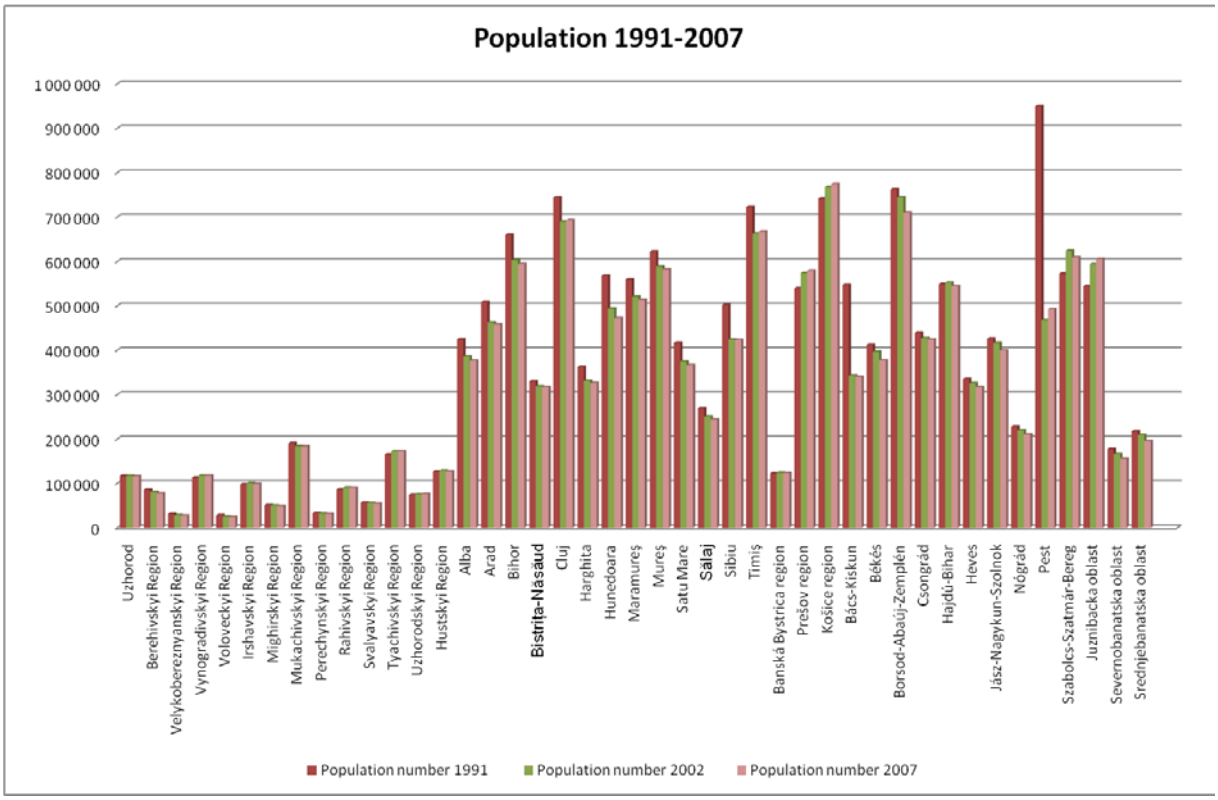
Population Density 2007*

- 18,10 - 60,00
- 60,01 - 75,00
- 75,01 - 90,00
- 90,01 - 100,00
- 100,01 -

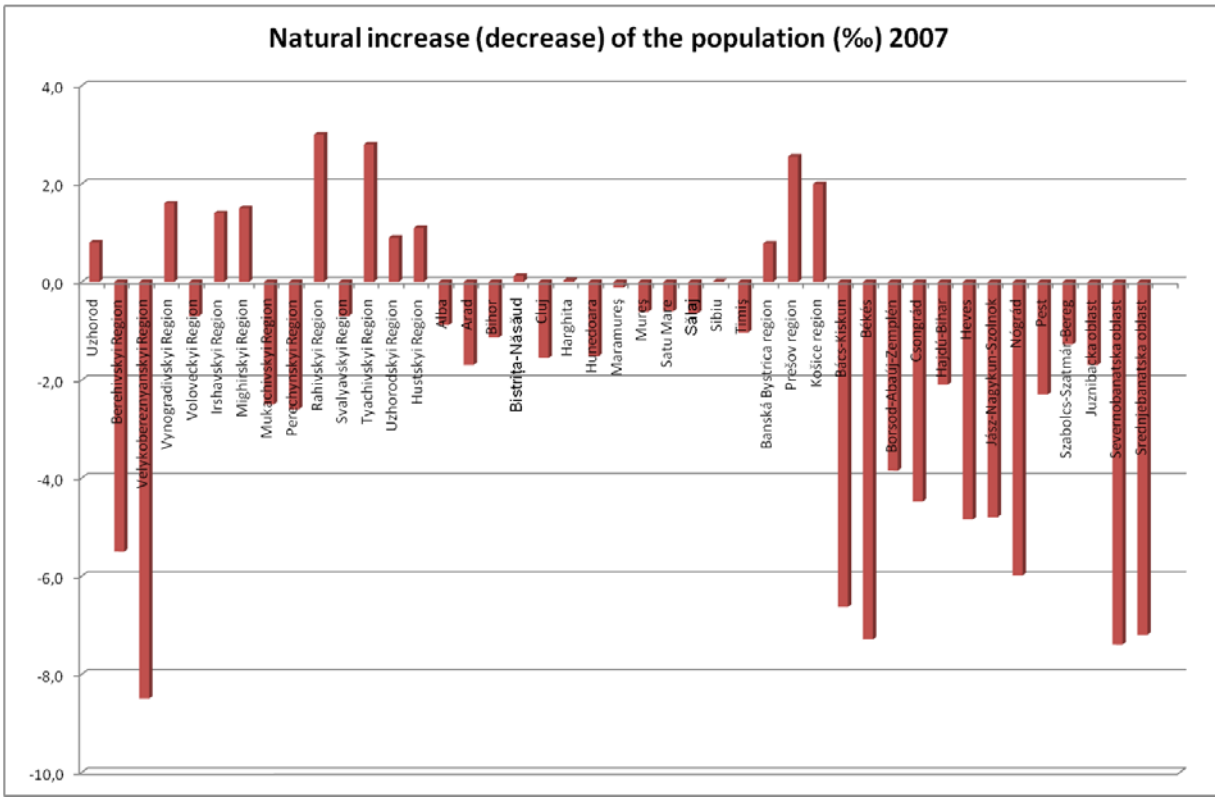
* Serbia 2008

SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistical Office of the SR / Geologic Cartographic Institutin Bratislava
Hungary: TEiR
Serbia: Statistical Office of the Republic of Serbia

There is a general population decline in the TICAD territory. The exceptions in this respect are the districts of Serbia, where the substantial growth during the last decade of the 20th century was due to migration from the conflicts and uncertainties in the southern parts of the country.
In the other parts of the catchment area the trend of population decrease is like the one in the whole EU territory. However, whereas in the West European countries natural decrease is compensated by migration from areas outside Europe, migration gain from foreign counties hardly occurs in Eastern Europe at the national level. If the trend of natural decrease (aggravated by the temporary or permanent out-migration of young, active, educated age groups) is lasting and permanent, it will be indeed detrimental for the social and economic recovery of these countries.



While, at European level (EU 27), between 1990-2000, there was some increase in population number (owing to migration first of all) of approximately 2.6% and about 2.7% between 2000-2007, in the TICAD area a decrease was experienced since 1991 and also since 2002 in all NUTS3 regions, with the exception of Prešov Region in Slovakia and some of the Zakarpatska area, though even here growth has not been remarkable at all.
Most regions lost population through outward migration. The only districts of positive migration balance are the urban districts of Zakarpatska (Uzhorod, Mukacheve), Timiş in Romania and at lesser rate Pest in Hungary, Arad, Bihor and Cluj in Romania. The greatest loss from migration was in some counties of Romania (Hunedoara, Alba, Harghita, Sălaj, Maramureş) and Hustskyi, Berehivskyi Regions in Ukraine.



In **Ukraine** decrease of population was observed in all administrative units, except for Uzhorodskyi Region. The highest relative indicators of population decrease are characteristic of Berehivskyi, Velykobereznyanskyi, Voloveckyi Regions, the lowest - of Vynogradivskyi, Mukachivskyi and Tyachivskyi Regions.

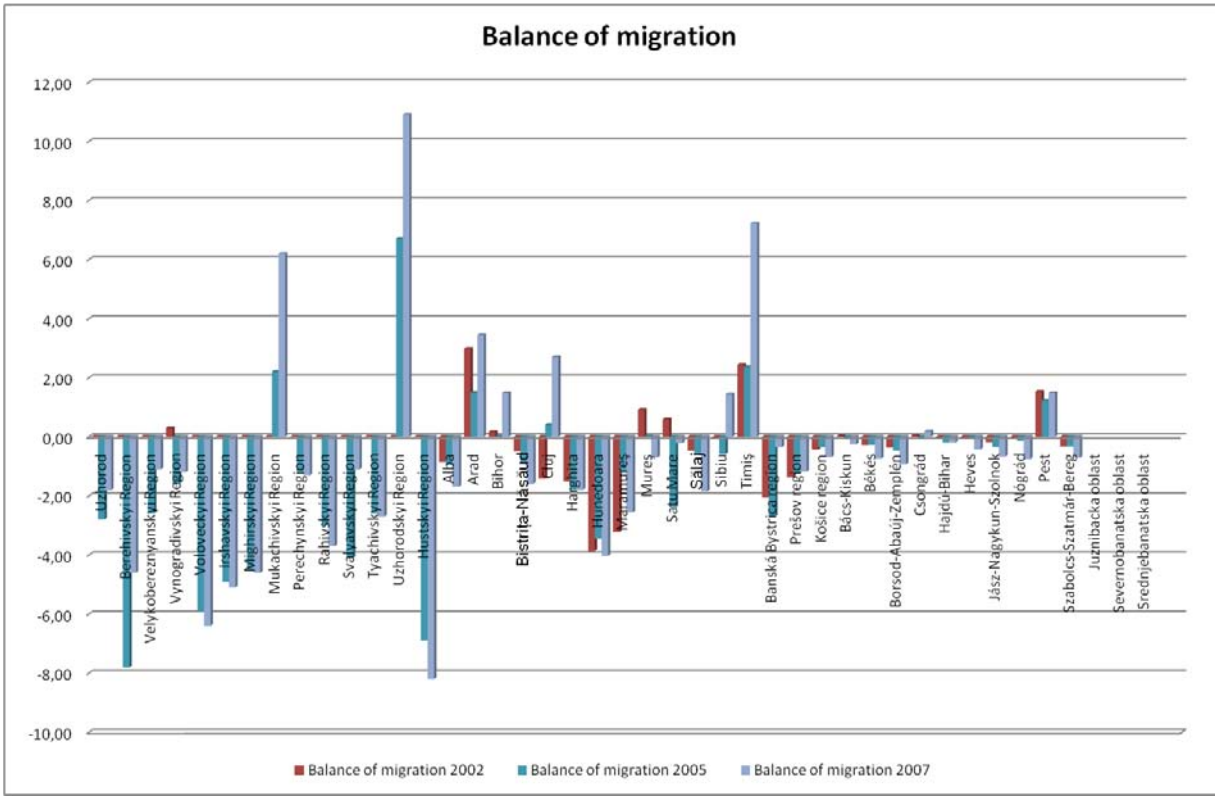
In the **Slovakian** area of the Tisa River there was a positive trend in reproductionin comparison with the EU27 and Slovakia. In 2002 – 2007 the balance of migration was negative. It was caused by high unemployment rate and migration of people out of the target area for finding employment.

In the **Romanian** part of the Tisa Catchment Area, during 2002-2007, the natural change of the population recorded negative annual values, with a slight growth trend from year to year, reaching from (-2,6 ‰) in 2002 (-1,6 ‰) in 2007. This trend of increase in the natural reproduction occurs in most of the counties in the studied area during 2002-2007. Counties which consistently recorded the lowest levels of natural increase are: Arad, Hunedoara, Sălaj and Alba. Contrary to the trend in the Romanian area, where the natural growth has constantly negative values between 2002-2007 on European level (EU27) the natural growth has constantly positive values.
Migration had positive values in 2007 due to the value recorded in Timiş County (7,5‰), which was much higher than the average in the studied area. Most counties (Alba, Bistriţa-Năsăud, Harghita, Hunedoara, Maramureş, Sălaj) having negative values for the net migration rate or values close to zero (Mureş, Bihor). During 2002-2008, the balance of migration had a relatively constant evolution, oscillating around zero.

In **Hungary** in Szabolcs-Szatmár-Bereg County birth rate was not much lower than mortality rate, while Békés County was affected by the highest natural decrease.

The indices of Csongrád County turned out a bit better than the national average due to extensive foreign immigration (Serbs) that compensated the negative growth of the population resulting from natural decrease. Northern Hungary and the Northern Great Plain became the most affected regions by migration. Compared to the number of their inhabitants, the counties of Szabolcs-Szatmár-Bereg and Borsod-Abaúj-Zemplén suffered most relevant migration losses. An increased migration characterised also Békés County, thus in a unique way, the county seat registered the highest migration, while the neighbouring micro-region of Gyula the highest immigration.
If we compare the international migration balance with the number of inhabitants then after the capital, the highest migration rate per 1,000 inhabitants was in Hajdú-Bihar County, bordering Romania.

In **Serbia** population movement in 1991-2002 had positive trend and the population increased by 3.2% as a consequence of population increase in Južno-Bački County while other two counties registered a depopulation trend.
Increase in population has not been continued after 2002. Total population number decreased in 2002-2008 period for 11,706 people (1.2%). Depopulation a phenomenon is present in Severno-Banatski and Srednje-Banatski Counties, but slightly increased in Južno-Bački County.



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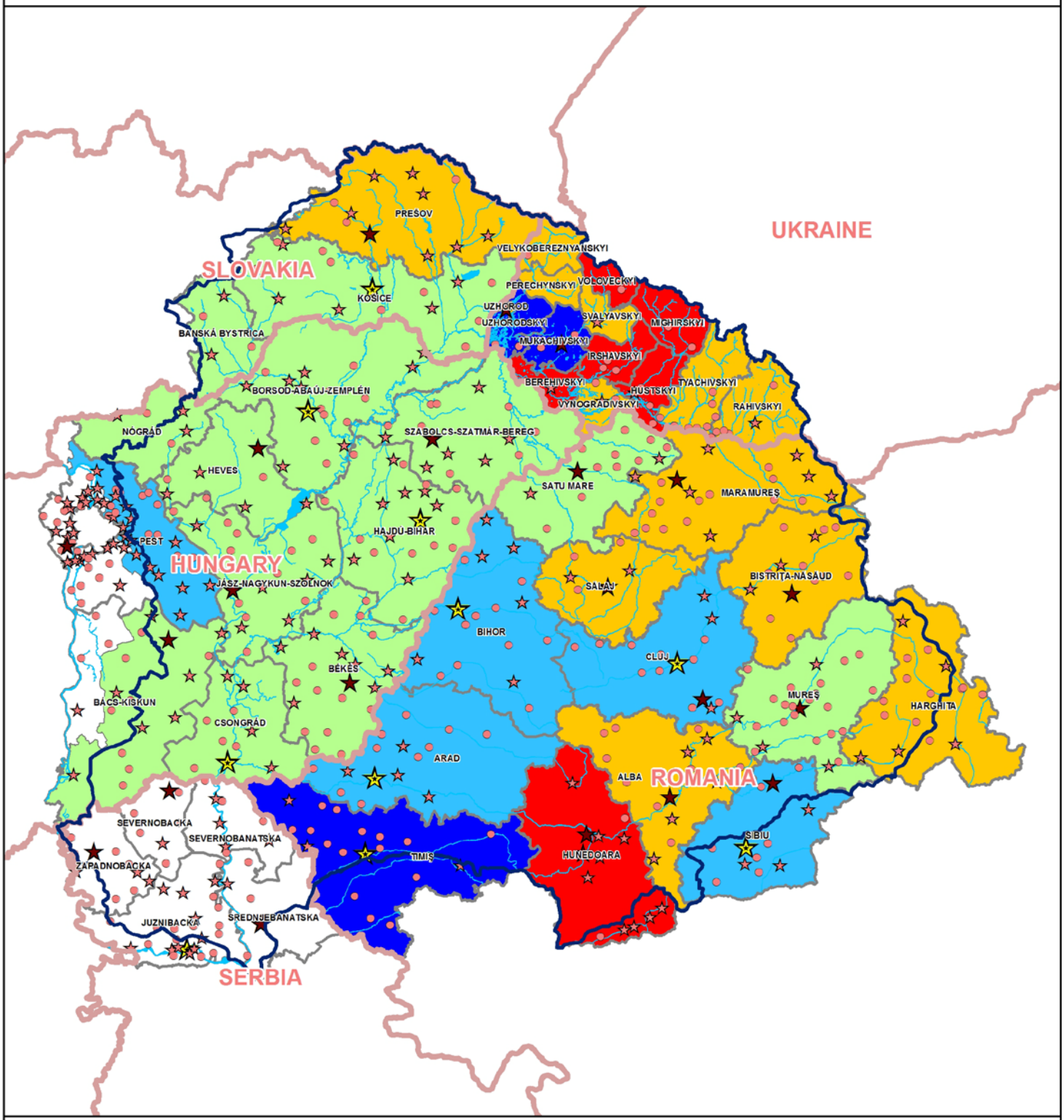
TICAD
SOCIAL SITUATION - MIGRATION



Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Balance of migration 2007
- -8,20 - -4,01
- -4,00 - -1,00
- -0,99 - 0,99
- 1,00 - 4,00
- 4,01 - 10,90

SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistical Office of the SR
Hungary: TEiR
Serbia: Statistical Office of the Republic of Serbia

The age structure is generally dominated by the elderly in Hungary, Cluj County in Romania and in the peripheral rural parts of Zakarpatska Oblast.

Negative natural demographic change is of course associated with the dominance or relatively high share of the elderly in the age structure. In the districts of Slovakia the age structure is fairly balanced, the age index indicates higher share of the young people than the elderly. Similar is the index in the border regions of Ukraine and Romania.

It is interesting to note that a comparison of regional (NUTS2) dependency rates of EU15, EU27 as well as Slovakian, Romanian and Hungarian regions of the Carpathian Basin (2002 figures) indicates that dependency rate was somewhat lower in 2002 in our (Hungarian, Romanian and Slovakian) NUTS2 regions and within this rate the share of younger age groups was a little higher than that of the elderly. The difference is, however, slight. At any rate, it is pointed out in several European studies that a greater than present and past involvement of the older people in the workforce is to be expected and promoted in Europe in the future. This may be the response to the demographic challenge in the Tisa catchment area too, and in the constituting states as well, which in turn raises the need for health care quality of life improvements.

In **Ukraine** as for the whole of Zakarpatska Oblast, the proportion of working-age population is 63.1%, which is one of the highest in Ukraine. Proportion of children aged 0-14 is 21.34%, and proportion of the retired - 15.56%. The largest proportion of the working-age population is in Uzhorod (69.51%), and the lowest - in Velykobereznyanskyi and Perechynskyi Regions, which are located in the north-western part of the Oblast. The highest proportion of the retired persons is observed in Velykobereznyanskyi Region – 20.38%, and the lowest - in Uzhorod and in Vynogradivskyi Region.

In the counties of **Romania** population is characterized by aging, caused by declining birth rates, by the decrease in absolute and relative terms of young population (0-14 years) and by increasing elderly population (65+). If in 1990 the share of young population (0-14 years) in the studied area represented 24.3%, in 2007 it was 15.4%. Aging population (65 +) increased from 1990 to 2007 by about 4 percentage points. Also, during 1990-2007 the share of working age population (15-65 years) increased from about 65% in 1990 to 70% in 2007. In 2007, the share of young population had values between 13.1% and 17.5% in all the counties in the studied area. The share of working population (15-64 years) had values between 68% and 72%, while the share of aging population had values between 12% and 15%.

In the Tisa River area of **Slovakia** the age structure of the population is favourable. Pre-productive age group exceeded post-productive age group. It is characterized by favorable reproductive trend of inhabitants, especially in the Prešovsky district, due to the influence of Roma ethnic minority, while in the Košice region the age structure is characterized by aging.

In **Hungary** the average aging index of the Tisa region (1.29) is lower than the national average (1.43). There are significant differences among the various counties. The counties of Békés (1.61), Csongrád (1.55), Heves (1.52) and Nógrád (1.5) have high rates of aging, while Szabolcs-Szatmár-Bereg can be characterised by relatively young age structure (0.98). The Counties of Pest and Hajdú-Bihar have also relatively young population. The young age structure in Szabolcs-Szatmár-Bereg and Hajdú-Bihar Counties can be explained by the high rate of the Roma population.

In the districts of **Serbia**[2] the age structure of the population is disappointing. Aging index has negative trend and it is set dramatically above the critical level. Population older than 60 is higher than the population of young from age 0 to 19. These figures are showing that the population is aging which is a common characteristic for all counties in Vojvodina. Extremely high aging index is recorded in Severno-Banatski County (1.09), Srednje-Banatski County (1.07). The lowest aging index is in Južno-Bački (92.66) while the average for Vojvodina is 0.99.

[2] The age groupping in Serbia is different from the other countries!

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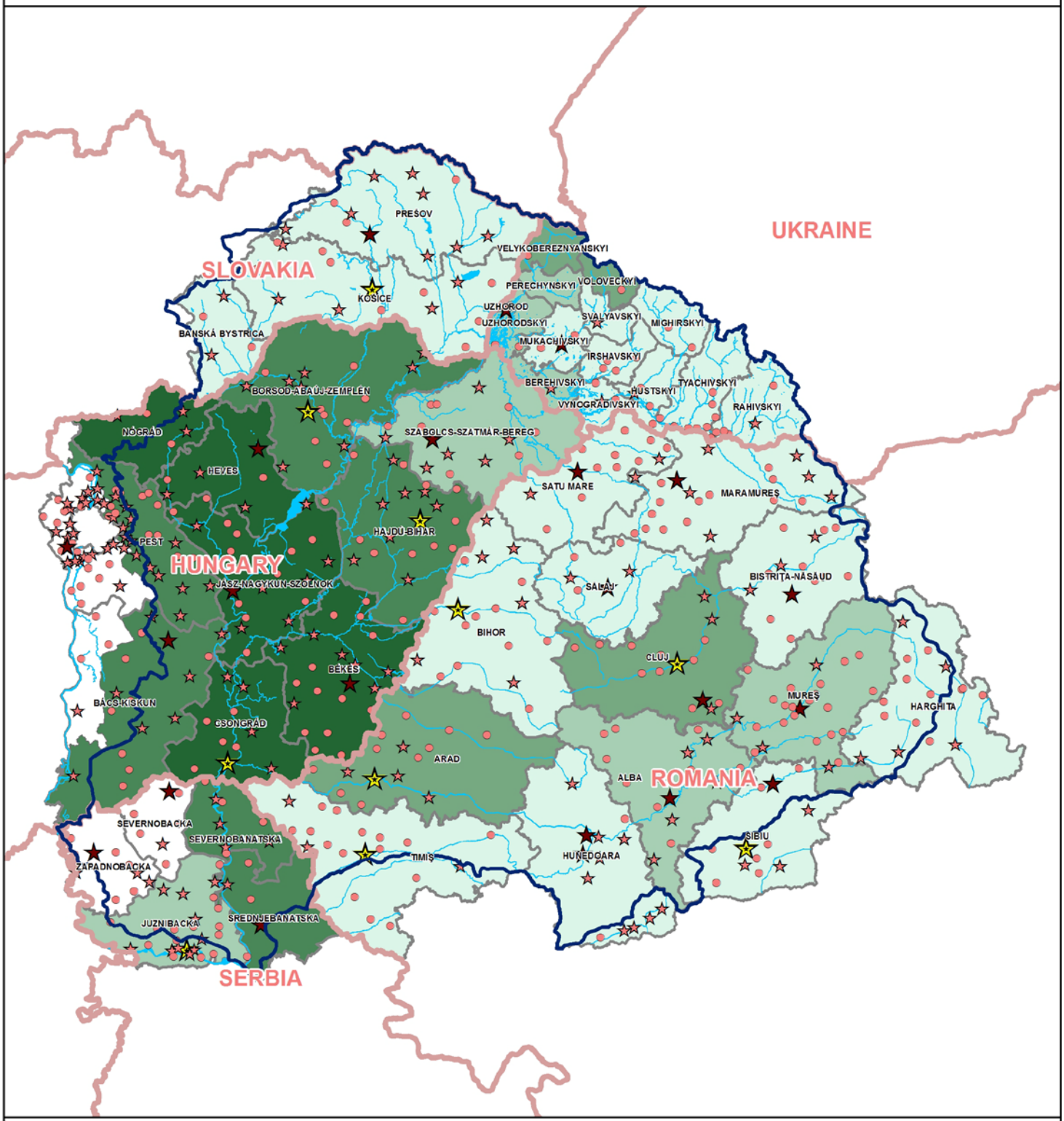
TICAD
SOCIAL SITUATION - AGE INDEX



Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Age index 2002 (post productive population / pre-productive population)*

- 0,49 - 0,80
- 0,81 - 0,90
- 0,91 - 1,00
- 1,01 - 1,20
- 1,21 - 1,39

* Ukraine 2001

SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistical Office of the SR
Hungary: TEiR
Serbia: Statistical Office of the Republic of Serbia

National and cultural diversity of population is indeed an asset of the Tisa catchment area. As mentioned before, this area is shared by five states – and at the same time it is shared by a multitude of nationalities. The overwhelming majority are the state forming nations to whom various nationalities (Roma, Russians, Croatians, Germans, etc.) are associated. Furthermore, the areas inhabited by the Romanians, Hungarians, Slovakians and Ukrainians are mixed and overlapping. In the districts of Romania the ratio of the Romanian people varies from over 90% (Alba, Hunedoara, Sibiu) to little more than 50% (Mureş) and even to 14% (Harghita). The largest minority group is Hungarian with share amounting to one fourth, one third and even to 85% (in Harghita). In the Slovakian part of the catchment area the largest national minority is Hungarian too, comprising 10 % in the Košice region and one third in the belt of the Banská Bystrica Region. In the districts of Vojvodina (Serbia) the ratio of Serbians is 65% and here again the largest minority is Hungarian (17%). In Zakarpatia, there are over 100 nationalities. The ratio of Ukranians is 80%, of Hungarians 12%. By the Hungarian national border they are in majority. All over the catchment area groups of various majorities are dispersed. A significant ethnic minority are the Roma. They themselves are a mixture of different nationalities, speak the language of their place of living as well as one of their own languages. In the catchment area of highly mixed nationality the ratio of Roma population is the highest in Counties Banská Bystrica, Borsod-Abaúj-Zemplén, Bihor, Sălaj and Mureş.

In **Ukraine** Zakarpatska Oblast is inhabited by over 100 nationalities and ethnic groups. It is one of the most multinational regions of Ukraine. Majority of the population are Ukrainians (80.5%), Hungarians account for 12.1%, Russians – 2.5%, Romanians– 2.6%, and Romas – 1.1%.
The areas densely inhabited by separate nationalities were formed in the region. In particular, Hungarians prevail in Berehivskyi Region (66.9%), with considerable proportion in Mukachivskyi (10.8%), Uzhorodskyi (34%) and Vynohradivskyi (26.2%) Regions. Romanians form a considerable part of population in Rakhivskyi (11.6%) and Tyachivskyi (12.4%) Regions. Romas form the largest part of population in Berehivskyi and Uzhorodskyi Regions, Germans – in Mukachivskyi, Russians - in Uzhorod, Slovaks – in Uzhorod and Uzhorodskyi Region.

The **Romanian** Tisa Catchment Area gathers most of the existing ethnic minorities in Romania, as demonstrated by values higher than those for the whole country, for each ethnic group separately. Thus, in the studied area, there are 19.7% Hungarians, the largest shares being in Harghita (84.6%), Mureş (39.3%) and Satu Mare (35.2%). Roma population is concentrated in Mureş (40425 inhabitants) and Bihor (30089 inhabitants), over 75% of them residing in rural areas. A high concentration of Roma in the total rural population at the county level is also recorded in Sibiu (8.6%), more than the share of Roma in Bihor (8.1%).

In **Slovakia** in Košice and Banská Bystrica Regions, the dominant national minority is Hungarian 11.20% and 4.43% respectively. In Prešov region Ruthenian and Ukrainian minorities are of 11.2 % share. The ratio of Roma minorities range between 3.5% and 5.5% in these districts.

In **Hungary** the presence of minorities in the Tisa catchment area (4.35%) does not differ from the national average (4.34%). Of the different minorities, the greatest proportion is represented by the Roma population (3.12%), which exceeds the national average (2.02%). Ethnic Slovaks make up 0.48%, Germans 0.3%, Romanians 0.2%, and Serbians 0.05% of the population of the area.

The **Serbian** Tisa Catchment Area, like the whole of Vojvodina has significantly heterogeneous nationality and ethnicity structure. It (2002 census) has changed comparing

to 1991 mostly to the consequence of migrations caused by complex political situation after 1991. The national minorities are Hungarians 17% (20% in 1991), Slovaks 3.1% (3.6% in 1991), Yugoslavians 2.3% (8.4% in 1991), Montenegrins 1.9% (2.4% in 1991) and Roma 1.6% (1.5% in 1991). Other ethnicities account less than 1.5% (Croatians, Russians, Romanians, Muslims and other). Hungarian population account 47% in Severno-Banatska County.

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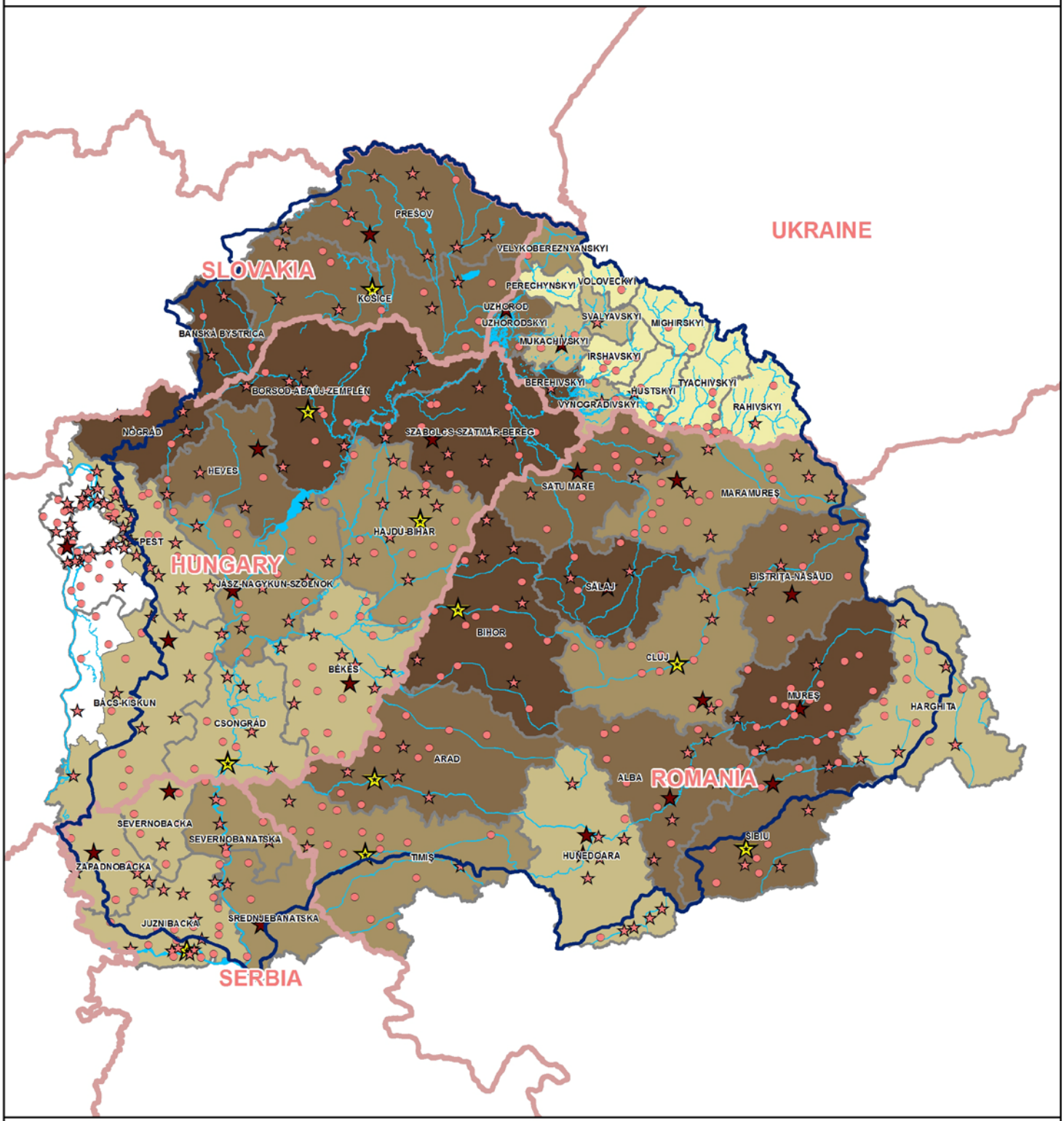
TICAD
SOCIAL SITUATION - ETHNIC STRUCTURE



Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Share of Roma population 2001

- 0,00% - 0,50%
- 0,51% - 1,50%
- 1,51% - 3,00%
- 3,01% - 4,50%
- 4,51% - 7,00%

SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistical Office of the SR
Hungary: TEiR
Serbia: Statistical Office of the Republic of Serbia

Essential feature of the quality of human resource is the **educational level**[3]**.**
In the educational structure (according to census of 2001 or 2002) incomplete primary education is of very low ratio, in the NUTS3 units of Hungary and Slovakia is less than 1 % of the people over 15 years. The ratio of people without basic education ranges between a bit over 6 % and 4 % in the NUTS3 units of Romania (Sălaj, Bihor, Bistriţa-Năsăud, Maramureş districts with the highest and Cluj and Sibiu districts with the lowest figures). In Vojvodina, however the respective figures are very high, 16 % is the relatively best in Južno-Bački, whereas it is over 20 % in the other district. Even higher is the ratio of people without or with incomplete basic education in Zakarpatska Oblast. It is interesting to note that in the Južno-Bački District of Serbia the rate of people with high (university) education is higher (13 %) than any of the highest rates in other countries (Presov: 9 %, Cluj and Timiş round 10 %) which highlights social polarisation.
The territorial comparison of the educational levels is difficult in view of the national differences of the interpretation of primary, secondary and tertiary levels. In the educational structure of population the high share of people with only primary education is linked with the high ratio of the elderly and therefore it is the highest in Counties Nográd, Bács Kiskun, Békés, Jász-Nagykun-Szolnok and Szabolcs-Szatmár-Bereg in Hungary. The share of high school and university graduates is the highest in the counties dominated by a university centre, such as Csongrád, Južno-Bački, Timiş and Cluj.

In **Ukraine** in Zakarpatska Oblast, according to the data of the latest census of population in 2001, the overwhelming majority of population (135.4 thousand persons) has primary higher education, 88.2 thousand persons – full higher education, 6.3 thousand persons – basic higher education, and 3.2 thousand persons – incomplete higher education. Thus, the persons having various forms of higher education account for 18.5% of the total population.

In **Slovakia**, in Kosice region inhabitants with lower than secondary education represented 42.5 % from the number of inhabitants, one-fifth of them represents inhabitants with primary (basic) education and 15.1 % with vocational education. Complete secondary education (including higher education) is achieved by more than one-fourth of the population, university education by 7.5 %. In the Prešov region the percentage of population with university education is above the national average. In Banská Bytrica region high proportion of population has only primary education (28.77 %). There is also very low proportion of population with university education, only 4.5 %.

In the **Hungarian** part of Tisa catchment area the schooling indicators are not significantly different from the national average, with the exception of the proportion of those with university or college diplomas. The proportion of the highly qualified population, that is, those with tertiary qualification, in the catchment area (7.72%) is lower by more than one third than the national average (12.6%), and its value is the highest in Pest County (9%). The proportion of those with tertiary qualification is the lowest in Szabolcs-Szatmár-Bereg (6.58%), Nógrád (6.96%) and Borsod-Abaúj-Zemplén (7.07%) Counties, where the proportion of the Roma population is at the same time the highest.

It should be noted that values have improved since the 2001 census, the proportion of tertiary qualification has increased, as well as the range of institutions providing tertiary education has widened.

[3] The educational structure in the TICAD countries are sufficiently different, especially in the field of secondary education. Therefore this chapter is concerned only with the analysis of primary and higher education.

In the **Romanian** Tisa Catchment Area the share of population with higher education is 6.7%. According to the last census (2002), 18.4% of the area's population has elementary education and 5.1% has no education whatsoever. The share of population with higher education is higher in Cluj (10.2%) and Timiş (9.5%), the main cause beying related to the concentration, in these counties, of major universities. The lowest shares of population with higher education are recorded in Harghita (4%), Bistriţa-Năsăud (4.3%) and Sălaj (4.3%). The share of population without education is relatively higher in the counties: Maramureş, Sălaj, Bistriţa-Năsăud and Bihor.

In the **Serbian** districts, according to 2002 census the education level of the population older than 15 (84.0% of population) 45% holds a high school level degree, 24% have finished education on primary school level and 11% holds university degrees. The ratio of population with no formal education is still rather high (19.0%). 47% of people above 15 in Južno-Bački County have a high school degrees and 13% hold university degrees. The county where high ratio of the population has just primary school education is Severno-Banatski County (28.0%). In this county 25% of population above 15 has no formal education or not completed primary school.

III.1.2. Employment, social position

The level of employment is particularly high in several counties of Romania (Timiş, Arad, Alba, Cluj, Bihor) and particularly low in Zakarpatska Oblast.

The overall employment structure (ratio of the three main economic branches: agriculture, industry and services) does not show significant variances of the NUTS3 regions of the Tisa catchment area.
Relatively high is the ratio of employees in agriculture (one third) in Harghita, Mureş, Bistriţa-Năsăud and Maramureş Districts of Romania, in the same country fairly high is the share of industry in Arad, Hunedoara, Alba and in Serbia in Severno-Bački and Srednje-Banatski Counties. In general, however, in the majority of the NUTS 3 regions of the catchment area the teriary sector has the dominance on the employment structure. In the less advanced areas like for instance the eastern counties of Hungary, this dominance is due to the fact that the national, regional and local governments are the greatest employers.

Unemployment has a tendency of growth in the whole are. The phenomenon of unemployment is redundancy, it means that a certain number of employees have lost their jobs, because of the decline, the shrinking and ultimately the closure of businesses, or else because of restructuring, that is, the modernisation of the manufacturing or service enterprises and often even of the whole economic structure. In such cases redundancy is also the consequence of outdated skills or expertise. Therefore unemployment generally occurs and increases in and around centres of manufacturing activities with outdated technology and less competitive production. This process has involved high unemployment rates in Hungary, whereas in several parts of Romania the relatively lower unemployment rate in general and particularly in the predominantly rural areas (e.g. Maramureş, Sălaj, Bistriţa) can be explained by the prevalence of subsistence farming. It is to be noted that relatively high is the level of unemployment in the district of Hunedoara, which may be due to the vulnerability of coal mining in the Jiu Valley. Although a large part of the Tisa catchment area of Hungary is rural too, but because of the scarcity and weakness of small holdings, agriculture does not ensure livelihood for the local people. In the counties of Hungary unemployment varies over time and space around 10 – 20 %, the worst figures are persistently in counties Borsod and Szabolcs. In the Slovakian parts of the catchment area the dominance of manufacturing industries and the process of restructuring have involved high unemployment rates up to nearly 30 % in Banska Bystrica

area and 15 % in the other districts in the worst years (currently deceasing). In Zakarpatia (Ukraine) unemployment is the highest in the mountainous area due to the decline of forestry which in turn is due to the sad process of the vanishing of forests.

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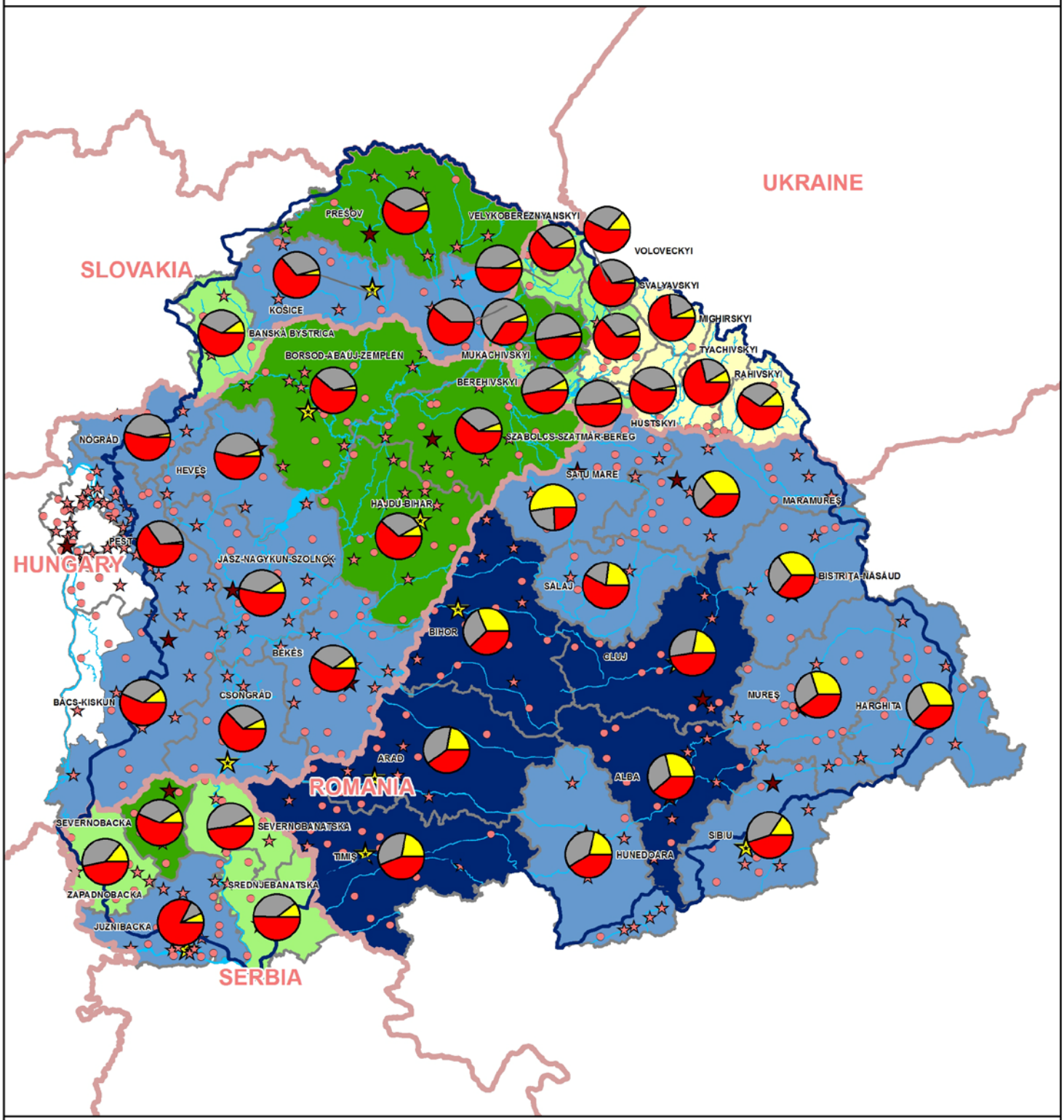
SOCIAL SITUATION - EMPLOYMENT



Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Share of employed people 2007
(No. of employed people / No. of pop)

- 9,85% - 15,00%
- 15,01% - 25,00%
- 25,01% - 35,00%
- 35,01% - 45,00%
- 45,01% - 52,51%

Share of people employed in different sectors

- Share of people employed in agriculture, forestry, fisheries and food 2007
- Share of people employed in industry and building industry 2007
- Share of people employed in service sector 2007

SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistical Office of the SR
Hungary: TEiR
Serbia: Statistical Office of the RS / Vojvodina Cess

In the **Ukrainian** part of the catchment area the ratio of economically active to economically inactive population in the region in 2007 amounted to 584.6 thousand/337 thousand people (or 63.4%/36.6%). The persons of working age dominated in the economically active group (88%), while the persons older than working age accounted for 12%. In Ukraine retirement age for men is 60 years, for women 55 years. The total working population in the region amounted to 547.6 thousand persons in 2007, which is 93.7% of the economically active population and 59.4% of the total population aged 15-70.
In the Zakarpatska Oblast the majority of population are engaged in agriculture, hunting, forestry, fishing and fish-farming – 26.4%, followed by trade and hotel and restaurant business - 18.9%, the third place is occupied by industry – 12.5%. Thus, the three leading industries account for 57.8%.
The unemployment level in the Zakarpatska Oblast 2.3% in 2007, and tended to decrease starting from 2002 when it was 5.4%. The unemployment level calculated according to International Labour Organization (ILO) methodology was 6.3% in 2007.
The highest unemployment level is characteristic of mounting regions – Velykobereznianskyi, Volovetskyi, Mizhgirskyi, Perechynskyi and Rakhivskyi. The lowest unemployment level is characteristic of the western regions: the city of Uzhorod, Mukachivskyi and Uzhorodskyi Regions.

In the Tisa River area in **Slovakia** employment rate is under the Slovak average. There are differences among areas: in 2007 employment rate in the target area of the Banská Bystrica Region was 33.12 % and in the Košice Region was 51.53 %.
The highest unemployment rate was in Banská Bystrica Region (29.24 %), unemployment rate in the Prešov and Košice Region was about 15 %. Since 2002 there has been a decreasing trend in unemployment rate in the whole target area of the Tisa River in Slovakia.

In the **Romanian** part of the catchment area the employment rate has higher values than the national average (68% vs. 63% in 2007). In five counties the employment rate has decreased, Maramureş and Bistriţa-Năsăud are the counties with the lowest employment rate. The counties of Bihor, Timiş and Arad are the ones with the highest employment rates. Generally, since 2004 the employment rates are in decline, fact explained by the restructuring of large enterprises throughout the area. The counties of Bihor, Alba and Timiş have the lowest economic inactivity rates. The unemployment rate follows a steady downward trend, similar to the national level, but with values much lower than national averages. The counties of Alba, Harghita and Hunedoara have the highest unemployment rates throughout the period (5.7%, 5.1% and 4.8% in 2007), while the counties of Arad and Timiş have the lowest (2.3% and 1.6%). Currently unemployment increases due to financial crisis.

In **Hungary** the central region has the most favourable labour-market characteristics, as its employment rate approaches the EU average, and the unemployment indicators are way below the average. In the northern region the rate of employment is low compared to the national average, and the unemployment rate is the highest. During these last few years the employment ratio has hardly changed in Hungary, although a slight improvement could be perceived in the Southern Great Plain mainly as a result of the data in Csongrád County, where the 57.8% ratio was above the country average.
In the Hungarian part of the catchment area, with the exception of Pest County the agricultural employment is higher than the national average in every concerned county. Furthermore, because of the domination of the large university centres, the rate of those working in an educational field is higher than the national level in the counties of Csongrád (Szeged), Hajdú-Bihar (Debrecen), and Borsod-Abaúj-Zemplén (Miskolc). The industrial

employment is significant in the counties of Heves, Nógrád, Borsod-Abaúj-Zemplén and Jász-Nagykun-Szolnok. The high employment rate in the service sector of some of the underdeveloped counties is noticeable.
The transformation crisis, which followed the regime change, lasted longer in these regions than in other parts of the country, the growth started later and the regression was greater. The underdevelopment of a significant part of the Tisa catchment area is the result of the collapse of the heavy industry and agricultural production contributed to the increase of Hungary's territorial inequality.
After a temporary decrease in 2006, the rate of the registered unemployed started to increase again in 2007. While in 2002 the unemployment rate had only been above 10% in Borsod-Abaúj-Zemplén County, by 2007 that rate was also reached and even exceeded in the counties of Szabolcs-Szatmár-Bereg, Hajdú-Bihar and Nográd (in the developed areas of the country this ratio even decreased). According to estimations, the rate of unregistered employment is around 15-20% in the country. In Hungary the Tisa catchment area bears the signs of severe crisis.

In the **Serbian** part of the catchment area the total employed population (2008) was 55.0% of total employed population in Vojvodina. Unemployed population on the same census (2008) was 53.0% of total unemployed population in Vojvodina. Employment rate of the area is 45.0% and varies from 32% (Srednji-Banatski County) to 51% (Južno- Bački County). Južno-Bački County has the most employed people per 1,000 inhabitans (356). The average for Vojvodina is 269; Srednje-Banatski 243 and Severno-Banatski 216. Unemployment rate for the whole area is almost the same and accounts to 15.0%.
In the Serbian area the period 2002-2008 featured certain employment shifts by sectors. The percentage of employed in agriculture, forestry, water management industries and fishery dropped from 7.6% to 4.5%. Srednje-Banatski County has the highest percentage of employments in those sectors (12%-8.5 % drop for 1991-2002). Južno-Bački County has the lowest percentage of population employed in those sectors. Building industry employment increased from 4.7% to 5.0% as the consequence of extreme increase in Južno-Bački County. Industry sector also increased employment with the highest change in processing industry (18.0%) and with significantly higher employment rate in Južno-Bački County (3-3.5 times higher than in other two counties). The highest growing employment rate has been recorded in services sector (Južno-Bački County accounts 5 to 6.5 times more than other counties).

III.2. ECONOMIC BASE OF THE REGION

In conclusion it should be emphasized that the breakthrough in the Tisa catchment area will depend on the structural and technological modernisation of the economy. Technological modernisation relies on the advancement of R+D+I and the multiplier effect of the knowledge base. Research and development are present in the centres of higher education like Timişoara, Košice, Cluj-Napoca, Szeged, Debrecen, Novi Sad and in secondary centres too (Kecskemét, Sibiu, Eger etc), though neither the volume nor the output is outstanding, and what must still be realized is the multiplier effect, the mobilising impact of intellectual capital upon the SME's to bring forth innovative products. Some minor achievements of this kind can be detected around some of the centres of learning.

In **manufacturing production** technological modernisation may be in progress in Košice, and innovative products are released at small scale by the enterprises of Debrecen, Miskolc and Szeged. In most of the new and modernised industrial parks, however, the typical activities are trade, storage and assembling plants, whereas the old mining and manufacturing bases are declining, closing, becoming derelict and leaving behind brown-fields, contaminated and devastated areas and hundreds and thousands of redundant workers in Hunedoara, Maramureş, Alba, Borsod, Nógrád, Prešov.

Agriculture, both cultivation and husbandry have excellent conditions in the greatest part of counties in Hungary, on the western plain in Romania, in south districts of Slovakia and Zakarpatia, in the districts of Voivodina. Neither the modernisation of production nor the processing of farm produce, nor the marketing of the products is adequate to capitalize from the great natural potentials. Exceptions and positive features are those of a few local specialities like wines, brandies, milk, meat and wood products, the marketing of which is successfully connected to tourism.

Structural modernisation will involve the increasing prominence and effectiveness of productive services (engineering, design, informatics, marketing and logistics) as well as quality (cultural, conference, business, eco- and adventure) tourism. For the latter there is ample opportunity, not only in urban but also in rural areas. Tourism, however, is not yet advanced either in volume or in quality in most of the area units except in major urban and resort centres and the mountainous districts of Slovakia.

III.2.1. Economic structure and performance

III.2.1.1 Gross Domestic Product

The Tisa catchment area is among the less advanced areas of the European Union. In all (NUTS2) regions GDP/capita is below 70% of the EU average, and therefore all the area (except for the narrow belt at the eastern edge of Central Hungary Region) is eligible to Structural Funds for convergence.

	GDP/inhabitant (2002)		***GDP/employment (2002)***	
	€	**%**	**€**	**%**
EU 15	22,463	100.0	52,442	100.0
EU 27	19,543	87.0	46,019	87.8
North Hungary	7,570	33.7	22,945	43.8
North Plain	7,682	34.2	23,236	44.3
South Plain	8,289	36.9	22,336	42.6

West Romania	5,930	26.4	13,057	24.9
NW Romania	4,852	21.6	10,082	19.2
Central Romania	5,278	23.5	12,088	23.1
Eastern Slovakia	7,637	34.0	21,795	41.5

The Zakarpatian regions and those of Voivodina are none the better either in terms of GDP or productivity. The comparison is therefore relative, bearing in mind, however, how and how far the area units of the Tisa catchment territory are in the process of convergence. (It needs to be added at this point too that the Tisa catchment area is among the less developed in national comparisons too. The capital regions for instance are outside this area although for instance Bratislava is faring very well, so does the region of Budapest too, especially in terms of productivity. The regions of Bucharest as well as Beograd and Kiev also have much better figures than the ones in the table above.)

The figures from 2002 indicate relatively better position of the area units of Hungary, but considerable improvement has taken place during the recent years in the NUTS2 areas of both Romania and Slovakia. The trend of improvement took place in the nodal areas of Voivodina (Južno-Bački) and Zakarpatia (Uzhorod) too. Productivity has improved throughout the territory, but it proceeded in a strongly polarised way, with concentration on the nodal areas, whereas the peripheries were further deteriorating.

The economic situation of the Tisa catchment area is most favourable in three Hungarian counties (Pest, Heves and Csongrád), where the GDP per capita in purchasing power standards exceeds 11.2 thousand. The influence of Budapest (in Pest and Heves County) and the presence of cities of regional importance (Szeged in Csongrád County) as well as the good accessibility are determinant in terms of economic development.

Counties with GDP between than 8.7 – 11.2 thousand in pps compose the next category. These are the Hungarian counties located in the Great Plain with high agricultural potentials, or having important urban centres such as Kecskemét, Debrecen, Szolnok or Miskolc. The Slovakian Košice Region belongs to this economic level due to the importance of manufacturing industries and services in the city of Košice as well as to the bases of power generation.

SOUTH EAST EUROPE
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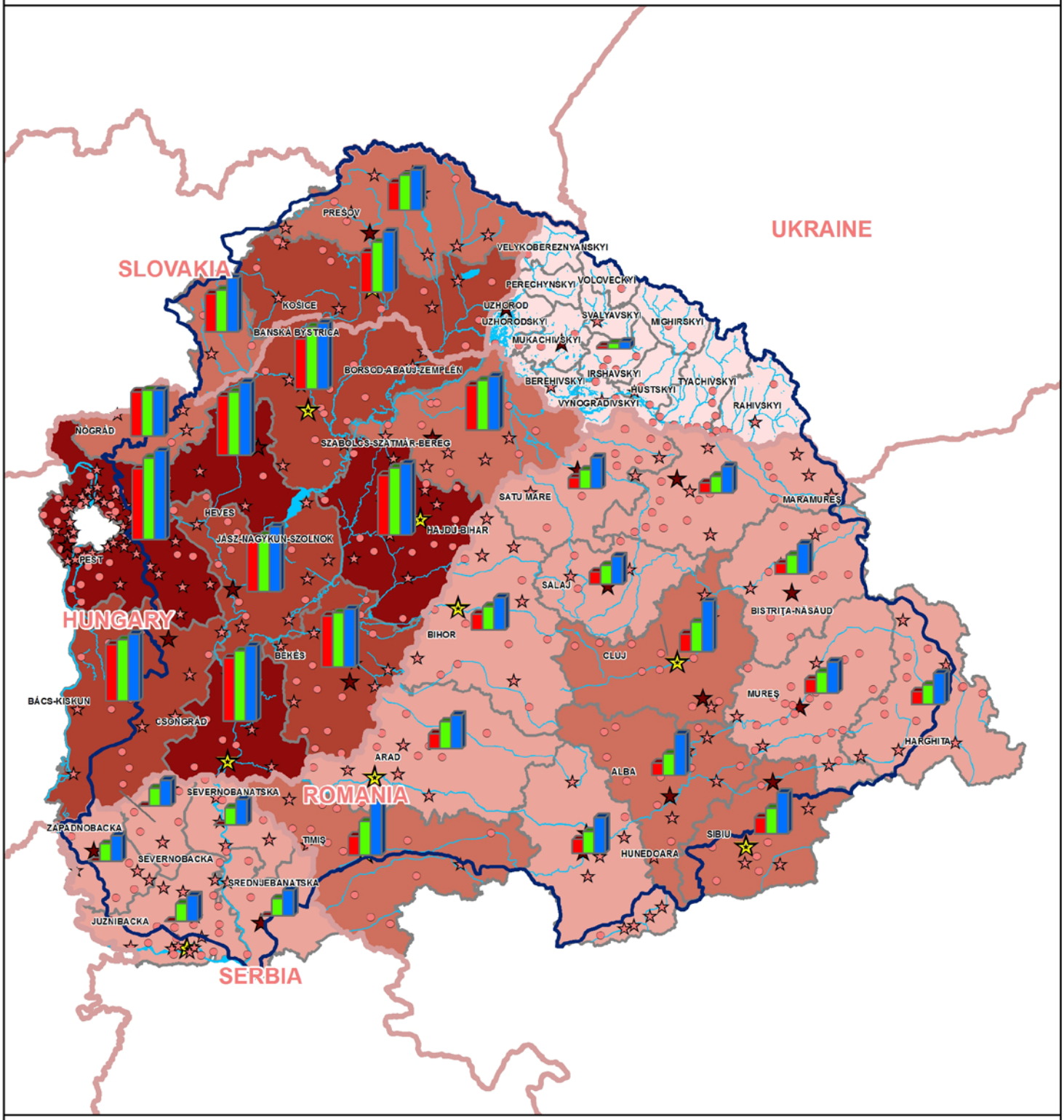
TICAD
ECONOMIC BASE - GDP



Tisa Basin
Country border
County border
Major Water

Municipality structure
5004 - 10000
10001 - 50000
50001 - 150000
150001 -

GDP per capita (pps) 2007* **
1139 - 3500
3501 - 6000
6001 - 8500
8501 - 11000
11001 - 13766

6 900

GDP per capita (pps) 2002
GDP per capita (pps) 2005
GDP per capita (pps) 2007

** in Ukraine the data refers to Zakarpatska oblast*
*** in Serbia the data refers to the National level*

SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistic Office of the SR
Hungary: TEiR
Serbia: Statistical Office of the Republic of Serbia

The next development level is the counties with GDP between 6.1 – 8.7 pps. In Hungary Nógrád and Szabolcs-Szatmár County belongs to this category. These two are the least developed counties in Hungary. Among other factors, the location near the border, the predominantly agrarian character (Szabolcs-Szatmár), or the former industrial profile (Nógrád) lead to this unfavourable situation. The low level economic productivity can be experienced in two Slovakian counties (Prešov and Banská Bystrica). In the Romanian part of the river catchment area, the most developed counties are on the level of the least developed ones in Hungary or in Slovakia. In counties with higher or identical economic values (Cluj, Alba, Sibiu and Timiş) the economic competitiveness is supported by relatively high values of labour productivity, especially in the industry and services.

The rest of the Romanian territory has lower economic values with GDP between 3.5 – 6.1 thousand pps (Bistriţa-Năsăud, Harghita, Hunedoara, Maramureş, Mureş, Satu Mare, Sălaj, Bihor and Arad). The fragility of the economy is induced by the immaturity of the horizontal and vertical productive relations, by the inefficient capitalization of human resources, as well as by the high inertia as regards the modernization of productive processes. In counties which moved from higher values than the national average (2002) to lower values (2007) – Bihor and Arad counties, border counties that, in 2006 and 2007, experienced changes in export/import balance, changes in agricultural subsidies (and the incapacity to counteract the imported products) and, in the case of Bihor County, the lowest labour productivity in industry.

Zakarpatska Region in Ukraine faces the most serious economic problems. GDP per capita is below 1.1 thousand pps. This region is quite much behind the national Ukrainian average as well, which is due to its peripheral location, which though is gaining more prominence owing to the connections to EU.

In terms of gross value added per person the **Ukraininan** Zakarpatska Oblast occupies 22-nd place among 25 regions of Ukraine (UAH6.073 or €819). The gross regional product was somewhat higher - in 2007 is amounted to UAH6.576 (€886) per person and over the past years it was growing steadily.

The counties of **Romania** contributed together about 28% of the national GDP. The absolute value of this indicator recorded a continuous increase during the analyzed period. The relative constant weight underlines the comparison with the national trend, as the two levels of comparison had practically the same growth rates. At the level of the counties, the average growth of the GDP was by 2.2 times; the highest growth was recorded in Timiş and Alba counties (2.5 times), and the lowest in Bihor County (1.8 times). The average value of the GDP/inhabitant increased from 2,159 in 2002 to 5,788 in 2007.

From the total gross domestic product (GDP) of **Slovakia**, the share of Košice region was 11.7 % in 2007. It is the third largest share of all regions in Slovakia. The share of Prešov region was 8.1 % in 2007 still decreasing (in 2002 – 9.1 %) and it is the lowest of all regions. These two districts of Banská Bystrica region have the share of 23.4 % of the total GDP of the whole Banská Bystrica region.

The Tisa region falls behind the **Hungarian** national average in terms of economic development. This region, which covers almost half of the country, holds a share of 37% in the GDP at national level, of which 28% is represented by Pest County, the most developed county in the region.

In **Serbia** Južna-Backi County with Novi Sad has significant concentration of economic development and is the most developed area in the country. GDP in Euro per capita is extremely low compared to the EU27 average. In 2008, Serbian GDP in Euro per capita was only about 18.1% of the European one. It was slightly higher in Vojvodina (20.8%) than in Central Serbia (17.1%).

The overall structure of the economy as well as the degree of technologisation and the optimisation of productive processes are the most influencial regarding **labour productivity** (Euro/employee). This indicator is the highest in two Slovakian counties, Banská Bystrica and Košice Region (20.9-25 thousand euro/employee) and the lowest in the neighbouring Ukrainian county, Zakarpatska Oblast (4.5-8.6 thousand euro/employee). The middle range (12.7 – 20.9 thousand euro/employee) is composed by the Hungarian counties (except the least developed Nógrád County), Prešov region in Slovakia and the most developed counties from Romania. The rest of the Romanian territory and Nógrád County form Hungary belongs to a relatively low labour productivity cathegory with 8,6 – 12.7 thousand euro/employee.

III.2.1.2. Business activities and business structure

The high **enterprise density** not only shows the high economic activity of an area but also can mean that the structure of enterprises is dominated by micro enterprises with low economic performance. In terms of economic performance, a considerable share of production and exports are mostly related to entirely or partly foreign owned large corporations. The economic performance of small enterprises falls substantially behind the performance mentioned, but their employment capacity is still significant.

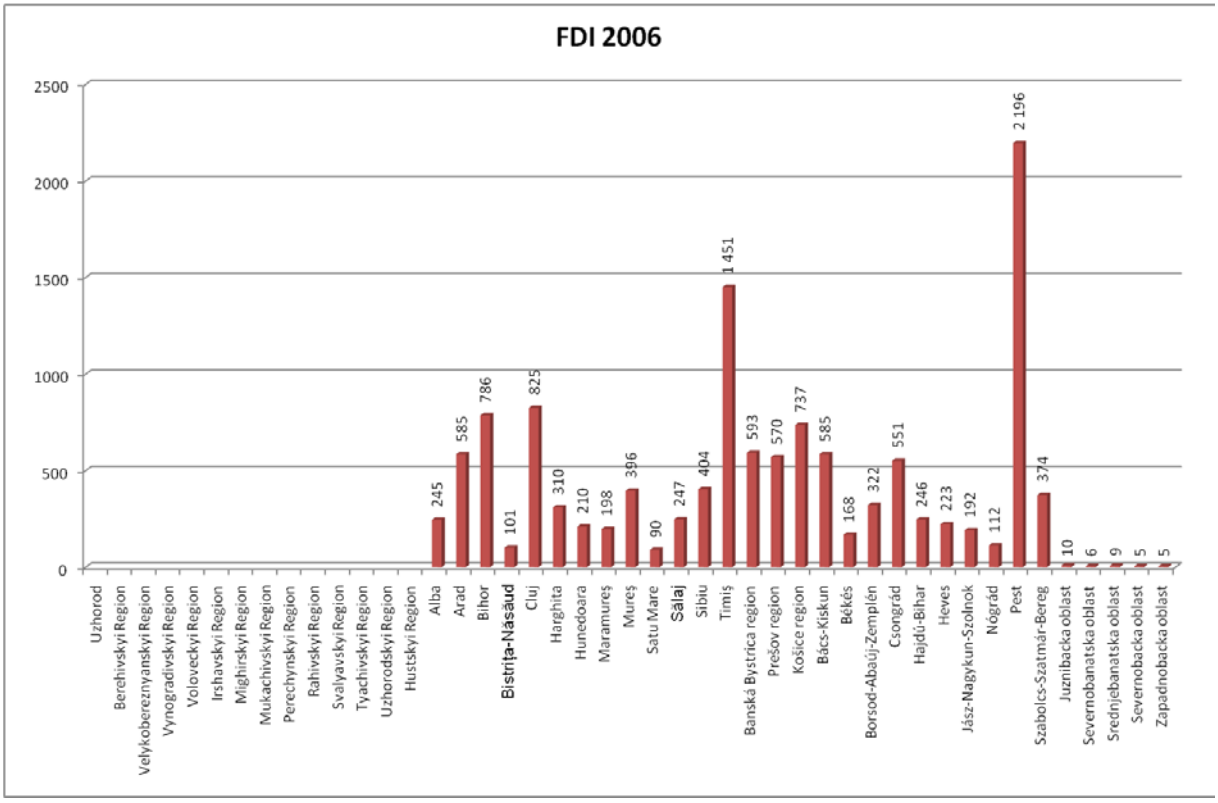
The **number of enterprises per 1000 inhabitant** are the *highest* in Hungary (41 – 67.4). This number is higher in the more developed counties especially in the ones containing significant size urban centre. It still falls behind the national average (79 enterprises / 1,000 people), which is also indicative of the Region's weak economy. The distribution of enterprises by size in the Hungarian Tisa region is similar to that registered on a national level. The majority are microenterprises (with 1 to 9 employees) (65%), the share of small business with 10 to 49 employees and medium-sized enterprises with 50 to 250 employees is 3% and 0.6%, respectively; the proportion of corporations (> 250 employees) is statistically insignificant (0.1%). Businesses with 0 or unknown number of employees can probably be included among microenterprises.

The *middle range category* concerning enterprise density (14.6 - 27.8) is composed by the more developed Romanian counties and the Serbian Južna Bačka County due to the presence of Novi Sad. This indicator recorded a constant growth. The highest number of companies/1000 inhabitants was recorded in Cluj County (27 companies/1000 inhabitants). Similarly to the Hungarian counties, in this category the majority of companies are small businesses (0 to 49 employees – 97.2%). The highest number of small companies was registered, in 2007, in Cluj (17,988) and Timiş (16,414) Counties. The companies with more than 250 employees have a very low weight (0.7%) of the total number of companies registered in 2007. Their highest number was recorded in Timiş (128) and Cluj (102), followed by Sibiu (83) and Bihor (79) counties.

The *lowest range category* concerning enterprise density (1.4 – 14.6) is composed by Zakarpatska Oblast from Ukraine, the Slovakian regions, the least developed Romanian counties (Bistriţa-Năsăud, Maramureş and Sălaj) as well as the two least developed Serbian counties (Srednje-Banatski and Severno-Banatski).

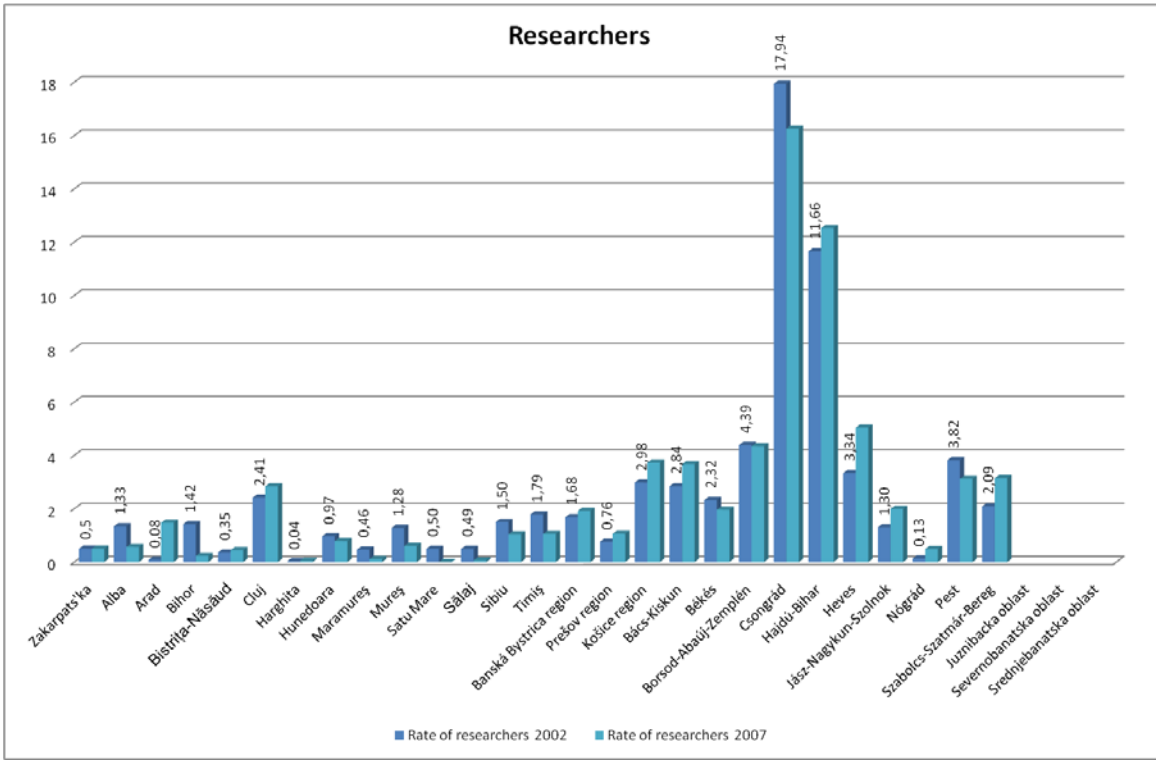
Concerning the Slovakian regions small companies (from 0 to 49 employees) have predominant position. Their share is 97 %. Small enterprises are predominant in all districts of the of the Tisa River Basin in Slovakia. Big companies (250 and more employees) present negligible share from the point of total number of companies. But they are irreplaceable for the target area of the Tisa River in Slovakia. The highest concentration of big enterprises is in the City of Košice.
In the Serbian Tisa catchment area small enterprises are dominating in all five counties (more than 77%).

Concerning **number of companies with foreign direct investment**, Pest County is outstanding due to the influence of Budapest. The rest of the Hungarian catchment area is characterized by very low and constantly decreasing FDI and shows a constantly decreasing trend. One reason may be that foreign investments are attracted by the industry, while the Tisa region shows a constantly decreasing trend in terms of the number of industrial enterprises.
Timiş, Cluj and Bihor County in Romania have relatively high FDI (785-1,451) compare to other counties of the target area and a continuous increase is registered. The increase in the number of foreign companies took place either because of the capacity of some local factors to facilitate the integration of some local economic agents in the supranational productive network, or in the conditions in which foreign companies speculated the existence of cheap labour force, with the relocation of some productive units from other countries (e.g. Nokia, textile and clothing companies or automotive industry). Most frequently it refers to increases that do not have a multiplying role in local economy. One positive aspect which should be noticed is the presence of strategic investments in the region: Continental and Siemens at Timişoara, Lafarge at Aleşd, Leoni at Bistriţa, Rambaxi at Cluj, Steilmann at Satu Mare and Sighetu Marmaţiei, Nokia and Ericsson at Cluj.
The Slovakian counties, the Romanian Arad County, and the Hungarian Bács-Kiskun and Csongrád County has FDI still somewhat above 500. In the Slovakian counties number of companies with foreign capital in the target area stagnates in the recent years and their share is decreasing.



The **density of industrial parks** is the highest in the Slovakian and Hungarian counties. Theres is only a few in Romania mainly close to urban centres.
There are several bussiness incubators in the Serbian Tisa catchment area, which contributes to the development of small enterprises but there is no exact data available on NUTS3 level.
There is no category of business infrastructure such as industrial parks in Ukraine. However the Council of Zakarpatska Oblast approved "The Program of Establishment of Logistic Centres in the Territory of Oblast for 2009-2011" and "The Program of Establishment of Industrial Parks in the Territory of Oblast for 2008-2012". Both Programs are referred to priority directions of economic development in the Oblast.
The Programs envisage establishment of 6 traffic logistic centres with the industrial park elements in the territory of the region: 3 in Uzhorodskyi Region («Chop-Záhony», «Rozivka» and «Solomonovo») and by 1 in Berehivskyi («Bereh Dyida»), Vynohradivskyi («Dyakove») and Mukachivskyi (Mukacheve International Airport) Regions.
The availability of developed transport infrastructure (airports in Uzhorod and Mukacheve, river transport in Chop, highways and railways) vicinity of frontiers of 3 European Union member-countries and availability of qualified manpower are the basis for establishment of logistic centres and industrial parks.
At present, the work of establishment of industrial parks "Solomonovo" (car manufacturing), "Rozivka" (electronic industry) and cross-border park "Bereh Dyida" is under way.

III.2.1.3. Buisness infrastructure and R+D



Within Zakarpatska Oblast which covers **Ukrainian** part of Tisa River Basin more then 50% of research organisations are concentrated in Uzhorod (14 organisations of 21 in total for the region). The rate of researches is also the highest here – 64% of the total number in Zakarpatska Oblast. Besides Uzhorod research organisations are in Mukachevo, Berehove and Rakhiv. Among the important research organisations of the region are Uzhorodskyi National University (Uzhorod), Zakarpatskyi State University (Uzhorod), Mukachivskyi State University (Mukachevo) and Ferenc Rákóczi II Zakarpatian

Hungarian Institute (Berehove). Also there are three institutions of National Academy of Science of Ukraine in Uzhorod – Institute of Electron Physics, Zakarpatskyi Regional Centre of Social-Economic and Humanitarian Research of National Academy of Science of Ukraine and Uzhorodskyi Scientific and Technical Centre of Materials of Optical Medium of Institute of Information Registration Problems. Besides the mentioned above organisations the Carpathian Biosphere Reserve and the National Parks "Synevyr", "Zacharovanyj Kraj" and Uzhanskyj realise research activities and contribute to development of the region.

In **Romania** the activity of research, quantified by the number of researchers, registered a decrease between 2002 and 2005, and then recorded a small upturn, without reaching the initial level. High number of researchers can be found in counties having universities, research institutes or industrial units which have such staff in their organisation chart (Cluj, Timiş). Besides universities, educational institutes or companies with some investments in research (eg. Babeş-Bolyai University, Technical University, University of Agricultural Sciences and Veterinary Medicine or "Iuliu Haţieganu" University of Medicine and Pharmacy, all from Cluj County, West University of Timişoara, North University of Baia Mare, University of Oradea or the two mining research institutes of Baia Mare), the presence of industrial parks or business incubators can also be mentioned.

In **Slovakia** science and research represent significant potential of further development of **Košice region** from the point of improvement of economy and maintenance of qualified people in this region. Infrastructure in this field consists of three universities, educational institutes and big enterprises with their research departments. A special group in the Košice region represents institutions which are orientated on direct support of innovations and transfer of technologies in the area where results of research and development are realized. There belong science-technical incubators or enterprise innovation centers and also established Science-Technologic Park Technicom Košice. R and D in other regions is quite insignificant.

Concerning research and development the **Hungarian** Csongrád and Hajdu-Bihar Counties have significantly the highest rate of researchers within the entire target area, due to university cities such as Szeged, Debrecen. Szeged is the second largest scientific and research center in the country (16.3 researchers per 1,000 capita in Csongrád County), while Debrecen is the fourth one (12.5 researchers per 1,000 capita in Hajdú-Bihar County). There are also universities in Gödöllő and Miskolc, and there is at least one institution of higher education (in addition to the above, these are mainly located in Kecskemét, Békéscsaba, Szarvas, Hódmezővásárhely, Szolnok, Jászberény, Nyíregyháza, Gyöngyös, Eger, and Salgótarján). At national level, Nógrád County has the least importance in research. The research institutions in the Tisa region are mainly organized around agricultural research in Szeged, in Kecskemét, in Szarvas, in Debrecen, in Karcag and biological research in Szeged, and in Gödöllő. Of course, there are also astronomical, geographical etc. research institutes in these university centers. Due to their industrial and economic relevance, it is important to mention the Nanotechnology Research Institute (Nanotechnológiai Kutatóintézet) and the Logistics and Production Engineering Institute (Logisztikai és Gyártástechnikai Intézet) in Miskolc. For the future, the plans to establish the Genomics Center (Genomikai Központ) are also worth mentioning, which is in a preparatory phase. In a European comparison, despite a still modest annual increase in R+D costs invested by Hungary, these costs are half of the EU average (0.97% compared to 1.85% in 2007), and in this respect the underdevelopment of Tisa region may be even of a greater degree.

In **Serbia** the main R&D center in Vojvodina is the University of Novi Sad (UNS). It consists of 13 faculties and several research institutes. The research stuff is made up of 2,098 lecturers and associates. UNS is an expert institution, competent to do R&D in a large number of scientific fields. Within the UNS there are three R&D centers: Scientific Center for Food Engineering and

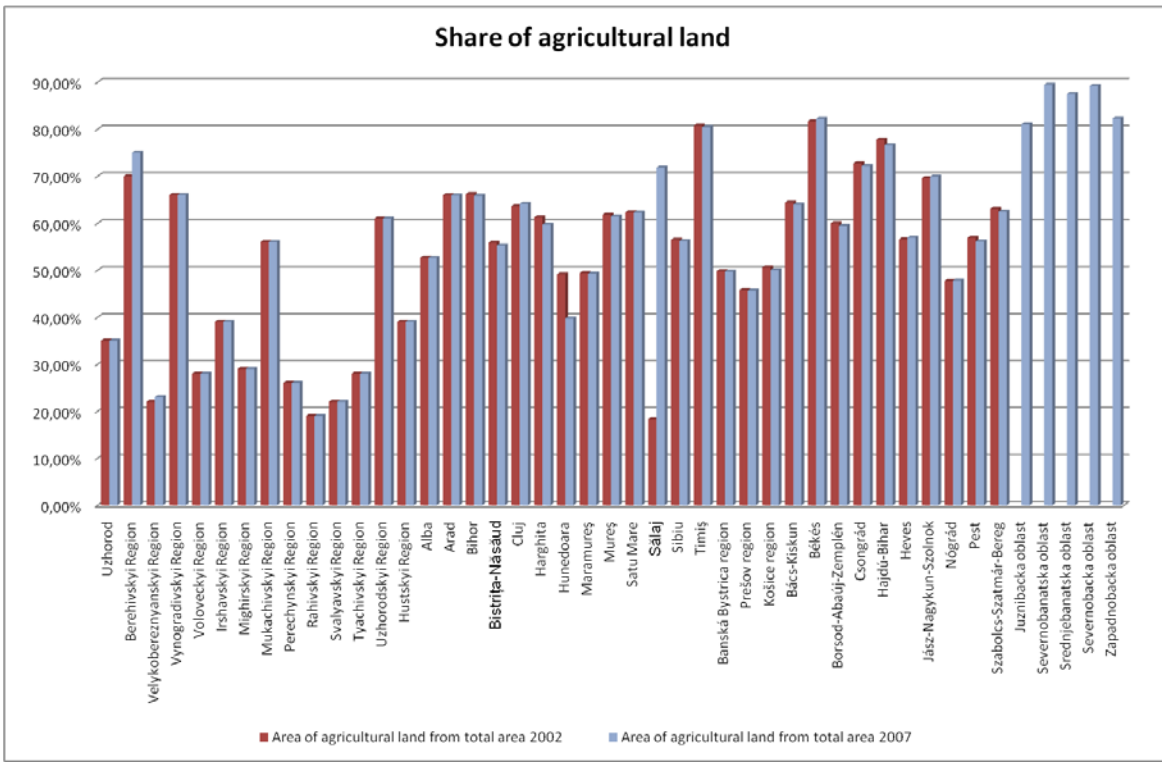
Management and the Research and Development Center of the Faculty of Technical Sciences. Besides, there are two independent scientific institutes in Vojvodina as well. There are 167 scientific workers employed in these institutes, and both enjoy a high-level scientific reputation acknowlidge worldwide in their arias.
In addition to this, there are 7 R&D units in the area, with 104 scientific workers and 58 expert collaborators. Medium and large enterprises in Vojvodina have their own R&D divisions, but there is no reliable information on them.

III.2.2. Agriculture and forestry

III.2.2.1. Agricultural land use

The proportion and structure of agricultural lands in themselves can be hardly evaluated. In order to describe them, one should know their **agricultural suitability and environmental features**, as well as their spatial relation to land use.

In general, the share of agricultural land use is quite high across the entire Tisa catchment area. Due to the agricultural suitability where the relative share of agricultural land use is high, the domination of arable land is also very strong. The share of grassland is higher in areas with lower share of agricultural land use.
The highest share of agricultural land use can be found in the Serbian counties, Békés County in Hungary, and Timiş County in Romania where the share of area used for agriculture is very significant, between 76.5-89.4%. In these areas arable land cultivation is the dominant. Still very high, around 70% is the share of agricultural land in Berehivskyi region in Ukraine, Sălaj in Romania and Csongrád, Hajdu-Bihar and Jász-Nagykun-Szolnok County in Hungary. The agricultural land use has the smallest share in Prešovski and Hunedoara Regions and in most of the Zakarpatska Oblast. In the latter, the low share of agricultural land use is the consequence of the predominance of mountain ranges in the region.



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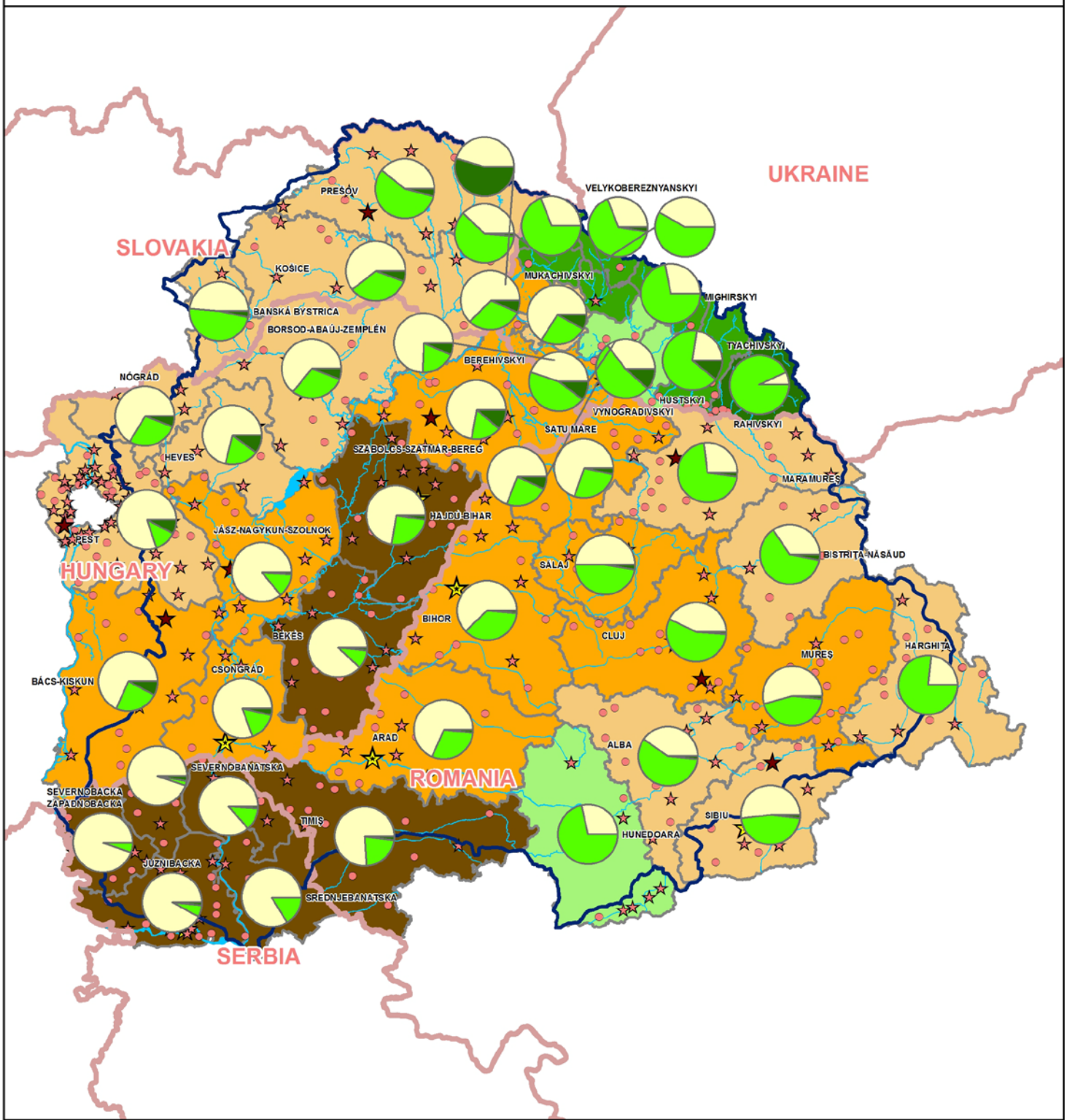

Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Share of agricultural land from total area 2007

- - 20,00%
- 20,01% - 30,00%
- 30,01% - 45,00%
- 45,01% - 60,00%
- 60,01% - 75,00%
- 75,01% -

Share of agricultural land use by Cultivations

- Arable land
- Grassland
- Plantation

SOURCE
Ukraine: State Agency of Land Resources of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistic Office of the SR
Hungary: TEiR
Serbia: Public Company "Vojvodinasume"

III.2.2.2. Agricultural suitability

In **Ukraine** there is high degree of afforestation, and the significant areas of agricultural land are permanently covered with grass vegetation and used for pastures and hayfields.
The south-western part of the region in the lowlands of Zakarpatia is more suitable for farming. Pastures and hayfields are mostly common for highlands.

In **Romania** at the level of the analyzed counties, one distinguishes 10 **pedoclimatic zones**. Their characteristics, technological priorities and directions of evolution are related to the setting up of the structure of crops and the interest of the farmers. The mountain areas of the region are suitable for natural grasslands (the average grade of land evaluation: 23) and for fodder, potatoes and cereals (oats, barley, rye). The plateau areas, with an evaluation class between 30 and 40, have soils with different fertility, suitable for cereals (maize, wheat, spring barley, oats), industrial crops or orchards. The hills with average heights, with an evaluation grade of 44, are favourable for cereals and the development of animal husbandry. The areas of the floodplains and terraces of Arieş and Someş, with evaluation grades between 60 and 70%, are suitable for different crops and vegetables. The areas of the contact area of the mountains include less fertile lands, favourable for autumn cereals, sugar beet, vegetables and alfalfa.
The area of the agricultural lands remained the same between 2002 and 2007, 8,270,074 ha. However, the structure of agricultural land suffered small changes, as the areas covered by arable land and forests increased, while the hayfields, grasslands, vineyards and plant nurseries decreased. Between 2002 and 2007, the agricultural land of the Romanian Tisa catchment area declined by 1.65% because of the conversion into forest land and built areas or because of the inclusion of some agricultural lands in urban areas. A major problem for the Romanian agricultural land use is the privatisation process, which is still ongoing.

In **Slovakia** there are 5 levels of **agricultural suitability**. This suitability of soils is derived from their productivity potential, climate conditions and their suitability for agricultural activities. There are the following categories: highly suitable soils, suitable soils, fair soils, acceptable soils and least suitable soils.
Highly suitable agricultural soils (0.5%) occur in the south part of the target area (in the districts Michalovce, Trebišov, Vranov nad Topľou, Rimavská Sobota, Revúca). These soils are also protected against occupying by non-agricultural activities by the Act No. 220/2004 Coll. on protection and use of agricultural soils. Because of increasing pressures on utilization of protected agricultural soils for non-agricultural activities the area of these soils is gradually decreasing.
Suitable conditions for crop production (are of suitable agricultural soils of 7%) are mostly in the south and southeast parts of the target area of the Tisa River in Slovakia, in the areas with the lowland character (south and southwest part of the Košice region, south part of the target area of the Banská Bystrica region). Fair suitable agricultural soils cover 24.5 % of the total area (in the south and southeast). Acceptable agricultural soils cover 17 % of the total area (in the north), and least suitable agricultural soils (with the lowest or any production potential called as **unfavourable areas**) cover 51 % of the total area of the target area of the Tisa River in Slovakia in the mountainous and hilly areas. Agricultural production in these areas is mostly oriented on livestock production (mostly target area of the Prešov Region, north part of the Košice Region and north part of the target area of the Banská Bystrica Region).
In the target area of the Tisa River in Slovakia there is as well observed gradual decrease of area of arable land and increase of area of grasslands.

In **Hungary** the results and proposals of the ***"three-category land use zone system"*** can help in determining (in particular for arable lands) where and to what extent the current land use structure matches the production and land conditions. This zone system defines three types of agricultural lands, and in particular in the case of arable lands. A**gricultural** production zones have favourable conditions for crop production and low environmental sensitivity. In contrast, environmentally sensitive zones have poor or moderate production conditions, and high environmental sensitivity. In addition to these two types, an interim category is also defined, which can be described by a combination of moderate or poor production conditions and moderate environmental sensitivity. In this system, conflicts appear in the interim zones (a category defined based on two criteria) and the environmentally sensitive zones. In some cases, these conflicts can be solved in such a way as to maintain their use as arable lands, while reducing the intensity of production. However, in most cases of conflicts, land use conversion is required. Based on this zone system, it can be estimated where and to what extent the current land use structure should be modified.

Based on the results of this system, significant changes (conversion to grasslands and afforestation) are required in the counties of the Tisa River Basin. The current land use structure differs to the greatest extent from the production and landscape conditions in the case of Szabolcs-Szatmár-Bereg, Bács-Kiskun, Borsod-Abaúj Zemplén and Nógrád Counties. In these counties the proportion of arable lands, as well as crop production on lands with poorer conditions for crop production and higher environmental sensitivity is unjustified.

The lands most suitable for agricultural production (arable lands) are the fan complex plain in the north part of the Great Plain, the region between the Körös River and Maros River, the chernozem in the Middle Tisa Valley and Hajdúság, which are lands with less forest and meadow soils. The remaining lands have moderate or poor conditions for crop production and high environmentally sensitivity. However, a significant proportion of these lands are also used as arable lands. The calcareous soil of the region between the Danube and Tisa, and the acidic sandy soils of the Nyírség region allows for the cultivation of only a few crops. The maintenance and development of intensive land uses and the conversion of a part of these lands into grasslands are essential in terms of protection against deflation. Due to their soils with fixed and often extreme water management, in the case of the Upper Tisa region and the Berettyó-Körös region it would be appropriate to create more extensive management systems and to convert the land use. In the middle of the Hortobágy, extensive (pastoral) use of the grasslands in areas with meadow solonetz soils constitutes the basis for sustainable management. While in the higher parts of the mountain regions (such as Cserhátvidék, Bükkvidék etc.) forestry plays a decisive role, a significant conversion of land use is required in the case of slopes and river valleys, in addition to the intensification of crop cultivation (afforestation, conversion to grasslands).

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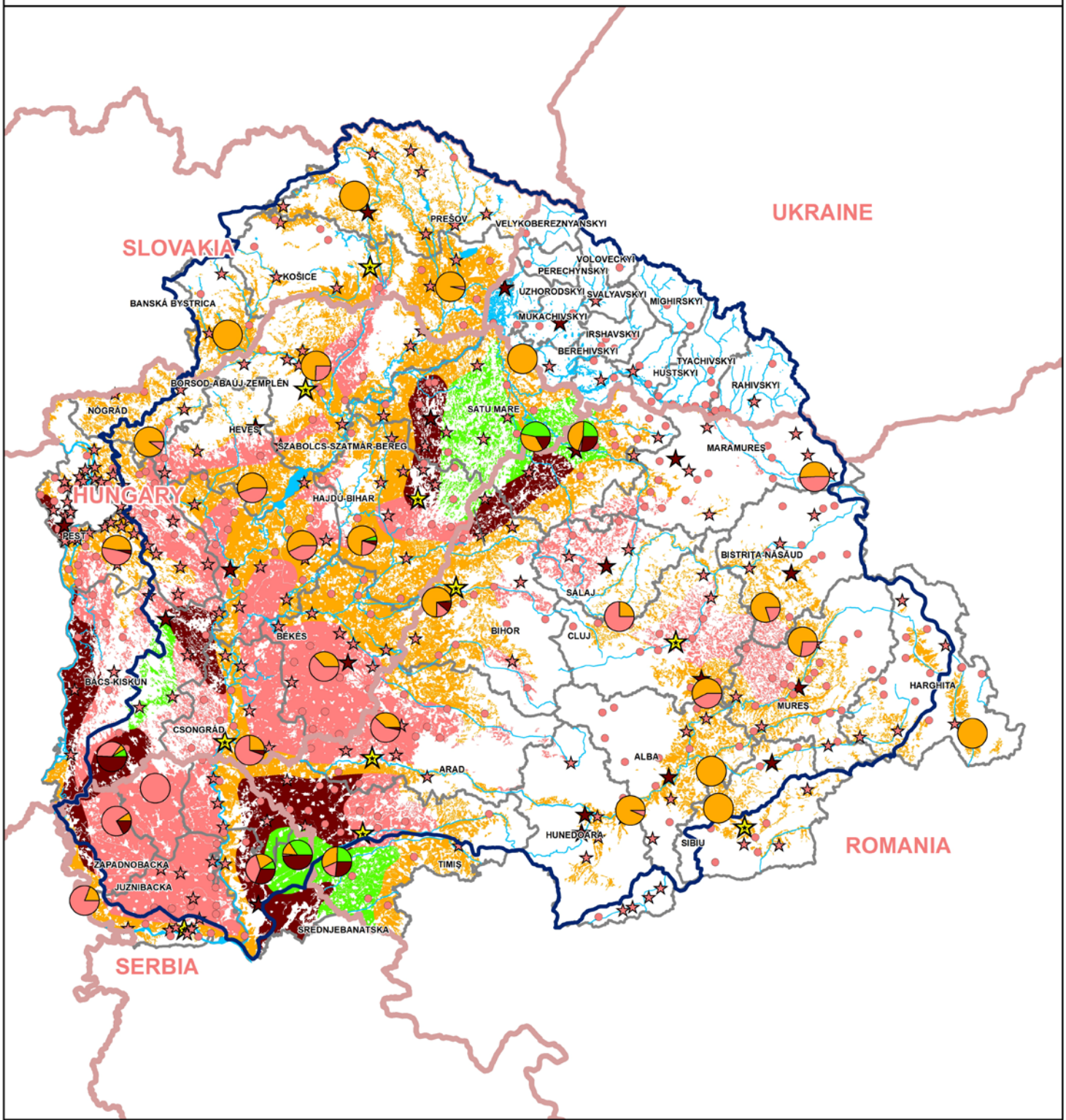
ECONOMIC BASE - SOIL SUITABILITY OF ARABLE LAND



Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Soil classification based on suitability for agricultur

- Least suitable
- Acceptable
- Fair
- Suitable
- Highly suitable

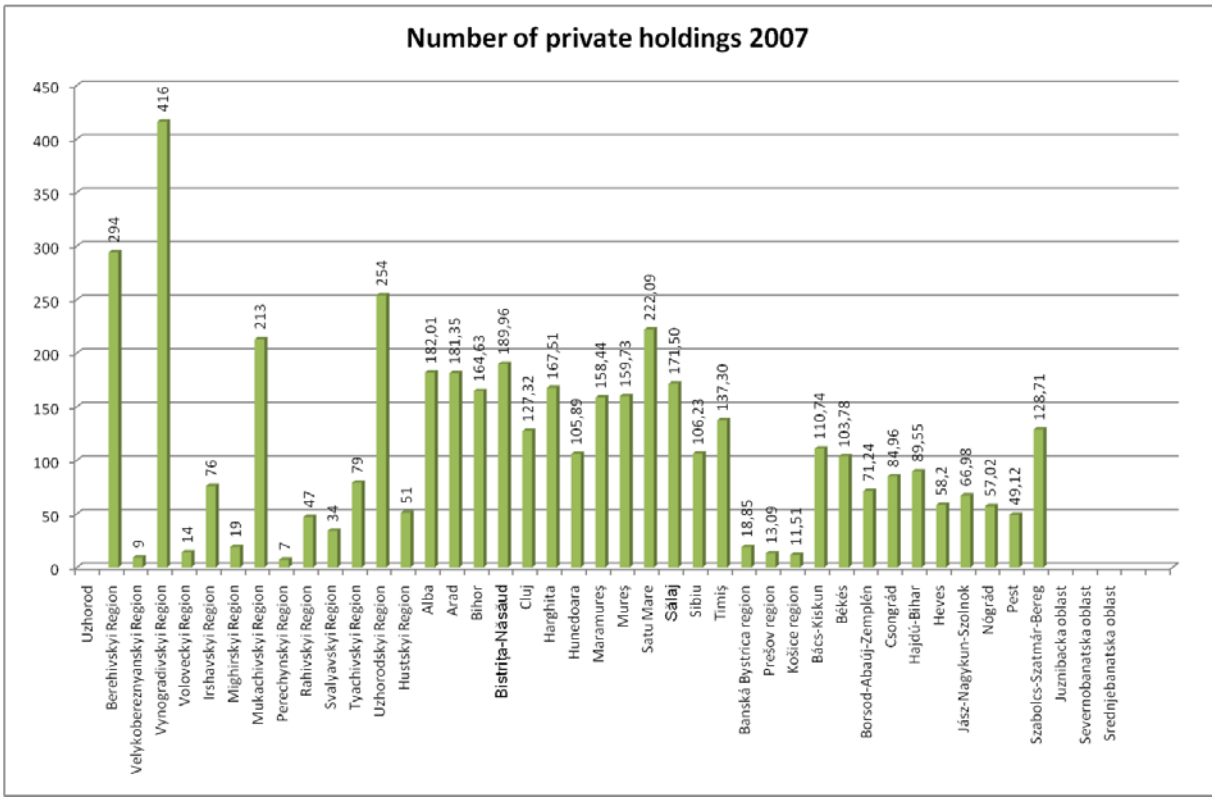
SOURCE
Food Agricultural Organisation - World Soil Map

III.2.2.3. Share and size of individual farms and collective enterprises

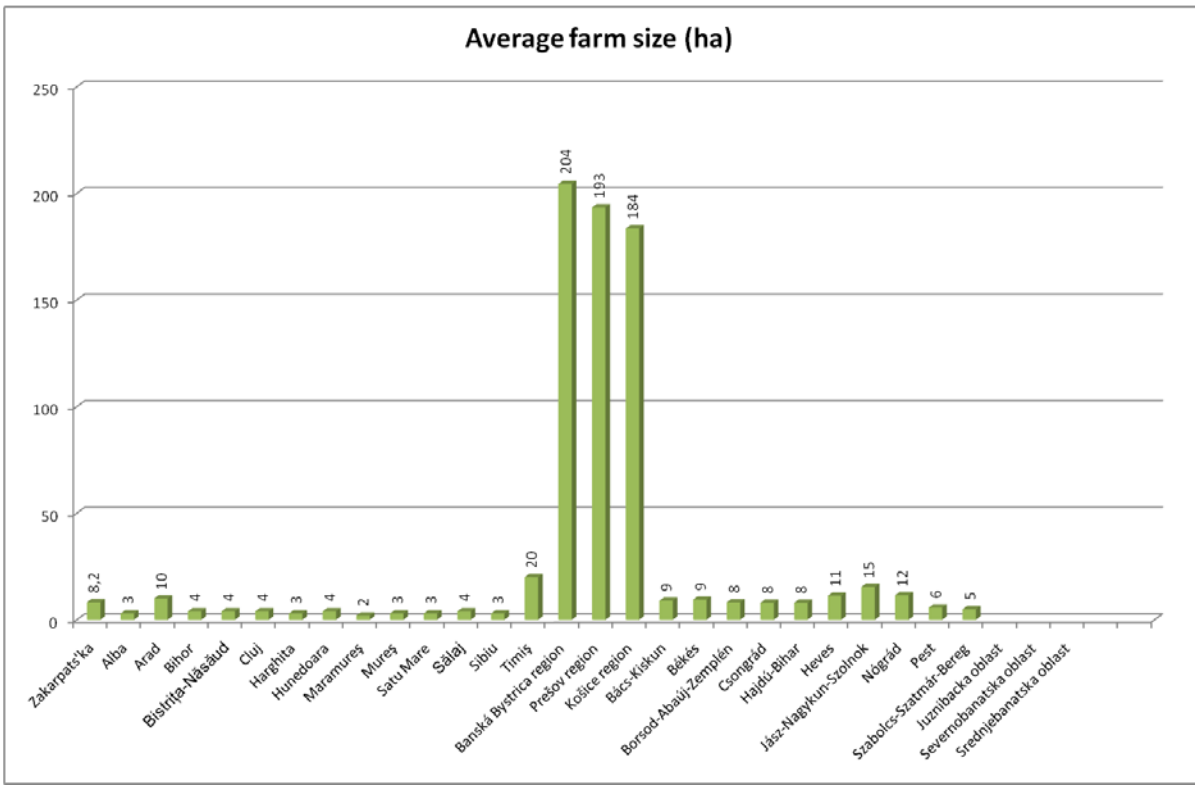
In **Ukraine** The share of population engaged in agriculture, hunting and forestry was 4.55% of the total number of workers engaged in all economic activities in 2007. This is significantly lower than the national average (16.6%). However, the employees of enterprises, establishments and organizations accounted for only 8.5% of such number and it does not include individual farmers. The rest (91.5%) were the persons engaged in individual farming, that plays the most important and increasing role in gross agricultural production (95.9%). Agricultural enterprises account for only 4.1% of such production. The overwhelming majority of individual farms are concentrated on plains (Berehivskyi, Mukachivskyi, Vynohradivskyi and Uzhorodskyi Regions).

In **Romania** most of the **agricultural companies/farms** (about 86%) are microenterprises with an increasing share.
The distribution of the registered companies by counties reveals significant differences. Thus, according to the number of registered companies, the county with the highest weight is Timiş (13%) and the county with the lowest weight is Sălaj, which has only 4% of the total number.
Of the total of 3,931,350 **farms** registered at the end of 2007, 3,913,651 (99.5%) were individual farms, covering 65% of the utilized agricultural land, while 17,699 units with legal personality covered the other 35% of the land.

In **Hungary** Békés, Bács-Kiskun and Szabolcs-Szatmár-Bereg Counties agricultural enterprises represent almost a quarter of the total individual enterprises.
Comparing the number of individual farms to the number of inhabitants, there are 61.6 farms per one thousand inhabitants at national level (in the European Union there are only 25 farms per 1000 inhabitants). The indicator shows the highest value in Szabolcs-Szatmár-Bereg County (here there are 128 farms per 1000 inhabitants), but it has values above 100 farms/1000 people in Bács-Kiskun and Békés Counties as well. In contrast, the values of Pest County and the mountainous Nógrád and Heves Counties are low, the indicator values are below 60 farms/1000 inhabitants.
In contrast to the high proportion of individual farms within the total number of farms, their share of crop lands does not even reach 40% at national level. However, in the regions of the Great Plain this value is significantly higher (about 50%). The individual farms use the greater part of crop land in the regions with lower or moderate agricultural suitability, while regions with higher agricultural suitability are characterised by the land use of economic organisations.



The **average farm size** is very low in general throughout the entire catchment area. It exceeds 10 ha only in Arad, Timiş, Heves, Szolnok and Nógrád County. The Slovakian regions belong to another order of magnitude, with average farms size around 200 ha. The lowest average farm size can be found in Romania.



III.2.2.4. Animal husbandry and plant cultivation

Animal husbandry

The indicator on **number of livestock per 100 ha** of agricultural land shows the leading role of the three counties of the Hungarian Great Plain, Bács-Kiskun, Hajdu-Bihar and Szabolcs-Szatmár County, which are leading in the density of all four economic animal species (cattle, pig, sheep and poultry). This is followed by the rest of the Great Plain counties together with Borsod and Pest County. The relative dominance of Hungary in intensive animal husbandry is significant.

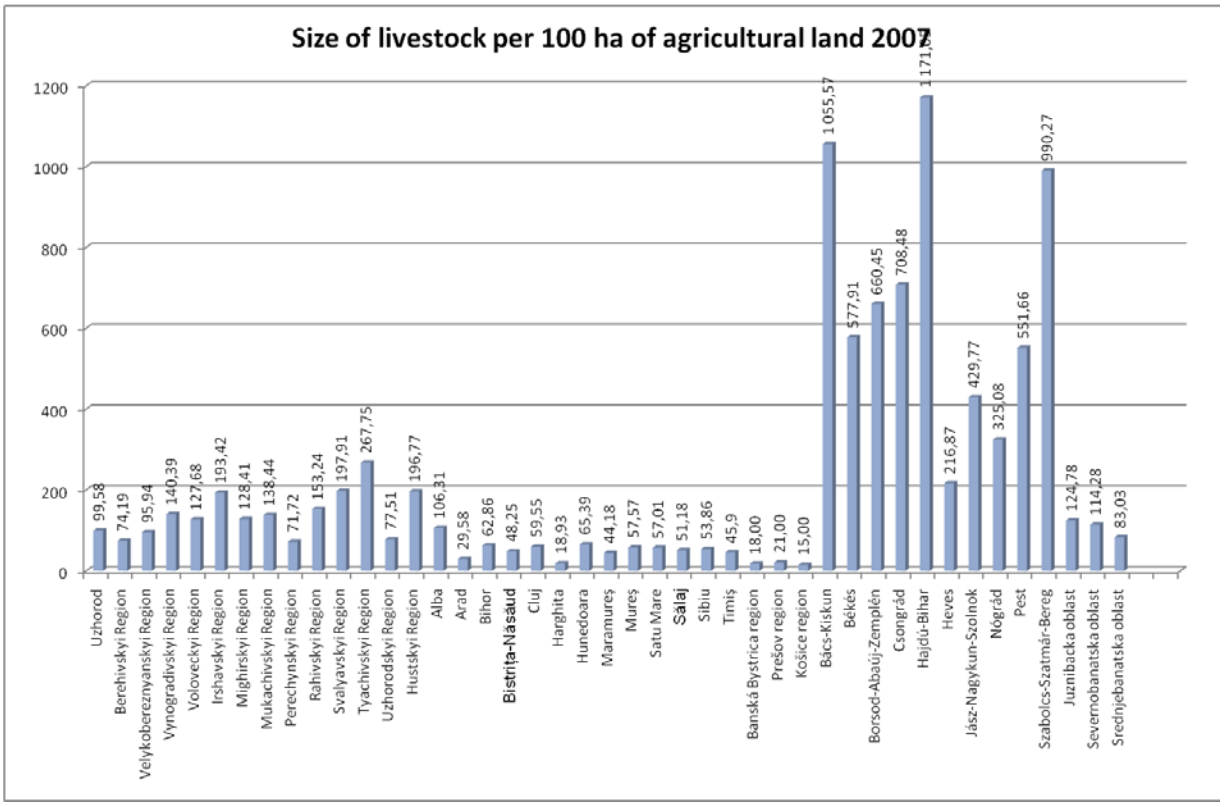
The next range is Zakarpatska Oblast where production of meat and dairy products is mostly focused on satisfaction of own needs. The region has long been specializing in sheep and goat farming.

This is followed by the Sebian counties, where animal husbandry has a relatively important role.

In Romania the size of livestock per 100 ha agricultural land is relatively low showing the very extensive characteristics of the production. It shows an increase in the Alba, Arad, Timiş Counties (counties with a high percentage of the plain or hill units, with a decrease of the agricultural land). The smallest values are peculiar to Harghita County, an administrative-territorial unit with the predominance of cattle and horses. The animal husbandry sector has an important weight in the Romanian agriculture and represents one of the basic activities in the rural areas and has been relatively stable. Due to the drought in 2007 except for sheep and goats, which registered an increase in their number, important decreases were registered in the other animal sectors. The presence of small farms discourages the livestock production. The total milk production is increasing by 1 million hl in the whole area, but the offer is still inadequate (higher values in Bihor, Cluj, Maramureş, Mureş Counties and lower values in Sălaj County).

Number of livestock/100 ha is the lowest in the Slovakian regions. Livestock production is mostly focused on cattle, pigs and sheep. Intensity of animal husbandry is the lowest in the Košice region, it doesn't reach national average. Prešov region contributes by 16 % to the Slovak total livestock production.

The animal husbandry sector has an important weight in the Serbian Tisa catchment area because agriculture represents one of the main activities in the rural areas. Number of cattle in 2008 ranged from 23,350 in Sevetno Banatski County to 47,268 in Severno Backi County. Breeding of pigs, sheeps and poultry in 2008 was the greatest in Juzna Backa County, while the smallest production was recorded in Srednjebanatski County.



Crop production

In **Ukraine** the largest share (47.8%) – is the land permanently covered with grass vegetation, of which pastures occupy 57.9% and hayfields 42.1%. 29% of all pastures are the mountain pastures. Arable agricultural land occupies 42.5% of the agricultural land. Perennial plantations occupy 5.8% of the agricultural land. Of these, 75% are orchards, 22.5% - vineyards, about 2% are orchards and other perennial plants. The rest 3.9% of agricultural land is the land for commercial buildings and houses, roads and trails, as well as the land reclamation construction, restoration of fertility, and temporary land conservation.

The Zakarpatska Oblast specializes in winegrowing, horticulture, tobacco and vegetable growing.

The areas under agricultural crops in the farms of all categories of the region were 190.7 thousand hectares in 2007. Out of these 45.3% were under grain crops, 1.2% under industrial crops, 25.4% under potato and vegetable-cucurbits crops, and 28.1% under forage crops.

The main areas specializing in growing grain crops in the region are Berehivskyi, Vynogradivskyi, Mukachivskyi and Uzhorodskyi Regions, located in the plain.

Mukachivskyi and Uzhorodskyi Regions are the main regions specializing in potato production, with one third of its total yield of the region. Berehivskyi, Vynogradivskyi, Irshavskyi, Mukachivskyi and Uzhorodskyi Regions are the main regions specializing in vegetable growing in the region.

Zakarpatska Oblast is the region of Ukraine specializing in growing fruits and berries, as well as grapes. The Regions specializing in growing fruits and berries are as follows: Berehivskyi, Vynogradivskyi, Irshavskyi, Mukachivskyi, Tyachivskyi, Uzhorodskyi and Hustskyi Regions. The vintage in 2007 in the region was 25 thousand tons, with 95% sold in five regions: Berehivskyi, Vynogradivskyi, Irshavskyi, Mukachivskyi and Uzhorodskyi.

In **Romania** the distribution of the **agricultural land** according to its various uses reveals the fact that the arable land covers about 64% of the agricultural land; about 30% is covered by grasslands and hay fields, while vineyards and orchards represent about 3%.
For major **crops**, production does not have a constant value and is well below potential. Almost two thirds of the cultivated area (INS, 2007) is dedicated to cereals and especially to wheat and maize. Industrial crops, especially oilseeds, reached the second place as share of cultivated area, following grain crops. In the case of vineyards, the areas with noble vineyard decreased by 18.6%, the most extended vineyards being located in Timiş, Arad or Alba counties. The same decreasing trend was registered in the case of orchards (a decrease by 16.26%), conditioned by the lack of financial measures, the purchase of fertilizers, or the construction of an adequate storage capacity. Vegetable production peaked in 2006 to over 4.8 million tones, with the highest values in Maramureş, Bistriţa-Năsăud, Sălaj, and Bihor Counties.

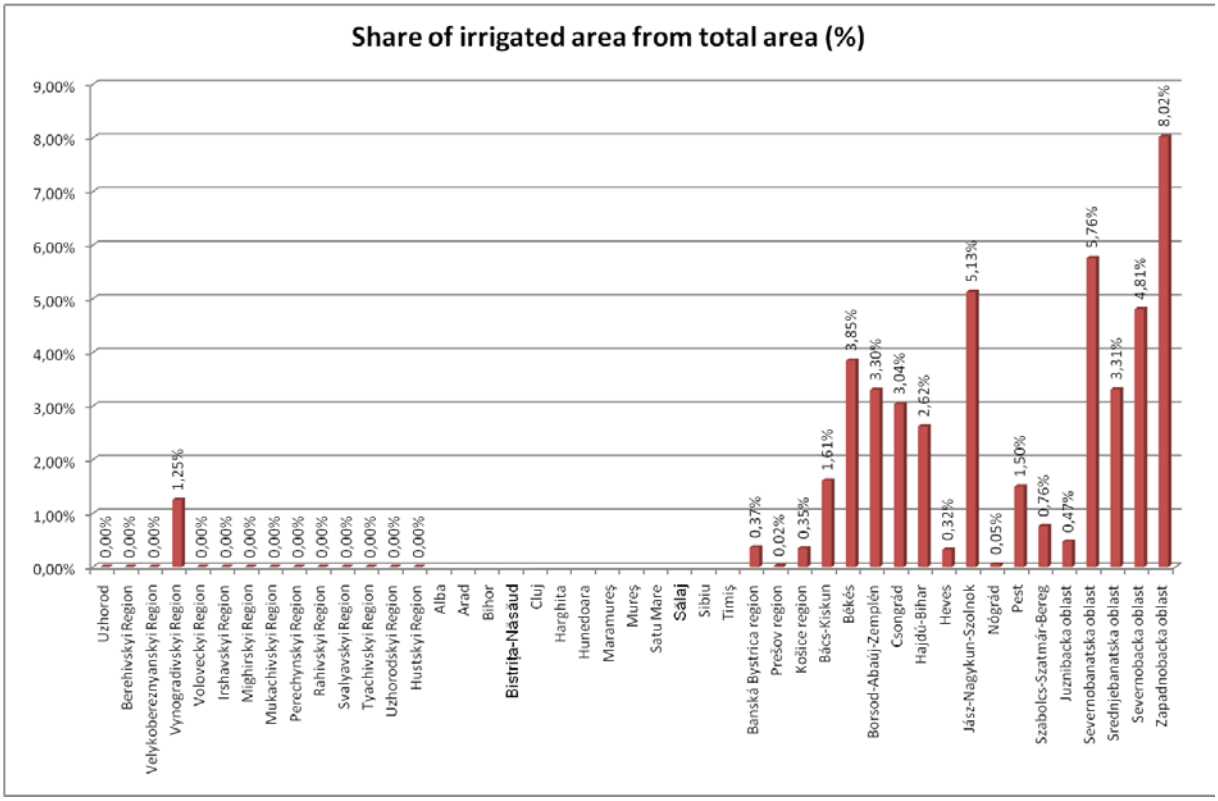
Due to the lowland character and optimal climate conditions of the south-east part of the **Slovakian** Košice Region this area is oriented on crop production, cereal growing. Crop production is quite low in Presow Region due to the unfavourable agricultural conditions. The north part of the target area of the Banská Bystrica Region is hilly with a great number of grasslands. Crop production is mainly oriented on potatoes and rye. The south part of the target area of the Banská Bystrica Region is warmer and almost all crops can be grown there including beet, vegetables, tobacco, etc.

It is **characteristic of the crop structure** of the **Hungarian** counties along the Tisa that the most important plant of the plough lands is wheat, whose production area represents a quarter of the arable land. This roughly corresponds to the national value (24%). The second most important crop of the region is maize, although the size of its production area is below the national indicator. Besides wheat and maize, the territorial proportion of sunflower and barley (especially autumn barley) is also significant. The average yield of the listed crops can be high especially in the regions with more favourable agricultural properties; therefore their cultivation is more significant in these regions. In regions with weaker agricultural properties (e.g. sandy soils) there is a greater emphasis on species and strains which adapt better to the properties of the land, thus these regions offer an opportunity to preserve agricultural biodiversity. On sandy soils these species include rye, lupines and sand potato, etc.

Planted meadow surface notably increased in all three **Serbian** counties with different growing index. Common feature for all three counties is the increase of seeded meadows total surface.
Orchard lands in Juyna Backa County increased, while in other two counties this land use surface had been considerably reduced. Vineyard areas also reduced their surface in two counties with significant grape growing tradition (Južno-Bački and Severno-Banatski). Srednje-Banatski, which is not traditional vine region, slightly increased vineyard surface.
Pasture lands were increased in traditional cattle breading regions (Srednje-Banatski, Severno-Banatski). In Južno-Bački County it is reduced.

III.2.2.5. Irrigation

Irrigation can be economical mostly in the case of garden cultures and seed production.
The proportion of irrigated land within agricultural land is the highest in the Serbian counties due to the natural features (two big river) and the crop structure. It is followed by the Great Plain region, especially Jász-Nagykun-Szolnok (5.13%) and Békés Counties (3.85%). In contrast, the values of the Northern Hungarian counties are very low, below 0.5%.
Irrigation system is the least developed in Romania, where in the last 20 years, the lack of investments in the field of **irrigation systems** can be remarked (rehabilitation or modernization), as well as low annual expenditures for the maintenance of irrigation systems.



III.2.2.6. Forest and wildlife management

Forest management
The share of area covered by forests is the highest (above 58,1%) in the eastern part of Zakarpatska Oblast in Ukraine**.**
In **Zakarpatska Oblast** forests are one of basic natural resources and perform water protection, protection, sanitary-and-hygienic, sanative, recreational, aesthetic, educational and other functions. By functional purpose, the forest structure is as follows: the largest share – 71.6% - merchantable forests, much lesser share – 27.2% - conservation value forests, and recreational forests – 1.2%. The trends for increase of the total area of forested land, general and average growing stock have been observed in the last years in the forest management of the Oblast. Tree planting and sowing volumes within the limits of the forest fund were stable enough, with very unstable planting volumes on non-agricultural lands and low-yielding agricultural lands outside the limits of the forest fund.
Hardwood (69%) and softwood (30%) species dominate by planting area. The prevailing species within the said groups include oak, beech, and fir trees. The age structure of forests has been greatly disturbed in consequence of unsustainable logging in the past: the young stand and average-age

stand account for 64 %, maturing stand – 13%, whereas final and over-matured stand account for 23%. However, over one half of matured and over-matured stand was excluded from principal felling calculation. Therefore, the Oblast faces now the aggravating problem of large felling volumes connected with forest management, though felling intensification has a negative influence on forest state.

Wood procurement for the last years reached 1 million m^3 (up to 40 % of annual stand growth), including principal felling – 500-530 thousand m^3, which is close to the maximum permissible level in view of the age structure and social and environmental importance of Zakarpatian forests.
A part of forests is in unsatisfactory sanitary condition in consequence of antropogenic, including technogenic and recreational influence, as well as in consequence of cutting silvicultural activities. The antropogenic influence on forests results in changes of the age and specie stand structure, its sanitary state and resistance, natural seed and natural sprout stand/forest culture stand ratio.
It is worth mentioning that forests of the Oblast are used for cultural and sanative purposes and have a recreational value, and fulfil important social functions, which is especially essential in such recreationally attractive region as Zakarpatska Oblast.
It is also worth mentioning that the production facilities of processing and food industries of the Oblast underuse the valuable forest raw materials (the volumes of forest product procurement are used for 30%). In fact, ecologically clean birch, sweet briar, and other natural berry juices and beverages, products of mushrooms, fruit powders of marc and non-standard raw materials for culinary and confectionery products are not available in the internal market. Thus, the forest resources are one of the main natural resources in the Oblast and define the priority position of forestry in its economy. Expansion of the forested areas shall be made by foresting non-agricultural lands and territories, which by their location and natural conditions are challenging for environmental network of the region.

The **Slovakian** target area and the eastern part of the Romanian target area composed by counties belonging to the second (39.4% – 58.1%) and the third categories (29.1% - 39.4%). In the Slovakian target area the largest share covered by forests is the north and northwest part. The share of commercial forests (economic forests) is 69 %, protection forests is 12 % and forests for special purpose (recreational forests) is 19 %. From protective forests the most predominate are forests in extremely severe areas and forests with soil protection function.

The structure of forests in the **Romanian** target area by functional groups highlights a high weight of forests meant to protect the soil and the lands (42% of the regional forestry fund) and of forests meant for protecting waters (31%). The other categories cover only a small percentage.
Western half of the Romanian target area and the Hungarian part of the Tisa catchment area has the lowest share of forest covered land (below 29%) and in the largest part of the Hungarian Great Plain and in Timiş County in Romania it is lower than 15,3%.

On the Great Plain in **Hungary** economic functions are decisive. In the Northern Hungarian counties the nature conservation function is the most significant within protective forests, since a significant part of forested areas in the Northern Hungarian mountainous regions are situated in protected natural areas. The proportion of recreational forests is around 1-2 % in all counties of the Hungarian target area.

In **Serbia** the dominant species are Euro-American tilia and mixed forests with pedunculate oak domination. The vastest forest land areas (22,433.89 ha) have protection function and the rest come with commercial (12,753.35 ha) and recreational (107.6 ha) functions. Forests with protection function are those within the protected nature areas with categorized protection zones. Category I

protection zone requires strict level of protection. Category II protection level enables just those activities that are improving nature in the designated area. Category III protection level enables limited commercial use of a forest as well as commercial activities that comply with general regulations designated by the low on nature protection and other national legislation acts.

As **regarding ownership structure** the highest share of state owned forests can be found in **Ukraine** and in Serbia (close to 100%). In the rest of the territory the share of privately and state owned forests are quite balanced, except in Kosice region, where the share owned by the state is much higher whereas in Szabolcs-Szatmár-Bereg County, privately owned forests dominate.

In **Romania i**n 1990, the entire national forestry fund was state-owned. After privatisation the forests owned by the state still form a majority, of about 54% of the total. However, since 2004, the percentage of private forests increased. They have an average regional weight of about 46%, with higher values in the counties of Timiş (49.9%), Sibiu (49.8%), Mureş (48.6%), Harghita (49.4%) etc. In the near future, the weight of private forests will further increase. There are still many claims and a high number of lawsuits regarding the recovery of possession which are about to be solved in justice.

In **Slovakia** 48 % of forests are in private ownership and 52 % are in the state ownership. The highest share of forests in private ownership is in the target area of the Banská Bystrica Region (56 %) and the lowest is in the Košice Region (27 %). The highest share of forests in state ownership is in the Košice Region (73 %) and the lowest is in the Banská Bystrica Region (44 %).

It is characteristic of the proprietary conditions of the forests that while in the Northern **Hungarian** counties with high forestation rates the territorial proportion of forests owned by the state exceeds the national value (55%), in the Great Plain counties with generally lower forestation rates (with the exception of Békés County) the proportion of privately owned forests is more significant. The higher share of the state means a value around 60%, while by the higher proportion of privately owned forests we mean an indicator value of around 50%. However, as regards private forests, we can also find an outstandingly high value in Szabolcs-Szatmár-Bereg County, where nearly three quarters of the forested areas are private property. The share of state ownership is accordingly the lowest here (27%).

Game management and hunting

The area of lands provided for hunting in **Zakarpatska** Oblast is 987.3 thousand hectares. Hunting arrangements were made in the area of 1,132.9 thousand hectares.

Such activity, as a component of indirect forest use, offers an opportunity of getting valuable food products and trophies, breeding of hunting dogs, development of hunting shooting sport, and satisfaction of the population needs for hunting. The hunting structures available in the Oblast do not fulfil in full their functions of zoonotic disease prevention in the hunting areas, exclusion of livestock from renewable areas, creation of biotechnical complexes, arranging renewable enclosures for wild animals etc.

Hunting and fishing grounds in **Romania** are managed by 82 specific institutions. Their area covers about 92% of the existing land fund. The Romanian part of Tisa catchment area has a remarkable biodiversity and a series of untouched natural ecosystems. Among the most valuable species for hunting, one remarks the following game: deer, chamois, roe deer, fallow deer, capercaillie, pheasant, wild goose, wild duck, the hazel grouse, hare, marten, wolf, wild boar, wild cat, pigeon, partridge, quail, lynx, brown bear, fox, brown trout, lake trout, rainbow trout, brook trout, grayling and carp.

The mountainous and hilly forested regions mainly in the north parts of target area of the Tisa River in **Slovakia** are characterised by great game management. In the plain areas of the studied area, small game management prevails. In 2008 there were in Slovakia 1,837 hunting districts with the area of 4,529,502 ha. The main species of hunting are: deer, fallow deer, moufflon, roe deer, wild-boar, pheasant, hare, rabbit, patridge, wild duck, and wild turkey.

The worldwide fame of **Hungarian** game management is primarily based on the quality of the big game stock of outstanding value and on the well-organised hunting services. This sector continues to be export-led: more than a quarter of revenues come from foreign contracted hunting. The majority of foreign contracted hunters come from the European Union. Of the game management areas the region contains the *Danube-Tisa interfluvial and the Trans-Tisa small game*, the *Northern Medium Mountains* big game and, to a smaller extent, the *Central Hungarian* game management areas. The mountainous and hilly forested regions (Northern Hungarian Medium Mountains) and the larger forests of the plains (e.g. certain parts of the Sandy Ridge) are characterised by big game management. In spite of this, in the mountainous regions only the populations of red deer, boar and mouflon are significant. In the agricultural areas of the plains small game management is emphasised. The most important small game species are the brown hare and the common pheasant, but of the big game species the larger populations of fallow deer and roe deer are also associated with the plains.

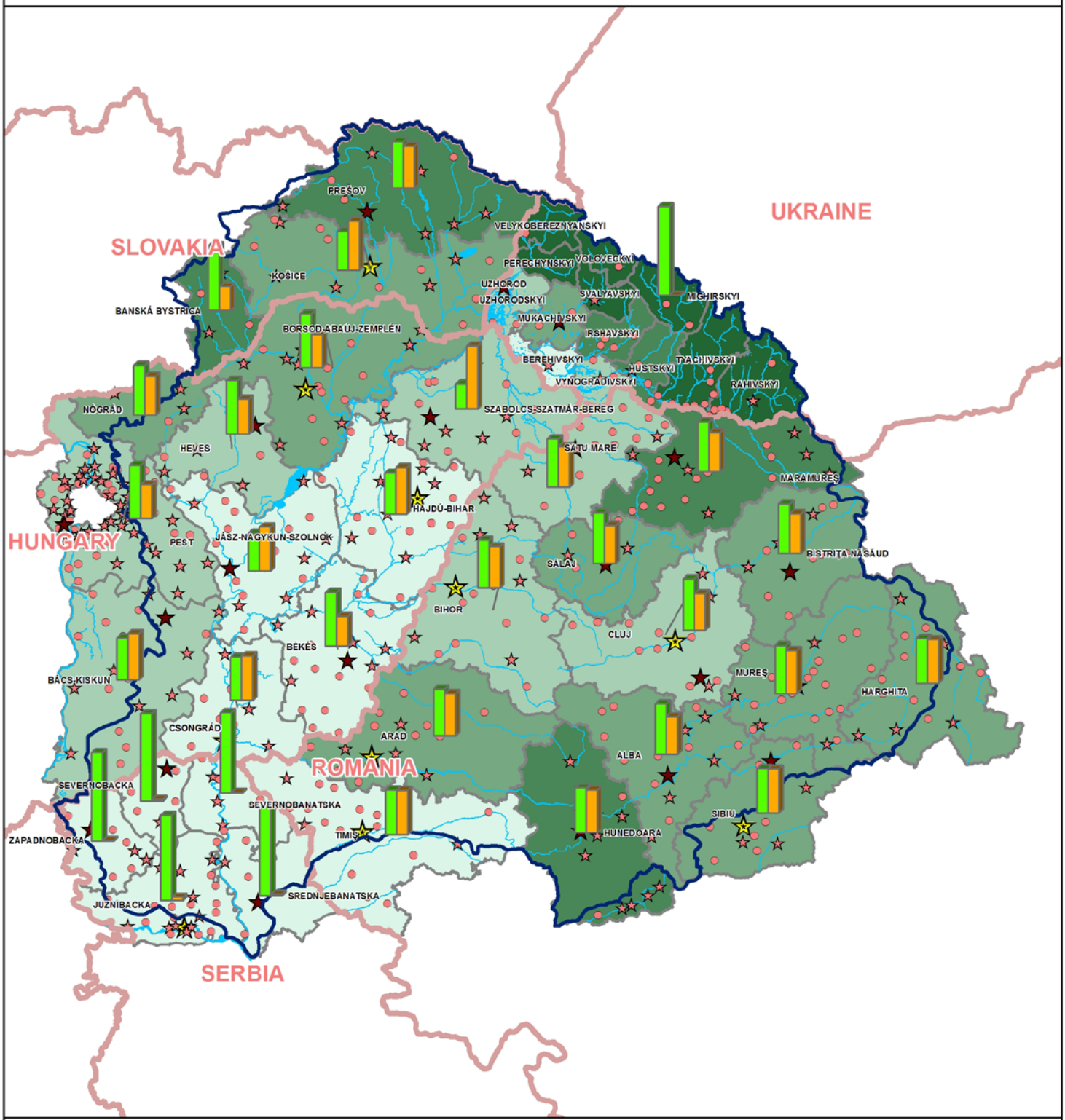
Serbian Tisa catchment area includes 48 hunting areas of total surface area of 975,376.62 ha. Most represented hunting wild animals are: European deer, mouflon, roe deer, wild boar, rabbit, partridge, and pheasant. Some hunting grounds are spreading over more municipalities.

SOUTH EAST EUROPE
Transnational Cooperation Programme

TICAD
TISA CATCHMENT AREA DEVELOPMENT

Programme co-funded by the EUROPEAN UNION

TICAD
ECONOMIC BASE - FOREST



Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Share of forests to total area 2006
- 3,68% - 15,00%
- 15,01% - 27,00%
- 27,01% - 40,00%
- 40,01% - 55,00%
- 55,01% - 71,80%

Forest ownership*
- 0,5
- State owned forests
- Privately owned forests

** Ukraine data refers to Zakarpatska oblast*

SOURCE
Ukraine: State Agency of Land Resources of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistic Office of the SR
Hungary: TEiR
Serbia: Public Company "Vojvodinasume"

III.2.3. Industry

III.2.3.1.Mining activities in the Tisa River Basin4

The mining industry is well developed in the Tisa River Basin. Mining for non-ferrous metals generates much needed income along the Someş and the Mureş Sub-basins, the major Romanian tributaries to the Tisa River. The mining industry has been developed in some mountainous areas such as the Maramureş, Gutâi and the Apuseni Mountains. This industry offers employment for ten thousand local inhabitants, but also constitutes a serious potential for soil and water pollution.

Small-scale mining also occurs in the **Ukrainian** section of the basin, with the extraction of salt, kaolin, mercury, gold, complex ores, zeolites and rocks used as construction material. There are three types of mines in Ukraine:

- There are many mines for building materials, such as rocks, clay and sand, and they cover the entire Tisa River Basin. Their impact on water quality is not significant. The volumes of broken brick were 897,000 m³, gravel – 20,000 m³ and sand – 30,000 m^3 (2003).
- Salt mines are located in Solotvyno in the Tisa floodplain (at the Ukrainian-Romanian reach of Tisa). The salt extraction was 132,000 tons (2003). Mining wastewaters are pumped into the Tisa River, but concentration of chlorides in the river does not exceed fishery MAC (maximum allowable concentration).
- Golden and polymetallic mine is located in Muzhievo village in the Verke River Sub-basin (river Verke flows into Tisa and Latorica through the network of canals). The mine became operational in 1998 and beneficiating factory – in 1999 in 12 km from the mine. The mine is of gallery type. Only gold is extracted at the mine using gravitation method. Since opening, tailing deposit of 150,000 tons was established as well as sludge pond. Deposits and sludge have high concentrations of Pb, Cd, Zn and Mn, and their drainage into groundwater creates a problem with drinking water in weirs of nearby villages and river Verke. In 2007 activities on the mine were stopped due to low economic value (from 2000 till 2005, only 632 kg of gold have been extracted). Although the sludge pond became dry, the remaining deposits caused significant environmental threat and additional researches are needed.
- In the Borzhava Basin there were several coal mines, but they closed in the 1960s.

In **Romania** at present, mining activity is severely reduced as several mines are closed and other mining sites will be closed in the future. Also, according to the Romanian – EU Adhesion Memorandum/Ro-EU Common Position and to Romanian legislation, the mine waste rock storage in non ecological dumps/piles has ceased, except for a few which have obtained a transition period.
Among the riparian countries, Romania has the most developed mining and ore processing industry due to its significant deposits of copper, lead, zinc, gold, silver, bauxite, manganese and iron ore. Copper is mined in two districts in the Tisa River Basin, both in Romania. Lead and zinc are produced at underground mines in Baia Mare, Baia Borşa, Certeze - Socea and Rodna districts. The regional production of alumina was performed by the Oradea refinery (since 2006, this company has temporarily ceased its activity). Gold resources in the Tisa River Basin region are mainly concentrated around the cities of Baia de Arieş, Roşia Montană, Brad, Zlatna. Uranium deposits are also found in the Romanian part of the Tisa River Basin, located in the Western Carpathians (Apuseni Mountains).

The target area of the Tisa River in the **Slovak Republic** is relatively rich in mineral raw materials. In the Košice Region in the area of the Eastern Slovak Plain there is the second biggest reservoir of the

[4] This chapter is based on ICPDR-Tisa River Basin Analysis Report 2007, on the national analyses and informations coming from the UNEP – Rapid Environmental Assessment of the Tisa River Basin, 2004

energy materials in Slovakia, with gasoline type of oil. About 70 % of domestic gas exploitation is realized there. Exploitation of ore metals is limited; there are mined deposits of iron ores in Rudňany and Nižná Slaná. The most important industrial mineral mined in the Košice region is limestone. Its biggest deposits are in the area of the Slovak Karst (Gombasek, Včeláre, Slavec, Drienovec)) and in the eastern part of the Slovak Ore Mountains. Košice Region is also rich in gypsum, anhydrite and barite. There is also important deposit of talc in Gemerská Poloma, which belongs among the highest quality deposits of it in Europe.
In the target area of the Prešov Region there prevail deposits of industrial minerals like zeolite, rock salts in Prešov, calcareous clays and construction materials. In the target area of the Banská Bystrica Region there are the most important the deposits of magnesite in Jelšava, Lubeník, Hnúšťa, deposits of limestone in Tisovec and talc in Hnúšťa – Mútnik.
Exploitation of construction materials (andesite, building stone, aggregates and sand, brick material and basalt) as well as industrial minerals (limestone, gypsum, anhydride, talc, bentonite, rock salt, zeolite and magnesite) has increasing trend. Exploitation of energy materials has declining trend. Similar situation is in the mining of ore metals caused by decrease of resources.

Mining activities in the **Hungarian** part of the TRB dates back to medieval times when copper was mined in the Mátra hills. Ores of non-ferrous metals were extracted in this region until the 1980s.
Coal mining was typical in the Northern central range of hills (Északi-középhegység) in the 19th and 20th centuries. At present only lignite is mined in an opencast mine at Bükkábrány.
Crude oil and natural gas exploitation started in the Great Hungarian Plain in the 1960s. The yield of the oil and gas fields is declining.
Sand and gravel have been exploited from alluvial layers and pits especially in the river basins of some tributaries of the Tisa river (river Sajó and Hernád).
Raw material for lime-burning and cement industry has been quarried in the Bükk hills.
At present, the Hungarian mining industry in the Tisa River Basin produces hydrocarbons, coals, industrial minerals and construction materials. Locations of mining activities are quite evenly distributed in the territory. The Tisa alluvial provides an opportunity for a great number of permitted and illegal gravel pits.

There are no significant mining activities in the **Serbian** part of the Tisa River Basin, except the extraction of clay and sand for construction. There are, however, many oil and gas wells – more than 100 gas wells and 8 oil fields in Vojvodine.

III.2.3.2. Manufacturing Industry

The recent past, the socialist period of the national economies of the Tisa catchment area was characterized by the dominance of **manufacturing industries** as well as mining and energy production. From the last quarter and especially the last decade of the 20th century industry lost this dominance both in power structure and in the percentage ration of employment. By now the share of industry from employment has decreased all over the territory. It has kept its leading position in the Košice region in Slovakia as well as in Uzhorod Vynogradovskyi Districts. There is an interesting, almost continuous zone of fairly high percentage industrial employment stretching from north-west to south east from Nógrád, heven and Jász-Nagykun-Szolnok Counties of Hungary to Arad, Hunedoara and Sibiu Counties in Romania. This belt is flanked on both sides by counties, where the share of industries from employment reaches one third (Pest, Bács-Kiskun, Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg and Békés in Hungary, Severno-Banatski in Serbia, Timiş and Alba in Romania. Most of the middle and eastern Counties like Csongrád and Hajdú-Bihar in Hungary and all other counties of Romania (Bihor, Sălaj, Satu Mare, Cluj, Mureş, Harghita, Bystrica-Năsăud, Maramureş) as well as several districts of Zakarpathia represent low share of industry, though for

different reasons. Whereas in Csongrád, Hajdu-Bihar, Cluj, Satu Mare the high level services (education, finance, medical services) take the leadership, in other counties agriculture and basic services have the substituting role for the earlier industrial workplaces.

In the **Ukrainian** Zakarpatska Oblast the total number of workers engaged in all spheres of industry in 2007 was 52.7 thousand persons, or 26.5% of the total employment. In 2002-2007, the number of workers engaged in industry increased by 5%. The light industry and machine building prevail in the structure. Their share is 23.3% and 23.7%, respectively. In 2002-2007, the share of machine building has grown noticeably (from 12.2 to 23.7%), and so has the rate of power generation, gas and water production, as well as pulp and paper industry. Significant decrease was observed in the share of the persons engaged in forestry and woodworking industry (from 19.9% to 13.5%), as well as in metalworking (from 2.5% to 1%). The decrease was characteristic of other spheres as well.

In 2007 in the **Romanian** Tisa counties the employment structure was dominated by the manufacture of wearing apparel, followed by the manufacture of food products, manufacture of wood, manufacture of motor vehicles and manufacture of furniture. As for the evolution of the number of employees the most significant growth was recorded in the manufacture of wood (+ 84%). The number of employees decreased in the case of 12 industrial sectors. The most severe decrease of the number of employees occurred in the mining sector, either the coal mining sector (-20.9%) or the metal ores mining sector (62.1%). Several centres of industrial polarization can be identified (eg. Timişoara, Arad, Satu Mare, Cluj-Napoca, Oradea, Târgu Mureş, Sibiu), as well as some industrial clusters, based on local resources (the cluster on Crişul Repede Valley, Carei-Satu Mare-Baia Mare cluster, Arad-Timişoara cluster, Zalău-Marghita industrial microregion).

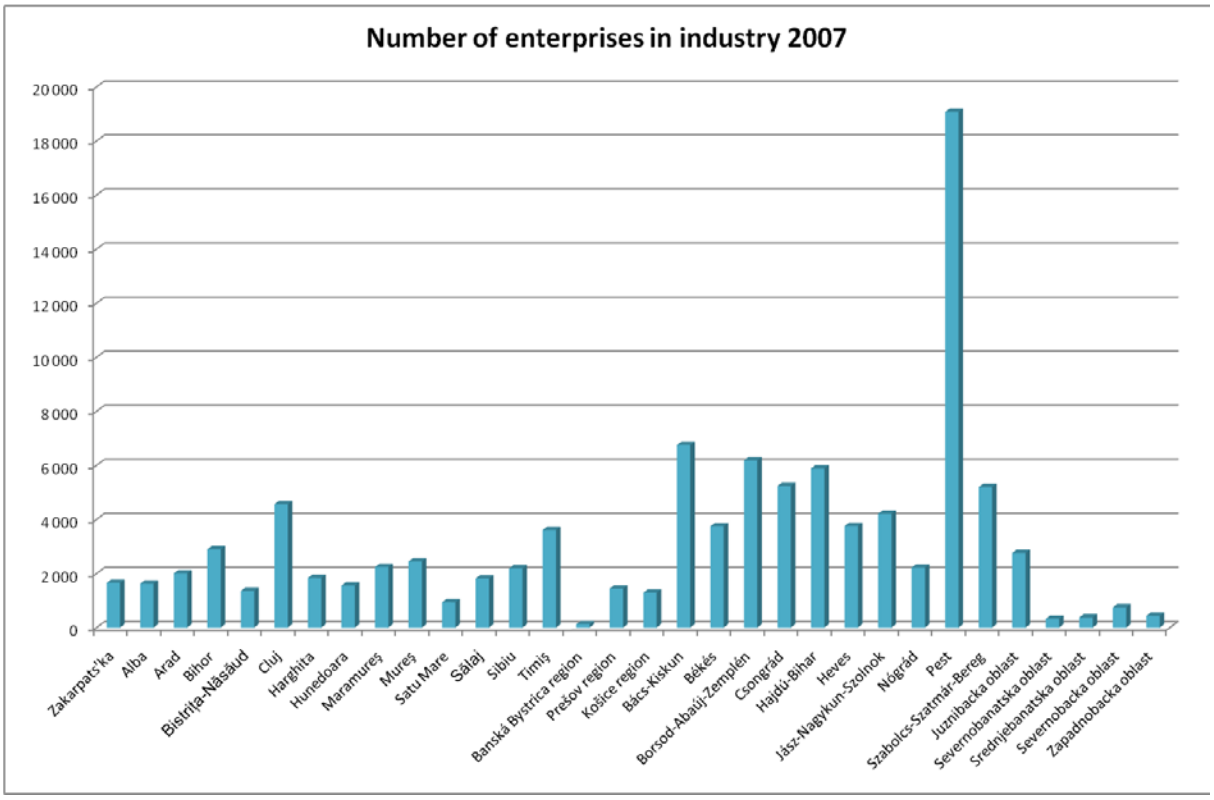
In the **Slovakian** area Košice Region belongs among the most important economic regions in Slovakia. The main industrial branches are: production of metals, engineering, food-processing, industry of building materials, fuels and energetics, mining industry, building industry and agriculture. Košice Region contributes by 12 % to the total revenue of Slovakia. The metallurgical factory US Steel Ltd is the biggest employer in the region. The company is one of the biggest producers of steel in Central and Eastern Europe. It has more than 12,000 employees. Industry in the Prešov Region is typical for its diversification without significant orientation on particular industry. Industry in the Banská Bystrica Region is represented mainly by exploitation and exploitation and processing of magnesite and food processing in the south part of the region.

In the **Hungarian** counties, in the sectoral distribution of those employed in industry, enginnering is the most important in the region (26% of those employed full-time in industrial sub-branches), and the food industry is also significant (18%). Textile industry, chemical industry, metallurgy and metal-working provide employment of around 10%. With the collapse of heavy industry the importance of the North Hungarian industrial region decreased, mining and metallurgy fell back, thus the industrial structure has changed. Food industry is the traditional branch of industry in the Great Plain, which has also suffered from reductions (e.g. sugar industry), but kept its significance. Light industry in general managed to preserve its economic significance, and it plays an important part in employment

In **Serbia** in 2001-2008 the industry sector shrank, which influenced general employment rate, most industrial centers were devastated, influencing serious weakening of some counties.

The **number of industrial enterprises** varies. High numbers indicate either high rate of entrepreneurial activity (like in Pest County in Hungary where this number is particularly high), and it may also indicate attempts to avoid unemployment and poverty (like in Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg Counties in Hungary). On the other hand very low number of industrial enterprises demonstrates concentration and overall dominance of a single or a few industrial firms like Košice Region in Slovakia and Hunedoara County in Romania.

The largest **industrial concentration** of the Tisa area is in Košice region, a production centre of steel as well as subsidiary smaller firms. The city is surrounded by other smaller industrial centres (district Michalovce, Trebišov and the city of Prešov. Košice industrial region is surrounded by an outer belt with Uzhorod and Mukachevo to the east, in Zakarpatska Oblast and Miskolc in Borsod Abaúj Zemplén County in Hungary. All these were traditional centres of the production of iron and steel and machinery. This role has since then almost disappeared from the Borsod area of Hungary apart from minor auxiliary firms. The traditional manufacturing centres of north Hungary are still struggling with restructuring. The production of iron, steel, machinery and chemicals are surviving in smaller centres (Hatvan, Kazincbarcika, Tisaújváros) and the larger cities (Miskolc, Eger) are likely to shift to tertiary functions (trade, education, business services). Food, textile and clothes manufacturing as well as engineering firms, multinational in majority are in operation in medium size town of the plain region, with Szolnok, a transport node and industrial concentration in the middle of the Hungarian plain region. The role of multinational companies (engineering, clothes and food manufacturing) is growing in the Romanian counties too. They are concentrated in the big urban centres like Timişoara, Arad, Cluj-Napoca, Satu Mare and Oradea. The production of steel, iron and machinery in Hunedoara and Deva is hoped to survive or be replaced so as to absorb the redundant industrial workers without skill or with outdated skills.



In the **Ukrainian** Zakarpatska Oblast engineering industry is strong and growing and light (for instance woodworking) industry, a traditional activity is still, though less significant.

In 2007 in the **Romanian** part of the catchment area the highest number of industrial companies was in Cluj County (4,559), followed by Timiş (3,608), or while the lowest number was registered in the counties of Bistriţa-Năsăud (1,356), and Sălaj (937). The highest growth in the period 2004-2006 was recorded in the counties of Sălaj and Satu Mare and the lowest in Harghita County. In 2007, the ranking of industrial sectors according to the number of registered companies was dominated by the manufacture of food products (2,251 companies), followed by the field of manufacture of wood and of products of wood and cork (2,194 companies), while the least represented were the manufacture of tobacco products (2 companies) and the extraction of crude petroleum and natural gas (1 company). Concerning the number of registered companies in construction, it is remarkable that their number doubled between 2004 and 2007, getting to 13,281, in a context of a positive dynamics of civil and industrial engineering.

The regions of **Slovakia** are characterized by diversity of industries, though steel industry of Košice region is dominant, so is magnesite mining in Banská Bystrica region. The most significant industry branches are engineering, food processing industry, wood-processing industry, electrical engineering, chemical industry, and textile industry. Industry of the target area of the Banská Bystrica Region is represented mainly by exploitation and processing of magnesite and food processing in the south part of the region. The reserves of magnesite in this area are the third biggest in the world.

Diversity of industrial production is also characteristic in the counties of **Hungary**, with the relatively highest share of engineering, electric-electronic industries and food processing. Also significant in terms of added value is chemical (pharmaceutical) industry as well as construction; this latter is outstanding in national terms. Machine industry is significant in Jász-Nagykun-Szolnok, Pest and Heves Counties, food industry in Bács-Kiskun, Békés and Csongrád Counties. Light industry (textile, clothing and leather industry) play a somewhat more important part in Jász-Nagykun-Szolnok, Békés and Szabolcs-Szatmár-Bereg Counties. Based on the number of enterprises in industry at county level, in mining, processing industry, electrical power, gas, steam and water supply Borsod-Abaúj-Zemplén and Pest Counties stand out, with values above the national average. Nógrád County has the smallest number of enterprises operating in this sub-branch; here the number of enterprises is half of the regional average. In the examined period (2002-2006) the significance of this sub-branch decreased at national level, for example, in Borsod-Abaúj-Zemplén County nearly 1,000, in Nógrád County 400 enterprises ceased to exist compared to 2002. In the Tisa region the average is 680 closed enterprises. 40% of the construction enterprises of Hungary operate in the Tisa region. Pest County stands out in this sector as well, as it is far above the national average, but the number of construction enterprises is significant in Borsod-Abaúj-Zemplén County as well.

Serbia is currently at a stage of economic restructuring when the decline and closure of industrial firms are characteristic due to outdated production and lack of investments. Most of the industrial activity has withdrawn to small enterprises. Half of the generally low number of enterprises, the smallest ones are in the industry sector.

III.2.4. Services

The tertiary sector is the growth sector practically all over the Tisa catchment area. The prominence of services is a general development attribute from the last third – last quarter of the 20th century in Europe. The growth and relative prominence of services results on the one hand from the advancement and technological development of the primary sectors (agriculture, mining, power generation). The mechanisation, automation of production processes, the extensive use of chemicals in crop production and modern, intensive modes of stock raining, remote control of work processes etc. and in the mean time the outdating of and inefficiency of the traditional fields and modes of production have made masses of workers of the primary and secondary sectors redundant. At the same time, on the other hand, these restructuring processes have increased the importance and work force need of several branches of services. Productive services directly attached to material production like engineering design, production management, accounting, financial and information services, trade, transport, logistics have opened broad employment possibilities in parallel with technological modernisation and with the increasing complexity of the world of business. The pressing need for qualified work force involved the growth and diversification of education and training, and large scale growth has evolved in other human – medical, social, wellness, cultural etc. – services. Owing to the increase of work intensity and lengthening of spare time and to the affordability of travel tourism has become a widespread and diversified activity and a growing business.

These processes of change have reached the Tisa catchment area to and have exerted their influence. There has been a substantial delay in their manifestation in this part of Europe, which has brought about controversial processes.

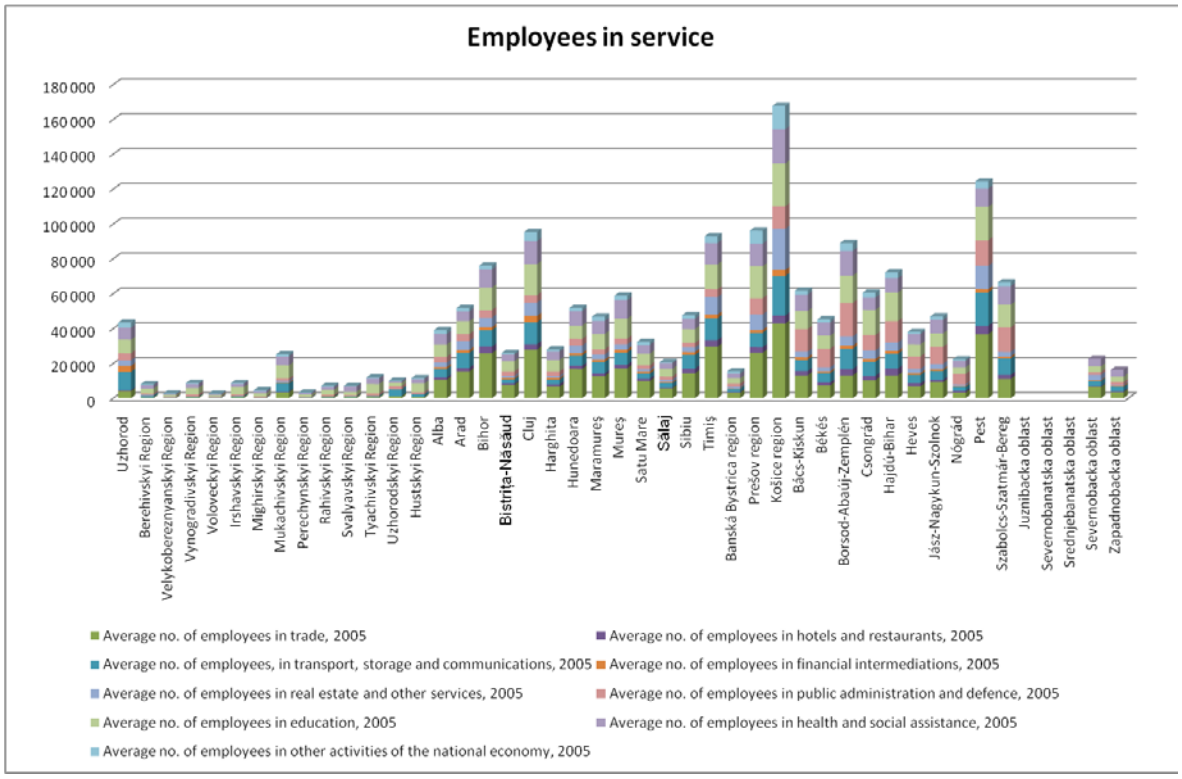
The developments of production technology have only partial, inconsistent impact upon manufacturing and agriculture and mining involving the outdating of the firms and their failure in the competitive European market. Technological modernisation of production has been rather scarce (one may even say exceptional) in this part of Europe. Redundant workers have partly become unemployed, many of them long-term unemployed. The service sector has been undergoing growth in all areas, though the level of modernisation is still lagging behind the European standards. Nevertheless, the tertiary sector has expanded enough to absorb a substantial part of the redundant workforce and the young age groups entering the world of employment.

The high share of the tertiary sector in several counties, districts of the Tisa catchment area is thus partly the result of contemporary economic development and the prominence of services, and is partly due to the substituting function (and low work efficiency) of services. In several counties, districts the national and local governments are the main employers providing the local population with livelihood.

There are three small area units (the Banská Bystrica Districts and two units in Zakarpatska Oblast), where the share of tertiary sector in the employment appears to be the highest, thou it may follow from the area delimitation. There are also rather high percentages (over 55-65 %) in several Hungarian counties:in Pest, Csongrád and Hajdú-Bihar Counties. This high share is mainly due to productive services in Pest (linked to the capital city). In Csongrád and Hajdú-Bihar the education, medical, cultural and financial services concentrating in the central cities play important role. In other counties and also in districts of Zakarpatska Oblast the above mentioned “substituting role” of services may prevail, though some of services concentrated in central cities are rather advanced. In Cluj and the relatively industrialized Hungarian counties (Nógrád, Heves, Jász-Nagykun-Szolnok) as well as in Mukachivskyi, Berehivskyi, Vinogradivskyi Districts of Zakarpatia the share of services from employment is around 50 %. In all other counties or districts it is lower than 50 %, though quite near to that in Južno-Bački, Timiş, Arad and Mureş. Even the lowest rates are higher than 30 %.

The counties with the greatest concentration of service employment (over or near 80,000 employees in 2005) have the common feature of the high ration a trade, which is largely due to the prominent

role of shopping centres. The ratios of other branches (education, medical services, transport etc.) are of nearly equal distribution.



The share of the employed in services, as tertiary sector, within the **Ukraininan** Zakarpatska Oblast is higher then 50% (2007). The highest share of employed in services is concentrated in plain regions, especially in Uzhorod and Mukachivskyi Region. In transport and communication the first two positions are occupied by Uzhorod and Mukachivskyi Region, too. The next two places are occupied by Uzhorodskyi and Hustskyi Regions.

In **Romania,** during the 2002-2007 period, there was an increase in the orientation of the population towards the sector of services, in the context of the privatization of industrial companies and of the reorientation of the population initially employed in the primary sector. By subsectors, most employees are active in trading activities, education and health.

In **Slovakia** in the Košice Region the chief branches of employment are trade, real estate and education. Since 2002 the number of employees in services has increased by more than 20%. In the Prešov Region people are mostly employed in trade, education and in health and service assistance. Since 2002 the number of employees in services has increased by 12.6%. In the Banská Bystrica region people are mostly employed in trade, education, health and service assistance, and in public administration and defense. Since 2002 the number of employees in services has increased only by 6.8%.

.

In **Hungary** public administration and public services (education, public health and social sector) prevail. The rate of public administration in Pest County is lower because the county administration is operated in Budapest. The rate of education is the highest in Csongrád and Hajdú-Bihar Counties thanks to the two university towns, Szeged and Debrecen. On the whole, economic services (real estate transactions, transportation, accommodation and tourism, finance) represent minor importance. Accordingly, in Csongrád and Hajdú-Bihar

Counties, the most significant tertiary sector is education, in Pest and Bács-Kiskun commerce, while in the rest of the counties of the Tisa region public administration and social services. The branches of transportation, storage, post and telecommunication are the most significant in Pest, Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg Counties, in Pest thanks to the capital, in Szabolcs thanks to logistics related to border traffic. Except in Csongrád and Hajdú-Bihar Counties, the employment rate of other counties is below average in this sector.

In the **Serbian** districts tertiary sector has absorbed much of the redundant industrial workforce and the new job seekers. Service employment is partly provided by the public sector (transport, education, health service) and partly linked to small businesses (trade, repair, transport, catering).

III.2.5 Tourism

Tourism is globally a growth industry, and **can be a breakthrough for the regional economies** of the Tisa catchment area. The policies to promote tourism are justified from various reasons. Tourism can mobilize the local and regional potentials which is in abundance in this area both in the field of natural assets, cultural monuments and traditions. The developments which are indispensable for the efficient and wise exploitation of these potentials are beneficial forthe locality or district as a whole. The improvements of accessibility (road, trail, air and water transport) to bring and attract tourists are essential for overall economic development as well as social advancement and networking. Environmental infrastructure such as supply of healthy drinking water and disposal of sewage and solid waste, electric supply, communication as well as clean and decent homes and local environment, well tended, nice landscapes are not only essential for the attraction of tourists but also for the civilized living of local population. The education and training in hospitality, entrepreneurship, accounting and communication in foreign languages are conditions of the regeneration of local economies in general, not only of tourism.
There are thus generally needed and essential developmental conditions for the promotion of tourism. These conditions though can be provided in step by step manner, gradually expanding from major and minor centres.
Though tourism may not become the main or single branch of local economy, its development can have multiplier effects through the strengthening of local identities and capacities, through networking and the marketing role of tourism. At the local level the most effective way is to link a couple or more potentials and activities, like excursion and country walk with rural farming and the sale of local farm products or thermal water base with medical and / or wellness services, eco tourism and cultural festivals etc.

Tourist attractions are in abundance in this region. The architectural monuments (still undiscovered for the most part of western tourists) form almost continous belt stretching from the northern edge of the region through Prešov, Uzhorod, Mukachevo, through Košice, Miskolc, Eger and along the north-south of the Hungarian plain from Debrecen down to Szeged and Subotica, Sombor, Kikinda, Novi Sad and Zrenjanin in Vojvodina. Another belt of architectural monuments, historic sites extend east of Debrecen from Satu Mare to Oreadea to the west and Baia Mare to the east and further south to Cluj-Napoca, Târgu Mureş, Alba, Deva, Hunedoara, Timişoara, Sibiu.
Similar, almost contiguous zones of natural beauty though of diverse character can be identified all over the area: dramatic mountainous landscapes, peaceful hillsides, far-stretching plains crossed by rivers. The town, cities and several rural municipalities are cultural centres with high class activities as well as folklore events. The area, especially the Hungarian plain region and also the northern hills are rich in medicinal thermal water bases and spas.

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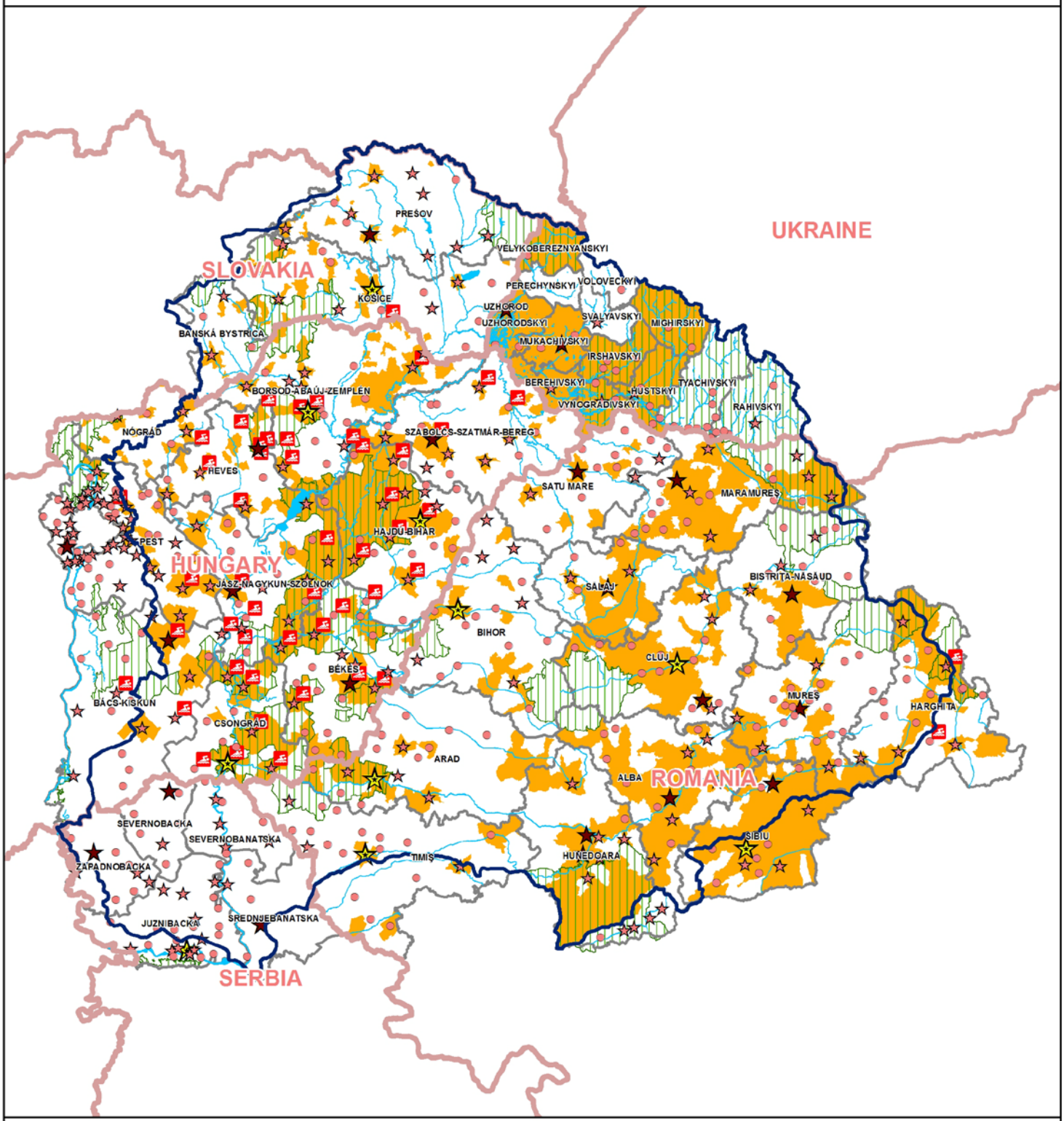
ECONOMIC BASE - TOURISTIC ATTRACTIONS



Tisa Basin
Country border
County border
Major Water

Therapeutic attractions (spa, balneal, climatic attraction)
Natural attractions (national or nature parks, nature reserves and monuments)
Very high concentration of built cultural heritage

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

SOURCE
Ukraine: Ministry of Ecology and Natural Resources of Ukraine
Romania: Ministry of Regional Development and Tourism / National Institute of Resource-Development in Tourism
Slovakia: Slovak Environmental Agency
Hungary: National Office of Cultural Herritage / Ministry of Rural Development / Hungarian National Tourist Office
Serbia: Institute for Natuire Conservation of Vojvodina / ITPV

The rate of tourist turnover (number of nights spent by tourists) was the highest in Kosice and Prešov Regions in Slovakia, Bihor, Timiş, Cluj and Mureş in Romania, Borsod-Abaúj-Zemplén and Hajdú-Bihar in Hungary. From 2003 to 2007 there was decline in tourist turnover in the majority of the counties, with the exception of Cluj and Mureş in Romania, Hajdú-Bihar in Hungary. In spite of the broad and varied tourist potentials, very low turnover was recorded in counties Nógrád, Pest, Heves, Békés, Szolnok and Szabolcs in Hungary, Hunedoara, Alba and Harghita. Tourist accommodation and weekend homes are in the greatest number in the Slovakian regions and in the mountains as well as in Hajdú-Bihar and Csongrád Counties in Hungary. Apart from Bihor County the provision of accommodation is fairly low in Romania. The relevant data were not accessible for Serbia and Ukraine.

Zakarpatska Oblast is one of leading touristic destinations in **Ukraine**. The main recreational resources include its climate, therapeutic muds and brine of lakes, mineral waters, forests, water bodies, landscape peculiarities. The total capacity of sanative and recreation establishments is 24,900 beds, including 5.7 thousand beds in the sanative establishments and 19.1 thousand beds in the resort establishments. Many private farmsteads are engaged in green tourism. Their capacity in the Oblast is 10.5 thousand beds, including 5.6 thousand beds in tourist establishments, 2.87 thousand beds in hotels, and 2 thousand beds in private farmsteads. According to the latest data, about 800 families offer in various quality levels are engaged in the service of holiday-makers. The resort establishments for children in 8 Regions of the Oblast are 20 in number with capacity of 4.27 thousand beds.

In **Romania** tourism is a growing economic branch supported by many attractive natural and anthropogenic resources (peaks, narrow ridges, small depressions, gorges, caves, lakes, valleys, protected areas, archeological vestiges, fortresses, castles, churches, museums, ethnographic resources, etc.) and promoted planning projects. The number of visitors to the Tisa region belonging to Romania reached almost 2.9 million in 2007, which represented 32.8% of visitor volume in the country. The number of accommodation units increased in 2002-2005, it decreased in 2006, and increased again in 2007. The territorial distribution of tourists varies. The most important flows are to counties Cluj (372,000), Sibiu (327,900), Timiş (283,400), Mureş (253,500) and Bihor (227,300), the lowest number was in counties of Harghita (85,300), Bistriţa-Năsăud (72,600), Alba (54,100) and Sălaj (16,300). The main destinations are the big cities (Cluj-Napoca, Sibiu, Timişoara and Târgu Mureş) as they offer a great number and diversity of architectonic and cultural-historical attractions as well as many events and cultural activities. The majority of visitors give preference to hotel accommodation. In the Romanian Tisa region the average number of visitor nights is 3.39, which is above the national average (2.45 days). This short duration of stay is peculiar to weekend tourism. The visitors spend the greatest amount of time in Sibiu County (6.4 days, due to the fact that in 2007 Sibiu was European Capital of Culture), in Cluj (5.26 (days) and Timiş (4.95 days), while the shortest time is registered in Harghita County (1.2 days) and Caraş-Severin County (1.85 days).

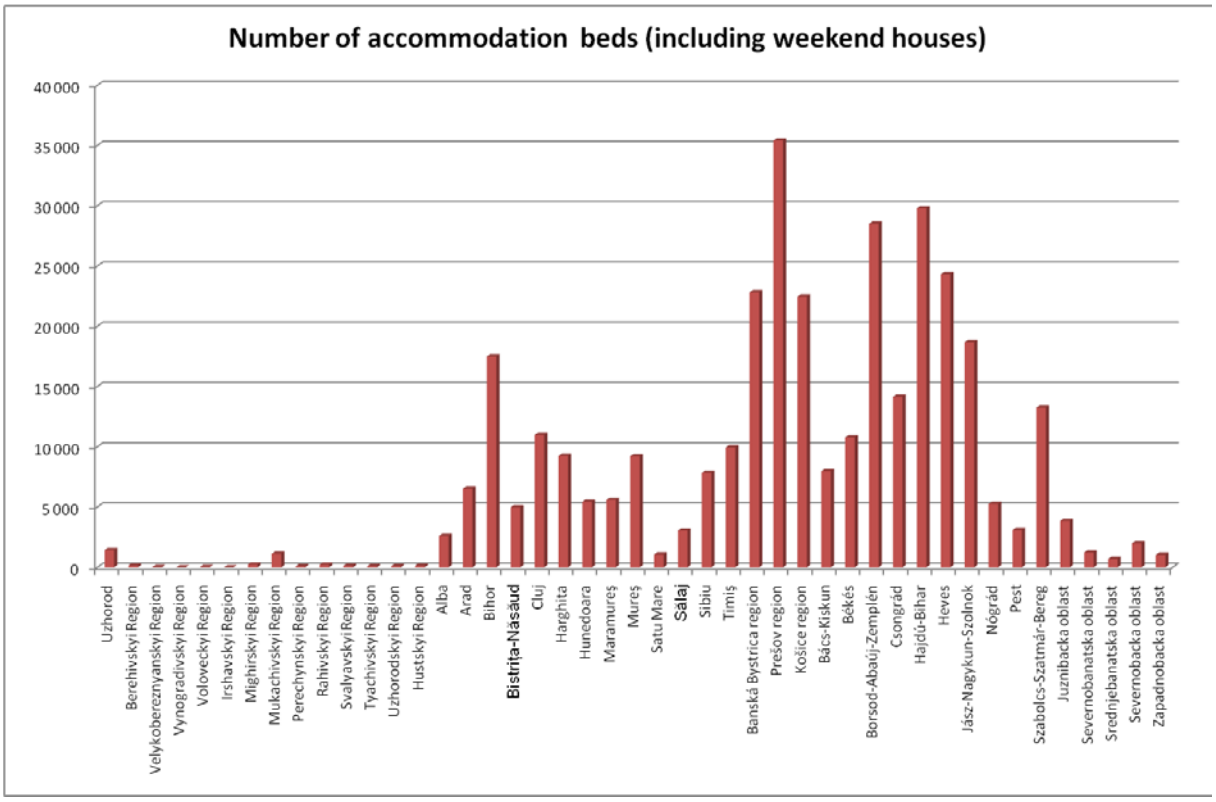
In the target area of **Slovakia** the total number of accommodation facilities was 579 in 2007 and of it 357 accommodation facilities were in the Košice region, 184 in the relevant part of the Prešov Region and 38 in the target area of Banská Bystrica Region. The accommodation facilities include hotels, motels, botels, guest houses, campsites, chalet sites, tourist hostels, B & B and other. The total average number of spent tourist guest nights was 2.9 nights in 2007 and of it 2.3 nights in the Košice Region, 3 nights in the target area of the Prešov Region and 3.4 nights in the target area of the Banská Bystrica Region.

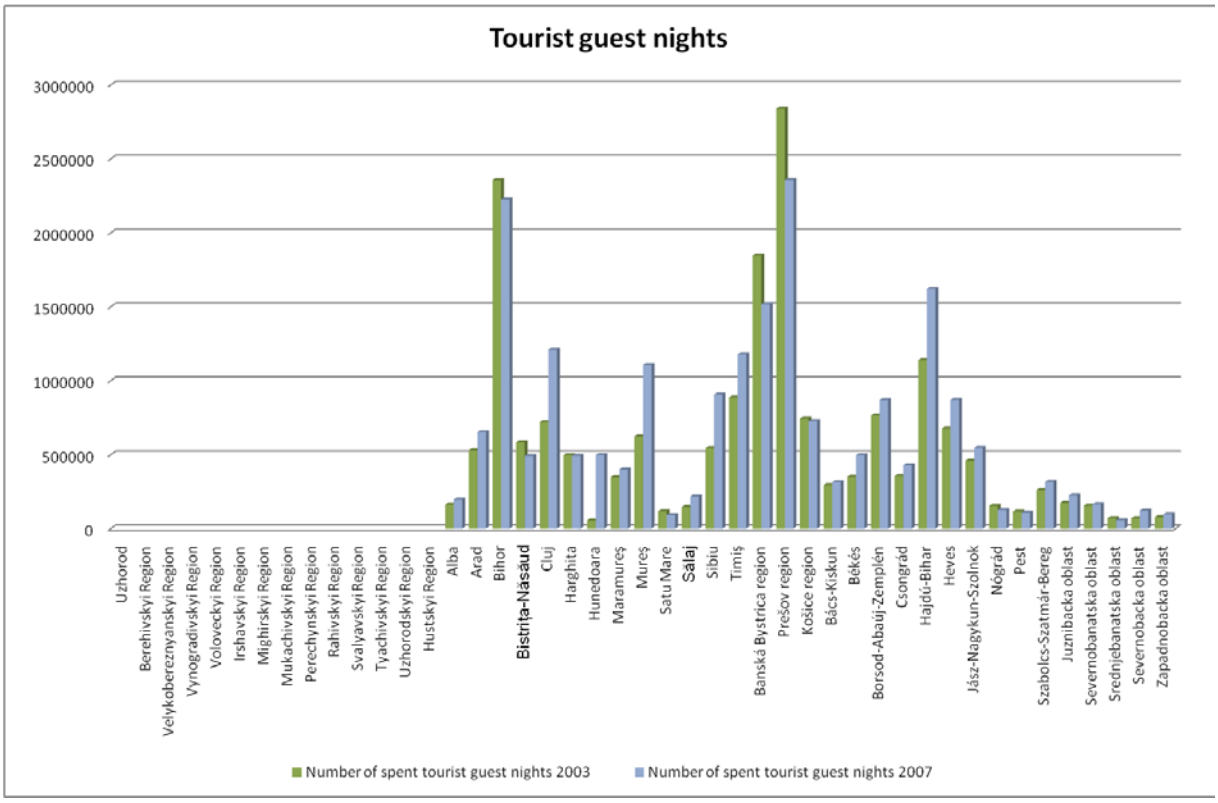
The total number of spent tourist guest nights was 1,430,866 nights in 2007 and of it 726,891 nights in the Košice Region, 559,240 nights in the target area of the Prešov Region and 144,735 nights in the target area of the Banská Bystrica Region.

In **Hungary** the number of bed places in the Tisa region was near 8,000 in 2007, which represents 18% of the national total. The greatest supply (over 1,000) is in Hajdú-Bihar, Borsod-Abaúj-Zemplén and Heves Counties, while the lowest (below 300) in Bács-Kiskun and Nógrád Counties. The ratio of private to commercial accommodation is above 80%, to 20%. The total number of lodging places in the Tisa region has grown by 9% since 2002. Growth was the most significant in Nógrád and Heves Counties (above 20%). The number of visitors to the Tisa region exceeded 2.3 million in 2007, which represents a quarter of the visitor volume of the country. The high number of visitors to the Hajdú-Bihar and Heves Counties is due to the dominance of three cities (Debrecen, Hajdúszoboszló and Eger). The proportion of visitors from abroad in the Tisa region is 20%, the national proportion is 41%. In some counties the proportion of foreign visitors is very low – in Békés (9%) and Nógrád (9%) Counties the number of visitors from abroad is above average in Bács-Kiskun (26%), Csongrád (26%) and Hajdú-Bihar (24%) Counties. The number of visitor nights is 2.4 days, somewhat below the national average (2.6 days). This short duration of stay is characteristic for weekend tourism. The visitors spend the longest time in Jász-Nagykun-Szolnok County (2.99 days), and the shortest time in Borsod-Abaúj-Zemplén County (1.85 days).

The **Serbian** Tisa catchment area (area along the river Tisa) is significant and important tourist receptor with more than 50% of total arrivals and overnight stays in Vojvodina.
The most receptive markets for both domestic and foreign tourists are Južno-Bački, Zapadno-Bački and Severno-Banatski Counties. The most attractive tourist destinations are city centers: Novi Sad, Kikinda, Subotica, Sombor and Zrenjanin; spa center in Kanjiža and Apatin other destinations which are not laying on the Tisa river banks.
The average stay in the assessed period was 2-4 days. Some municipalities (Novi Sad, Kanjiža, Zrenjanin,) have varied and numerous accommodation facilities.
Throughout the region of the Tisa River, registered accommodation facilities are in the function of tourism supply. It is observed that some municipalities (Novi Sad, Kanjiža, Zrenjanin, Sombor and Subotica) have varied and numerous accommodation facilities, while most of them have less diverse gastronomic offer and / or facilities with a lower category is particularly evident with Coka, N. Knezevac, Žabalj). In some municipalities there is no hotel accommodation at all, while in others there is insufficient accommodation capacity in private households. For some objects information about the type, capacity and category are uncleare, and traffic data are missing completely.
The accommodation facilities in Serbia are divided into two groups: primary and complementary capacities. The main facilities are: hotels (first, second, third, the fourth, fifth category and unclassified), boarding houses, motels, tourist resorts, tourist apartments, holiday resorts, inns, restaurants and more. Complementary facilities include: spa resort, climatic health resorts, mountain lodges and houses, workers holiday, children and youth resorts, camps, housing (private rooms), private homes and apartments, cabins.
The accommodation facilities are increasing in the Serbian Tisa catchment area i.

The availability of **tourist information centres is** a sign of tourist capacity and preparation for visitors. Tourist information centres are accessible all over Hungary, Slovakia and the Serbian regions, they are missing from Zakarpatia except Uzhorod, Mukachevo and Beregovo, they are scarce in Romania except in centres of Timiş, Hunedoara, Sibiu, Alba, Mureş, Cluj.


Number of accommodation beds (including weekend houses)
40 000
35 000
30 000
25 000
20 000
15 000
10 000
5 000
0
Uzhorod
Berehivskyi Region
Velykoberezneanskyi Region
Vynogradivskyi Region
Voloveckyi Region
Irshavskyi Region
Mighirskyi Region
Mukachivskyi Region
Perechynskyi Region
Rahivskyi Region
Svalyavskyi Region
Tyachivskyi Region
Uzhorodskyi Region
Hustskyi Region
Alba
Arad
Bihor
Bistrita-Năsăud
Cluj
Harghita
Hunedoara
Maramureş
Mureş
Satu Mare
Sălaj
Sibiu
Timiş
Banská Bystrica region
Prešov region
Košice region
Bács-Kiskun
Békés
Borsod-Abaúj-Zemplén
Csongrád
Hajdú-Bihar
Heves
Jász-Nagykun-Szolnok
Nógrád
Pest
Szabolcs-Szatmár-Bereg
Juznibacka oblast
Severnobanatska oblast
Srednjebanatska oblast
Severnobacka oblast
Zapadnobacka oblast


Tourist guest nights
3000000
2500000
2000000
1500000
1000000
500000
0
Uzhorod
Berehivskyi Region
Velykoberezneanskyi Region
Vynogradivskyi Region
Voloveckyi Region
Irshavskyi Region
Mighirskyi Region
Mukachivskyi Region
Perechynskyi Region
Rahivskyi Region
Svalyavskyi Region
Tyachivskyi Region
Uzhorodskyi Region
Hustskyi Region
Alba
Arad
Bihor
Bistrita-Năsăud
Cluj
Harghita
Hunedoara
Maramureş
Mureş
Satu Mare
Sălaj
Sibiu
Timiş
Banská Bystrica region
Prešov region
Košice region
Bács-Kiskun
Békés
Borsod-Abaúj-Zemplén
Csongrád
Hajdú-Bihar
Heves
Jász-Nagykun-Szolnok
Nógrád
Pest
Szabolcs-Szatmár-Bereg
Juznibacka oblast
Severnobanatska oblast
Srednjebanatska oblast
Severnobacka oblast
Zapadnobacka oblast
Number of spent tourist guest nights 2003
Number of spent tourist guest nights 2007

III.3. NATURAL AND ENVIRONMENTAL FEATURES

III.3.1. Natural features

III.3.1.1. Landscape features[5]

The Tisa River Basin is the largest sub-basin in the Danube River Basin, covering 157,186 km² or 19.5% of the Danube Basin. Together with its tributaries, the Tisa River drains the largest catchment area in the Carpathian Mountains before flowing through the Great Hungarian Plain and joining the Danube River.
With a strongly meandering riverbed, the original length of the Tisa River was 1,400 km from its spring in the northeastern Carpathian Mountains in Ukraine to its mouth at the Danube. During the second half of the 19th century, extensive measures of river training and flood control were undertaken along the river. As a result of these works, the river's total length was shortened by approximately 30% and it is today 966 km. However, it is still the longest tributary of the Danube River with the second largest discharge after the Sava River.

The Tisa River Basin can be divided into two main parts:

- the mountainous Upper Tisa and the tributaries in Ukraine, Romania and the eastern part of the Slovak Republic and
- the lowland parts mainly in Hungary and in Serbia surrounded by the Eastern-Slovak Plain, the Zakarpatian lowland (Ukraine), and the plains on the western fringes of Romania.

The Tisa itself can be divided into three parts:

- the Upper Tisa upstream from the confluence of the Someş/Szamos River,
- the Middle Tisa in Hungary which receives the largest right hand tributaries: the Bodrog and Slaná/Sajó Rivers together with the Hornád/Hernád River collecting water from the Carpathian Mountains in the Slovak Republic and Ukraine, and the Zagyva River draining the Mátra and Bükk, as well as the largest left hand tributaries: the Szamos/Someş River, the Körös/Criş River System and Maros/Mureş River draining Transylvania in Romania and
- the Lower Tisa downstream from the mouth of the Maros/Mureş River where it receives the Bega /Begej River and other tributaries indirectly through the Danube – Tisa – Danube Canal System.

Geographic characterisation
The 1,800-2,500 m high ridge of the Carpathian Mountains create in a semicircle the northern, eastern and southeastern boundary of the Tisa catchment. The western–southwestern reach of the watershed is comparatively low in some places – on its Hungarian and Serbian parts it is almost flat.
The area is divided roughly along the centreline by the Carpathians Mountains, east of which lies the 400-600 m high plateau of the Transylvanian Basin, and the plains to the west. The highest summits of the river basin reach 1,948 m in the Low Tatras (Kráľova hoľa), 2,061 m in the Chornogora Mountains (Hoverla), 2,303 m in the Rodna Mountains (Pietrosul Rodnei) and even higher in the Retezat Mountains of the Southern Carpathians (Peleaga, 2,509 m). Areas above elevations higher than 1,600 m occupy only 1 % of the total area; 46 % of the territory lies below 200 m.

[5] This chapter is in an excerpt from the Analysis of the Tisa River Basin 2007, Initial step toward the Tisa Basin Management Plan – 2007 made by ICPDR – International Commission for the Protection of the Danube River

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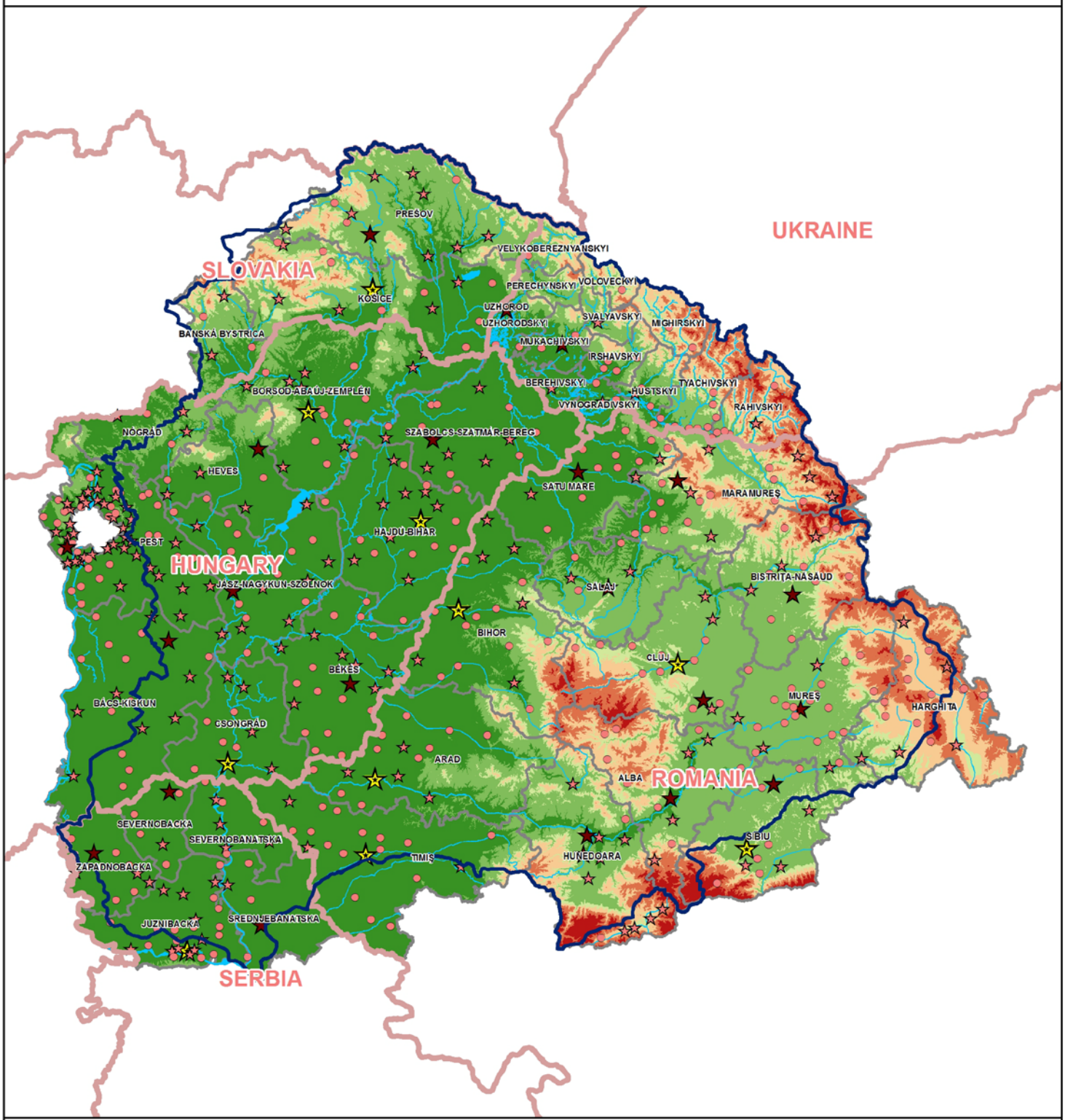
NATURAL AND ENVIRONMENTAL FEATURES - ELEVATION



Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Elevation (m)
- - 250
- 250 - 550
- 550 - 700
- 700 - 1 000
- 1 000 - 1 400
- 1 400 -

The Tisa River rises in the Carpathian Mountains in northwestern Ukraine and is formed from the confluence of the Bila and Chorna Tisa Rivers. Further headwaters rise in the eastern mountains of the Slovak Republic, two of them in the Narodny (National) Park. The Uzh/Uh and Latorytsa/Latorica tributaries flow from Ukraine into the Slovak Republic where they, together with Ondava, Topľa and Laborec Rivers, form the Bodrog River before it enters Hungary. The Someş/Szamos and the Mureş/Maros rise in the Romanian Carpathians, while the rivers forming the Criş/Körös system rise in the Apuseni Mountains.
The Tisa River Basin in the Slovak Republic is predominantly hilly area and the highest mountain peak is Kráľova hoľa - in the Low Tatras Mountain Range at 1,948 m. The lowland area lies in the south, forming the northern edge of the Hungarian Lowland. The lowest point in the Slovakia is the village of Streda nad Bodrogom in the Eastern Slovak Lowland (96 m) in the Bodrog River Basin.
The Hungarian part of the Tisa River Basin is a flat area bordered by small ranges of hills and mountains from the north and dominated by the Great Hungarian Plain.
The Tisa River Basin in Romania is located in the northwest part of Romania, and is characterised by a high relief diversity: mountain areas (with elevations above 2,000 m), hilly areas (400-800 m) and plain areas (200-300 m).

The mountain unit is generally located above the 700 m contour line and corresponds to the western part of the Eastern Carpathians, the north-western part of the Southern Carpathians and the northern half of the Western Carpathians, and includes a series of large intra-Carpathian basins (Maramureş, Giurgeu, Haţeg) and marginal basins which penetrate from the plains in the shape of "gulfs" (Vad-Borod, Beiuş, Zarand and so on). It covers 25.5% of the total area of the Romanian sector of the Tisa catchment area (82,721 km^2), or 21,055 km^2.

The hilly unit, ranging between 250 and 700 m, is represented by the vast area of the Transylvanian Depression and by the Banat-Crişana Hills (or the Western Hills), located along the western edge of the Romanian Carpathians. It covers about 36,695 km^2, which represents 44.7% of the total area of the Romanian sector of the Tisa catchment area. It is the largest landform of the analysed area.

The plain (lowland) unit, located at altitudes below 250 m, is represented by Banat and Crişana Plain (the Western Plain, in other sources) covering an area of 36,965 km^2 (29.8%).
A small, lowland part of the Tisa watershed area belongs to Serbia. There are various geomorphological elements in relief, with elevations of 74-143 m above sea level.

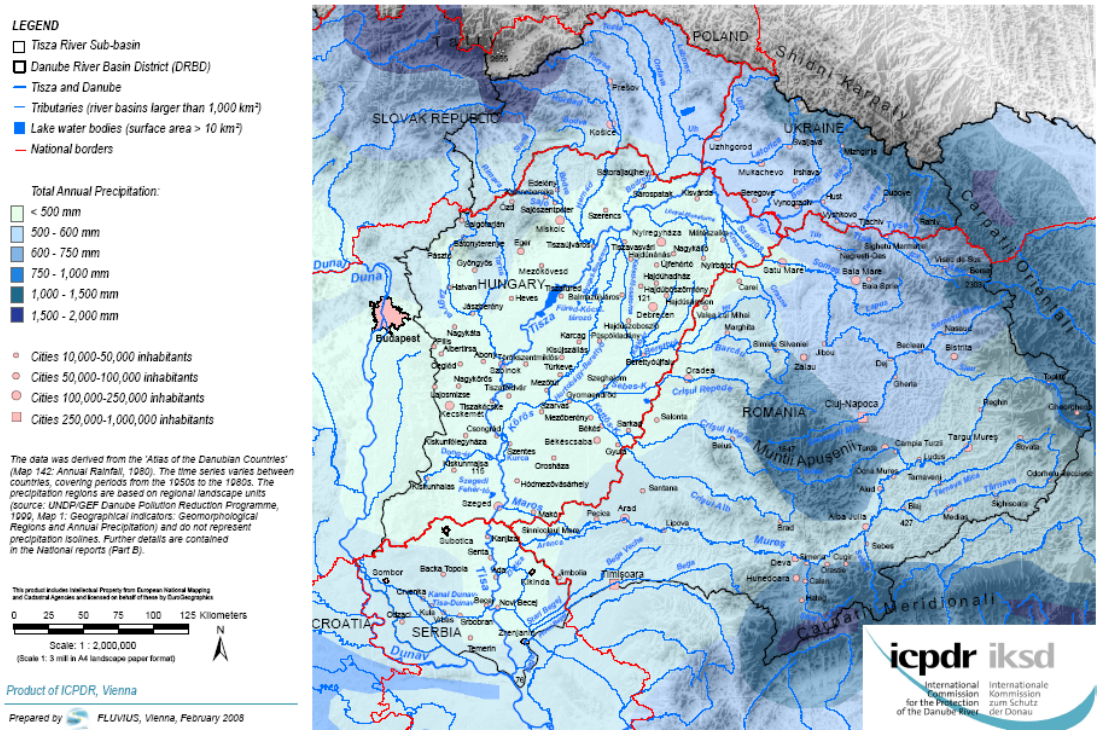
Climate and hydrology
The Tisa River Basin is influenced by the Atlantic, Mediterranean and Continental climates, which impact regional precipitation. About 60% of the Upper Tisa River Basin gets more than 1,000 mm of precipitation annually. Warm air masses from the Mediterranean Sea and the Atlantic Ocean cause cyclones with heavy rainfall on the southern and western slopes. In general, two-thirds of the precipitation occurs in the warm half of the year. Furthermore, land surface is subdivided into the Carpathian Mountains (70 % of catchment area) and the wide Tisa lowlands.

The isotherms of the multi-annual mean air temperature vary from less than 3°C (in the Apuseni Mountains) to more than 11°C (along the middle and lower reach of the Tisa itself). The maximum temperatures are observed in July, the minimum in January (from –1 to –7°C). The annual mean potential evaporation (in RO and HU) is around 700 mm/a and the maximum monthly values (125-145 mm) occur in June and July.

The multi-annual mean values of annual precipitation vary within the Tisa River Basin from 500 to 1600 mm/a. The lowest values (500 mm/a and below) occur in the southwestern part of the basin,

close to the Tisa River. The highest values (around 1 600 mm/a) occur in the northwestern Carpathians and in the Apuseni Mountains. Dry spells (with less then 10 mm/month) are frequent in most areas of the Tisa River Basin in February and March.

The Tisa River Sub-basin – annual percipitation



The highest maximum depth of snow, measured in various mountains of the Tisa River Basin (including the relatively low Mátra Mountains in Hungary) are above 100 cm, with water equivalents of 250-300 mm. Lower maximum values (40-60 cm with equivalents of 100-200 mm) were registered in the lowland parts of the basin.

The aridity factor (defined as the relation of annual potential evaporation to mean annual precipitation) at the eastern border of the Tisa River Basin (such as in the Carpathian Mountains) is below 0.2 and increases from the northeast to the southwest up to 1.4 in the middle of the Great Hungarian Plain (the mouth of the Körös Rivers).

In the mountainous regions, flash floods are common in the spring and summer. These are further intensified by the low infiltration capacity of the soils in the Carpathian Mountains. These floods cause enormous inundation in the lowland areas.

Flooding is a natural event necessary for riverine ecosystems, but it is also a significant threat to communities settled in the floodplain. Rainfall in the Carpathian Mountains can be substantial and sudden. Extensive runoff, floodplain deforestation and river canalisation reduce the ability of the catchment to attenuate the flood wave. When heavy rains occur, flooding threatens human lives as water levels rise quickly without sufficient retention capacity.

Surface geology

Concentration and drainage of the surface runoff depends fundamentally on the permeability of the soils close to the surface. Impervious soils induce flashy spates; pervious ones attenuate the runoff, store part of the rain and recharge the groundwater.

Volcanic rocks cover minor parts of the basin and sedimentary ones cover major parts of basin. Most of the volcanic and metamorphosed rocks tend to be impervious, though their weathered zones

close to the surface and fissured faults convey often-appreciable flows, evidence of which has been found in mines.
Volcanic tuffs, unless weathered, are semi-pervious. Most of the sedimentary rocks are impervious, though cavities in karstified limestone and dolomite, loose sandstone, windblown sand, gravel and peat may convey large underground flows.
Predominant semi-pervious rocks in the upstream watersheds of the Tisa, the Someş/Szamos and the Bodrog rivers tend to attenuate flood waves and to store some water to augment autumn low flows. Large impervious areas in the Criş/Körös catchment lend a flashy character to the regime of these streams. Similar conditions also prevail over the major part of the Mureş/Maros catchment, but adverse effects are offset by more pervious soils along the headwater reaches.

III.3.1.2. Landscape history

The review of national landscape histories indicate and justify two distinct and interacting processes forming the character of the Tisa catchment area. In the mountains of Ukraine and Romania there has been large scale deforestation from the industrial revolution of the 19th century, resulting in substantial decrease of woodland and the expansion of arable land even on the steep slopes, and therefore the ratio of pastures and meadows was decreasing too. Water flow in the rivers thus speeded up involving erosion.

On the plains of Slovakia, Hungary and Serbia the most important intervention was the regulation of rivers. With the purpose to increase arable land the rivers were constrained into narrow bed between dykes, they lost their natural floodplains and therefore the ratio of semi-natural areas substantially decreased. The ratio of cultivated land increased, but new problems had to be faced in large areas. In the low-lying depressions the threat of ground water inundation was growing, so was salinity. Water supply in the small rivers and oxbows was limited to certain periods, while flood level rose in the beds of rivers confined within dykes.

In **Ukraine** wider spread influence on the landscape started in the first part of I century, when the upper Tisa region had been populated by Eastern Slavic tribes. The main environmental effects were slash-and-burn agriculture, outrun stock-breeding, hunting. During VIII and IX centuries arable agriculture expanded mountainous areas. Among forest vegetation oak forests as they concentrated on warm flat and submontane territories had been suffered mostly. Often the forest had been cut down to clear land for agriculture.
Forests had been extremely destructed in the second part of XIX century while railways had been constructed. Wood had been used for ties, bridges. The share of forests on areas of oak forests had been decreased during period of anthropogenic influence from 90-95% to 5-15%.
The areas of beech forests had been suffered less because during long time beech wood hadn't industrial significance.
In high mountainous areas the pasture had great influence on vegetation cover. That had resulted in common spruce forests border lowering for 200-300 m, erosion processes development, increase the frequency of avalanches and landslides etc.

Since the 18th century, in the **Romanian** part of the Tisa catchment area, the main process regarding landscape is the decrease in area of forests and grasslands and a constant increase of arable lands. The process of deforestation had started much earlier, even since the Roman times, but increased in intensity after the Industrial Revolution, especially during the 19th century, when wood was needed especially in a number of industrial branches, such as the metallurgic industry and the wood processing industry. Forest clearings were also a characteristic at the upper limit of the forests in the Carpathians, at the expense of

grasslands, due to the development of pastoral activities. On the other hand, the forests were cleared almost completely in the Western Plain and Hills, except for the higher hills, steep slopes, several hunting reserves and the floodplains of the main rivers. During the 20th century, measures were taken to preserve the forests, including the reforestation of some areas with fast-growing species. Therefore the weight of forests has remained rather constant in the last 100 years. However, the trend of transforming large areas of grasslands and pastures into arable lands, which started at a higher pace in the Middle Ages, continued during the 20th century. The communist planning system encouraged by all means and invested substantial amounts of money in the transformation of less fertile or unproductive lands into arable lands, which constantly increased their weight at the expense of grasslands and hay fields.

In the 1780s the main focus of **Slovakia** was on agriculture. Majority of people lived in countryside and deal with the agriculture production. Aristocratic country estates had the predominant position in agriculture. The crop planting (barley, rye, oat and wheat) and livestock production prevailed. Since the end of the 18th century, the agriculture was oriented on production of potateos and corn. In the south parts of Slovakia viticulture developed. In the north parts mountain farming developed. Totally, there prevailed low productivity in agricultural production due to low modernization and low labour productivity of villeins.

After the Austria – Hungary Alignment in 1867, with regard to ownership of land, country estates had predominant position while individual farming presented minor half. The area of arable land increased mainly by plough-up of grassland and pastures and by decrease of fallows. In the period of the agricultural crisis in the 1880s and 1890s other production activities widespread, the production of industrial crops and forage crops markedly increased and the activities in food industry as well as developed markedly.

After the establishment of the Czechoslovak Republic in 1918, Slovakia ranked among industrial undeveloped and mainly agricultural countries. Agriculture employed in Slovakia more than 60% of inhabitants.

The period of socialism in the years 1948 – 1989 was characterised by declaration of industry nationalization and development of heavy industry, mining industry, metallurgical industry, and chemical industry. In the agricultural production there was as well the nationalization and national properties and state agricultural cooperatives were established. There was also the development of cities and huge agglomerations like Košice and Prešov.

After the changes in 1989 and after the establishment of the independent Slovak Republic in 1993, there was the change in the landscape use. There gradually occurred attenuation of industy production, disintegration of state agricultural cooperatives, attenuation of agricultural production and transition to private business.

The significant action into the ecosystem of the Tisa River Basin in Slovakia presented dewatering of the Eastern Slovak Lowland. Systematical regulation actions began at the courses of the Bodrog River Basin in the middle of the 19th century. The main actions were at the rivers the Tisa, the Ondava, the Trnávka, the Laborec, the Latorica, and the Uh. Those actions should have prevented flooding of great waters and following damages on settlements and agricultural soils. The movers of those regulation actions were land owners who began to associate into the communities for water regulation. The complex solution of runoff relations was realized in the second half of the 20th century when the protection of land to flow Q_{100}- year big water was ensured. Till the end of the year 1990, 112,565 ha of agricultural lands were dewatered by drainage. As the part of the flood protection of the Eastern Lowland and water resource for irrigation, there was built in the first half of the

1960s the Zemplínska Šírava Water Reservoir with the area of 33 km^2, with the storage volume of 304 million m^3 and the retentive volume of 70 million m^3.
Within the water management modifications of the Moldava Lowland realized in the years 1960 – 1964 there were realized extensive modifications at the courses. The aim of those modifications was mainly to protect the agricultural soils. Those modifications protected the area of the Moldava Lowland against flow of Q_{20} – year big water and enabled more intensive land use.
Dewatering of inlad waters formed behind the dyked stretches of the rivers the Bodva and the Ida was realized by gravitation network of dewatering canals flowing into the natural courses without water-pumping stations and individual dewatering networks.
Within the listed water management modifications the courses were diking, shortening, their inclination was increased, natural meanders were blinded, banks and bottoms of the rivers were reinforced, and the dams were raised. These modifications resulted in decrease of land ability to retain water, desiccantion of springs in agricultural land, increase of water and wind erosion at integrated lands, cessation of wethlands in agricultural land.

In **Hungary** the early relationship of humans and water was characterised by symbiosis. Lush pastures and meadows grew after the floods. Our ancestors tried to control the water of the floods, to use it to their own advantage. This conscious use is called “fok”-management, which means that the water flowing into the canals called fok was not allowed to run back into the riverbed after the flood, but was retained on the meadows and pastures with the help of dams, and distributed according to needs. The majority of the foks on the Tisa were natural formations, but there were a few artificial, so-called dug foks as well. The largest – Mirhó-fok, Dobi-fok – were created by the movements of the riverbed, which crossed the beds of the tributaries, and the isolated beds, now foks, influenced the economic life of large areas. The related bays and beds were used as fisheries as early as the Árpád age, which is commemorated by several place names.
Along the rivers *animal husbandry and fishing* were the main forms of utilisation, besides which *agriculture*, riparian *orchardry,* beekeeping, reed and bulrush harvesting and the collection of other natural goods were the activities which served self-preservation. Production zones adapted to heights above sea level. This type of floodplain farming was profitable, since it simultaneously solved the problems of “flood control” (which was not the same as flood prevention), groundwater (fishing lakes) and irrigation (inundation) in a way whose costs the region could support on its own, amply compensated by the advantages, which ensure a decent living for the inhabitants of the Great Plain.
The loss of the forests (the decrease in the retentive – storage – role of the forests) *caused an increase in flood levels* (floods reached the erosion base of the Great Plain with a steep descent and within a shorter period of time), as a result of which landforms formerly not affected by floods came under water for periods of varying length (thus numerous settlements as well, which had previously been safe on the islands or the fringes of the floodplain). Some settlements (e.g. on the Sárrét) were moved, relocated. According to some records, during the 1838 Tisa survey 854 communities were found to be potentially threatened. Before the regulation, there were major floods on the Tisa in 1816 and 1830.
The dynamic spread of cultivated areas was launched by the end of Turkish occupation: in the 67 years between 1720 and 1787 their area increased sixfold on average (by 6.7 times in the Danube-Tisa interfluve, by 5 times in the Trans-Tisa region, and by 5.5 times to the west of the Tisa).
The *boom of the corn business* at the turn of the 18^{th}-19^{th} centuries as a result of the Napoleonic wars benefited Hungary in that its territory was not affected by battles – with the exception of the campaign of 1809 –, thus it reacted to the steep rise in the price of corn with

the expansion of arable land. A further intensifying factor was the rapid growth of the population, as *the population of the country multiplied manifold over 100 years*. During the expansion, more and more of the arable lands came up against the fringe of the flood-free landform. In this period the landlord system led to the appearance of large estates. Another problem was that as a result of the increase in corn production watermills also multiplied in number, whose dams and canals enhanced waterlogging. Grassland also fells victim to the boom of the corn business, and animal husbandry started to decline.

As a consequence of these different processes *the need for regulating the Tisa* emerged – on the basis of the plans by Pál Vásárhelyi and the modifications by Paleocapa –, as a result of which the river became shorter by 37%, 453 kilometres, and it was confined to one tenth of its former inundation area.

Those living along the river, however, also had to face the numerous drawbacks of the regulation of the Tisa. The reduction in the water surface led to changes in humidity, micro-climate, groundwater and soil-formation processes. The lack of the regular inundation affecting large areas which accompanied the floods resulted in the desiccation of the marsh forests of the floodplain and the alkalization of part of the arable lands, as well as in the decimation of the previously rich fauna: it is estimated, for example, that the legendary fish population is now only a few percent of what it was two hundred years ago. A new problem was represented by groundwater, which was very difficult and costly to divert because of the dams. Low stream levels became more frequent on the river because of the quick floods, and their water levels were lower and lower (an average one and a half metre decrease within sixty years). Thus one of the fundamental objectives of the Age of Reforms, ensuring navigation, became uncertain. Accordingly, from the beginning of the century the new task was the low stream level regulation of the Tisa. The aim was to ensure a relatively uniform stream level on the Tisa, and to create the conditions for the irrigation of the desiccated lands.

The *flood regulation of the Tisa came to an end in 1905.* In 1908 the development plan for the next 20 years was approved, however, its implementation was prevented by World War I and the Treaty of Trianon, which broke up the previously unified drainage system of the Tisa.

The first third of the 20th century was characterised by a receding natural environment. After the regulation, landscape, environmental and soil features had an ever decreasing influence on agricultural utilisation. More and more areas were cultivated, part of the former meadows and pastures were replaced by arable lands, and grassland was confined to the lowest-lying, marshy, waterlogged areas.

In the changed political and economic-geographical situation *between the two World Wars* the mineral deposits and the timber stock of the Northern Medium Mountains increased in value, which assisted the *industrial development* of the region. Many of the inhabitants of the small villages of the region found employment in the rapidly developing industrial towns. Act 19 of 1923, which provided for forestation on the Great Plain – adopted in order to urgently replace the large forests lost due to the Treaty of Trianon –, gave greater impetus to the planting of forests.

The landscape use and economy of the examined area *after 1945* was characterised by the forced development of *mining and heavy industry* in the Nort- Hungarian Range, while the *agriculture* on the Great Plain by the large-field cultivation arable land, which was managed by *well mechanised collective farms*, and shaped with the help of significant ameliorating work. The aim was increasing the volume of production in all sectors. For example, from the 1950's extended rice fields appear on the arable lands alkalized as a result of river regulation, representing a new element in the landscape of the Great Plain. The water necessary for growing rice was ensured by the construction of further irrigation canals.

In the socialist time it was intended to solve the *navigation on the Tisa* by barraged *river canalisation*. In 1954 work was completed on Tisalök Dam and power plant. The barrage and reservoir at Kisköre, the so-called Lake Tisa, finished in 1973, was built for a similar purpose, and besides regulating the water level of the river it was also intended to provide the Nagykunság and Jászság Districts with water for irrigation.
The reservoirs failed to fully meet the expectations concerning navigation and energy production, however, Lake Tisa had a more beneficial impact than expected on wildlife. In parts of the lake which turned marshy – not exactly "according to plans" – habitats were formed which evoke the former river water world of the Tisa. In addition, the area surrounding the lake has become a popular tourist destination.

III.3.1.3. Landscape use

In spite of landscape modifications on the Carpathian heights of Romania 50 % of land are covered by **forests**, this ratio is somewhat higher in Ukraine. On the plains of Hungary, Serbia and also in Romania 60 or more % of land is **agricultural use.**

The ratio of **urban fabric** is low. The ratio is less than 40 % in Ukraine, in Romanian counties of Alba, Sibiu, Harghita and Bistriţa-Năsăud, in Banska Bystrica region in Slovakia and Bács-Kiskun County in Hungary. This ratio is the highest in Pest County of Hungary affected by suburbanisation.

Owing to extensive (low intensity) farming, grassland and forests the ratio of **semi-natural and natural land cover** is high in several counties. This ratio is over 50% in Hunedoara (Romania) and several parts of Zakarpatska Oblast. Fair and acceptable is the ratio (23-50%) of natural uses in the areas of Slovakia and in ther majority of the Romanian counties, as well as in Counties Nógrád, Heves and Borsod-Abaúj-Zemplén of Hungary. Low (below 12%) is the ratio of natural and semi-natural areas in regions of intensive farming of Serbia and in Counties Jász-Nagykun-Szolnok, Békés and Csongrád in Hungary.

SOUTH EAST EUROPE
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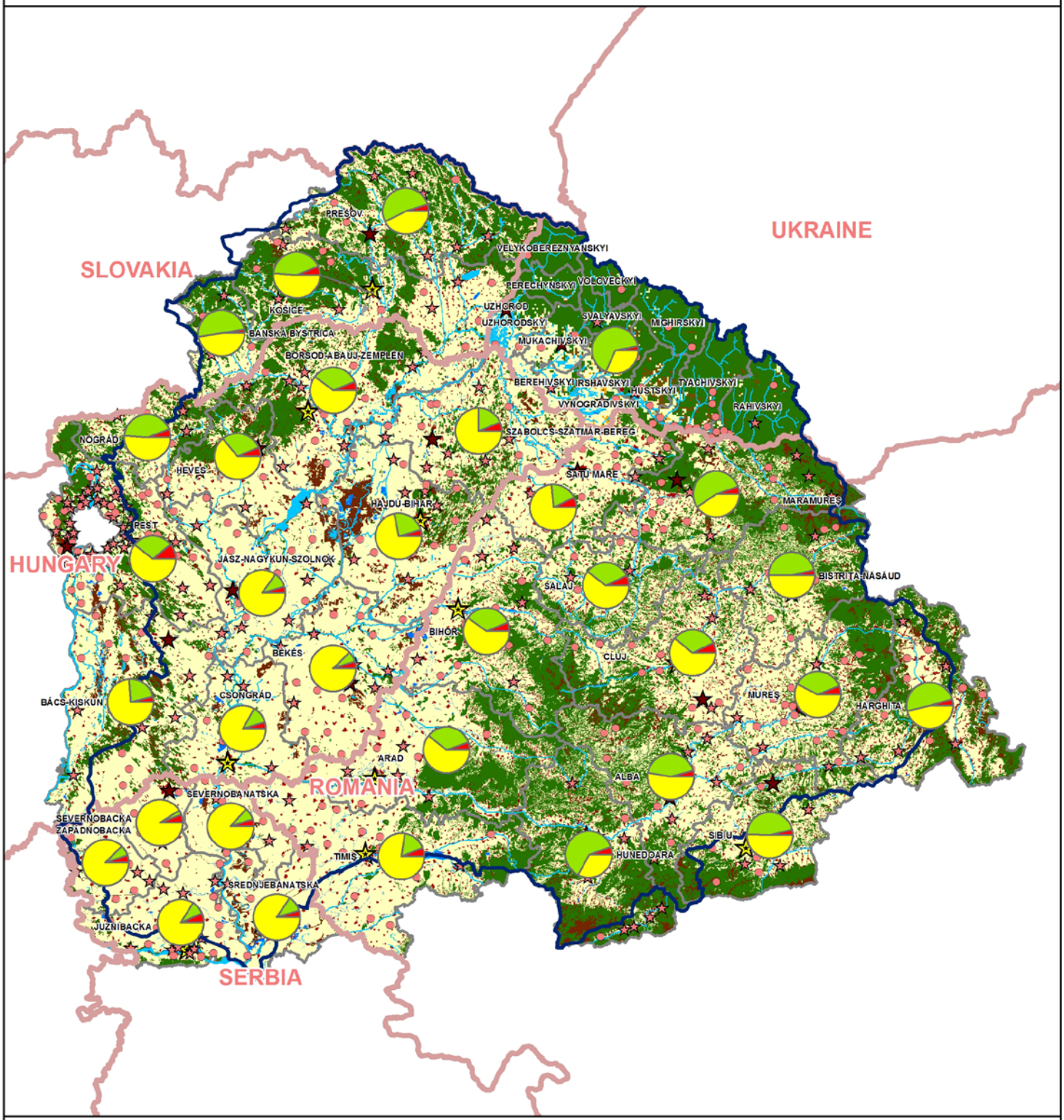

Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Land Use 2006
- Agricultural area
- Forests
- Industrial and commercial area
- Inland waters
- Inland wetlands
- Natural grassland
- Built up area

Distribution of Land Use
- Artificial surface
- Natural and Semi-natural area
- Agricultural area

SOURCE
Corine Land Cover 2006 / ICPDR

III.3.2. Environmental features

III.3.2.1. Water bodies[6]

The **Tisa River** rises in the southeastern part of the Carpathian Mountains and is a result of confluence of the Bila and Chorna Tisa Rivers. The Chorna Tisa River begins in foothill of the Svidovets Mountain at 1,680 m. The Bila Tisa River begins in the Black Mountain ('Chorna Hora') at 1,650m. Once the Chorna and Bila Tisa join near Rakhiv at 450 m above sea level, the river is called the Tisa. The riverhead of Chorna Tisa is taken as the riverhead of the Tisa River as it has the larger catchment area and the length to the confluence with the Bila Tisa River.

The united Tisa River maintains the roughly north-south direction of the Chorna Tisa as far as the Vişeu Stream on the left side, which is the first tributary of significant size. The Tisa turns west from here and after 26 km takes up the Iza River, which has its source in the Rodna Mountains. In this section, t*he rivers are characterized by small catchment areas (do not exceed 1,630 km²), high average altitudes and asymmetric basins.* The Tisa follows the southeast - northwest direction of the Iza at the foot of the Oaşului Mountains (M. Avas), which makes the precursor of the Lăpuş (M. Ţibleşului) and Gutîiului (M. Gutin) Ranges. Between the Oaşului Mountains and the right bank of the Vinogradov (Nagyszılısi) Mountains in the Hust gate, the river suddenly widens, and before reaching the edge of the Great Plain it takes up the Terešva, Tereblya and Rika Rivers from the right bank. Between the Korolevo/Királyháza and the Someş/Szamos Rivers the Tisa follows an east-western direction. In this section it receives two larger tributaries; the Borzhava River from the right and the Tur/Túr River from the left in Hungary. The upper course of the river extends until the Szamos/Someş mouth. The Mureş/Maros inflow serves as the border of the middle and lower course.

From a total length of 415 km, only 50 km of the Someş/Szamos River lies in Hungary. The river drains the northern part of the Transylvanian Basin. Its two main branches are the Someşul Mare accompanying the Rodna Mountains to the south, and the Someşul Mic originating from the union of the Someşul Cald – rising in the Transsylvanian range, on the eastern slope of the Bihor Mountains (M. Bihorului) – and the Someşul Rece rising in the Gilău (Gyalu) Mountains (M. Gilăului). The united Someş/Szamos has two larger tributaries: the Almaş/Almás and the Lăpuş/Lápos, which takes its source in the Lăpuş/Lápos and Gutin Mountains.

The Crasna/Kraszna River, feeding the former Ecsed Moor, flowed into the Someş until the 1890's. Its lower course has since been regulated so that it now flows directly into the Tisa about 3.5 km below the Szamos/Someş mouth. From the mouth of the Crasna/Kraszna, the Tisa turns north, going round the 170 m Nyírség sand ridge, until it reaches its northernmost point at Záhony. Here it makes its way west by southwest with a sharp bend, and takes up the Lónya Main Channel from the left, which collects the waters of the Nyírség, and in the foot of the Tokaj Kopasz hill it takes up the Bodrog River – its most important right tributary – at 544 km from its mouth.

The source of the Bodrog River is the confluence of the Latorica and Ondava Rivers. Their significant tributaries are the Ondava, Topľa, Laborec and Uzh/Uh Rivers. From some 53.5% of the total catchment area of the Bodrog is located in the Slovak Republic, the rest in Ukraine and partly in Hungary. The maximum vertical dissection of the catchment area is 1,127 m.
The flow of the Tisa is directed southwest from the inflow of the Bodrog. It follows the Taktaköz sinking, and on the south edge of that it takes up the Sajó/Slaná River, increased by the

[6] This chapter is in an excerpt from the Analysis of the Tisa River Basin 2007, Initial step toward the Tisa Basin Management Plan – 2009 made by ICPDR – International Commission for the Protection of the Danube River

Hernád/Hornád, also from the right. The waters of the Bükk Mountains drain into the Tisa through an old Tisa bed, the Small Tisa.

By damming up the section between the Kisköre and Tiszavalk Rivers (441.0-403.2 river kilometres) Lake Tisa was created within the foreshore of the Tisa River, which with its 127 km2 extension has become the second largest stagnant water bodies of the Carpathian Basin. Putting the Kisköre barrage into operation in 1973 enabled damming and aimed at the complex eco-geographical reconstruction of the mid Tisa Valley, as well as the improvement of natural and social relationships.
The next tributary of the Tisa is the Zagyva River, also from the right bank, which drains the Mátra and Cserhát Mountains. After the mouth of the Zagyva River, the Tisa turns south and remains parallel to the Danube until the mouth. West of the Tisa River, between it and the Danube, lies the sand ridge, from which it does not get any significant inflow of water. However, the next left tributary, the Hármas-Körös River, is quite important and its is the second largest among the Tisa River's tributaries. Its network consists of five rivers which spread like a fan: the Crişul Alb/Fehér-Körös, Crişul Negru/Fekete-Körös, Crişul Repede/Sebes-Körös and Barcău/Berettyó and Hortobágy-Berettyó Rivers, the first four of which are fed by waters of the Transylvanian island range, while the last one drains waters from the plains beyond the Tisa River.

The last important water flowing into the Tisa in Hungary is the Mureş/Maros River.
Along the Serbian section, the Tisa only receives two left tributaries flowing from Romania, the Aranca/Zlatica and Bega/Begej Rivers, with the mouth only 9.6 km upstream from the Danube confluence. The tributaries from the right are very small.

Water bodies in rivers
According to Annex II 1.1 WFD *"Member States shall identify the location and boundaries of bodies of surface water…"*. *"A body of surface water means a discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water"* (Art. 2. 10. WFD).

Some 16 water bodies were identified on the Tisa River. The number of water bodies on the Tisa varied per country – seven delineated on the Hungarian part of the Tisa and only one on the Romanian and Slovakian part. This means that the size of the water bodies also varies significantly. The smallest water body on the Tisa is only 5 km long (Slovak Republic) and the longest is 159 km (Hungary).

So far, 203 water bodies have been identified on the tributaries on the overview scale. Romania has the largest number of water bodies but also the largest part of the basin. The mean length of water bodies is 37 km on the tributaries and 62 km on the Tisa.

Number and lengths of water bodies at the Tisa River

Country	number	mean length (km)	min (km)	max (km)
Ukraine	5	35,5	13	75
Romania	1	61	-	-
Hungary	7	83,5	21	159
Slovak Republic	1	5	-	-
Serbia	2	80,5	63	98
Summa	**16**			

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Number and lengths of water bodies at tributaries of the Tisa River Basin

Country	number	mean length (km)	min (km)	max (km)
Ukraine	17	34	6	65
Romania	100	38,5	1	142
Hungary	43	39,5	7	94
Slovak Republic	30	34	5	91
Serbia	13	39,5	13	81
Summa	**203**			

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Water bodies in lakes

There are two natural lakes greater than 10 km^2 in the Tisa River Basin, the Szegedi Fehér Lake and the Füred-Kócsi Reservoir.

The Szegedi Fehér Lake is situated in Hungary in the Kiskunsági National Park (KNP) and is 13.1 km2. The lake is a significant habitat for birds, and nearly 280 bird species have been recorded so far. The territory of the lake was inundated regularly in the past, but after the river regulation the inundation was blocked.

The Füred-Kócsi Reservoir is in the Hortobágy National Park. Its surface is around 600 ha, and the area regularly inundated is approximately 400 ha. Bulrush and reed are typical macrophyta in the reservoir. In addition to an ecological aquatic habitat, the reservoir aids emergency flood control functions.

Artificial water bodies and reservoirs

The Danube-Tisa-Danube Canal System (DTD): is situated in the Vojvodina province of the Republic of Serbia. The DTD is divided into two independent parts; the Bačka and the Banat Region. The DTD is a multi-purpose system with the following tasks: flood protection – adequate level achieved; draining excess interior waters and routing drainage waters through main channels towards the Danube and the Tisa Rivers; conveying water for the irrigation of agricultural land – presently very modest; water supply for industry and fisheries; navigation; receiving and conveying wastewaters; water quality protection; recreation, sports and tourism.

The Eastern and Western Main Canals: are located in Hungary and are mainly used to assist water resource distribution.

Reservoirs: more than 60 reservoirs were built during the last century for various purposes including: drinking and industrial water supply, hydropower, flood protection, irrigation, fish farming and recreation, as well as seasonal flow regulation. The total reservoir capacity in the Tisa River Basin is estimated at about 2.7 billion m^3.

Groundwater

Groundwater bodies are important sources of drinking water, industry and agriculture in the Tisa River Basin.

The countries in the region depend mainly on groundwater sources to meet their drinking water needs, with the exception of Romania and the Slovak Republic.

Shallow aquifers are at high risk of pollution as a result of the use of fertilisers and chemicals from agriculture, untreated sewage water and leaching from contaminated soils. In some cases, groundwater sources cannot be used without prior treatment. Therefore, countries need to ensure that the groundwater is not overexploited and that the quality of groundwater is preserved.

Mineral springs and thermal waters

Throughout the Romanian Tisa catchment area, numerous **mineral springs** appear which provide a range of hydrochemical types (simple carbonated, bicarbonated, ferruginous, sulphurous, sulphated, iodated, etc.).

Thermal waters appear on the fault lines of the Western Hills and the Western Plain (Timişoara, Călacea, Arad, Răbăgani, Tinca, Salonta, Oradea, etc.), in the southern part of the Apuseni Mountains (Vaţa, Moneasa, Geoagiu) and the Haţeg Depression (Călan), in the regions with high geothermal gradients, in the eruptive areas of the Eastern Carpathians (Topliţa) or in the sedimentary areas of the Western Plain (Oradea, Tăşnad, Satu Mare, etc.), and they represent an important factor for the tourism valorisation.

Water Quality

Point sources of pollution

The values in the emission inventories were determined as loads for individual plants, based on continuous or periodic measurements. All municipal sources with more than 10,000 PE (population equivalents) have been included in the emission inventory. The inventory of industrial discharges takes into consideration the most relevant types of industry: food, chemical, pulp and paper, fertiliser, mining, iron and steel, metal surface treatment, textile, leather industry and large agricultural plants. All direct industrial discharges, which are bigger than 2 ton/a COD or 1 ton/a BOD has been reported according to EPER10. All agricultural emissions from agricultural sources (farms) with more than 2,000 pigs, more than 30,000 chicken, more than 2,000 dairy cows and more than 1,000 sheep have been considered. For agricultural sources, the main parameters are: COD, BOD, NH4-N, total P, suspended solids, total N, total dissolved solids, sulphides, detergents, phenols.

Significant pressures (point sources) in the Tisa River Basin (based on the agreed ICPDR criteria)

Country	Municipal	Industrial	Agricultural
Ukraine	1	0	0
Romania	22	25	2
Hungary	11	7	0
Slovak Republic	1	1	0
Serbia*	16	6	0
Summa	**51**	**93**	**2**

ICPDR: Analysis ot the Tisa River Basin - 2007

*Municipal and industrial point sources discharges for Tisa River Basin in Serbia are only estimated

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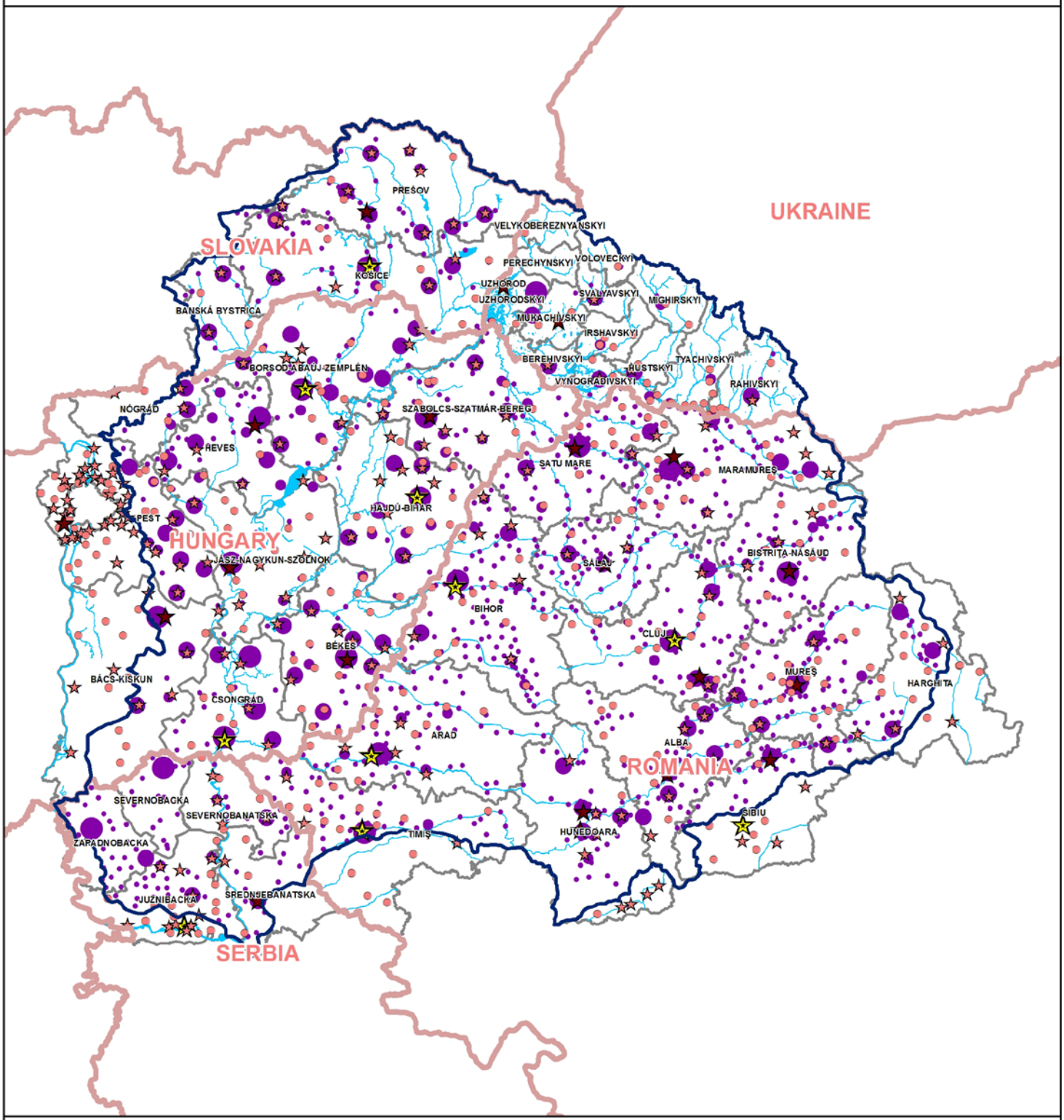
NATURAL AND ENVIRONMENTAL FEATURES - SEWEGE WATER TREATMENT PLANT



Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Treatment plant (pe)
- 2000 - 10000
- 10001 - 15000
- 15001 - 100000
- 100001 - 540624

SOURCE ICPDR

Municipal point source discharges of COD, BOD, total nitrogen and phosphorus in the TRB (based on ICPDR Emission Inventory data of 2005)

Country	BOD (t/a)	COD (t/a)	N (t/a)	P(t/a)
Ukraine	558	820	145	117
Romania	12275	30092	5094	685
Hungary	6896	13507	2501	311
Slovak Republic	230	667	401	64
Serbia*	660	1198	15	5
Summa	**21285**	**48234**	**8821**	**1264**

ICPDR: Analysis of the Tisa River Basin - 2007

*Municipal and industrial point sources discharges for Tisa River Basin in Serbia are only estimated

Diffuse sources of pollution

The MONERIS (MOdelling Nutrient Emissions in RIver Systems) model allows for the estimation of nutrient emissions to the surface water on a very large geographical scale and provides quantification of nutrient emissions to the surface water at the catchments level, in order to optimally support the river basin approach. Whereas point emissions from wastewater treatment plants and industrial sources are directly discharged into the rivers, diffuse emissions into the surface waters reflect the sum of different pathways. Seven pathways are taken into consideration: point sources; atmospheric deposition; erosion; surface runoff; groundwater; tile drainage and urban surface water runoff. Estimates of diffuse sources of pollution in the Tisa River Basin would be available once the MONERIS update for 2005 is finalised.

The specific P point discharges reflect, not only the state of the P elimination in wastewater treatment plants, but also the existing use of phosphorus in detergents, and discharges from direct industrial sources, as well as the amount of the population connected to wastewater treatment plants. According to the MONERIS modelling results of based on data representing the period from 2002 to 2004, the nutrient inputs by point sources into the surface waters of Tisa Sub-basin are:

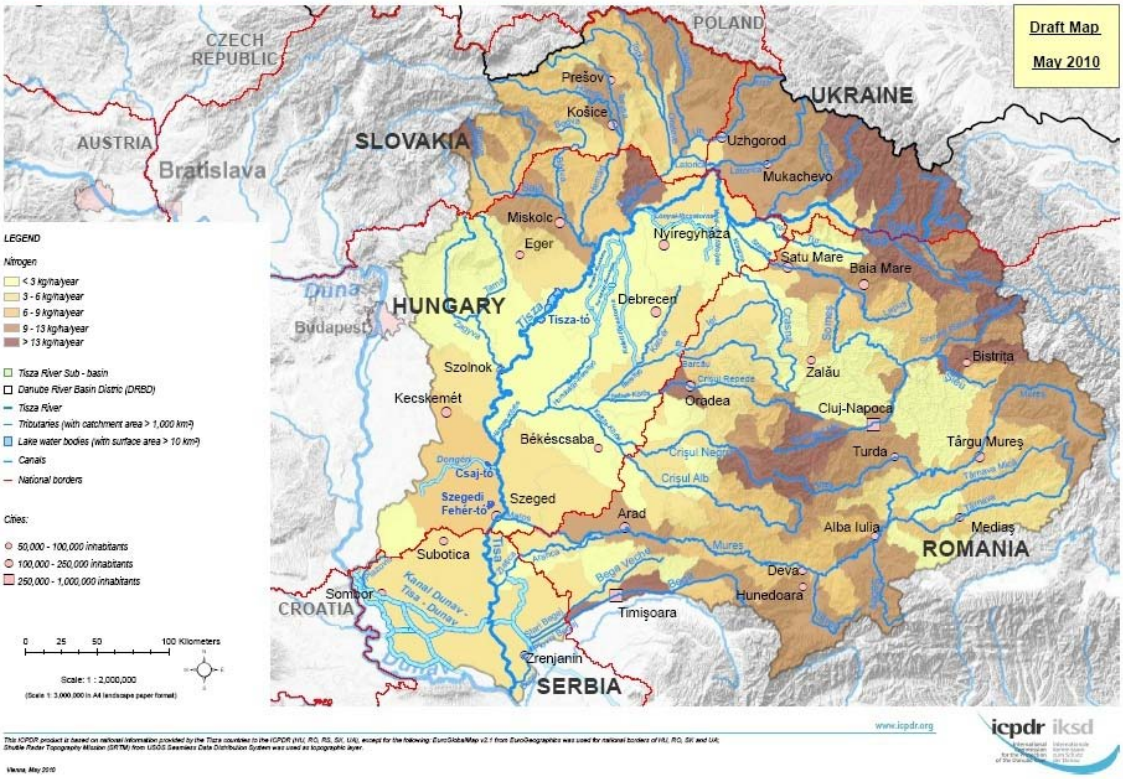
Emissions of Phosphorus 2636 t/a P
Specific Emissions of Phosphorus 0.50 g/(inh.d) P
Emissions of Nitrogen 14044 t/a N
Specific Emissions of Nitrogen 2.67 g/(inh.d) N

National average nutrient inputs by countries in the period 2002-2004

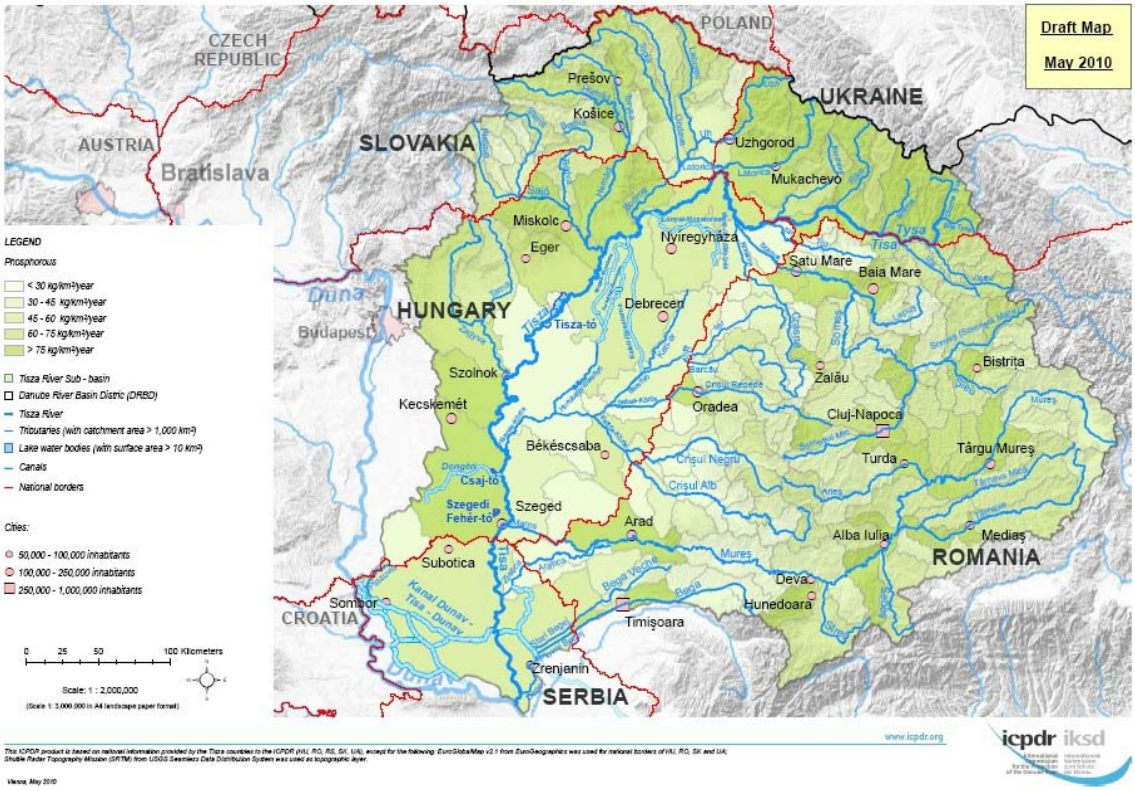
Country	P specific emissions from point sources (g/(inh.d)P)	P- point sources (t/y)	Tot. P (t/y)	Nspecific emissions from point sources (g/(inh.d)P)	N- point sources (t/y)	Tot. N (t/y)
Ukraine	0,26	121	684	1,06	499	14467
Romania	0,63	1171	3222	4,82	8995	46647
Hungary	0,59	1194	3147	1,74	3520	22738
Slovak Republic	0,27	142	698	1,86	969	12058
Serbia	0,02	8	463	0,17	63	2689

ICPDR: Analysis of the Tisa River Basin - 2007

Tisza River Sub - Basin: Nutrient Pollution from Point and Diffuse Sources - Reference Situation for Nitrogen MAP 22



Tisza River Sub - Basin: Nutrient Pollution from Point and Diffuse Sources - Reference Situation for Phosphorous MAP 23



These specific discharges are calculated based on the total population living within the Tisa Basin and reflect two effects: the level of nutrient elimination in the municipal and industrial wastewater treatment plants and the level of population connected to wastewater treatment plants.

Land use patterns and agricultural indicators

The Tisa River Basin is characterised by large gradients of anthropogenic and natural indicators, which are important for affecting nutrient inputs into the river system. One indicator for the level of the diffuse emissions of substances can be the land use within the basin and its regional distribution. Sources of information are results of the MONERIS application and the available CORINE land cover map.

Besides being influenced by the land use itself, the level of the emissions into the surface waters of a river system is also dependent on the intensity of the land use. Because agricultural activities are a main source for the diffuse nutrient emissions into the river system, it is important to show differences in intensity of use on a unique statistical database.

According to the FAO agricultural statistics for the individual countries for the years 1998 to 2000, the use of mineral fertilisers in agriculture in the Slovak Republic and Hungary is low to moderate, between 25 and 50 kg/ha/a N. In all other countries the level of mineral fertiliser consumption is significantly below 25 kg/ha/a N.

An overview on **the total Nutrient emissions (point and diffuse sources)** into the river system of the Tisa is given below:

Emissions of Phosphorus 8213 t/a P
Specific Emissions of Phosphorus 526 g/ha a P
Emissions of Nitrogen 98599 t/a N
Specific Emissions of Nitrogen 6.31 kg/ha a N

Estimation of the origins of nutrient pollution after recalculation from MONERIS (2007) based on referece year 2004

	Agriculture	Urban system	Background	Other sources
N-sources: 98,6 kt/y	**49%**	**30%**	**8%**	**13%**
P-sources: 8,2 kt/y	**21%**	**70%**	**8%**	**1%**

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Sum of total specific nutrient emissions into country parts of Tisa River Basin in the period 2002-2004 from MONERIS (2007)

Country	sum specific P emission (kg/ha a P)	sum specific N emission (kg/ha a N)
Ukraine	536	11,33
Romania	451	6,53
Hungary	694	5,01
Slovak Republic	441	7,63
Serbia	426	2,47

ICPDR: Analysis of the Tisa River Basin - 2007

Hydromorphological alterations

In the Tisa River Basin all together 37 hydropower plants are located. 35 hyropower stations of these are with installed capacity> 10MW, and two additional situated in Ukraine with installed capacity <10MW. 28 hydropower plants were built in Romania, three in Slovakia, three in Hungary and four in Ukraine.

Hydropower plants are mainly situated in the tributaries, only two hydropower plants were built in the Tisa River in Hungary at Tiszalök and Kisköre.

Flood Defence Measures

Most of the larger rivers in densely populated areas are characterised by anthropogenic modifications for flood protection to secure safety for the protected areas as well as land for urban development. In many cases, hydro-engineering structures have multiple purposes often resulting in changes of the river character, e.g. straightening of a meandering or anabranching river. These changes affect not only the river itself but larger areas of the valley floor.

Major systematic regulations for flood defence and navigation purposes began in the second half of the 19th century, when extensive measures of river training and flood control were taken along the river. As a results of this work approximately 30% of the total river length was shortened. In Hungary the draining of the Tisa wetlands begun in the 19th century and today some of 500,000 people (5% of the Hungarian population) live on land reclaimed from the Tisa.

Navigation

The Tisa River is used as a waterway from the Ukrainian-Hungarian border (downstream from the border towns of Chop and Záhony) to the confluence with the Danube, which over 70% of the total river length. Some Tisa tributaries are navigable on shorter sections: Bodrog (Hungarian stretch and 15 km in the Slovak Republic), Mureş (25 km, which corresponds to less than 5% of its total length), Körös (115 km in Hungary) and the Bega/Begej River (presently 75 km in Serbia and 45 km in Romania before 1967).

Water transfer, diversion and water abstraction

In the Tisa River Basin three main canals can be found - located in Serbia and Hungary - which are playing an important role in water supply. The Danube-Tisa-Danube Canal System is situated in the Vojvodina province of the Republic of Serbia and has multi-purpose system. The Eastern and Western Main Canals are located in Hungary and are mainly used to assist with water resource distribution.

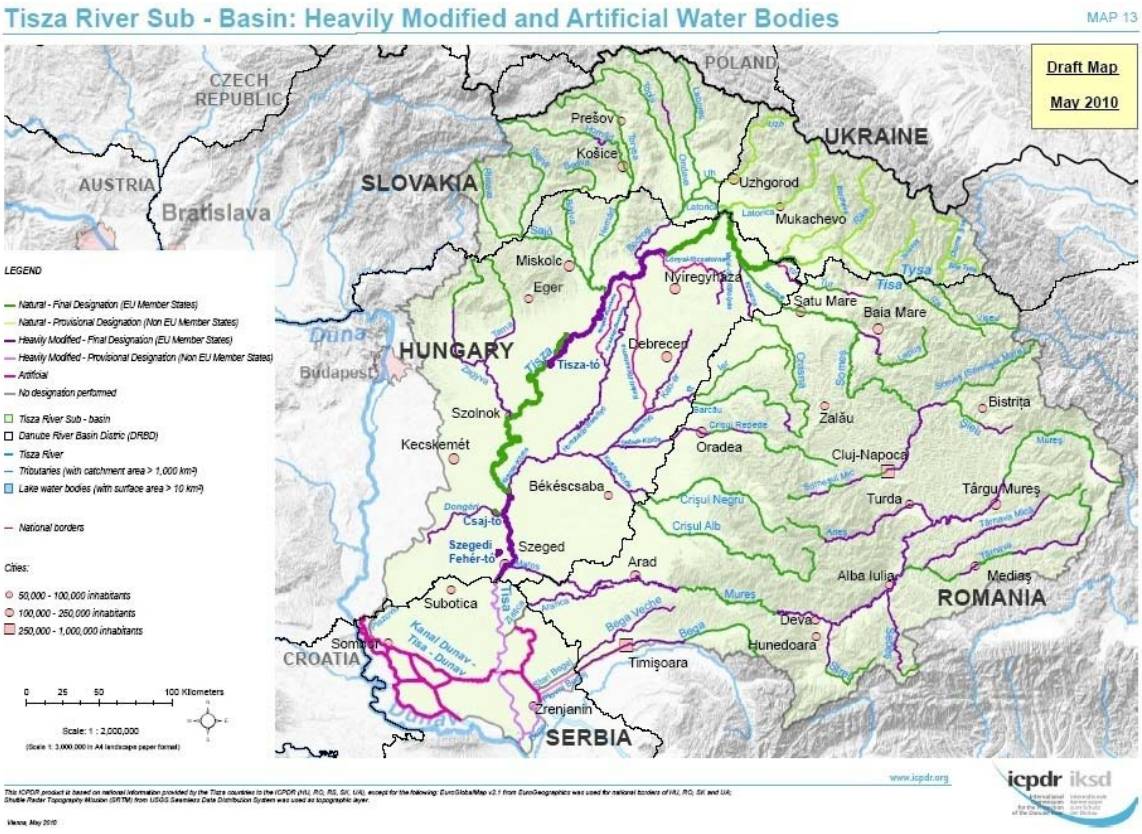
However, at this moment it is very hard to estimate water quantities which will be used for preservation of the good ecological status in rivers and canals, the increase of water use in Tisa River Basin set in national water management plans, will be an additional pressure on already endangered aquatic ecosystems. This stands in particular for irrigation, because this consumptive use takes place in low water period of the year.

Artificial and heavily modified water bodies (provisional identification)

In total, 21 **artificial water bodies (AWB)** were identified on tributaries of the Tisa River Basin in Romania, Hungary and Serbia. No AWBs were identified in Ukraine and the Slovak Republic. The identified AWBs amount to 10% of the total identified tributary water bodies in the Tisa Basin and have a total length of around 772 km. Serbia identified the majority of its tributary water bodies as AWBs (»85%), due to the significant presence of canals in this lower part of the Tisa River Basin. The Serbian AWBs mainly used for navigation and flood protection. In other parts of the basin, such as Romania, AWBs are also used for hydropower.

Eight **provisional heavily modified water bodies (HMWBs)** were identified **on the main Tisa River** of 540 km length. The provisional HMWBs identified are equivalent to 56% of the total length of the Tisa River (of 966 km) and to 50% of the total Tisa water bodies. The provisional HMWBs on the Tisa River are concentrated in Hungary and Serbia (the middle and lower part of Tisa). It must also be mentioned that preliminary designation of the HMWBs is higher in the Tisa River than the European average. Further approach of the methodology on final designation of HMWB is under development.

The **77 provisional HMWBs** identified **on the tributaries of the Tisa River** are 2,431.77 km long. Most of the tributary provisional HMWBs lie in Romania, the Slovak Republic and Hungary. The provisional HMWBs identified are equivalent to »38% of the total tributary water bodies of the basin.



From a cross-country perspective, it is interesting to note that the Slovak Republic identified up to »83% of its total tributary water bodies as provisional HMWBs. The high percentage of provisional HMWBs within the Slovak Republic can be explained by the fact that the main Slovakian rivers were regulated after World War II. Regulation served to provide enough water for economic development (as reservoirs for industry and hydropower generation) and for flood protection of inhabited areas. On the other hand, Ukraine identified only »6% of its tributary water bodies as provisional HMWBs. The low percentage of provisional HMWBs on the Ukrainian tributaries of the Tisa is due to the fact that rivers in Ukraine have not been very developed and are thus not significantly modified yet in their hydromorphology.

Risk analysis of rivers

Tisa River

On the Tisa River, 11 water bodies (668 km long) were assessed as 'at risk'. This is equivalent to 69% of the total Tisa water bodies and of the total length of the Tisa River. The main part of water bodies 'at risk' lies in Hungary and Serbia. Tisa water bodies possibly at risk 25% of the total) were reported only by Ukraine and Hungary, while the only Tisa section not at risk (6% of the total) lies in Ukraine.
Three Tisa countries (the Slovak Republic, Romania and Serbia) classified up to 100% of their national share of Tisa WBs as at risk. In Ukraine, only 20% of its national Tisa water bodies were classified as at risk but 60% were classified as possibly at risk.

The Upper Tisa in the mountainous area of Ukraine is classified as 'possibly at risk' due to hydromorphological alterations. In Romania, the Tisa is classified 'at risk' due to hazardous substances and possibly at risk for hydromorphological alterations, nutrient pollution and organic pollution. The Middle Tisa is partly classified as 'at risk' and partly as 'possibly at risk' due to hydromorphological alterations, hazardous substances and organic pollution. In this middle part, nutrient pollution is also as a reason for the possible risk of a significant part of the Tisa River. The Lower Tisa is 'at risk' due to hydromorphological alterations, hazardous substances and nutrient pollution.
The high risk or possible risk due to hydromorphological alterations is related to the presence of physical pressures such as weirs, bank reinforcement, channelisation and river regulation, especially in the middle and lower parts of the Tisa. Hydromorphological risk is also linked to the identification of approximately 50% of the length of the Tisa as provisionally heavily modified in its middle and lower part.

The Tisa has also been classified to a substantial extent as 'at risk' or 'possibly at risk' due to the presence of hazardous substances. A major problem in assessing the results on hazardous substances is the limited data availability in the Tisa River Basin. In Ukraine, risk and possible risk were related mainly to heavy metals and cyanides from Romanian mines, chlorides from Ukrainian mines as well as mercury.
Romanian sections of the Tisa were also assessed as 'at risk' from hazardous substances coming from upstream in Ukraine. Specifically, the waters of the Romanian Tisa constantly exceeded second class limits (Target Values) for heavy metals Pb, Cd and Cu at Valea Viseului, the entry of Tisa in Romania. At the exit of the Romanian/Ukrainan Tisa at Teceu/Tyacchiv, concentrations of heavy metals were lower in 2001 - 2003 than those for the entry and as the same as for the entry in 2005-2006.

In Hungary, heavy metals mainly of transboundary origin were reported as responsible hazardous substances for classifying water bodies on the Tisa River as 'at risk'. In Serbia, parameters such as mercury (Hg) and phenols exceeded the set thresholds of 0.1 µg/l and 1 µg/l respectively.
Tisa water bodies at risk due to nutrient pollution were classified mainly in Hungary and Serbia. The main reason for failing the WFD objectives for nutrient pollution is the incomplete implementation of the urban wastewater treatment directive and diffuse nutrient pollution from agriculture.

Results on the Tisa tributaries
On the Tisa tributaries, 144 water bodies were assessed as 'at risk'. This is equivalent to 71% of the total tributary water bodies in the Tisa River Basin. The main water bodies 'at risk' lie in Romania, the Slovak Republic, Hungary and Serbia. Tributary water bodies possibly at risk (15% of the total) were reported by all Tisa countries except for Serbia. Tributary water bodies not at risk (14% of the total) are found in Ukraine, the Slovak Republic and Romania.

On one hand, Serbia, Hungary, Romania and the Slovak Republic classified the largest part of their tributary water bodies as 'at risk'. On the other hand, Ukraine classified 41% of its national share of Tisa tributary water bodies as 'possibly at risk' and 47% as 'not at risk'.
The Tisa tributaries are at risk mainly due to hydromorphological alterations and nutrient pollution followed by organic pollution and hazardous substances. Hazardous substances, however, were the main reason for the classification of tributary water bodies as 'possibly at risk' (especially in Romania, Hungary and the Slovak Republic).
The high risk of tributary water bodies due to hydromorphological alterations is related to the frequent presence of bank reinforcements, channelisation and transverse river structures for flood protection and urbanisation.

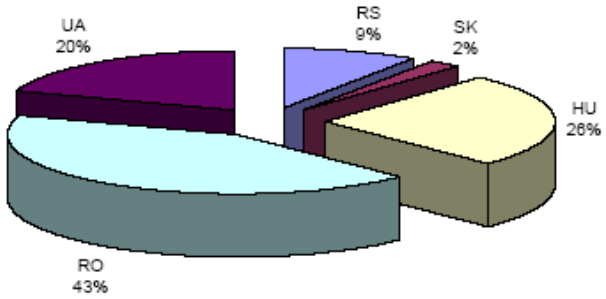
The high risk from nutrient pollution in Romania is caused by diffuse pollution sources from human settlements, especially in rural areas where a small part of the population is connected to sewage systems and wastewater treatment plants. In Hungary and the Slovak Republic, the high risk from nutrient pollution can be explained by the incomplete implementation of the urban wastewater treatment directive and diffuse nutrient pollution from agriculture.

For the extended classification of water bodies as 'possibly at risk' and 'at risk' due to hazardous substances, several tributaries in Romania exceeded second class limits for heavy metals. These rivers were thus classified as at risk due to natural background and discharges (direct or by tributaries) from mining pollution sources. In Hungary, the presence of heavy metals is mainly responsible for the classification of water bodies as at risk or possibly at risk due to hazardous substances. In the Slovak Republic, hazardous substances such as mercury (HG), zinc (Zn), trichlormethane, trichlorethane-1,1,2 and Polychlorinated Biphenyls (PCBs) are responsible for the water bodies being at risk. Serbia reported mercury (Hg) and phenols as reasons for the risk of water bodies due to hazardous substances.

Important transboundary groundwater bodies in the Tisa River Basin

In total, 33 important transboundary GWBs were identified.

Country repartition of transboundary GWBs (related to size/km²)



Groundwater use: Groundwater in the Tisa River Basin is used mostly for drinking water purposes (91% of the transboundary GWBs). It also supplies water for industry (58% of the GWBs) and agriculture (mainly irrigation, in 48% of the GWBs). In some cases, groundwater is also used in balneology, for industrial bottling and geothermal purposes.
The chemical pressures on groundwaters most often named were from agriculture (use of fertilisers) and settlements (absence of wastewater services). Overabstraction of groundwater in some parts of the Tisa River Basin is recognised as a possible cause for the unbalance between abstraction and recharge of groundwater.

(Quality) chemical status
The majority (88%) of the transboundary GWBs was reported as not at risk in terms of (quality) **chemical status**. Transboundary GWBs at qualitative risk (12%) were reported by the Slovak Republic, Romania and Ukraine.

Quantity status
Of the nominated transboundary GWBs, 85% were assessed as 'not at risk' in terms of quantity status. Transboundary GWBs at quantitative risk were reported by Hungary (3%) and GWBs possibly at risk were reported by Serbia and Ukraine (12%).

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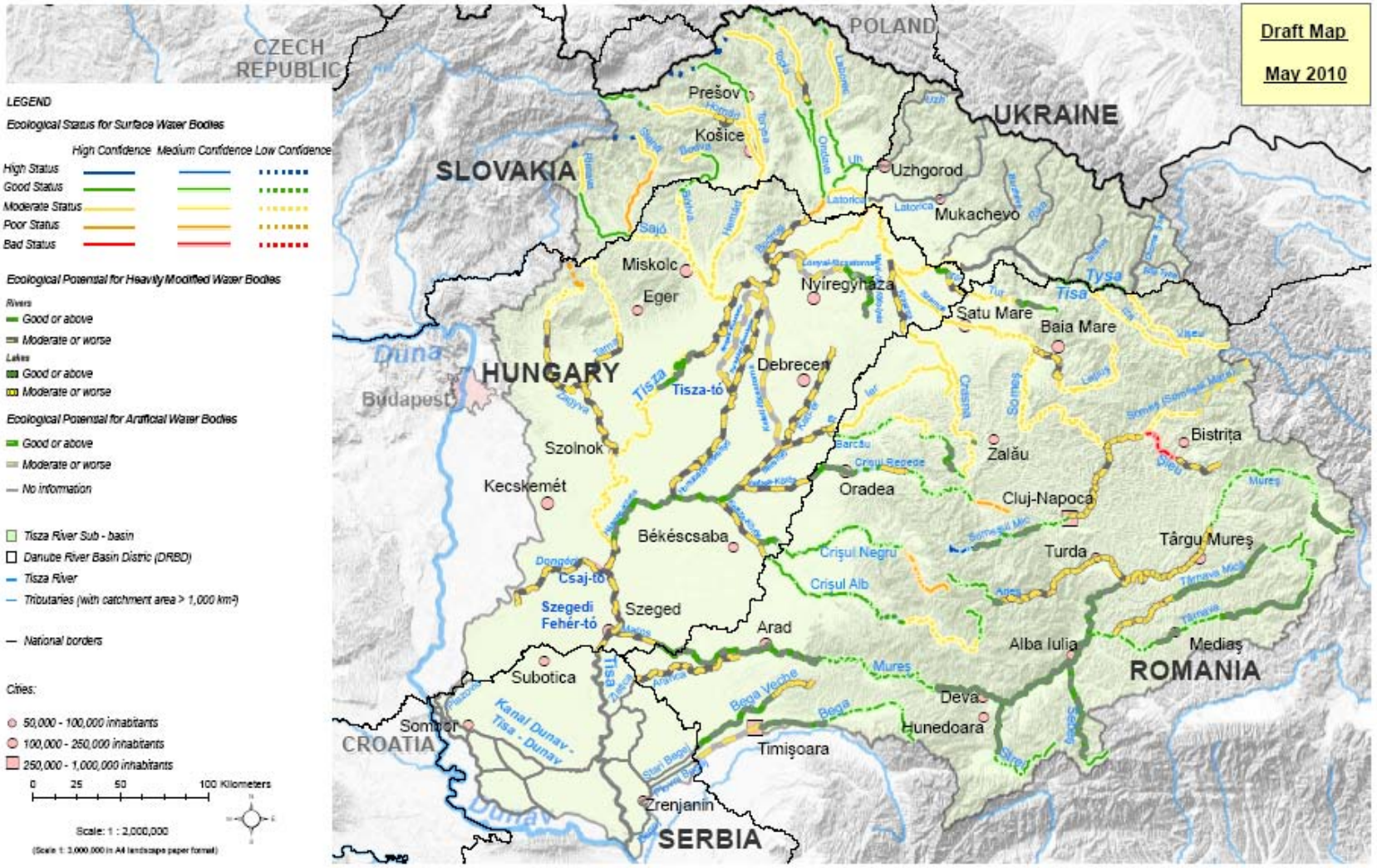
Tisza River Sub - Basin: Ecological Status and Ecological Potential of Surface Water Bodies

MAP 11



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This ICPDR product is based on national information provided by the Tisza countries to the ICPDR (HU, RO, RS, SK, UA), except for the following: EuroGlobalMap v2.1 from EuroGeographics was used for national borders of HU, RO, SK and UA; Shuttle Radar Topography Mission (SRTM) from USGS Seamless Data Distribution System was used as topographic layer.

Vienna, May 2010

III.3.2.2. Soil

In the region all main types of soil can be found. The main types and the individual types belonging to them can be well associated with geographical landscapes, thus during the characterisation of the soils their incidence will be presented in connection with landscape geographical borders.

Earlier historical periods were characterised by natural soil degradation processes, but today **soil degradation** caused by human activities (especially intensive agricultural activities) has become the most decisive besides natural processes. The most evident soil degradation processes, to which intensive farming also contributes, are the following: **soil erosion** (wind and water erosion), ***deterioration of physical structure*** (compaction, pulverization), ***unfavourable chemical processes*** (acidification, alkalinisation, nitrate contamination). Besides agriculture, industry and transport also contribute to the chemical pollution of soils (heavy metal pollution).

Besides physical and chemical pollution degrading the quality of soils, human activities also threaten soil quantity. ***The natural soil surface has significantly decreased recently.*** It can be explained by great proportion of greenbelt investments.

Soil erosion
The soil of the Tisa River Basin within **Ukraine** in the mountain area is characterized by low fertility, the Zakarpatian Lowland – by medium and high fertility. The erosion index of soil in the region is on average 10%, in the Zakarpatian Lowland – under 1%, and in Horhany Mountain Range it is as high as 70%.

In the **Slovakian** target area agricultural land endangered by wind erosion is 25,708, which is 1.67 % of the total catchment area on the Slovakian river section. The agricultural land endangered by water erosion is 291,987 ha presenting 19.01 % of the target area. In the target area danger of wind erosion of agricultural soils is from medium to strong. There are also observed large areas damaged by wind erosion in the surroundings of the plants for mining and processing of magnesite in Jelšava and Hnúšťa. Danger of water erosion of agricultural soils is from strong to very strong mainly in the north parts of the regions.

In **Hungary** the proportion of soils exposed to the most significant deflation (wind erosion**)** is 28%. Most of the endangered areas are situated on the Danube-Tisa Interfluvial Plain and in the Nyírség. In 4.5% of the region the danger of water erosion is strong or very strong. The areas most endangered by erosion are those situated in the mountainous of hilly regions (Hungarian Range) and utilised as ploughland or by garden cultures.

III.3.2.3. Air quality

EPER sources

To identify the main sources of air pollution represented on the map we used the data of European Pollutant Emission Register (EPER) and national data in the case of non EU member countries.
EPER data base has been established to survey and register the major emissions. The EU Member States collect and transfer comparable data of their industrial activities and their pollutant emissions. The European Commission then synthesizes and publishes these data.
In their EPER report the Member States are obliged to supply data on activities and emissions falling under the Integrated Pollution Prevention and Control (IPPC) system. IPPC was established according to the Directive 96/61/EC of the European Council for the prevention, mitigation and control of industrial and agricultural companies responsible for large-scale pollution.
The air pollution sources marked on the map are the locations of pollutants (power plants, factories, agricultural plants) with the highest emission indicators in the respective countries. These pollutants occur mostly in regions of high manufacturing (of machines, chemicals) potential and excavation and processing of minerals.

CO_2 emissions

CO_2 emission has decreased recently in the target area. It is still high in areas of substantial manufacturing industry, power generation, roads of heavy traffic and transport junctions. Emission has been reduced by means of the modernisation of power plants, decrease of the coal use, removal of hazardous gases by means of up-to-date methods, technological development manufacturing and modernisation of vehicles.
For all the overall decrease, CO_2 emission increase in the majority of the relevant countries due to the growing number of motor vehicles, growth of the volume of traffic and growing energy consumption of comfort facilities like air conditioners.

The emissions of CO_2 into atmosphere had been 49,3 thousand tons during 2007 year in **Ukraine**. The highest value was in Mukachivskyi Region, in Uzhorod, and the lowest value was in Voloveckyi Region, Velykobereznyanskyi Region and other mountainious regions with lower population and industry density. In Zakarpatska Oblast the share of autotransport is great in total amount of emissions because this area is of less industrial loading.

In **Romania** the main sources of CO_2 emissions are represented by combustions in the energy sector, non-industrial combustion plants, combustion in manufacturing industry, plus emissions resulted from road transport, production processes, waste treatment and disposal. In 2004, there was a significant increase in CO_2 emissions in Bihor County (76.96 tones/capita), due to activities falling within Non-industrial combustion plants and Combustion in manufacturing industry, respectively. However, for the interval 2004-2006, a decreasing evolution of total annual CO_2 emissions was registered.
The evolution of annual emissions of greenhouse gases, expressed in CO_2-eq had a decreasing gradient between 2002 and 2007. Romania is to reduce CO_2 emissions equivalent to 8% in the first commitment period, 2008-2012, compared to reference year 1989.

In **Slovakia** the most important anthropogenic source of CO_2 emissions is the combustion and transformation of fossil fuels, which accounts for about 90% of the total CO_2 emissions. In addition, CO_2 arises during technological processes of the production of cement, lime, magnesite and using of limestone. The balance includes also the production of coke, iron and steel. Total net CO_2 emissions decreased moderately in 2007 in comparison with 2006. Total decrease of CO_2 was more than 38% in comparison with the reference year 1990. The most

feasible explanation of the significant CO_2 reduction is the gradual decrease in energy demands in certain heavy energy demanding sectors (except for metallurgy) from 1993, higher share of services in the generation of GDP, higher share of gas fuels in the consumption of primary energy resources, reclassification of industry and the impact of air protection legislative measures influencing directly or indirectly the generation of greenhouse gas emissions. But in the future a long-time increasing trend of CO_2 emissions is expected due to the expected recovery of the Slovak economy, followed by new sources of pollution and transition to solid fuels due to increasing prices of natural gas. Similarly, increased trend of CO_2 emissions can be expected due to transport sector.

In **Hungary** carbon dioxide's emissions have been monitored since 1985, the 90,000 kt value of that year was reduced to 60,000-70,000 kt by the 1990's, due to the – mainly heavy industrial – facilities which stopped production and then were closed in the period of economic regime change. In Hungary the emission of carbon dioxide continues to show a decreasing tendency, similarly to previous years. Only the CO_2 emissions of public roads showed an increase due to the greater number of vehicles, the enhancement of the volume of traffic and the so-called "amenities" (e.g. air conditioning), which increased consumption.

III.3.3. Value protection

III.3.3.1. Nature protection

Because of the differences among the countries in nature protection policies and capacities, the ratios of protected areas vary from one country to the other. This ratio is very low in Serbia and in Sălaj County in Romania. On the other hand this ratio is very high (over 20 %) – owing to the extension of precious forests and meadows – in Maramureş, Hunedoara, Mureş and Sibiu in Romania, in Slovakia and in Borsod-Abaúj-Zemplén, Heves, Hajdú-Bihar and Csongrád Counties in Hungary.

Protected natural areas of international importance
The nature protection areas of international importance, NATURA 2000 areas, biosphere reserves and Ramsari areas are designated in each country, though their size and ration varies.

The **Natura 2000 network** includes areas designated under the two nature conservation directives of the European Union: the Special Protection Areas to be designated in the course of the implementation of the Birds Directive adopted in 1979 (79/409/EEC), and the Sites of Community Importance to be designated under the Habitats Directive adopted in 1992 (43/92/EEC).
The main objectives of the Habitats Directive are to protect biodiversity and to ensure the long-term survival of species and habitat types by maintaining or increasing their natural spread range. Sites of Community importance have to be designated for the protection of natural habitat types of Community interest (which are threatened by disappearance, have low natural distribution, or have distinctive characteristics within a given bio-geographical region) and of animal and plant species of Community interest (endangered, vulnerable, rare or endemic). Habitat types and species whose survival can only be ensured by immediate measures are of special importance and have priority in the European Union.
The EU Member States, **Romania, Slovakia and Hungary** designated a total of 9,953,522.67 hectare of **NATURA 2000 areas** which are now under European protection.

UNESCO, the United Nations Educational, Scientific and Cultural Organization, launched a research program entitled **"Man and Biosphere"** (MAB) in 1970 for the conservation of the natural

environment. The programme was approved on 5 June 1972 by the participating countries at the United Nations Stockholm Conference on the Human Environment entitled “Man and Biosphere”. So-called biosphere reserves were designated within the framework of the programme. The main aim of this establishment was the protection of areas of outstanding value which represent the large ecosystem types of the Earth, as well as the observation of the human and natural processes unfolding in these areas. However, these areas do not only serve the conservation of natural values. This programme was the first to call attention to the fact that the conservation of only natural values is insufficient, and improving the connection between human beings and nature is another objective of special importance.
The Intergovernmental Conference on Biosphere Reserves held in Seville in 1995 decided that, besides conserving landscapes, ecosystems, species and their genetic diversity, biosphere reserves should also serve as model areas of sustainable development, that is, they should promote economic development at the local level which ensures the sustainability of cultural, social and ecological assets.
The total area of **biosphere reserves** in the **Tisa catchment area** is 716,200.31 hectare.

The Carpathian Biosphere Reserve’s area is at present 61,138.8 ha. It is located in Rakhivskyi, Tyachivskyi, Hustskyi and Vynohradivskyi Regions in **Ukraine.** Also a part of Uzahnskyi Park is introduced into the World Network of UNESCO within the framework of trilateral Biosphere Reserve "Eastern Carpathians" (Poland, Slovakia and Ukraine). Besides, the Carpathian Biosphere Reserve was awarded the European Diploma of Protected Areas.
In **Romania** there are two *biosphere reserves*: Retezat and Pietrosul Rodnei.
In **Hungary** the Aggtelek-Domica (partly in Slovakia) and Hortobágy Biosphere Reserves are situated in the planning area on a total of 74,670 ha, and part of the Kiskunság Biosphere Reserve is also included there. The Aggtelek-Domica Biosphere Reserve is situated on the **Hungarian and Slovakian** territory.
In **Slovakia** there are two biosphere reserves: the Slovak Karst and the Eastern Carpathians

The Ramsar Convention, officially known as the “Convention on Wetlands of International Importance, especially as Waterfowl Habitat”, is one of the oldest intergovernmental treaties on nature conservation. The accelerating pace of the transformation and destruction of wetlands in the second half of the 20th century led to the international cooperation which resulted in the creation of the Convention. During its history of more than thirty years, it gradually expanded its activities as one of the most dynamically developing conventions, and the currently 150 signatory countries, the numerous international non-governmental partners’ organizations and the working system of connections established with other conventions enables it to take global action for the conservation of wetlands and aquatic ecosystems. The participating nations originally wished to ensure protection for rapidly dwindling waterfowl populations. Experience, however, soon made it clear that it is not enough to protect habitats only, but the ecological system itself, which is capable of sustaining the species living there, has to be preserved.
The total area of **Ramsari sites** in the **Tisa catchment area** is 441,502.91 hectare.
In **Ukraine** there is one Ramsar site Lake Synevyr with adjacent coasts, with the total area of 29 ha.The swamps Chorne Bahno (Irshavskyi RegionRegion) and small reservoir Fornosh (Mukachivskyi Region) are potential objects to be included in the Ramsar Network. There is only one RAMSAR site in **Romania**, the Mureş Floodplain, with the area of 17,166 ha. In **Hungary** there are currently **11** Ramsar sites with the total area of 100,789.4 ha (Baradla, Biharugra Fishponds, Bodrogzug, Borsodi-Mezőség, Lake Sós at Csongrád-bokros, Upper Tisa, Hortobágy, Lake Fehér at Kardoskút, Mártély, Montág-puszta and Pusztaszer). In **Slovakia** there are currently **4** Ramsar sites with the total area of 6,891 ha (Senné fishponds, the Latorica, The Domica the Tisa River).

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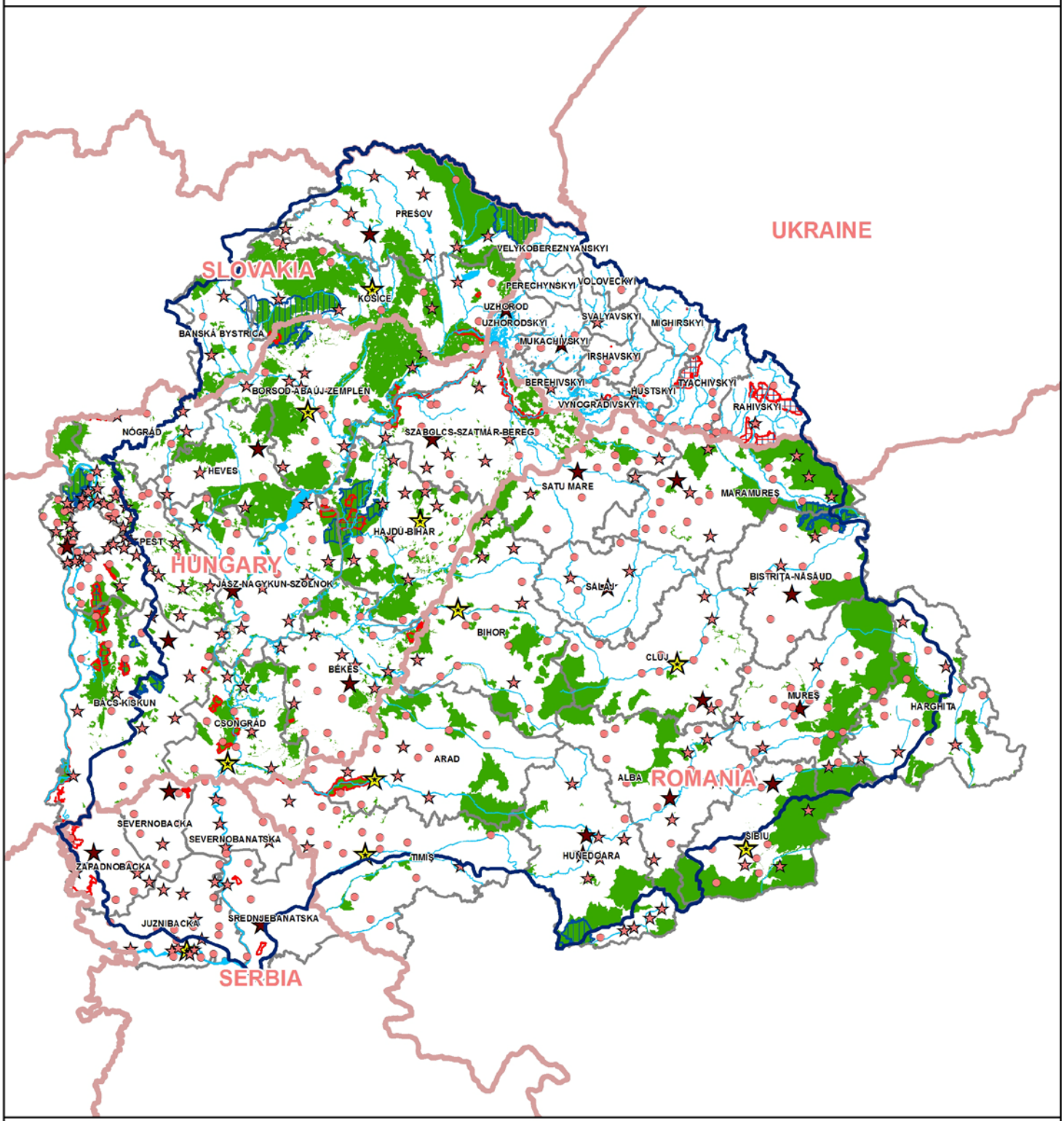

Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Protected natural areas of international importance

- NATURA 2000
- Biosphere reserve (MAB)
- Ramsar

SOURCE
Ukraine: Ministry of Ecology and Natural Resources of Ukraine
Romania: National Agency for Environmental Protection
Slovakia: Slovak Environmental Agency
Hungary: Ministry for Rural Development
Serbia: Institute for Nature Conservation for Vojvodina

Protected natural areas of national importance

The national categories of nature conservation vary. Nevertheless, there are National Parks in each country, on a total of 2,129,394.88 hectares. The other area categories under national protection amount to 1,116,526.56 hectares.

National parks

Country	Name	Territory	Established	Situated
Ukraine	Synevyr National Park		1989	
Ukraine	Uzhanskyi National Park	39,159.3 ha	1999	northwest of Zakarpatska Oblast
Ukraine	Zacharovanyi Kray (Enchanted Land)	6101 ha	2009	Irshavskyi Region
Romania	Retezat	38,117.06 ha		Hunedoara
Romania	Bicaz-Hăşmaş Gorges	6,933.23 ha		Harghita, Neamţ
Romania	Călimani	23,915.37 ha		Bistriţa-Năsăud, Harghita, Mureş, Suceava
Romania	Rodna	47,207 ha		Bistriţa-Năsăud, Maramureş, Suceava
Romania	Jiu Defile	13,782 ha		Gorj, Hunedoara
Slovakia	Slovak Paradise	19,763	1988	Košice Region
Slovakia	Slovak Karst	34,611	2002	Košice Rregion
Slovakia	Poloniny	29,805 ha	1997	Prešov Region
Slovakia	Muránska Plain	20,318 ha	1997	Banská Bystrica Region
Hungary	Aggtelek National Park	16,753 ha	1985	Borsod-Abaúj-Zemplén
Hungary	Bükk National Park	41,834.2 ha	1977	Borsod-Abaúj-Zemplén, Heves
Hungary	Hortobágyi National Park	82,000 ha	1973	Jász-Nagykun-Szolnok, Hajdú-Bihar
Hungary	Kiskunság National Park	76,600 ha	1975	Bács-Kiskun
Hungary	Körös-Maros National Park		1997	Békés, Csongrád, Jász-Nagykun-Szolnok
Serbia	National Park Fruška Gora			

Synevyr National Park is especially designed to preserve valuable ecosystems of the Eastern Carpathians, organization of tourism and recreation, scientific research and promotion of environmental awareness. It is Lake Synevyr that is the central natural object of the Park. It is entered in the List of International Importance of Ramsar Convention. Lake Synevyr is located at an altitude of 989 m above sea level. It was formed in the postglacial period, approximately 10 thousand years ago in consequence of the river valley landslides. It serves as a reference model of transformation of the lake in the upland moor. There are three tourist itineraries in the Park, with a network of stationary recreational points, 6 ecological and scientific routes, as well as horse and bicycle routes.

Uzhanskyi National Park is a part of the world's first trilateral Ukrainian-Polish-Slovak Biosphere Reserve "Eastern Carpathians" included in the global computer network in 1998.
According to the recent data, 863 species of higher vascular plants, in particular, 312 lichens, 143 mosses, 55 higher fungi, 164 algae grow in the territory of the Park. To date, 80 species of vascular plants are registered that are entered in the Red Book of Zakarpattia, 43 species are entered in the

Red Book of Ukraine, 2 species – in the International Red List. 231 species of animals are described, out of which 30 species are entered in the Red Book of Ukraine and 12 species - in the International Red List.
Of the cultural monuments, wooden churches should be mentioned which belong to the masterpieces of folk art of the land and are under state protection. There are 6 wooden churches in the Park. Besides, there are over 15 mineral springs in the Park.

National Park "Zacharovanyi Kray (Enchanted Land)" is located in the heart of Velykodilskyi Ridge, which is of volcanic origin. The area is unique in its geological structure with the original rare form of rock relief. The landscape structure features unique natural cavity-tracts, one of which is known as oligotrophic swamp Bahno - the deepest turf swamp in the Ukrainian Carpathians, which has a pronounced convex surface. Beech forests dominate in its natural vegetation with the areas of rocky-oak-beech forests. Most of the forest vegetation is coniferous stands of different ages. Park is a famous centre of tourism and recreation. Quaint cliff of Smerekovyi Kamin' ravine is known among the climbers of Ukraine.

The **Retezat National Park** was the first Romanian national park, created in 1935, and it contains more than 60 peaks and over 100 crystal clear deep glacier lakes.

The **Bicaz Gorges - Hăşmaş Mountain National Park** has a great geologic, geomorphologic and paleontologic interest, and a rich biodiversity, reflected of its landscapes. The Red Lake, included in this area, formed through the natural blocking of the Bicaz river's waters represent a special tourist destination.

The **Rodna Mountains National Park** includes one of the longest continuous ridges in Romania, with over 50 km from west to east, suitable for hiking and skiing. The massif has some caves, such as "Izvorul Tăuşoarelor", the deepest cave in Romania, going about 479 metres beneath the surface and "Jgheabul lui Zalion", 242 metres deep.

The **Călimani Mountains National Park**, perceived as a barrier between the two former provinces, Moldavia and Transylvania, includes the biggest inactive crater in Europe. The natural elements of vegetation and the presence of a volcanic lake (Sf. Ana), the special landscape characterized by the presence of a sulphur quarry are just some of the pecularities of this protected area.
The **Slovak Paradise National Park** is the typical example of mountainous karstic area. It is known by its deep clefts, many waterfalls and tablelands. The rivers deepened lot of deep clefts of the depth of 150 – 450 m. The forests cover about 90 % of the area of the national park.

The **Slovak Karst National Park** belongs among the largest karstic areas with very good formed karstic relief. Karstic forms present grikes, karstic holes, karstic ridges, valleys, seepages, gorges, canyon valleys, caves, abysses with rich stalactic, stalagmitic and glacial decorations. The Domica Cave creates the biggest cave system together with the Baradla Cave in Hungary with the total length of 21 km. The Karstic Complex of the Slovak Karst is important archeological locality as well. Caves of the Slovak Karst and of the Aggletec Karst are inscribed on the World Heritage List.

The **Poloniny National Park** is situated in the northeast of Slovakia on the border with Poland and Ukraine. There is the highest concentration of primeval forests in Slovakia. There are also typical mountain meadows situated in the main ridges of the Bukovské Mountains. Fauna of the national park is typical with it high biological diversity. The large complexes of original beech and fir-beech forests provide the background for occurrence of numerous species of fauna.

The **Muránska Plain National Park** is situated in the west part of the Slovak Ore Mountains and presents geomorphologically important karstic area. Its core is formed by limestone-dolomite plain with numerous karstic forms. There are more than 150 caves which are not available for public, more than 50 seepages, and numerous surface karstic phenomena such as grikes, karstic holes, gorges, rock towers, cliffs, and others. The nature of the Muránska Plain is rich in rare and little changed phytocoenose and zoocoenosis with many relict and endemic species. More than 90 protected species, 35 endemits and several relicts occur there.

The **Aggtelek National Park** is situated in a part of Hungary rich in unique natural and cultural historical values, on the territory of the Gömör-Torna Karst. It is the first national park in Hungary which was created primarily for the protection of the geological natural values, surface landforms and caves. On this relatively small area we can find almost all forms of appearance of karst development typical of temperate zones. The great diversity and mosaic spatial distribution of the vegetation of the Aggtelek Karst and the Cserehát is due in part to the peculiar karstic surface and the extreme microclimatic conditions. Because of the proximity of the Carpathians, the vegetation contains several elements characteristic of higher-altitude mountainous regions, and islands of a few boreal, alpine species also occur as rarities.

The **Bükk National Park** was created primarily for the conservation of the characteristic and varied aspect, favourable natural conditions and significant natural values of the Bükk medium-mountain landscape (different rock formations, caves, ponors, springs and waterways; mountain meadows and pastures rich in Carpathian flora elements, typical and rare forest and stand types, natural plant associations, protected animal species). Today the Bükk National Park covers almost all of the Bükk Mountains, including its most beautiful areas richest in natural values.

The **Hortobágy National Park** is the first and largest national park in Hungary. The reason for the creation of the national park was to protect and improve the characteristic natural values of the puszta, preserve the distinctive steppe landscape, flora and the fauna of the Hortobágy, ensure the undisturbed nesting and migration of the special avifauna of the Hortobágy, to preserve and display the traditional puszta lifestyle, the nearly extinct ancient Hungarian animal species, as well as the cultural values and historical monuments of the Hortobágy in natural circumstances and in an authentic manner, taking into account their outstanding significance in Hungary and abroad.
The Danube-Tisa Interfluve is one of the most characteristic geographical regions of Hungary. The protection of the environmental values found here is the task of the Directorate of the **Kiskunság National Park,** which was established as the second of its kind in Hungary in 1975.

The **Körös-Maros National Park** was created as the seventh national park in Hungary, for the conservation of the natural and landscape values of the Southern Tiszántúl region. The area of operation of the National Park Directorate is 800,000 hectares and consists of mosaics of varying size, thus it concerns Békés County, half of Csongrád County east of the Tisa, as well as parts of the Körös Floodplain and Dévaványa-Ecseg Steppes territorial units in Jász-Nagykun-Szolnok County. As a consequence of the development of agriculture on the territories with favourable soil properties of the Csanádi and Békési ridges in the Körös-Maros interfluve, the protection of the surviving natural plant associations, especially of the loess grasslands, represents an outstanding nature conservation task today. On the territories of the former Kis-Sárrét, the Körösök region and the Dévaványa, Békés and Csanád plains, extensive salt steppes, forest steppe and marshland remnants, hayfields and riverine forests have survived thanks to their scenic and natural values.

Other nationally protected area

Within the **Ukrainian** part of Tisa River Basin there are 451 nature protection areas, which are divided into 11 categories of Nature Reserved Fund of Ukraine, with the total area of 167.7 thousand hectares, including 33 objects of national importance with the total area of 154.1 hectares

Natural parks in **Romania**:

- Apuseni (NUTS 3: Alba, Bihor, Cluj, area - 76,022.34 ha)
- Grădiştea Muncelului - Cioclovina (NUTS3: Hunedoara, area – 38,116.34 ha),
- the Mureş Floodplain (NUTS3: Arad, Timiş, area – 17,428 ha),
- Dinosaurs Geopark, the Land of Haţeg (NUTS3: Hunedoara, area – 100,486.72 ha),
- the Maramureş Mountains (NUTS3: Maramureş, area – 133,418.96 ha),
- the Defile of the Upper Mureş (NUTS3: Mureş, area – 9,156 ha);

Nature reserves and monuments: more than 380, with a total area of 53,851.48 ha.

The Apuseni Mountains was declared as “Apuseni Natural Park” in 1990, covering 76,022.34 ha. Due to its landscape, especially karst landscape (the Piatra Altarului Cave, the Valea Rea Cave, the Micula Cave, the Scărişoara ice cave etc.), this territory became an important tourist location. This territory is populated up to the highest altitudes, its inhabitants (the Moţi) being well closed to their places.

In **Slovakia** there are situated 4 protected landscape areas:

- the Vihorlat (NUTS 3: Košice region and Prešov region) covering the area of 17,485 ha ,
- the Latorica (NUTS 3: Košice region) covering the area of 23,198 ha,
- the Eastern Carpathians (NUTS 3: Prešov region) covering the area of 25,307 ha and
- the Cerová Highlans (NUTS 3: Banská Bystrica region) covering the area of 16,771 ha.

In Slovakia there are also 285 small-sized protected areas. The total area of protected areas of national network is 257,457 ha which presents 16.8% of the target area of the Tisa River in Slovakia and 5.25% of the Slovak Republic.

In **Hungary** the planning area concern 18 landscape protection reserves on 191,894.60 hectares and 52 nature conservation areas on 13,509.63 hectares, which means that the Hungarian catchment area includes almost half (~49 %) of the nationally protected areas.

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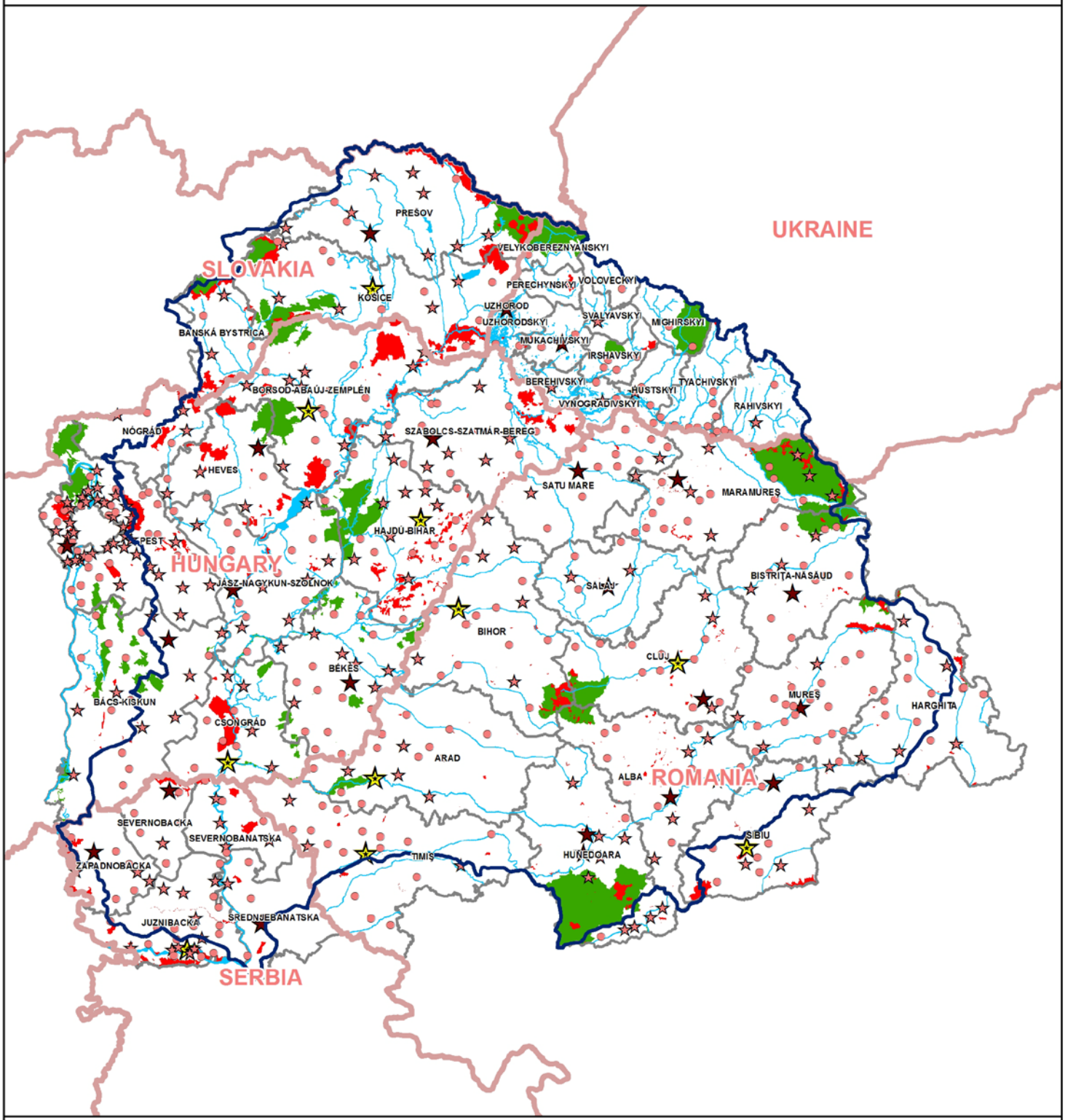

Tisa Basin
Country border
County border
Major Water

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Protected natural areas of national importance

- National Park
- Other national protected areas

SOURCE
Ukraine: Ministry of Ecology and Natural Resources of Ukraine
Romania: National Agency for Environmental Protection
Slovakia: Slovak Environmental Agency
Hungary: Ministry for Rural Development
Serbia: Institute for Nature Conservation for Vojvodina

III.3.3.2. Protection of built heritage[7]

In the five countries of the Tisa catchment area architectural heritage is protected and managed at different territorial levels and according to different aspects. The heritage sites and buildings of outstanding international importance are the UNESCO World Heritage sites. The World Heritage sites of the target area are presented in the following table.

County	World Heritage	Date of Inscription, type	Situated
Ukraine Slovakia	Primeval Beech Forests of the Carpathians	2007 natural site	mountain massif Chorna Hora and Rakhiv Mountains in Ukraine to the west along Polonynskyi ridge to Bukovetsky peaks and Vihorlat Mountains in Slovakia territory: 29,279 ha
Romania	Wooden churches of Maramureş	1999 cultural site	Districts of Bârsana, Budeşti, Deseşti, Ieud, Sisesti, Poienile Izei, Târgu-Lăpuş; Maramureş County,
Romania	Historic centre of Sighişoara	1999 cultural site	Mureş County
Romania	Villages with Fortified Churches in Transylvania	1993, extention: 1999 cultural site	Counties of Alba (Câlnic) Braşov, Harghita (Dârjiu), Mureş (Saschiz), Sibiu (Biertan, Valea Viilor) terrritory: 553 ha
Romania	Dacian fortresses of the Orăştie Mountains	1999 cultural site	Counties of Alba (Căpâlna) and Hunedoara (Sarmizegetusa Regia-Grădiştea de Munte, Costeşti-Cetăţuie, Costeşti-Blidaru, Luncani-Piatra Roşie, Băniţa)
Slovakia Hungary	Caves of the Slovak Karst and Aggtelek Karst	1995 extention: 2000 natural site	Districts Rožnava and Košice – okolie, Košice region County of Borsod-Abaúj-Zemplén territory: 56,651 ha
Slovakia	Levoča, Spiš Castle and the Associated Cultural Monuments	2000 extention: 2009 cultural site	District Spišská Nová Ves, Košice region territory: 1,351 ha
Slovakia	Wooden churches of the Slovak part of the Carpathian Mountain Area	2008 cultural site	Prešov and Košice regions territory: 2.56 ha
Slovakia	Bardejov Town Conservation Reserve	2000 cultural site	Bardejov Town, Prešov region
Hungary	Hortobágy National Park - the *Puszta*	1999 cultural site	Counties of Borsod-Abaúj-Zemplén, Heves, Hajdú-Bihar and Jász-Nagykun-Szolnok
Hungary	Old village of Hollókő and its surroundings	1987 cultural site	County of Nógrád
Hungary	Tokaj wine region and historic cultural landscape	2002 cultural site	County of Borsod-Abaúj-Zemplén territory: 13,255 ha

[7] Source: www.whc.unesco.org/

The Primeval Beech Forests of the Carpathian: an outstanding example of undisturbed, complex temperate forests, constitute a transnational serial property of ten separate components along a 185 km axis from the Rakhiv Mountains and the Chornohirskyi Range in Ukraine, west along the Polonynian Ridge, to the Bukovské Vrchy and Vihorlat Mountains in Slovakia. They contain an invaluable genetic reservoir of beech and many species associated with, and dependent on, these forest habitats. They are also an outstanding example of the recolonization and development of terrestrial ecosystems and communities after the last Ice Age, a process which is still ongoing.

Wooden churches of Maramureş: these eight churches are outstanding examples of a range of architectural solutions from different periods and areas. They show the variety of designs and craftsmanship adopted in these narrow, high, timber constructions with their characteristic tall, slim clock towers at the western end of the building, either single- or double-roofed and covered by shingles. As such, they are a particular vernacular expression of the cultural landscape of this mountainous area of northern Romania.

Historic centre of Sighişoara: founded by German craftsmen and merchants known as the Saxons of Transylvania, Sighişoara is a fine example of a small, fortified medieval town which played an important strategic and commercial role on the fringes of central Europe for several centuries.

Transylvanian villages with their fortified churches: provide a vivid picture of the cultural landscape of southern Transylvania. The seven villages inscribed, founded by the Transylvanian Saxons, are characterized by a specific land-use system, settlement pattern and organization of the family farmstead that have been preserved since the late Middle Ages. They are dominated by their fortified churches, which illustrate building styles from the 13th to the 16th century.

Dacian fortresses of the Orăştie Mountains: built in the 1st centuries B.C. and A.D. under Dacian rule, these fortresses show an unusual fusion of military and religious architectural techniques and concepts from the classical world and the late European Iron Age. The six defensive works, the nucleus of the Dacian Kingdom, were conquered by the Romans at the beginning of the 2nd century A.D.; their extensive and well-preserved remains stand in spectacular natural surroundings and give a dramatic picture of a vigorous and innovative civilization.

Caves of the Slovak Karst and Aggtelek Karst: the variety of formations and the fact that they are concentrated in a restricted area means that the 712 caves currently identified make up a typical temperate-zone karstic system. Because they display an extremely rare combination of tropical and glacial climatic effects, they make it possible to study geological history over tens of millions of years.

Levoča, Spiš Castle and the Associated Cultural Monuments: Spišský Hrad has one of the largest ensembles of 13th and 14th century military, political and religious buildings in Eastern Europe, and its Romanesque and Gothic architecture has remained remarkably intact. The historic town-centre of Levoča preserved and it includes the 14th century church of St James with its ten alters of the 15th and 16th centuries, a remarkable collection of polychrome works in the Late Gothic style, including an 18.6 metre high alterpiece by completed around 1510 by Master Paul.

Wooden churches of the Slovak part of the Carpathian Mountain Area: present the group of 9 wooden objects, 8 churches and 1 detached bell tower, built between the 16th and 18th centuries. In the Tisa River in Slovakia there are present the following churches: Greek Catholic Wooden Church of St Nicolas in Ruská Bystrá, Greek Catholic Wooden Church of St Michael the Archangel in Ladomírová, Greek Catholic Wooden Church of St Nicolas in Bodružal and Roman Catholic Wooden

Church of St Francis of Assisi in Hervartov.. The churches present good examples of rich local traditions of religious architecture, marked by the meeting of Latin and Byzantine cultures. The edifices exhibit some typological variations in their floor plans, interior spaces and external appearance due to their respective religious practices. They bear testimony to the development of major architectural and artistic trends during the period of construction and to their interpretation and adaptation to a specific geographical and cultural context. Interiors are decorated with paintings on the walls and ceilings and other works of art that enrich the cultural significance of the properties.

Bardejov Town Conservation Reserve: consists of town monument reserve in the historical core of the Bardejov Town including Jewish quarter around the fine 18th-century synagogue. Bardejov is a small but exceptionally complete and well-preserved example of a fortified medieval town, which typifies the urbanisation in this region. Among other remarkable features, it also contains a small Jewish quarter around a fine 18th-century synagogue.
The cultural landscape of the **Hortobágy *Puszta:*** consists of a vast area of plains and wetlands in eastern Hungary. Traditional forms of land use, such as the grazing of domestic animals, have been present in this pastoral society for more than two millennia.

Hollokő: is an outstanding example of a deliberately preserved traditional settlement. This village, which developed mainly during the 17th and 18th centuries, is a living example of rural life before the agricultural revolution of the 20th century.

The cultural landscape of **Tokaj:** graphically demonstrates the long tradition of wine production in this region of low hills and river valleys. The intricate pattern of vineyards, farms, villages and small towns, with their historic networks of deep wine cellars, illustrates every facet of the production of the famous Tokaj wines, the quality and management of which have been strictly regulated for nearly three centuries.

One of the specificities found on the Romanian Tisa catchment area is also the immaterial heritage, similarly to the built heritage (monuments included in the national or in the UNESCO heritage list), very well represented because of the presence of the twelve **“land”-type units**: the Land of Oaş, the Land of Maramureş, the Land of Năsăud, the Land of Lăpuş, the Land of Chioar, the Land of Silvania, the Land of the Moţi, the Land of Beiuş, the Land of Zărand, the Land of Haţeg, the Land of Făgăraş, and the Land of Amlaş. The functioning of the “lands” and their originality were created and supported by highlighting a distinct collective conscience for each such territorial entity delineated based on the mental criterion. The construction of a “land’s” mental space is accomplished with the contribution of several factors: physical-geographical factors, political factors, social and cultural factors, as well as the characteristics of economy over time.

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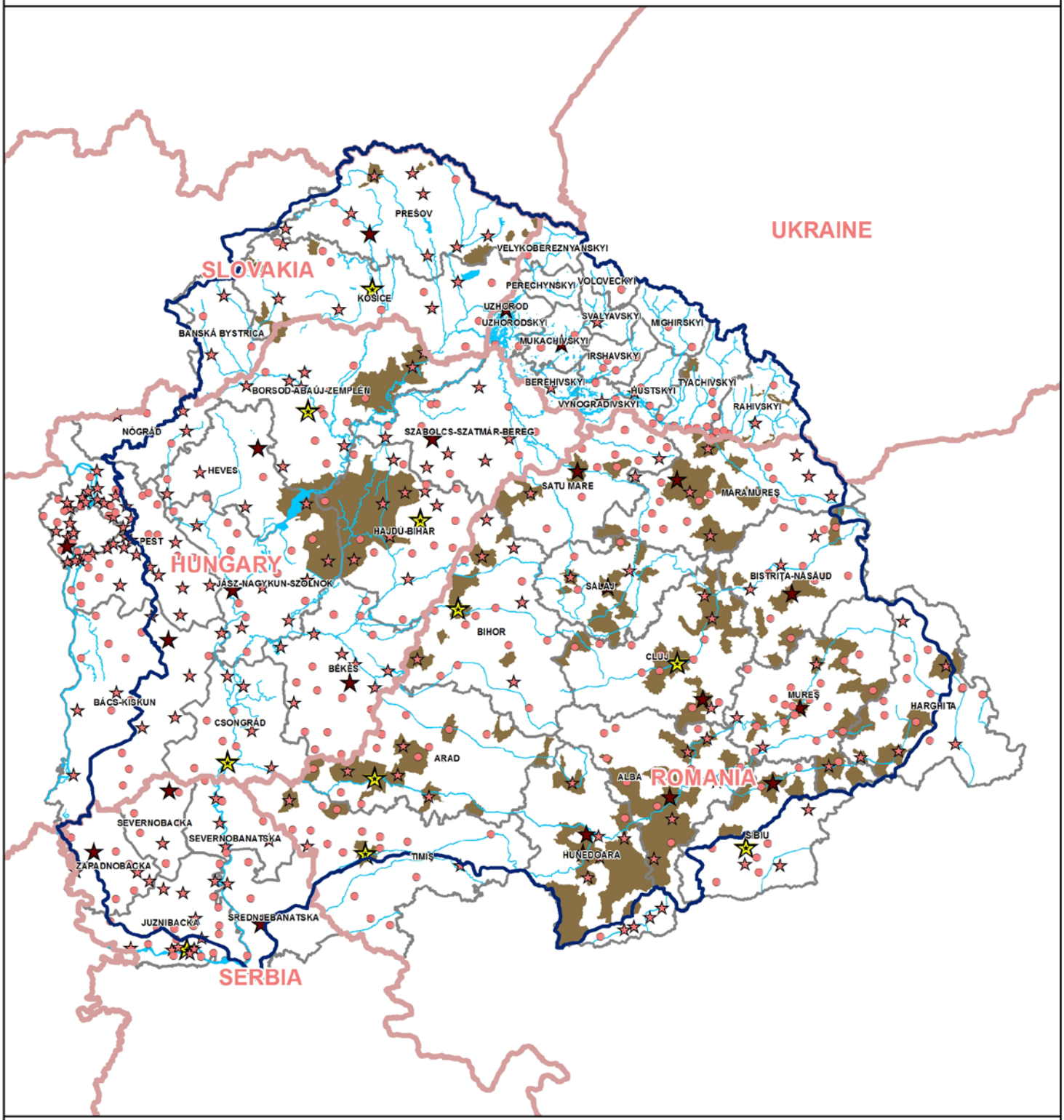

Tisa Basin
Country border
County border
Major Water
Settlement with World heritage sites

Municipality structure

- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

SOURCE
Ukraine: Ministry of Ecology and Natural Resources of Ukraine
Romania: Ministry of Cultural and Cults
Slovakia: Slovak Environmental Agency
Hungary: National Office of Cultural Heritage
Serbia: Provincial Institute of Cultural Heritage Protection

III.4. REGIONAL AND LOCAL INFRASTRUCTURE

III.4.1. Transport network and access

III.4.1.1. International connections

The Catchment Area of River Tisa is of favourable location in the European transport network. It has several east – west and north – south links. The external transport connections are realized through international transport corridors and the E-highway network linking Western Europe and Asia.

International transport corridors across the Tisa catchment area

The ten **Pan-European transport corridors** were defined at the second Pan-European transport Conference in Crete, March 1994, as routes in Central and Eastern Europe that required major investment over the next ten to fifteen years. Additions were made at the third conference in Helsinki in 1997. Therefore, these corridors are sometimes referred to as the "Crete corridors" or "Helsinki corridors", regardless of their geographical locations. A tenth corridor was proposed after the end of hostilities between the states of the former Yugoslavia. Recently, an eleventh corridor was adopted that stretched from Romania, through Serbia and Montenegro, to Italy. It is known that this will pass through Belgrade and will incorporate the Belgrade-Bar highway. The corridors variously encompass road, rail and waterway routes.

These development corridors are distinct from the Trans-European transport networks, which is an European Union project and include all major established routes in the European Union, although there are proposals to combine the two systems, since most of the involved countries now are members of the EU. The European Commission adopted the first action plans on trans-European networks (transport, energy and telecommunications) in 1996. The transport network is known as **TEN-T**. TEN-T envisages coordinated improvements to primary roads, railways, inland waterways, airports, seaports, inland ports and traffic management systems, so as to provide integrated and intermodal long-distance high-speed routes for the movement of people and freight throughout Europe. A decision to adopt TEN-T was made by the European Parliament and Council in July 1996, and as a result of this, the EU works to promote the networks by a combination of leadership, coordination, issuance of guidelines, and the funding of aspects of development through a series of projects.[8]

IV. corridor: Dresden/Nuremberg - Prague - Brno - Bratislava - Győr - ***Budapest - Arad -*** Timişoara - Istanbul.

- Branch A – Brno - Vienna
- Branch B – Arad - Bucharest
- Branch C – Sofia – Thessaloniki

V. corridor: (East-West) Venice - Trieste/Koper - Ljubljana - Maribor - ***Budapest - Uzhorod - Lviv*** - Kiev. 1,600 km long.

- Branch A - Bratislava - Žilina - ***Košice - Uzhorod***
- Branch B - Rijeka - Zagreb - Budapest
- Branch C - Ploče - Sarajevo - Osijek - Budapest

X. corridor: Salzburg - Ljubljana - Zagreb - Beograd - Niš - Skopje - Veles - Thessaloniki.

- Branch A: Graz - Maribor - Zagreb
- Branch B: ***Budapest - Novi Sad - Belgrade***
- Branch C: Niš - Sofia - Plovdiv - Dimitrovgrad - Istanbul via Corridor IV
- Branch D: Veles - Prilep - Bitola - Florina - Igoumenitsa

[8] source:www.en.wikipedia.org

The international E-road network A class roads across the targeted area

The **international E-road network** is a numbering system for roads in Europe developed by the United Nations Economic Commission for Europe (UNECE). The network is numbered from E 1 up and its roads cross national borders. It also reaches Central Asian countries like Kyrgyzstan, since they are members of the UNECE.[9]

North-South reference:

E75 starts from Vardø, Norway in the Barents Sea and runs south through Finland, Poland, Czech Republic, Slovakia, Hungary, Serbia and Republic of Macedonia to Sitia, Greece on the island of Crete in the Mediterranean Sea. E71 routes through the targeted area: ***Budapest – Kecskemét – Szeged - Subotica - Novi Sad - Belgrade***

West-East reference:

E50 is a highway running from Brest, France (on the Atlantic coast), to Makhachkala, Russi. E50 sector through the targeted area: ***Prešov – Vyšné Nemecké – Uzhorod - Mukachevo***

E60 is a highway running from Brest, France (on the Atlantic coast), to Irkeshtam, Kyrgyzstan (on the border with People's Republic of China). The road crosses thirteen country. E60 sector through the targeted area: ***Budapest – Cegléd - Szolnok – Kisújszállás – Püspökladány – Berettyófalu - Oradea - Aleşd - Huedin - Cluj-Napoca - Turda - Câmpia Turzii - Luduş - Iernut - Târgu Mureş - Sighişoara - Braşov***

E70 is West-East European route, extending from A Coruña in Spain in the west to the Georgian city of Poti in the east. The E70 routes through ten European countries, and includes one sea-crossing, from Varna in Bulgaria to Samsun in Turkey. E70 sector through the targeted area: ***Serbia - Timişoara- Lugoj - Caransebeş - Orşova - Drobeta-Turnu Severin - Filiaşi - Craiova***

North-South intermediate:

E71: This intermediate north-south route is 970 kilometres long and it connects the central part of the continent (Kosice) with the Adriatic Sea (Split), through four European countries: Slovakia, Hungary, Croatia, Bosnia and Herzegovina.
E71 routes through the targeted area: ***Kosice - Milhost' - Tornyosnémeti – Miskolc - Budapest***

E79 It begins in Miskolc, Hungary and ends in Thessaloniki, Greece, also running through Bulgaria. The road is 1 160 km long. The road follows the route ***Miskolc – Debrecen – Berettyóújfalu - Oradea – Beiuş – Deva*** – Petroşani – Târgu Jiu – Craiova – Calafat – Vidin – Vratsa – Botevgrad – Sofia – Pernik - Blagoevgrad – Kulata/Promachonas (Bulgaria-Greece border crossing) - Serres – Thessaloniki

E81 It begins in Mukachevo, Ukraine and ends in Constanţa, Romania. The road is 990 km long. ***Mukachevo – Halmeu – Satu Mare – Zalău – Cluj-Napoca – Turda – Sebeş – Sibiu – Piteşti – Bucureşti - Constanţa***

West-East intermediate:

E58 begins in Vienna, Austria and ends in Rostov-na-Donu, Russia. The road follows the route: Vienna – Bratislava – ***Zvolen – Košice – Uzhorod – Mukachevo – Halmeu – Baia Mare - Dej - Bistriţa - Vatra Dornei*** - Suceava – Botoşani - Târgu Frumos - Iaşi – Sculeni – Chişinău – Odessa – Mykolayiv – Kherson - Nova Kakhovka – Melitopol – Taganrog – Rostov-on-Don.

E68 links Hungary with Romania. It starts in Szeged, Hungary and ends in Braşov, The road follows: ***Szeged - Makó - Nădlac - Arad - Lipova - Deva - Simeria - Orăştie - Sebeş - Sibiu - Şelimbăr*** - Făgăraş - Braşov

[9] http://en.wikipedia.org/wiki/International_E-road_network

International railway lines

Ukraine: The Chop-Lviv electrified double-track trunk-railway, which coincides with a route of the Kritsky No.5 international transport corridor. There is also the Chop-Uzhgorod-Sambir-Lviv electrified single-line trunk-railway. Other tracks have not been electrified, are single-line, with the width of a track: 1.520 mm and 1.435 mm (compatible) - Chop - Halmeu, Batevo-Solovka to Hungary, Chop-Záhony; 750 mm - Beregovo-Priborzhavske, Vinograd-Hmelnik, Irshava-Ilnitsia.

Romania: Corridor IV: border Curtici – Arad – Simeria – Vinţu de Jos - Alba Iulia – Coşlariu - Copşa Mică – Braşov – Bucureşti – Feteşti – Medgidia – Constanţa with a branch from Arad to Timişoara – Caransebeş – Drobeta Turnu Severin – Strehaia – Craiova – Border Calafat. There is a broad-gauge line (32 km), on the northern limit of the area, at the Ukraine border.

Slovakia: The railway no.180 Žilina – Kysak – Košice, together with the railway no.190 Košice – Čierna nad Tisou make up the main west-east transport ax of the international importance in the target area. The railway no.188 Plaveč – Prešov – Kysak together with the railway No.169 Košice – Barca – Kechnec make up the main north-south transport ax of the international importance in the target area.

Hungary: The railway lines between Budapest – Hatvan – Miskolc – Mezőzombor, as well as Budapest – Szolnok – Debrecen – Nyíregyháza – Záhony – border are electrified double-track rail lines with a maximum permitted speed of 120 km/h and a maximum permitted axle weight of 210 kN. The railway line between Budapest – Kelebia – border is also an electrified double-track rail line, but allowing a running speed of only 60 to 100 km/h. One of the most important lines connecting Europe and the Balkans, which is also one of the main railway connections between Hungary and Romania, the Budapest – Szolnok – Békéscsaba – Lökösháza – border rail line has only a single-track line on some sections. The line between Püspökladány – Biharkeresztes – national border is a non-electrified, single-track rail line with a maximum permitted running speed of merely 100 km/h.

Serbia: (Belgrade) - Stara Pazova - Novi Sad - Subotica – state border with Hungary - (Kelebia).

Schengen border crossing point

	existing border crossing point		planned border crossing point	
	on road	**on rail**	**on road**	**on rail**
Slovakia-Ukraine	Vyšné Nemecké - Užhorod	Čierna nad Tisou - Čop	Záhor - Storožnica	
	Ubľa – Malyj Bereznyj	Maťovce - Užhorod	Čierna nad Tisou - Solomonovo	
	Veľké Slemence - Mali Slemenci		Maťovské Vojkovce - Pavlovo	
Ukraine-Romania				
Hungary-Ukraine	Záhony - Chop	Záhony – Chop	Beregdaróc (M3) - Berehove	Záhony – Chop high speed railway
	Beregsurány - Berehove	Eperjeske – Velika Dobrony		
	Tiszabecs - Vilok			
Hungary-Romania	Csengersima –Satu Mare	Vállaj - Carei	Csenger (M49) – Satu Mare	Kübekháza - Beba Veche high speed railway
	Vállaj – Carei	Nyírábrány - Valea lui Mihai	Nagykereki (M4) - Biharia	
	Nyírábrány – Valea lui Mihai	Biharkeresztes – Oradea	Csanádpalota (M43) - Nădlac	
	Ártánd - Oradea	Kötegyán – Salonta	Kübekháza – Beba Veche	
	Méhkerék - Salonta	Lőkösháza – Curtici		
	Gyula – Chisineu – Cris	Nagylak – Nădlac		
	Battonya - Arad			
	Nagylak - Nădlac			
	Kiszombor - Cenad			
Hungary-Serbia	Röszke - Horgoš	Kelebia – Subotica	Kübekháza - Rabe	Csikéria - Subotica
	Tompa - Subotica			Röszke - Horgoš high speed railway
	Hercegszántó - Bezdan			
Serbia-Romania				

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TICAD
REGIONAL AND LOCAL INFRASTRUCTURE - ROAD NETWORK

Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Road Network
- High speed road
- High speed road (proposal)
- Main road
- Main road (proposal)

Border crossing point of road
- existing
- planned

SOURCE
Ukraine: Ministry of Infrastructure of Ukraine
Romania: The Ministry of Regional Development and Tourism National Spatial Plan
Slovakia: Topographical Institute Banska Bystica / Geodesy, Cartography and Cadastre of the Slovak Republic
Hungary: National Spatial Plan
Serbia: Public Enterprise "Roads of Serbia"

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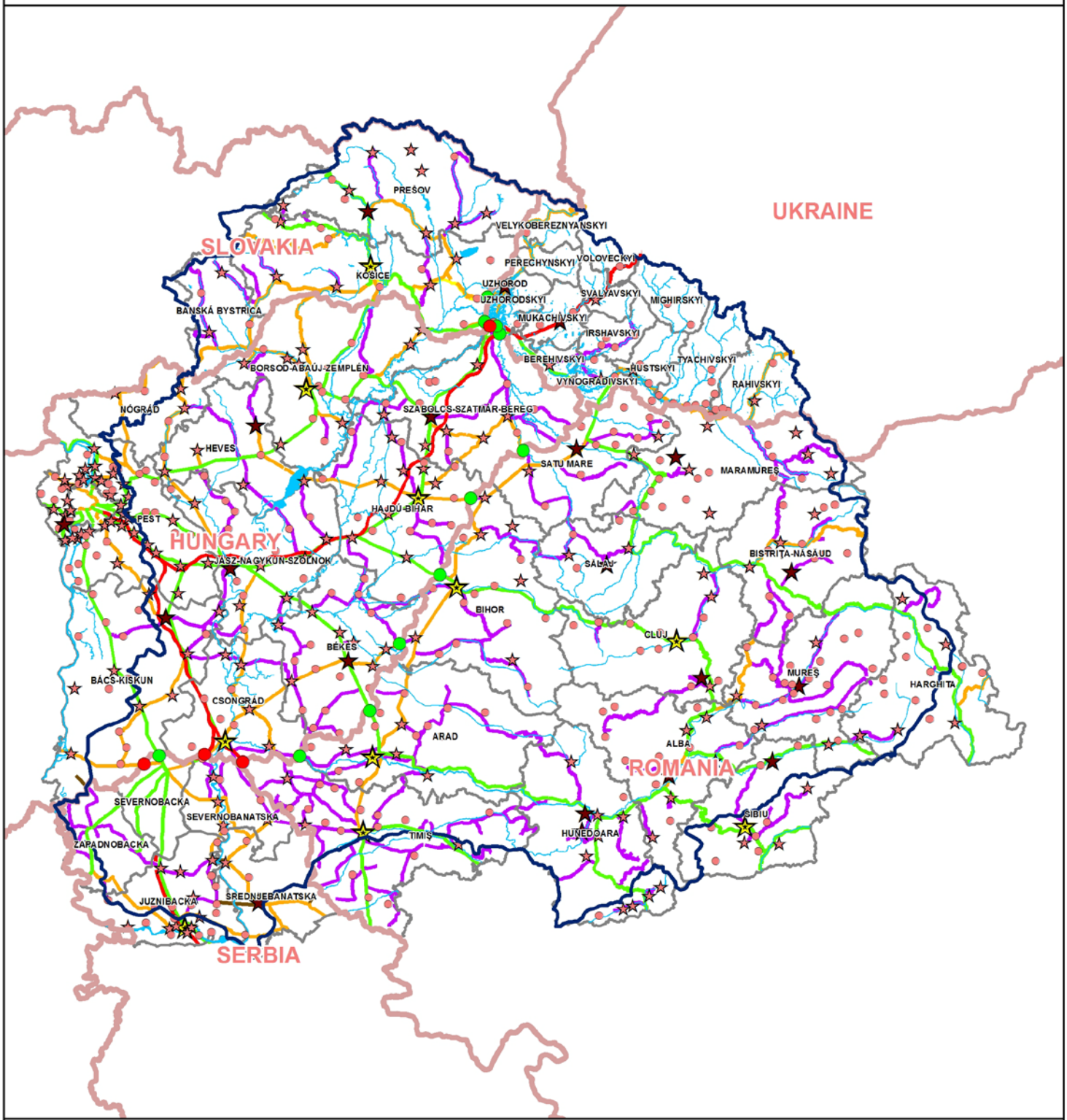

Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Railway Network
- high speed railway lines (proposed)
- trans-European Railway lines
- railway lines of national and regional importance
- railway lines of national and regional importance (proposed)
- railway lines of local importance
- wide-gauge rails

Border crossing point of railway
- existing
- planned

SOURCE
Ukraine: Ministry of Infrastructure of Ukraine
Romania: The Ministry of Regional Development and Tourism National Spatial Plan
Slovakia: Topographical Institute Banska Bystica / Geodesy, Cartography and Cadastre of the Slovak Republic
Hungary: National Spatial Plan
Serbia: Serbian Railways

III.4.1.2. Road network

The trans-border regional connections are most effective on the high speed roads. There is no continuous high-speed road network in the area shared by the five countries. The only trans-border motorway line is the one connecting Budapest – Szeged – Röszke – Horgoš–Subotica– Bačka Topola – Srbobran–Zmajevo – Novi Sad. The lower capacity highways are first of all for domestic and cross-border regional accessibility.
There are great differences in the target area in the density of national road networks. The level of supply depends on the density and quality of the various road categories.

Existing high speed roads:

Slovakia:
- D1 (Prešov-Košice)

Hungary:
- M3 (Budapest-Nyíregyháza)
- M30 (M3-Miskolc)
- M31 (M0-M3)
- M35 (M3-Debrecen)
- M43 (Szeged north – 5. main road)
- M5 (Budapest-Szeged-Röszke)

Serbia:
- E75 (Horgoš-Subotica-Bačka Topola-Srbobran-Zmajevo- Novi Sad)

Proposed high speed roads:

Slovakia:
- D1 Poprad – Prešov south, launch of complete scheme by 2017,
- D1 Košice – Michalovce – Záhor – state border Slovakia/Ukraine, launch of the section Budimír – Bidovce in 2013, the deadline for the complete section has not been set yet,
- High speed road R4 - (roads I/73, I/68) Vyšný Komárnik – Prešov – Košice - Milhosť

Hungary
- M2, M30 and M34 to Slovakia
- M34 and M3 to Ukraine
- M49, M4 and M43 to Romania

It is a sign of the general quality standards that only the international corridors and main highways can be classified into the “good” category. The subsidiary roads are of the worst quality ranked in categories IV and V.
The by-pass roads are missing, sometimes even in the case of international corridors, which have to cross the urban built up areas causing air pollution and noise.

In the Tisa region, the relations between counties and micro-regions are significantly influenced by the **number of crossing points on the rivers**.
In **Hungary** the distance on public roads between *bridges* varies from 6 km to 73 km (on average approx. 40 km). There are many *ferries* between these bridges (especially in the north of the Tisa region), but these do not represent a viable alternative due to their seasonal operation and limited capacity, and this represents a disadvantage especially for the public transportation system. There are a suitable number of bridges available on the other major rivers in the region. There are three floating bridges on the Tisa River between Lónya and Tiszamogyorós, Tiszadob and Tiszalúc, as well

as Csongrád and Csépa. Limited load carrying capacity, seasonal operation, susceptibility to extreme water level and obstructing navigation represent the weaknesses of such floating bridges.
In addition to the need for new bridges on the Tisa River associated with the development of the express way and highway network, there is also a need for a bridge-connection on the Bodrog River and Szamos River. In the case of Körös Rivers, the technical condition of the existing bridges poses a series of problems.

III.4.1.3. Railway transport

At the present time, the infrastructure of the main railroad lines in **Ukraine** in the directions of the transport corridors is capable to provide the passage of all cargo traffics which are expected in immediate prospects. Because of the absence of freight traffic since 1998, the transportation of passengers on the Vinograd-Hmelnik-Irshava section is carried out only in suburb communications. The Irshava-Priborzhavske and Irshava-Ilnitsia sections are closed for traffic. The narrow track is very unprofitable; the expenses have increased 4 times in comparison with 2000.

One of the urgent issues, which break the railway development, is a physical aging and obsolescence of its industrial base, including its rolling stock, a slow restoration of its technical resources, which does not assist in the support of safety conditions of traffic and requires the development of the repair base first of all.

The passage of transit cargo and passenger traffics puts increased requirements for the quality of transportations and for their safety, the preservation of cargo and the acceleration of turn-round. Thus the requirements for the infrastructure of the railway transport a new organisation of the traffic and the technology of work increase, which require in future considerable capital investments and reorganisation and modernisation.

The railway network of the studied area **in Romania** is electrified at a rate of 30,6%. Railway facilities level and technical condition do not allow speeds over 60-80 km/h. Most of the railway level crossings lack automatic road traffic signal. Uneven top and bottom passages are in a small number. There are railway network sectors affected by natural phenomena such as floods, landslides, as well as erosion and subsidence of the embankment.

In **Serbia i**ntraregional connections are implemented via *branch lines (*lines branching off the main lines) for the regional-local traffic. The following branch lines are operating in the Project Area*: Subotica-Horgoš-državna granica-(Röszke),Pančevo glavna stanica - Zrenjanin - Kikinda - državna granica - (Jimbolia), (Novo) Banatsko Miloševo - Senta – Subotica, Novi Sad - Odzaci - Bogojevo, Novi Sad - Rasputnica Sajlovo - Rimski Sancevi – Orlovat.*

III.4.1.4. Combined transport

Combined transport in the **Romanian** studied area is represented by 16 terminals located relatively balanced in the area: Alba Iulia, Baia Mare, Bistriţa Nord, Cluj-Napoca Est, Deva, Glogovăţ-Arad, Mediaş, Oradea Est, Petea-Satu Mare, Semenic-Timişoara, Târgu Mureş Sud, Târnăveni Vest, Zalău Nord, Miercurea Ciuc, Sibiu Triaj and Turda. Among these terminals, Timişoara and Cluj Napoca are the main terminals. Many of them do not have the facilities required for the pursuit of optimum conditions.

In **Slovakia** the railway junction Čierna and Tisou terminal of combined transport Dobra has been built. The terminal is connected with the network of standard and broad-gauge and serves for the

vertical transfer between road and rail transport, between standard-gauge lines and broad-gauge lines and for horizontal transfer of trucks. The second branch of broad-gauge railway continues form the transfer station Matovce – Užhorod to Haniska pri Košiciach. In the conception of development of Slovak Republic railway transport it is planned to operate four terminals of intermodal transport of European level (in transport-gravitational centres of Slovakia) and one of them is planned to be built in the transport junction Košice. It is supposed that these terminals will be part of logistics and goods centres of cargo transport.

In **Hungary** the goods are transported on most part of the transport distance using green means of transport, by water or railway, while shorter sections of pre- or post-transport are made by road vehicles. In the so-called Huckepack (unescorted) traffic, in which the transcontainers, trailers or swap bodies containing the goods are transported on closed freight trains on a largely regular basis, are involved container loaders from Debrecen and Szolnok. The accompanied RoLa (Rollende Landstrasse) terminal is in Szeged, which ensures the transportation of road vehicles by railway. The Szeged (Kiskundorozsma), which is also an accompanied RoRo (Roll on - Roll off) terminal, and which ensures the transportation of road vehicles by vessels (ferries) to the target port), is not on the area concerned.

III.4.1.5. Air transport

International airports in the Tisa catchment area:

Uzhorod (Uk),
Timişoara, Baia Mare, Satu Mare, Arad, Târgu Mureş, Sibiu, Cluj-Napoca (RO),
Košice (Sk),
Debrecen (H),

National airports in the Tisa catchment area:

Oradea (Ro)

Other airports: suitable for regional or micro-regional transport, leisure, tourism, sport and training. In view of their existing or envisaged infrastructure they may create opportunities to ensure access to European cities and may contribute to the development of the transport system of the region.

Békéscsaba, Kunmadaras, Nyíregyháza, Szeged, and Mezőkövesd-Mezőkeresztes (H)
Novi Sad, Zrenjanin and Kikinda (Sr)

Special airports: for both civil and military use or for state flights

Munkachinskyi (Uk)
Szolnok, Kecskemét (H)

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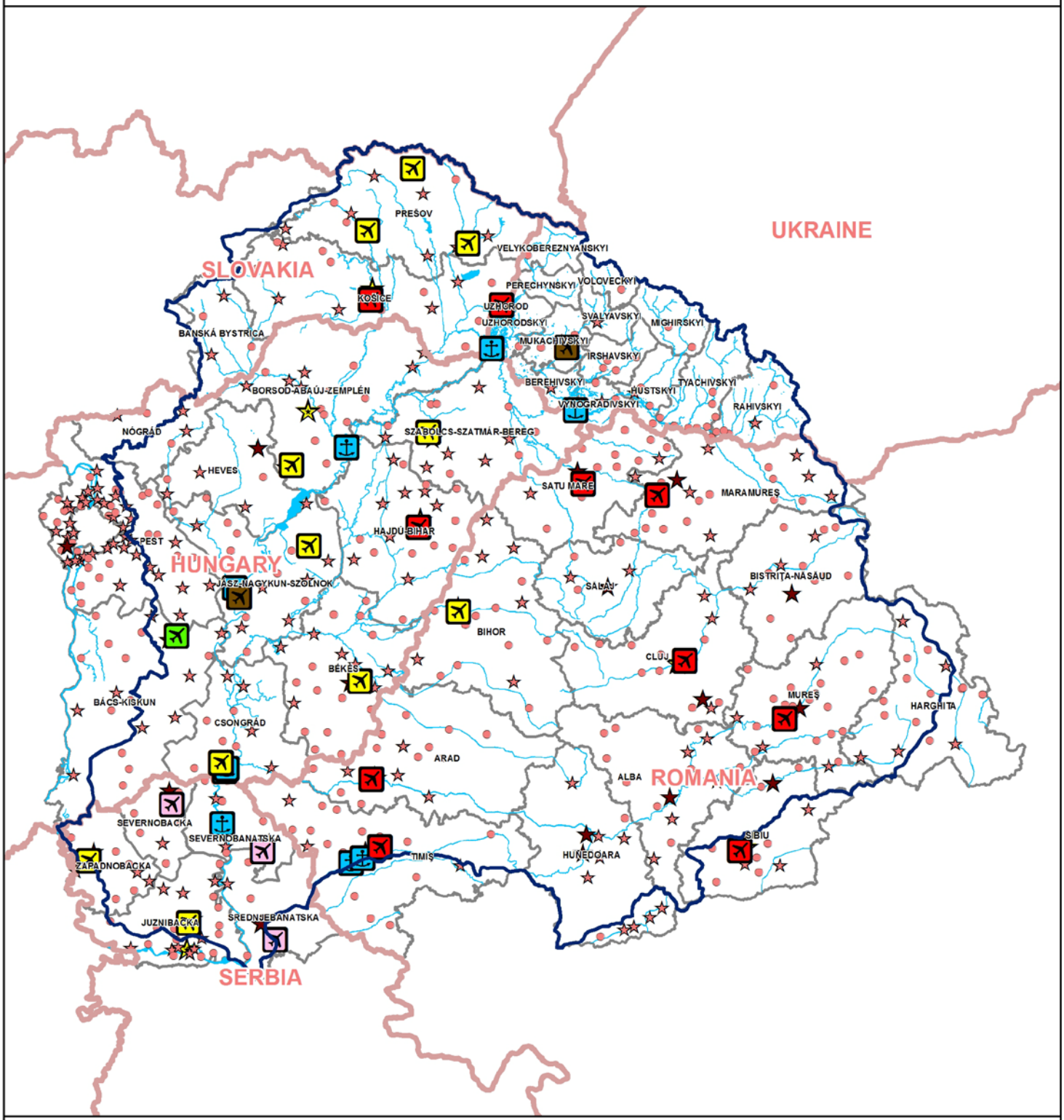

Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Airport
- International
- National
- Military and Civil
- State aviation
- Local importance

Ports
- Ports

SOURCE
Ukraine: Ministry of Infrastructure of Ukraine
Romania: National Spatial Plan
Slovakia: Topographical Institute Banska Bystrica
Hungary: National Spatial Development Plan
Serbia: ITPV

III.4.1.6. Water transport

The Tisa River is used as a waterway from the Ukrainian-Hungarian border to the confluence with the Danube – over 70% of the river's total length.
„The regime of navigation on part of the Tisa River, from the Danube confluence to Tokaj, is set by bilateral agreement signed in 1955 by Yugoslavia and Hungary. The agreement enacted a commitment for common works on the waterway maintenance and upgrade, but waterway category and navigational conditions were not prescribed. The adoption of the European Agreement on Main Inland Waterways of International Importance (AGN) in 1996 included the navigable waterway on the Tisa River up to Szeged in the European network as an international waterway. This requires the fulfilment of required criteria for class IV waterways, including required water way depths between 2.5 and 2.8 m and a minimal width of 75 m. These conditions can be achieved along the Serbian part (with the exception of some short stretches in sharp bends, accounting for less than 2% of the total length) at low of 95% duration, being approximately 175m3/s."[10]

In terms of navigation, the Tisa River is an unregulated river with a unique natural environment in Europe, which is of a major national and international interest due to its features in the circle of those who wish to navigate.
The development of international level navigation on the Tisa River has basic limitations, which can be summarized as follows:

- International legal status of the Tisa River. The Tisa River should be certified as an international waterway from the border to Záhony. Without this, the predominantly domestic traffic can be extended by transports from Slovakia via Bodrog, which is also possible in the case of the traffic to Romania via the Körös Rivers. Similarly, it may be possible to re-open the traffic to South toward Serbia. The most relevant provision of the European Agreement on Main Inland Waterways of ***International*** Importance (AGN Convention) states that all new waterways of international importance should be developed in such a manner to meet the criteria of at least Class V.a. In order to ensure a waterway class, a drought of 2.5 m is required in the case of vessels with a deadweight capacity of 1500 to 3000 tones, and the establishment of a new ferry is not possible. It is difficult to see how the abovementioned criteria can be meeting on the Tisa River without the weir at Csongrád, which also raises a series of environmental and economic issues.
- There are unfavorable waterway conditions, which hinder competitive navigation, at the following locations:
  - the section between Szolnok and Kisköre on the Tisa River,
  - the section between Tokaj and Záhony on the Tisa River,
  - the dam and the weir with lock at Bökény on the Körös River.
- The lack of ports and loading areas, which ensures prompt and high-standard services for goods and vessels. This problem appears in the case of all navigable waterways of the Tisa River Basin.

Some Tisa tributaries are navigable on shorter sections:

- local section of water way on the Bodrog River from quay Ladmovce (Košice Region) to Hungary (Tokaj locality). It is used for cargo transport,
  In accordance with the conception of water transport in **Slovakia** it is expected to launch operation on the east Slovak rivers the Laborec, the Latorica, the Bodrog which will be interconnected with Tisa river in Hungary. According to the AGN treaty, the Tisa River from

[10] This section is an excerpt from the Analysis of the Tisa River Basin 2007, Initial step toward the Tisa Basin Management Plan – 2009 made by ICPDR – International Commission for the Protection of the Danube River

Danube estuary to town Szeged forms branch no. E80-01, which belongs to the water way E80 (Main - Danube). Currently there is absence of interconnection of water way from the town Szeged to Bodrog River on Slovak – Hungarian border.

- the Mureş River (25 km, or less than 5% of its total length),
- the Körös River (115 km in Hungary)
- Bega Canal is the only waterway in the area, upstream from Timişoara to the Serbian border and it is also border on 2 km length. The Canal has a 44,5km in length, 30-45m in width and a depth of 15-20m. Navigation of the channel began with Coştei hydro node achievement. In 1958, the transport of goods ceased, and in 1968 the passenger transport was stopped, the navigation on Bega Canal being currently still suspended. The reopening of navigation on the canal would help shortening the distance to the Romanian Danube ports, as well as to the ports in the EU countries.
- Canal System Danube-Tisa-Danube (DTD) is a multipurpose hydraulic system, with main purpose to control the regime of surface and ground water. It provides, however, very good conditions for sailing on 600 km. According to the UNECE criteria, 55% of the system falls into navigable classes IV and V, around 20% into navigable class III, and the remaining 25% in lower classes of navigability. Still, the DTD system is currently in a very poor condition.

Ports in the Tisa Catchment area

Country	Ports	Type	River
Hungary	Szeged	International and national	Tisa
Hungary	Hódmezővásárhely, Csongrád, Martfű, Szolnok, Tiszafüred, Tiszaújváros, Tokaj	regional public	Tisa
Hungary	Békés, Mezőberény, Köröstarcsa, Körösladány, Gyomaendrőd	regional public	Körös
Hungary	Sárospatak	regional public	Bodrog
Serbia	Novi Sad, Backa Palanka	international	Danube
Serbia	Senta	international	Tisa

III.4.2. Energy management, energy supply systems and alternative energy sources

III.4.2.1. Fossil fuels (not renewable energy resource)

Most countries in Western-Central Europe and South Europe are in need of petroleum imports, so the national and international petroleum conduct systems have been developed for some time. The petroleum pipeline "Barátság (Friendship) I and II" runs accross the project area.
The national gas transportation system of the five countries is connected to the gas transportation systems of Europe. The pipelines receive natural gas from Russia, via Ukraine, and transmit through the catchment area to supply the countries of Balkan Peninsula. Currently the construction of a DN 400 mm connection pipe between Szeged (Hungary) – Arad (Romania) is in progress, which is part of the "Nabucco" pipeline project to connect the Caspian Sea region and Central Europe via Turkey, Bulgaria, Romania, Hungary and Austria.

In the **Romanian** Tisa Catchment Area, there are the most important deposits of natural gas (methane gas, respectively associated gas), methane gas deposits being located particularly in Mureş county as well as in adjacent Counties Bistriţa-Năsăud, Cluj, Alba, Sibiu and Harghita.
From the exploitations of methane gas in Mureş county leaves a series of main transport pipelines to the south, west and northwest that feed Bucharest area and, respectively, Banat and Cluj, Bihor and Maramureş regions.

In **Slovakia** in the districts Michalovce, Sobrance and Trebišov there are major natural gas reserves (deposits Bánovce and Ondavou, Senné, Stretava, Ptrukša, Kapušianske Kľačany, Pavlovce na Uhom, Pozdišovce I, Rakovec nad Ondavou, Bačkov and Trebišov). The resources of anthracite are in the area of the deposit Veľká Tŕňa and resources of lignite are in the area of the deposit Hnojné. According to the geographical research, there is methane and light paraffinic oil deposit in Lipany. In Hanušovce in the district Vranov and Topľou there is flow of methane. Lignite oil presence was discovered near village Bánske in the district Vranov and Topľou.

Petroleum and natural gas extraction areas are located in **Hungary** on the Great Plain (Bács-Kiskun, Csongrád, Békés, Hajdú-Bihar and Jász-Nagykun-Szolnok Counties), while the coal and mainly lignite extraction sites are in the North-Central Mountains (Nógrád, Heves and Borsod-Abaúj-Zemplén Counties). With the exception of Szabolcs-Szatmár-Bereg County, major (and potential) hydrocarbon extraction areas are located on the Great Plain, while in the north-western part of the Borsod-Abaúj-Zemplén County are some potential coal extraction areas.
Though the Tisa River Basin has relatively great hydrocarbon resource potential, the underground extraction technology of which proved to be inefficient according to previous calculations (based on periods of cheap oil price), and therefore it has been described as a reserve energy source. Operational petroleum and natural gas fields are in the south part of the programming area, which transport the hydrocarbon gas extracted into the basic supply system. The natural gas reintroduced into the worked out gas fields in Hajdúszoboszló and Algyő is a part of the national gas supply reserve.

Thermo-electric power plants:

Romania:	Mintia, Paroşeni (Hunedoara County), Iernut, Fântânele (Mureş County)
Hungary:	Mátrai (Visonta), Tisa II. (Tisaújváros), Tisapalkonyai, Lőrinci, Borsodi (Kazincbarcika), Sajószögedi, Debreceni, Diósgyőri, Nyiregyházi
Serbia:	Thermal Power Plant-Heating Plant in Novi Sad and Zrenjanin

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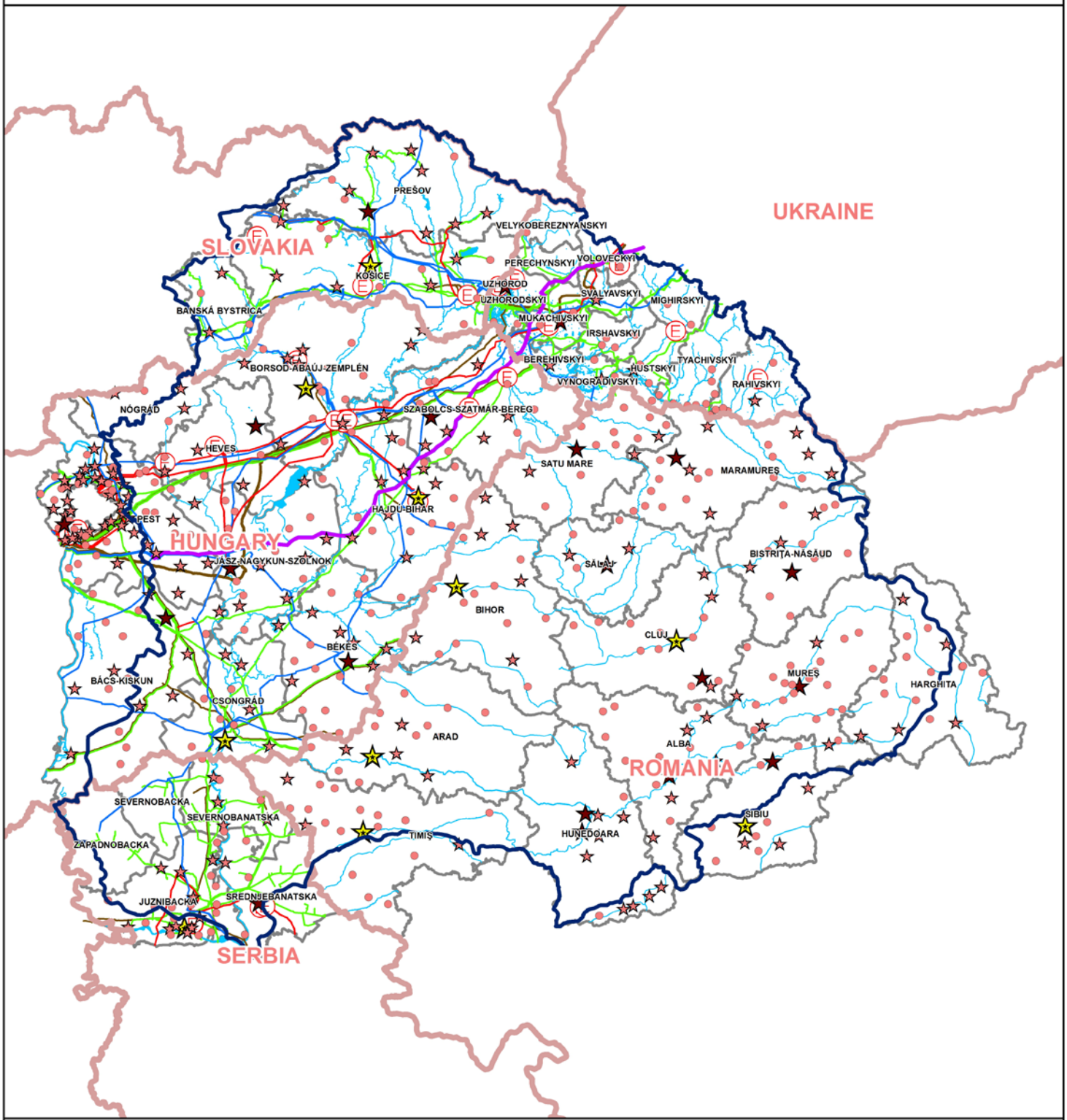
REGIONAL AND LOCAL INFRASTRUCTURE - ENERGY SUPPLY SYSTEM



Tisa Basin
Country border
County border
Major Water

Municipality structure

5004 - 10000
10001 - 50000
50001 - 150000
150001 -

Power plant
750kV Transmission network
400kV Transmission network
220kV Transmission network
Gas network
Petroleum network

SOURCE
Ukraine: Ministry of Energy and Coal Industry of Ukraine
Romania: Urbanproject
Slovakia: Statistic Office of the SR
Hungary: National Spatial Plan
Serbia: Public Company "Elektrovojvodina"

III.4.2.2. Renewable Energy Sources

Renewable energy resources in use, with varying degrees of efficiency in the project area, are hydropower energy, solar energy, geothermal energy, wind energy and the energy resulting from burning and, possible decomposing the biomass. The use of renewable energy sources is particularly beneficial not only for the improvement of air quality and natural environment protection but also in economic and social terms, through promoting energy security/independence, providing employment and contributing to business development.

„The European Council adopted in 2007 ambitious energy and climate change objectives for 2020 – to reduce greenhouse gas emissions by 20%, rising to 30% if the conditions are right, to increase the share of renewable energy to 20% and to make a 20% improvement in energy efficiency."[11]

Renewable energy in final energy consumption (2020 target)

Country	Share of renewable consumption to gross final energy consumption
Romania	24%
Slovakia	14%
Hungary	13%

In the project area various kinds of renewable energy sources are available, but their exploitation is at a very preliminary stage.

Capacity installed by the end of 2008 (MW)[12]

Country	Wind	Photovoltaic	Hydro energy
Romania	10	0,5	325
Slovakia	3	0,1	63
Hungary	127	0,5	12

Hydropower

In **Zakarpatska** Oblast there are 4 hydroelectric power stations with the total installed capacity equal to 32,13 MW- (Treblia-Rikska 27 MW, Onokivska 2,6 MW, Uzhorodska 1,9 MW, Bilinska 0,63 MW).

In **Romanian** Tisa catchment area there is a number of 121 hydropower plants (HPP) currently running, with a total installed power over 1.571 MW. River basins with th ebest endowment with hydropower plants and installed power are the Criş rivers and the Mureş. Counties using most efficiently hydropower are Hunedoara (18 plants, 484,7 MW), Cluj (7 plants, 300 MW) and Bihor (7 plants, 201 MW).

In **Slovakia** hydropower is the main renewable energy resource, espatial in the Prešov region. In the Košice region it is especially at the rivers of Hnilec and Hornád. These are usually small water power stations with power smaller than 1 MW (altogether 56 localities in the target area).

The rate of flow is extremley slow on the rivers of **Hungary**. The differences of the water level on river Tisa in the great Hungarian Plain is only 2-3 cm within 1 km. Under these circumtenses using hydropower on the Hungarian part of the Tisa River is limited enough.

[11] Communication from the Commission to the European Parlament, the Council, the European Economic and Social Committee and the Committee of the Regions
Energy 2020 - A strategy for competitive, sustainable and secure energy

[12] sources: www.energy.eu

Today there are two hydro power stations in operation on the Hungarian section of river Tisa, Tiszalök and Kisköre, producing 11.5+28=39.5 MW. There are two tiny little hydro power plants on river Hernád (Felsődobsza, Kesznyéten, Gilbert) with a total output of 5.6 MW yearly.
Hydroelectric power potential of the **Serbian** Tisa Catchment Area is not being utilised, and no hydroelectric power plants have been built. Recent research has shown that there is a possibility to utilise the hydroelectric power on Danube (HPP Novi Sad, 130-210 MW in capacity). According to the recent analysis, it is possible to build 13 small hydroelectric power plants with 20,2 MW of power summary. The greatest potential is found on the Danube-Tisa-Danube hydro system, where small hydroelectric power plants would be built within the actual water gate (including also the dam on Tisa), given that we already have formed water sluices. Primary functions of the hydro system would still have priority, but the „forced" activities would be implemented with the objective to increase hydroelectric power potential.

Wind energy
The sites suitable for the establishment of wind power plants are those, where the average speed of wind is about 4m/sec. The most appropriate sites for the use of wind power are on the peaks of Apusani Mountains in Romania. There are suitable sites on the plains of the catchment area too, with 3-4 m/s wind power, but the potential is used in Hungary only. There are five wind turbines in the Hungarian part of the Tisa catchment area (Bükkaranyos, Erk, Felsőzsolca, Mezőtúr, Törökszentmiklós, one turbine in each community) built in 2004 – 2006 with the total power capacity of nearly 6MW.

Solar energy
The solar energy potentials are abundant in the Tisa catchment area, mainly on the plains. Exploitation and use of this resource is, however, at a very early stage.
There is an increasing demand for usage of solar energy to make hot water in households and a tendency of using them in hospitals and tourist facilities has been observed.
Currently, in the village Jebel from Timiş county, in **Romania**, a power generation system using solar cell panels is in progress to be used for public building lighting.
In **Slovakia** the construction of photovoltaic power stations started to be prepared, especially in the districts Michalovce and Trebišov.

Geothermal energy
In the plains of the Tisa catchment area, in West Plains of Romania, Great Plain of Hungary and the plains of Voivodina the geothermal gradient is double of the global average. This unique resource is not exploited as yet in any of the countries, but one can expect the increasing use of geothermal energy in the future.

The number of geothermal systems that have wells in operation in **Romania** is about 70. The high temperature of geothermal waters from Oradea-Borş area, made them to be the first used in the country for heating and, also as domestic hot water. Direct using has been dropped when significant deposits of salt were found on the installation, as well as radioactivity of these waters.
In **Slovakia** there are thermal water reservoirs in the wide area below the High Tatras and the Vihorlat territory. The water temperature is about 90^0 C and the reservoirs are suitable for energy use. Reservoirs yield in the west part of Poprad – Prešov is estimated of about 100 MW in Humenne it is estimated about of 800 - 1000 MW. Economic use of geothermal heat is perspective in towns. Earth heat in dry or wet form is becoming increasingly popular energy source. In the Košice Region the prospective areas or structures of geothermal waters are the following: Beša – Čičarovce, Humenský Ridge, Košice Basin, Levočská Basin and Rimavská Basin. The level of geothermal energy use in the Košice Region can not be evaluated, as no locality is being used.

Hungary uses the geothermal energy of thermal springs only. There are more than a thousand hot springs in Hungary most of them on the Great Hungarian Plain.

III.4.2.3. Electric energy system

The countries sharing the Tisa catchment area – with the exception of Ukraine –are all members of ENTSO-E, a body responsible for the development of the European electric networks.

ENTSO-E is the European Network of Transmission System Operators for Electricity, representing 42 Transmission System Operators (TSOs) from 34 countries. Founded in December 2008, it became fully operational on 1 July 2009. TSOs are responsible for the bulk transmission of electric power on the main high voltage electric networks, one of the most important infrastructure backbones of Europe's service and industrial economy.

The TYNDP presents a forward-looking proposal for electricity transmission infrastructure investments across 34 European countries. In accordance with EU Regulation (EC) 714/2009 on cross-border electricity exchanges, the TYNDP is a non-binding plan, to be updated every two years. This first release of the TYNDP puts forward a total of close to 500 investment projects, worth 23-28€ billion over the first five years.

The objectives of the TYNDP are to ensure transparency regarding the electricity transmission network and to support decision-making processes at regional and European level. The report is the most comprehensive and up-to-date European-wide reference for the transmission network. It points to significant investments in the European power grid in order to help achieve the European energy policy goals:

- increasing the use of renewable energy sources (RES) to 20% of total energy production by 2020;
- further promoting the Internal Energy Market (IEM) by alleviating congestion on the transmission network;
- ensuring security of supply (SoS) and system reliability of an increasingly complex transmission system connecting 525 million citizens across the ENTSO-E area.

Meeting these goals demands some 35,000 km of new transmission lines and 7,000 km of existing line upgrades. Out of the total of 42,000 km, which represents 14% of the existing transmission lines, TSOs plan to complete 44% of the work in the coming five years, and about 56% in the following five-year period.[13]

Transmission lines in the target area:
Communication between Ukraine and Hungary:

750 kV transmission line "West Ukrainian - Albertirsa (Hungary)"
400 kV line "Mukachevo - Sajoszeged"
220 kV power lines: "Mukachevo - Tiszalök"
220 Kv "Mukachevo - Kisvárda".

Communication between Ukraine and Slovakia:

400 kV transmission line "Mukachevo - Veľké Kapušany - planned"

[13] sources: http://www.entsoe.eu

Communication between Ukraine and Romania:

400 kV transmission line "Mukachevo – Roşiori – Tihău – Gădălin – Iernut - Sibiu"

Communication between Romania and Hungary:

400 kV transmission line “Sibiu – Mintia – Arad – Szeged”

Communication between Hungary and Serbia:

400kV “Sándorfalva – Subotica”

III.4.3. Water management[14]

III.4.3.1. Water resources management

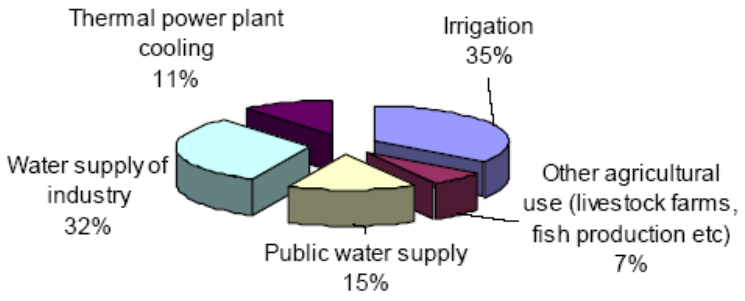
The Tisa River ranks as the longest tributary (966 km) and the second largest tributary of the Danube River by flow volume, with an average discharge of about 830 m^3/sec. The basin drains an area of 157,186 km^2 and is the main water source for Hungary, a significant source for Serbia and an important source for western Romania and southeastern part of the Slovak Republic.
The multi-annual area mean values of the main balance elements of the Tisa River Basin are:

- precipitation 744 mm/a,
- evapotranspiration 560 mm/a,
- runoff 177 mm/a (= 830 m^3/s).

Water uses

The water resources of the Tisa River Basin are mainly used for public water supply, irrigation and industrial purposes, but also for other agricultural uses, such as fishery, and recreation. Analyses were made in the framework of the ICPDR Tisa Group on the present water uses of the public water supply for agriculture irrigation or other agricultural use, as well as for industria purposes where the average value for three years (2002-2004) was analysed.

Estimation of consumptive use in the Tisa River Basin area



The total annual water consumption in the Tisa River Basin is estimated at about 700 million m^3, or about 2-3% of the total annual flow. About 20% of this consumption comes from deeper aquifers. As further analysis of the ICPDR Tisa Group, detailed information was collected on the average total water quantities used annually for various water uses in the last three years which also illustrates the major sources of water for the water users.

[14] This chapter is an excerpt from the Analysis of the Tisa River Basin 2007, Initial step toward the Tisa Basin Management Plan – 2009 made by ICPDR – International Commission for the Protection of the Danube River

Irrigation represents the major consumptive use of water in the Tisa River Basin. Many older irrigation systems are temporarily out of operation due to reasons that may include the economic situation in countries or change of ownership, among others. The total annual consumptive use of water for irrigation is about 250 million m^3, or about 8 m^3 per second, representing about 1% of the annual flow.

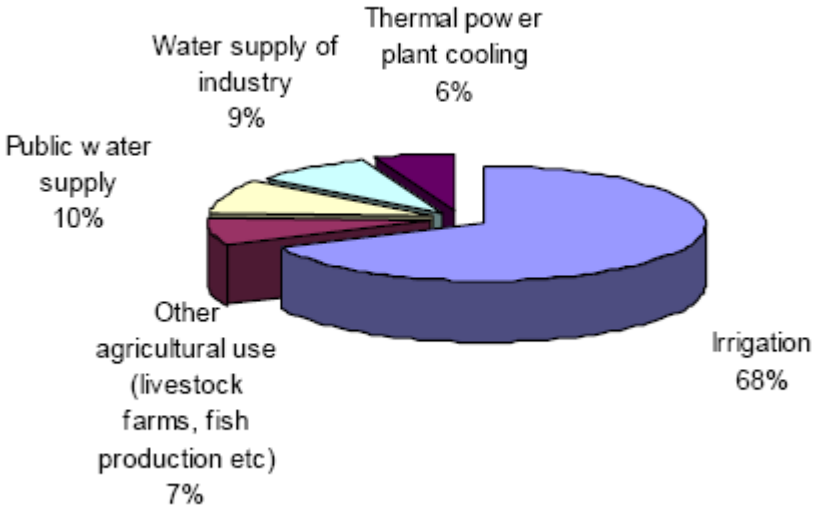
The use of water for other **agricultural uses** (livestock farms, fish production or other uses) is relatively low due to the reduced number of livestock lately also resulting from the economic situation in countries or change of ownership. The use of water for livestock is highest in Serbia and Hungary, and the use of water for fish production is significant in most of the countries, especially in Serbia, Romania and Hungary. The total annual consumptive use is relatively small - about 50 million m^3.

Total annual consumptive use of water for **public water supply** is about 110 million m^3, while for **industrial water supply** the total annual consumptive use of water is about 230 million m^3.
There are no thermal power plants in Ukraine and Serbia and the total annual consumptive use of water for **cooling of the thermal power plants** is about 80 million m^3, required by Romania, Hungary and the Slovak Republic.

Altogether 38 **hydropower plants** were identified by the countries, and out of these, 28 with the highest installed capacity are in Romania.

Scenario for 2015 – water demand
Based on the `*average total water quantities annually used by the given users*` and the `*percentage of the estimated consumptive use*`, a scenario for 2015 was created giving the estimated consumptive uses by various water users (million m^3).

Estimation of consumptive use (scenario 2015)



Data on planned water uses were collected and water demand in the Tisa River Basin was analysed for the year 2015. The total water demand is given for: irrigation, other agricultural uses (such as livestock farms or fish production), municipal and industrial water supply, hydropower, navigation, preservation of water regimes and ecological requirements.

It is likely that the total annual water demand in the Tisa River Basin will be about 1.5 billion m^3 in 2015, or 5.5-6% of the total annual runoff. Deeper aquifers are planned as a supply source for approximately 20% of the expected water demand.

A significant increase in water use for **irrigation** is planned for 2015. All countries plan to upgrade their existing irrigation systems or build new ones. Irrigated areas will increase from about 500,000 ha to about 625,000 ha.
The total annual consumptive use of water for irrigation is predicted to be about 950 million m^3 or about 35 m^3 per second, representing about 4,2% of the mean annual flow. Future augmentation of water use for irrigation, where consumptive use is a major component, will be an additional pressure in the Tisa River Basin. Aquatic ecosystems already vulnerable will be particularly endangered in the summer, when planned irrigation can go beyond available water quantities.

For other **agricultural uses** it is estimated that the total consumptive use will be around 100 million m^3.
Estimations related to the water quantities planned for **public water supply** by 2015 indicate a 25% increase by 2015. The total consumptive use will be relatively low – about 140 million m^3 – and will not be a key pressure if adequate treatment of municipal wastewater can be provided.
On the other hand, a significant portion of water for municipal water supply originates from slowly renewable deep aquifers, and the sustainability of the water supply from these aquifers must be ensured.

An increase in water use for **industrial water supply** is not planned. However it is important to note that some industries require large water quantities, while untreated wastewater may be polluted in some cases.

No new hydropower plants are planned in the Slovak Republic, Hungary, Serbia or Ukraine, but one on the border between Romania and Ukraine. The future increase of **hydropower** capacities in the Tisa River Basin should be through the reconstruction and upgrade of the existing infrastructure to minimise the need for development of new structures. New developments or reconstruction/upgrade of existing facilities should be in line with EU environment protection standards (i.e. new hydropower plants should have fish passages and respect requirements for minimum environmental flow) to lessen the impact on water quality.

The quantity of cooling water for **thermal power plants** will remain the same in 2015.
The increase of water use in the Tisa River Basin as set in national water management plans will be an additional pressure on already endangered aquatic ecosystems. This is particularly true for irrigation, as this consumptive use takes place in low water period of the year.

Surface water storage
The total reservoir capacity in the Tisa River Basin is about 2.7 billion m^3 and this amount represents about 10% of the average annual flow for the Tisa. There are 7 reservoirs larger than 100 million m^3 which were built for a variety of purposes.

Reservoirs in the Tisa River Basin larger than 100 million m^3

Capacity range (Mm3)	Country	River basin	River	name of the reservoir	Catchment upstream of reservoir (km^2)	Volume (Mm^3)	Surface	Purpose
100-200	RO	Criş rivers	Drăgan	Drăgan	159	112	292	multipurpose
	RO	Mureş	Sebeş	Oaşa	187	136	401	multipurpose
	SK	Bodrog	Ondava	VD Vel'ka Domasa and mala Domasa	827	178	1510	electricity production, recreation, fishing, flood protection, industry water supply, irrigation
	SR	Tisa	Tisa	Tisa	nd	160	nd	irrigation, flood protection
200-500	RO	Someş	Someşul Cald	Fântânele	325	225	826	hydropower, flood protection
	RO	Mureş	Râul Mare	Gura Apelor	235	210	411	hydropower
	HU	Tisa	Tisa	Kisköre	65,670	253	12,700	Multipurpose
	SK	Bodrog	Laborecbočná nádrž	VN Zemplínska Šírava	1,567	297	3,280	recreation, fishing, irrigation, industry water supply, flood production

III.4.3.2. Flood management

Floods in the Tisa River Basin

Floods in the Tisa River Basin can form at any season as a result of rainstorm, snowmelt or the combination of the two. Thus large flood waves are generated more frequently in late winter and early spring.

The floods generated in Ukraine, Romania and the Slovak Republic are mainly rapid floods and last from 2-20 days. Large floods on the Tisa in Hungary and in Serbia, in contrast, can last for as long as 100 days or more (the 1970 flood lasted for 180 days). This is due to the very flat characteristic of the river in this region and multi-peak waves which may catch up on the Middle Tisa causing long flood situations. Also characteristic of the Middle Tisa region is that the Tisa floods often coincide with floods on the tributaries, which is especially dangerous in the case of the Someş/Szamos, Crasna/Kraszna Bodrog, Criş/Körös and Mureş/Maros Rivers.

Long-observations of level regime and maximum flow provide evidence of the distribution of extremely high severe floods in the Tisa River Basin along the Upper, Middle and Lower Tisa and its tributaries. However, not all high upstream floods cause severe floods along the Middle or Lower Tisa due to attenuation.

Recent severe floods have highlighted the problem of the inundation of landfills, dump sites and storage facilities where harmful substances are deposited and toxic substances can be transferred into the water posing a clear threat to the environment.

In the 19th century, river floodplains traditionally supported flood-tolerant land uses, such as forests, meadows and fishponds. Since then, land development interests have changed to modern agricultural production demanding low and tightly-regulated water levels and protection from seasonal inundation. This trend has been facilitated by the availability of arable land, crop intervention payments and grant aid for drainage, including pumped drainage within floodplains. This has led to the development of arable agriculture that demands low water levels in associated rivers. Industrial and urban building has also increased within drained floodplains lasting recent decades. In Hungary, work to drain the Tisa wetlands began in the 19th century and today some 500,000 people – 5% of Hungary's population – live on land reclaimed from the Tisa. Efforts to reduce flood impacts by building higher dikes and continued river bed regulation have resulted in a deposit of silt within the main bed which has inadvertently increased flood risks.

In addition to the altered nature of floodplains, the reduction in upper and mid-catchment water retention leads to more flood events downstream where river channels and small floodplains no longer contain peak water levels, even for minor flood events. The lack of coordinated mechanisms to mitigate floods in the upper catchment may lead to compounded impacts downstream. When flooding occurs, industrial sites, mining areas, agricultural fields and municipal waste facilities can become inundated and pollute the waters of the Tisa Basin.

Flood protection systems and the status of flood protection structures

In the Tisa Valley, organised, systematic flood protection started in the mid 19th century. The backbones of these works are the flood protection dikes along the main river, but also include river training works, bank protections, flood retention reservoirs and polders. At this time drainage systems with pumping stations were also built. As the hydrological regime of the Tisa River became better understood and some dikes breached or failed to meet the design criteria, the dikes had to be reconstructed, upgraded and strengthened.

Generally, the main dikes are designed for the ‘one in hundred year’ return period floods. Although this is a general design criterion, there is still a major difference between the approach used in Ukraine, Romania and the Slovak Republic as compared to the method used in Hungary. In upstream countries where reliable discharge intervals are available, the ‘Q1%’ is used for the design of the structures. On the flat region of the Tisa the rating curves are not single-valued, and the discharge statistics are not reliable and water level statistics are used to provide the ‘h1%’ design level. This leads to a different degree of protection at border sections, but in the frame of the existing bilateral agreements, this problem is relaxed during negotiations.

To provide security against wave actions and to compensate for the uncertainty in the calculation of design flood level and in the dimensioning of dikes, a freeboard of 1 m is generally applied with positive and negative deviances in justified cases.

Reservoirs are mainly multi-purpose in mountainous area and are used for water management, fish farming, electricity production, providing ecological flow and some are also used for flood retention.
The polders (flood detention basins) on the lowland regions are used for emergency flood detention only.

Flood protection structures

Country	River	Length of the dike km	Reservoir and/or polders 10^6 m^3
Ukraine	Tisa River Basin	726 (embankments) + 276 (bank protecting and training structures)	65.8 in 9 reservoirs and 59 ponds
Romania	Tisa	5.56	-
	Vişeu	7.85	-
	Iza	13.53	
	Tur	77.12	28.09 in 4 reservoirs
	Someş	1198.00	557.0in 35 reservoirs
	Crasna	163.39	28.79in 1 reservoir and 1 polder
	Barcău	336.00	
	Crişul Alb	210.19	
	Crişul Negru	378.10	45.50 in 2 polders
	Crişul Repede	55.40	117.25 in 3 reservoirs
	Mureş	825.00	524524 in 31 reservoirs and polders
	Bega-Veche	104.30	46.94in 9 reservoirs and polders
	Bega	115.40	65.43in 15 reservoirs and polders
Slovakia	Tisa	6	-
	Slaná	5.7	-
	Tributaries of the Slaná	107.8	14.1 in 4 reservoirs
	Bodva	28.6	
	Tributary of the Bodva	41.0	25.6 in 2 reservoirs
	Hornád	34.2	62.7in 2 reservoirs
	Tributaries of the Hornád		11.5 in 1 reservoir
	Bodrog	22.12	-
	Tributaries of Bodrog	230.87	631.9 in 3 reservoirs and 1 polder
Hungary	Tisa	1064.1	
	Túr	75.7	-
	Szamos	93.0	-
	Kraszna	62.3	-
	Lónyay Main Canal	102.8	
	Bodrog	57.9	-
	Sajó (incl. Takta)	119.6	
	Hernád	62.0	-
	Zagyva-Tarna	389.0	46.0 in 3 reservoirs and 2 flood detention basins
	Körösök (incl. Berettyó, Hortobágy-Berettyó)	747.9	295.0 in 6 flood detention basins
	Maros	95.1	-
Serbia	Tisa	314.8	-
	Old Bega	71.5	-
	Bega	62	-

SOUTH EAST EUROPE
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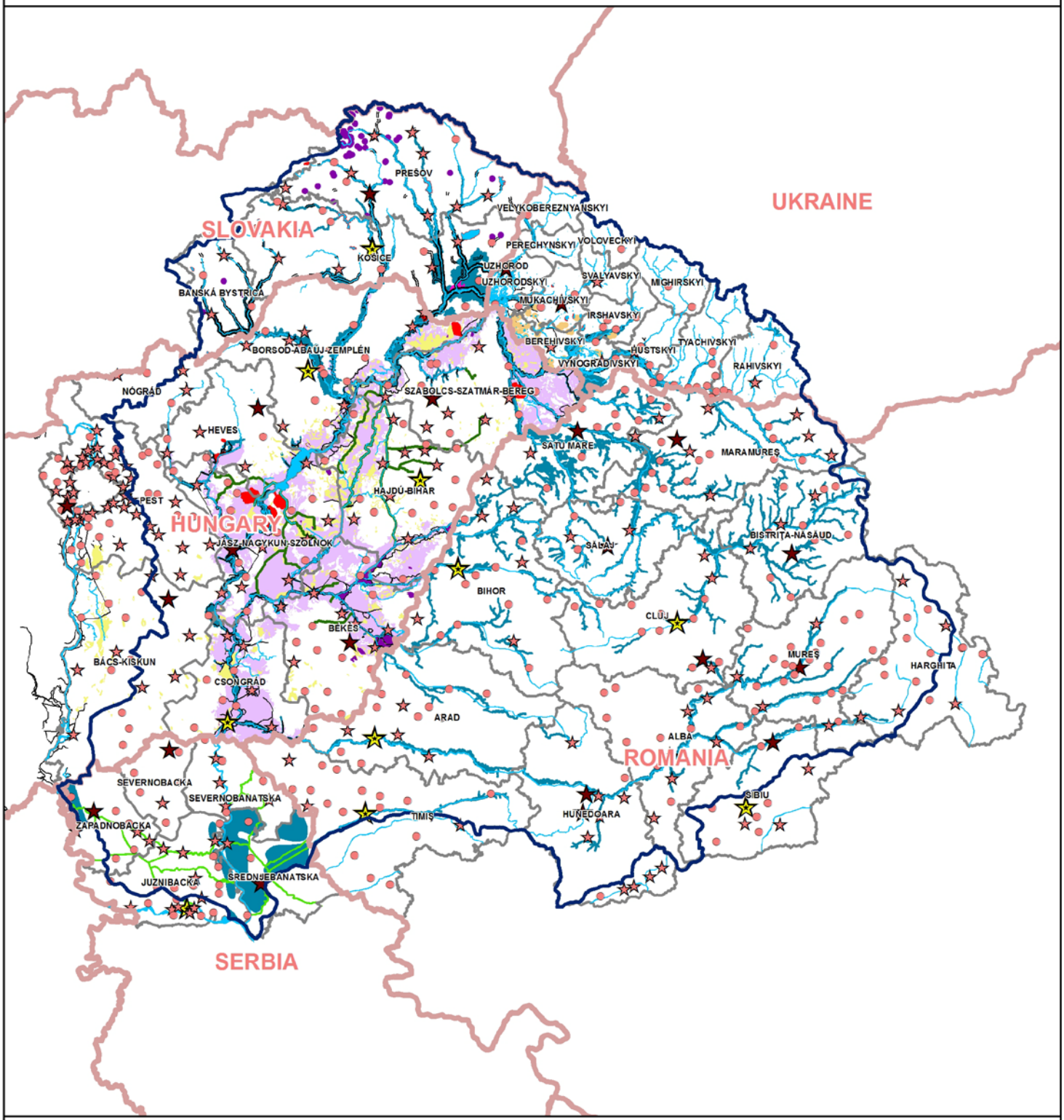
TICAD
TISA CATCHMENT AREA DEVELOPMENT

Programme co-funded by the EUROPEAN UNION

TICAD
REGIONAL AND LOCAL INFRASTRUCTURE - WATER MANAGEMENT



Tisa Basin
Country border
County border
Major Water

Municipality structure
5004 - 10000
10001 - 50000
50001 - 150000
150001 -

Flood prone area
Flood risk area (Hungary)
Area of strong excess water hazard (Hungary)
Flood protection reservoir
Excess water reservoir (Hungary)
Flood protection polders (Slovakia)
Flood protection line
Main irrigation chanel (Hungary)
Main chanel (Serbia)

Flood protection point (Ukraine)
Flood protection polders point (Slovakia)

SOURCE
Ukraine: State Agency of Water Resources of Ukraine
Romania: Cadastral Atlas of Waters 1992 / Hydrographical Map of Romania 1983
Slovakia: Slovak Environmental Agency
Hungary: Central Directorate for Water and Environment
Serbia: Public Company "Vodevojvodine"

III.4.3.3. Excess water (undrained runoff) in the Tisa River Basin

Another type of inundation in the lowland areas of the Tisa River Basin originate from unfavourable meteorological, hydrological and morphological conditions on saturated or frozen surface layers as a result of sudden melting snow or heavy precipitation, or as a result of groundwater flooding. This undrained runoff or excess water cannot be evacuated from the affected area by gravity and may cause significant damages to agriculture or even to traffic infrastructure and settlements.

The appearance of the inundation caused by *excess water* (undrained runoff) is determined together by natural and artificial circumstances. Natural circumstances can be the meteorological conditions (temperature, precipitation), morphological conditions (altitude, geographic structure), soil properties (permeability, physical structure, reservoir ability, type of soil), hydrogeological conditions (groundwater level state), geological conditions (soil, rock, impermeable layer). Artificial conditions include drainage networks (the capacity of the network during the excess water's period, its construction, backwater effect), agricultural practice (irrigation, used agricultural technologies, type of cultivated plant) and the increase in urbanised areas.

Lowland drainage systems are characteristic attributes of the Tisa Valley. These networks determine surface water accumulation and effect runoff in the whole lowland area along the Tisa River. These networks have been always connected to the everyday life of the population living in the lowland.
Small local depressions and small valleys were the first elements of these networks, and were later modified for a higher capacity.

Experience with the formation of the undrained runoff phenomena shows that the most critical period is the springtime. The most serious inundations are registered at this period when the natural conditions are unfavourable for natural runoff. In spring rapidly melting snow combined with rains may cause inundations over significant areas.

The biggest inundated areas were observed in 1942 when 9,000 km^2 along the Tisa Valley were underwater due to undrained runoff. At the end of 1999 the inundated areas were about 8,000 km^2, which represented the second largest inundation in the region. The database doesn't have precise or homogeneous inundation data because the registration of the inundated areas was made with different procedures and with different precision. Some 20% of the total Tisa lowland catchment was inundated by undrained runoff. These inundations are meaningful from the point of view of surface water resources: every 1 km^2 represent 100,000 m^3 of water which can possibly mitigate the negative consequences of water scarcity.

Characteristics of lowland drainage
The total area covered by lowland drainage networks in the Tisa Valley is 56,789.37 km^2.
According to geomorphological conditions, the longitudinal slope of the canals is very small (0,1-0,2bm/km). Consequently grass and water-receptive vegetation decrease the conveyance capacity of the canals, and the backwater effect (at the mouths) can cause similar difficulties in the systems.

Reservoirs are used in several locations to reduce damage caused by undrained runoff. Most of them are former wetlands or other low value areas where the morphological conditions are advantageous for the storage. The utilisation of these areas is complex – outside of the inundation period they function as fishponds, wet meadows or wetlands and they provide free storage capacity at inundation times for excess water. This may cause conflicts between operational and storage functions. The reservoirs play a key role in the lowland drainage in Hungary, with a total volume of 227 million m^3.

Excess water prevention and mitigation, present practice and future possibilities
For the effective prevention and mitigation of the consequences of inundations, the capacity of the lowland drainage networks are very important. For this reason continuous maintenance activities have to be carried out. These activities should include mowing the grass and water-receptive vegetation in canals; dredging canals; stabilising canal beds and banks; depositing and treating dredged material and maintenance and repairing pumping stations, weirs and bridges. Unfortunately, the lack of financial resources has caused difficulties in maintenance activities, and inundations have occurred in some cases as a consequence.

In many lowland drainage systems the original capacity of the system has been reduced due to the lack of continuous maintenance causing lot of problems during periods of inundation. Mowing the grass and removing sludge are very expensive and not as efficient as prevention.
Using the mobile pumping stations increase the surface slope along the canal can be useful in those areas where conditions are provided for continuous operation. However there have been some negative experiences of using of them in the Slovak Republic.

With the transition to a more market-based agriculture after 1989, state subsidies for agriculture declined and state funding for large-scale drainage operations was reduced as well. These factors, along with low productivity of 'converted wetlands', have resulted in a decline in agricultural activity.
In most Eastern European countries, the policy is changing. New policies call for approaches that rely on ecological means to control flood and on defining water management priorities more broadly, but also focus on preserving natural habitat for biodiversity conservation, on water quality and other more broadly defined benefits. Governments have made great efforts to comply with the EU legislation and seek ways of improving water management and encouraging appropriate agricultural practices in the region. The transition from conventional water and agricultural management techniques to an integrated ecosystem management should lead to an effective utilization of the Tisa Valley.
The inner area of settlements represent a key question in connection with the lowland drainage networks.
The increasing areas of the settlements is accompanied with an increase in the paved impervious areas and the increase in urban runoff in terms of volume and peak discharge as well. To reduce urban flood risk, storm water reservoirs should be constructed (wet ponds and dry ponds).

III.4.3.4. Drought

The Tisa River Basin runoff is highly variable – there are alternate periods of drought and flooding that are difficult to forecast and manage effectively. The droughts of recent years, such as the drought of August 2003, had severe effects in the region, particularly on the Hungarian Plain where agriculture was extremely affected. The lack of water reduces not only agricultural activity, but also the development of industry and urbanisation. Cities and other communities demand more water than the quantity available from rainfall, and it has always been difficult to get enough water for settlements far away from rivers.

There is no general definition of drought, but it is commonly understood to be a less than usual natural water supply. Water scarcity refers to long-term water imbalances, combining an arid or semi-arid climate (low water availability) with a level of water demand exceeding the supply capacity of the natural system.
Aridity and droughts are natural aspects of the Earth's climate, but aridity is a long-term average feature while droughts are a deviation from an average situation for limited period of time. Aridity is

defined by long-term low precipitation rates, often together with high evaporation rates, and results in a limited availability of water resources.

Drought and drought management in the Tisa River Basin countries (time and space varying droughts in theTisa Valley)

In **Ukraine** the term 'd,rought management' has never been applied to the Ukrainian part of the Upper Tisa River Basin due to the fact that in Zakarpattya the annual surface water resources potential per capita (3130 m^3) is three times as much as the same index for the whole country (1,000 m^3). In this case the only terms which fit are 'water scarcity' or 'water deficit'. In the set of observations available there were examples of dry years (1961, 1963) but which didn't result in water shortage.
According to official statistics (State Water Counting) the actual water extraction out of different water bodies since 1990 has been decreasing, and this trend will continue. In any scenario of water sector development for 2015, a water deficit can hardly be considered for the Ukrainian part of the Upper Tisa River Basin.

In **Romania** the identification of high drought risk areas in the Tisa River Basin was made on the basis of the correlation of the aridity index calculated through the reporting of precipitations to the potential evapotranspiration with the one of the aridity index Palfay (PAI) which takes into consideration the frequency of the dry years. For the basins afferent to the Tisa River tributaries, the areas with moderate sensibility (PAI index values between 4 and 6) and high sensibility (6 and 8) are only encountered in the Salaj Hills and in the Western Plain, at the border with Hungary and Serbia**.** The respective areas are fragmented and comprise a relatively small surface. This area is, to a great extent, classified as a dry/sub/humid area. In this region there are still dry years and even dry periods, the most important being the 1961 – 1973 period, but interrupted by excessively rainy years. Analyses emphasise that the driest season is autumn, especially in September and October.

Most of the **Slovak** part of the Tisa River Basin was classified as having 'moderate draught', with the exception of the the vicinity of the Bodrog River as 'severe draught', and the Laborec Valley as 'medium draught'. Return periods were not calculated. The aridity factor – defined as the relation of annual potential evaporation to a mean annual precipitation – is below 0.2 at the eastern border of the Tisa Basin (in the Carpathian Mountains) and increases from northeast to southwest up to 1.4 in the middle of the Hungarian Plain (at the mouth of the Körös Rivers)**.**

Drought is a recurrent feature of the **Hungarian** climate and can cause substantial damage to the nation's agriculture. Each year from 1983 to 1995, with the exception of 1987, 1988 and 1991, were drought years. This long period of drought was unprecedented in the 20th century in the region. Since eight of the twelve years were disastrous drought years, this series of dry years has increased the scientific and political interest in climate variability and climate change and the importance of drought as an extreme meteorological event. After a couple of normally wet years, Hungary experienced very dry years again in 2000 and 2003.

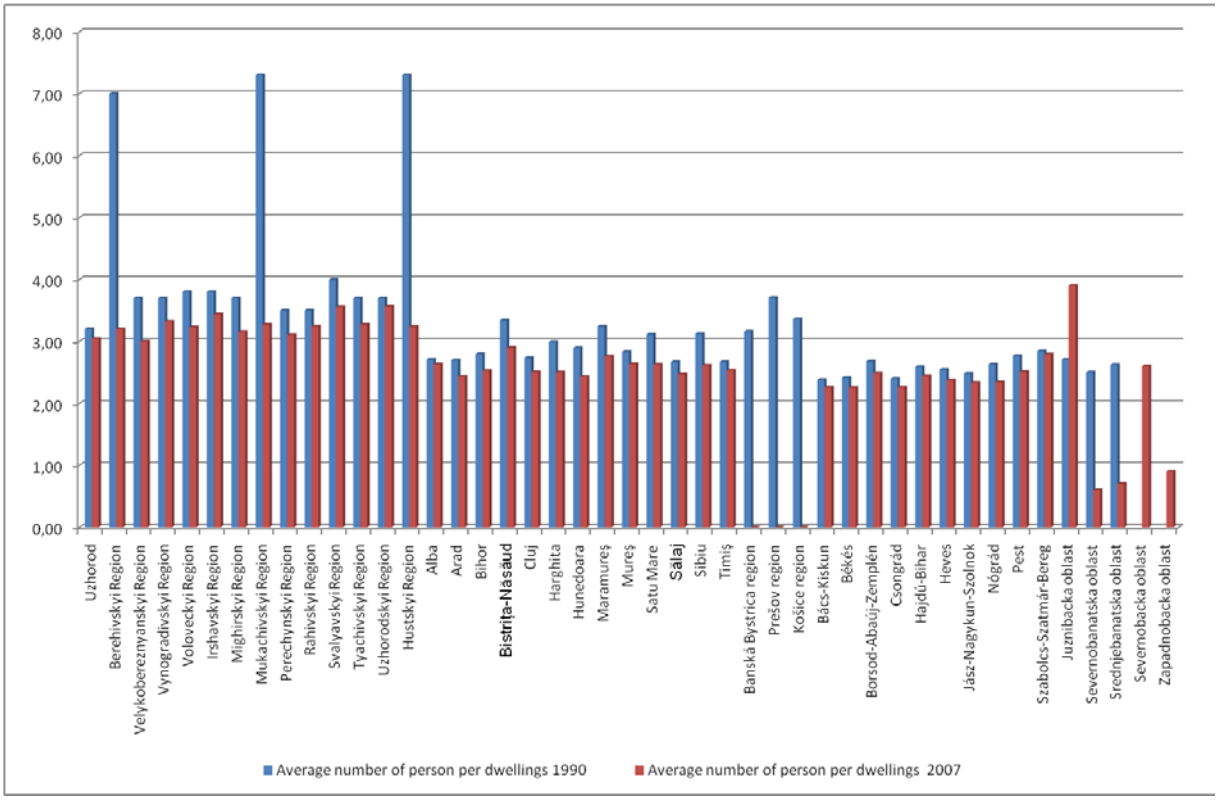
In **Serbia** drought has been the object of much research and investigation by a number of Serbian authors. This research and investigation encompasses all aspects of drought: from global and regional problems, environmental impacts, morphological, physiological and biochemical aspects of plant resistance to drought, to irrigation problems.

III.4.4. Public utility supply

III.4.4.1. Housing

The indicator of regional housing supply is the number of inhabitants per dwellings. The comparison of the relevant data for 1990 and 2007 indicates substantial improvement in each area unit except Alba County (Romania) and Južno-Bački Oblast (Serbia).

The rates for Ukraine (3.26 persons/dwelling) and Slovakia (3.42 persons/dwelling, 2001) are relatively high. The averages are: in Romania 2.58 persons/dwelling, in Hungary 2.40, in Serbia 1.74. The worst figure of housing supply is in Južno-Bački Oblast 3.9 persons/dwelling, while the relevant figures for the other counties of Voivodina are around the average or much lower. The extreme values are due mainly to migration flows involved by the political changes undergoing in this region. Housing supply is also lower than the average in the Ukranian and Slovakian parts of the region.

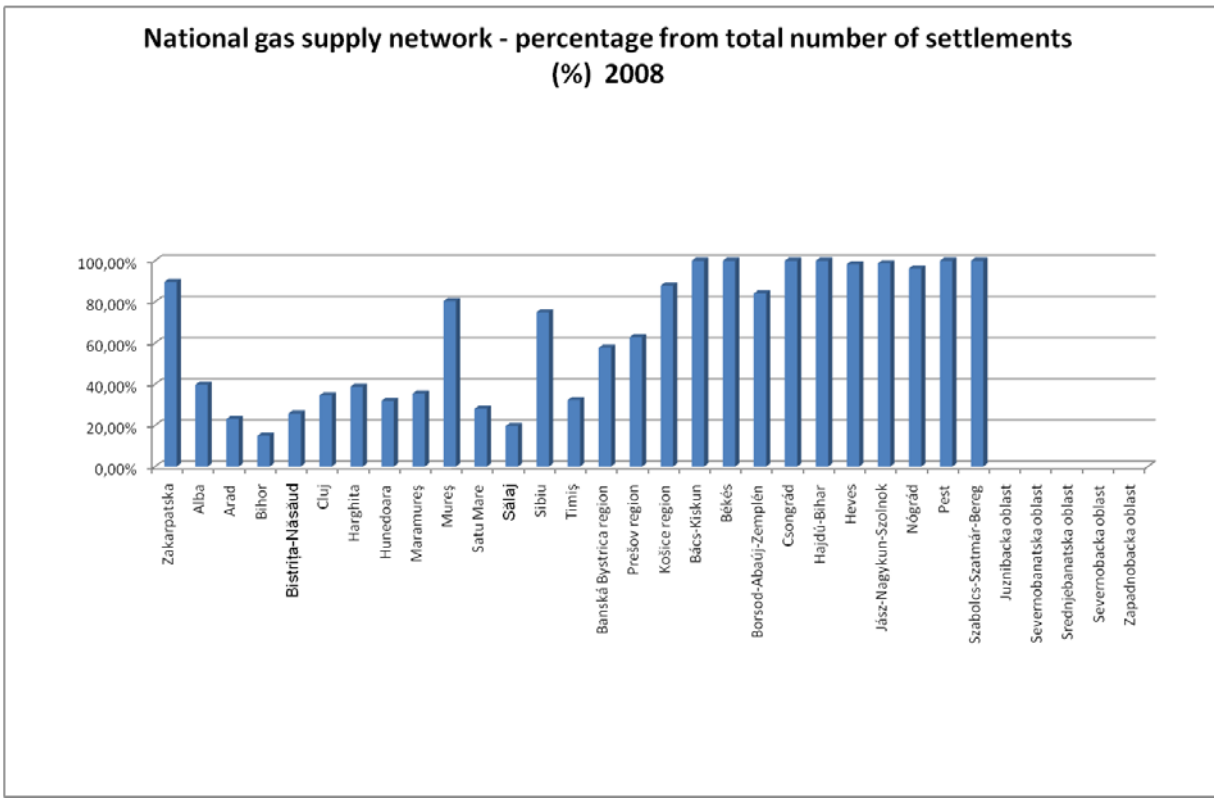


III.4.4.2. Supply of electric energy

Almost each municipality of the catchment area is connected to the electric energy network. The only exception is Alba County (Romania), where 37 municipalities have no connection to the network and 90 municipalities are only partially connected.

III.4.4.3. Gas supply

The network of gas supply is available in the Hungarian and Ukrainian parts of the catchment area as well as in Košice (Slovakia), Mureş and Sibiu (Romania), where 75 – 100 % of the dwellings have access to the gas network. The worst situation is in counties Arad, Bihor, Bistriţa-Năsăud, Satu Mare and Sălaj (Romania), where less than 30 % of the municipalities are connected to the gas supply network. The poorest supply is typical for the mountain villages, where the establishment of links to the network has physical obstacles. There is no data for Serbia.

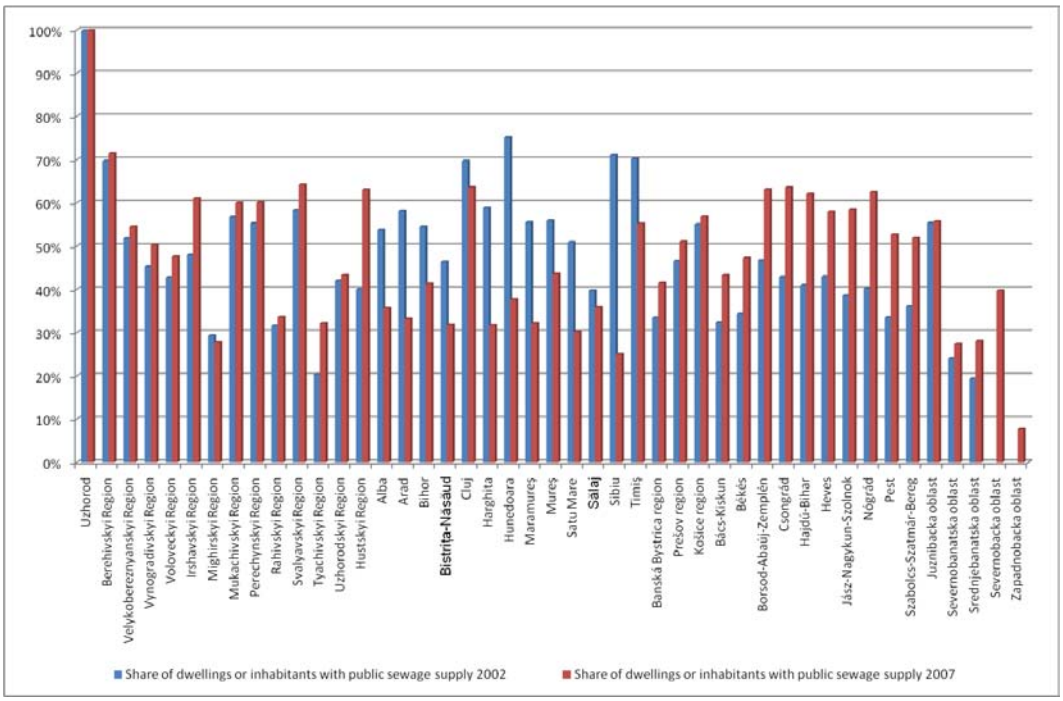


III.4.4.4. Supply of drinking water[15]

In the Tisa catchment area 64 % of the total number of dwellings has access to communal water supply. The rate is over 90 % in Hungary and Serbia, round 77 % in Slovakia, 67 % in Romania and 55.5 %, below the average in Ukraine. The poorest is the supply, below 45 % in the Ukrainian Districts Mighirskyi, Rahivskyi, Tyachivskyi, Voloveckyi, Uzhorodskyi and the Romanian counties Bistriţa-Năsăud, Mureş, in the isolated mountain villages.

III.4.4.5. Public sewage disposal

46 % of the dwellings of the project area are connected to the public sewage disposal systems. The relevant figures are 50 % in Ukraine, Slovakia and Hungary, 38 % in Romania, 32 % in Serbia. The best 99.9 % is the NUTS3 of Uzhorod, which is though a single city. Over 60 % is the supply in the urbanized Ukrainian Districts Berehivskyi, Irshavskyi, Mukachivskyi, Perechynskyi, Svalyavskyi, Hustskyi, the Romanian Cluj County and the Hungarian Counties Borsod-Abaúj-Zemplén, Csongrád, Hajdú-Bihar, Nógrád. Less than 30 % is the supply in districts with extensive rural areas in Ukraine Mighirsky, Romania (Sibiu), Serbia (Severno-Banatski, Srednje-Banatski, Zapadno-Bački).



[15] For Romania, the data regarding the supply of drinking water and public sewage disposal for 2007 is estimation and is based on calculation of various available indicators. The official data for the mentioned indicators refers only to the year 2002 and the real situation in 2007 might be different than the estimation. Next official data regarding the supply of drinking water and public sewage disposal will be collected at the end of 2011.

SOUTH EAST EUROPE
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TICAD
TISA CATCHMENT AREA DEVELOPMENT

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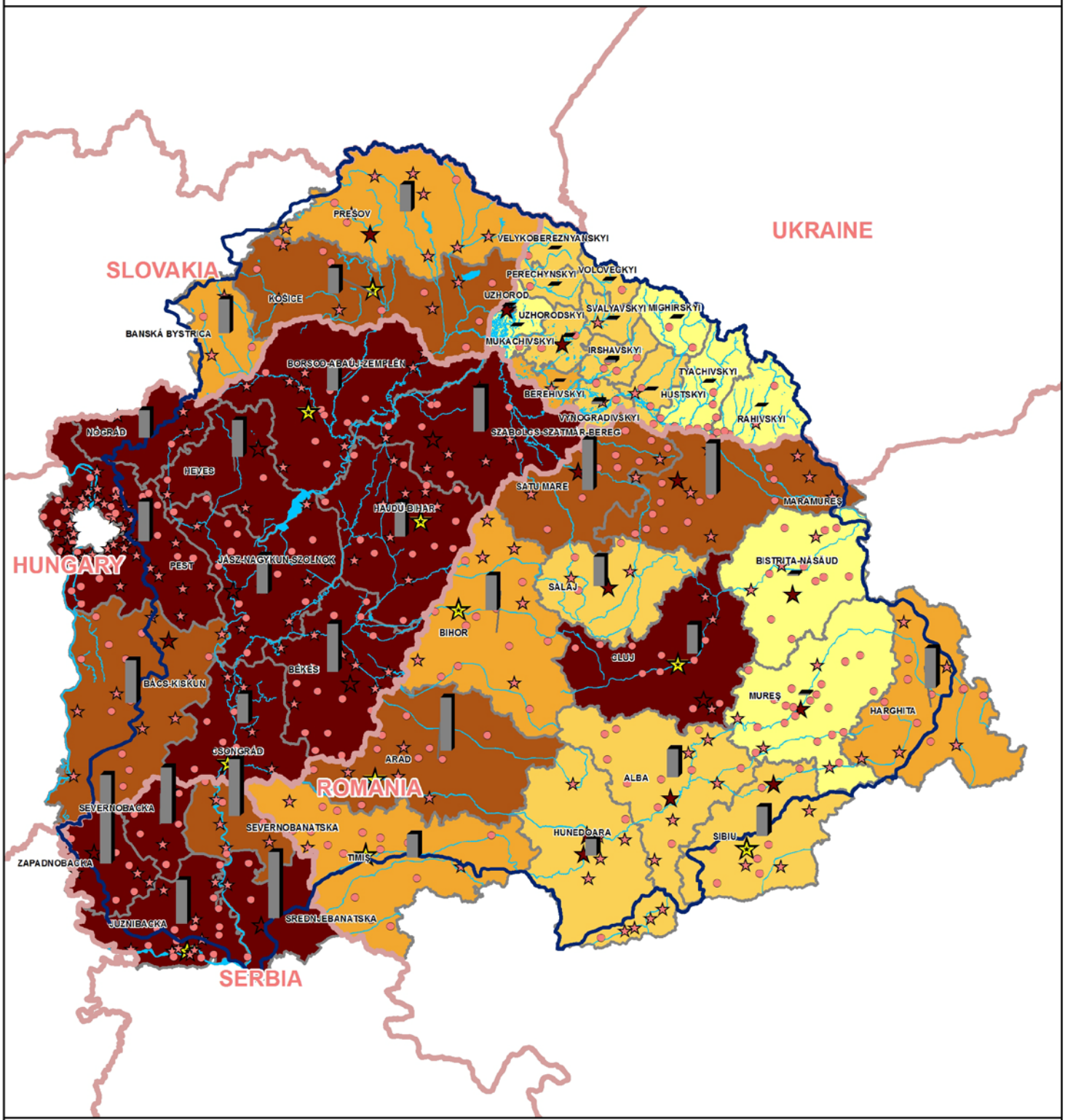


Tisa Basin
Country border
County border
Major Water

Municipality structure
- 5004 - 10000
- 10001 - 50000
- 50001 - 150000
- 150001 -

Share of dwellings or inhabitants with running water 2007*
- 29% - 45%
- 46% - 65%
- 66% - 77%
- 78% - 85%
- 86% - 100%

Share of dwellings supplyed with running water only (no public sewage supply) 2007

** For Romania the data is estination and is based on calculation of various available indicators*

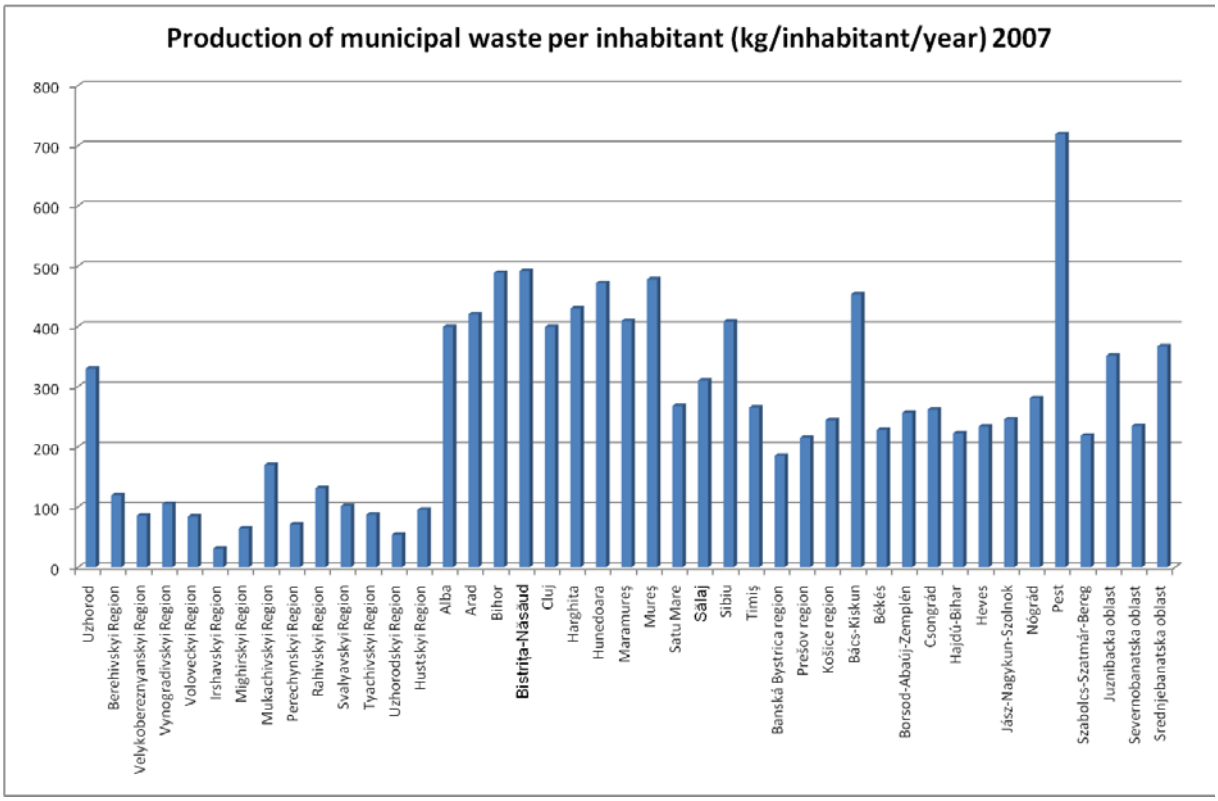
SOURCE
Ukraine: State Statistic Service of Ukraine
Romania: National Institute of Statistic
Slovakia: Statistical Office of the SR
Hungary: TEiR
Serbia: Statistical Office of the Republic of Serbia

III.4.5. Waste management

One of the most significant environmental problems in Tisa region are persistent weaknesses in the waste management – insufficient processing and further use of waste, low proportion of waste recycling.

Volume of household waste

The per capita rate of the volume of household waste is by far the highest in County Pest of Hungary. The volume of household waste is correlated with urbanisation. In the rural districts of Ukraine the volume of household waste is below the average, but the figure for Uzhorod is equal to or higher than the Hungarian and Slovakian averages. The volume is rather great in all counties of Romania, though there are differences between rural and urbanized counties. Assessments would be misleading because of the differences in registration and waste collection systems.



Waste management

In **Ukraine** at the present stage, there is no factory for processing hard human refuse in the territory of the **Zakarpatska Oblast**. Potential there is a creation of refuse-processing factories is possible, proceeding from the territorial distribution of volumes of waste accumulation. Thus, the Regions, which are characterised by low volumes of waste accumulation, form an integral region, which divides other 7 Regions into two regions: the first one includes Uzhorodskyi, Mukachivskyi, Beregivskyi Regions, and the second one includes Vinogradovskyi, Hustskyi, Tiachivskyi and Rahivskyi Regions. It is considered expedient to create small refuse-processing factories in each of them.

In the **Romanian** Tisa River Basin the current situation on waste management can be characterized by:

- a degree of coverage with sanitation services of under 75% of the total population

- in rural areas, waste collection activity does not cover the whole territory because of higher costs and a low level of income. lack of extensive programmes of separate collection at source of the recycling waste;
- the most used collection of domestic waste is non-selective, mixed collection, selective collection has begun only in the major urban centres, lack of waste treatment facilities (minimization of quantities and recycling) (waste sorting stations, composting plants);
- exploitation of certain non-compliant municipal deposits and rural waste dumps.

It is necessary to implement an integrated household solid waste management system (separate collection system of household waste by fractions, separate collection of green waste from individual homes, construction of sorting stations, closure of the last municipal household waste deposits) supported by an investment plan.

In **Slovakia** the most common way of hazardous waste and other waste disposal is recycling and landfilling. Out of overall production of waste about 50% is recycled, 40% is landfilled and approximately 1% is burned by means of incineration process. One of the important factors in the sustainable development in waste processing is recycling and reuse of waste.

In **Hungary** the quantity of municipal solid waste has showed a decreasing tendency, after an increase registered during the previous years. In 2008, most part of the municipal solid waste (80%) was collected using traditional methods, and only 17% of the waste was collected in a selective way, the remaining waste through bulk waste collection actions and cleaning of public areas.

As a result of regulatory requirements, the proportion of households involved in regular waste collection has continued to increase over the last years and reached 92.3% in 2007. The lowest and the highest values are registered in the south part of the Great Plain and Central Hungary, respectively.

In Hungary, most of the municipal solid waste is disposed, but the quantity of disposed waste decreased during the period between 2003 and 2007 by more than 6% (83.4%), while the quantity of used municipal solid waste increased accordingly (16.6%) due to energy use (burning) and reprocessing. 99.6% of the municipal solid waste disposed was stored, and only 0.4% was burned without energy use, including in the Kecskemét and Püspökladány micro-regions. In the other micro-regions, 100% of the waste was disposed by storage.

In 2007, 16.6% of the municipal solid waste collected was used, which means a significant increase of 8.8% compared to 2003. This increase is due, on the one hand, to the development of the selective collection and separate treatment of bio-wastes, and the other hand, to complying with the requirements concerning the use of packaging and electronic waste covered by the producers' responsibilities.

The current situation on waste management in **Serbia** can be characterized by:

- The most used collection of domestic waste is non-selective, mixed collection, selective collection has begun only in the major urban centres.
- a degree of coverage with sanitation services is about 90% of the total population in the Serbian Tisa River Basin;
- lack of extensive programmes of separate collection at source of the recycling waste;
- lack of waste treatment facilities (minimization of quantities and recycling) (waste sorting stations, composting plants);
- exploitation of certain non-compliant municipal landfills and waste dumps.

Landfills, incineration plant

As of the early 2008, in **Ukraine** territory of the **Zakarpatska Oblast** registered were 310 places of waste removal with a total area of 216 hectares whereon about 1,14 million tons of industrial and human refuse have been accumulated. Of them 6,2 thousand tons belong to hazardous waste.

In **Romania** in the studied area there are more than 100 non-compliance landfills. Many landfills were reaching capacities and will be closed step by step, according *G.D. no. 349/2005 regarding waste landfilling*. According to the Landfill Implementation Plan, after the date of Romanian European accession landfills which have stoped landfilling will be closed, according to the requirements of Directive 1999/31/EC and respecting the Romanian legal previsions in force. The Landfill Implementation Plan, foresees the closure of all these landfills, replaced by new county centralized sanitary landfills. In the rural area have been recorded a large number of illicit dump. These dump sites have had to be closed and remediated by 2009.
The non-compliant landfills from urban area covered the most extended surfaces in Alba, Bihor, Maramureş, Satu Mare Counties (over 20 ha total size). There are landfills in Alba, Bistriţa-Năsăud, Bihor, Maramureş, Mureş, Sălaj, Satu Mare and Timiş Counties which could have stopped landfilling until the date of the study, as the closure term was 2009.
Hazardous waste landfills (mainly sterile dump, flotation ponds, uranium waste dumps, chemical industry waste) are mostly inappropriate managed. Most hazardous waste landfills are in Alba, Arad, Maramureş, Harghita, Sălaj and Hunedoara Counties.

Waste disposal in **Slovakia** is realized mostly by landfilling and incineration processes. The total amount of landfills in the target area is 33. There are 15 landfills in the Košice Region. Out of these there are 3 landfills for hazardous waste, 10 landfills for non-hazardous waste and 2 landfills for inert waste. In the Prešov region there are 14 landfills, all of them are for non-hazardous waste. In the Banská Bystrica there are 4 landfills, 3 are used for landfilling hazardous waste and 1 for inert waste.
In the target area there are 4 incineration plants. Near Košice in Kokšov - Bakši is the incineration plant for municipal waste. Incineration plant for industrial waste is in Strážske and in Turňa nad Bodvou there is is the incineration plant for municipal waste The newest and the technically most modern one the is incineration plant for hazardous waste in Veľký Šariš.

In the 90's there were almost 2,700 landfills in **Hungary**, and only 30% of these complied with the relevant requirements. The number of landfills has gradually decreased during recent years, primarily due to the development of regional landfills.
In a national survey concerning municipal solid waste landfills, conducted in 2007, there were 2,667 landfills, of which 1,300 are already out of order, while 1,367 are still in operation. By 2008, the number of operational landfills was reduced to 205. Of these, 70 landfills may continue to operate even after 2009. In 2009, a number of 39 landfills were operational or under construction.

According to the Waste Management Strategy of the Republic of **Serbia** for the period 2010-2019, there are more then 60 **landfills for communal waste** within the TICAD area. At the level of the Serbian Tisa catchment area, there are more than 100 dumps.