GreenInfranet – Best Practice Transfer: Spatial planning tools for the protection of natural values in Hungary

Spatial planning Support System

Executive summary

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Coordinator	*Réka Prokai (REC)*
Project leaders:	*Krisztián Schneller*
	Vilja Vaszócsik
Experts:	*Annamária Göncz*
	Krisztina Magócs
	Anna Sárdi
	Gergő Szankó
	Ágnes Tóth
	Péter Tóth

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I. Summary

Green infrastructure concept

As a component of EU policy, the green infrastructure concept was introduced in the 2009 European Commission White Paper on Adapting to Climate Change (COM [2009] 147 Final). According to the EC, green infrastructure is "essential to mitigate fragmentation and unsustainable land use both within and outside Natura 2000 areas and to address the need for and multiple benefits of maintaining and restoring ecosystem services" (background paper, Green Infrastructure Implementation Conference, November 19, 2010).

Green infrastructure is an emerging concept in many European regions where new approaches to biodiversity conservation are developing in a broader policy and implementation framework. Green infrastructure aims to conserve biodiversity by strengthening the coherence and resilience of ecosystems, while at the same time contributing to climate change adaptation and reducing vulnerability to natural disasters. The green infrastructure concept also contributes to the creation of a sustainable economy by maintaining ecosystem services and mitigating the adverse effects of transport and energy infrastructure and economic development in general.

Biodiversity conservation has traditionally been pursued through nature conservation measures formulated in isolation from broader land-use and economic development policies. Green infrastructure places biodiversity conservation within a broader policy framework, in which primary nature conservation objectives are achieved in close harmony with other land-use objectives related, for example, to agriculture, forestry, recreation and climate change adaptation.

For the introduction of green infrastructure concept into Hungarian planning practice, similarly to many other European countries, primarily the basic data on open areas and the assessment of territorial decisions on the long-term functions and use of the area are missing. The green infrastructure network can be implemented properly to the national concept, but only with the participation of the local decision-makers and stakeholders. For this, it is indispensable to ensure widespread information for the open public on the state of the ecological environment, landscape function and socio-economic value of the open areas at the preparation phase of the decision process.

Best practice transfer

The Greeninfranet project aims to strengthen the development and implementation of green infrastructure in EU regions. This can be achieved through exchanging experience and by identifying, analyzing and transferring good practices for the implementation of green infrastructure policies. One of the successful examples of the planning methodology aiming the integration of green infrastructure concept into development planning is the regional development Plan for the Metropolitan Region of Barcelona. During the development of the plan the Barcelona Provincial Council main aim was to provide information and criteria to

support local administrations in their land planning and management responsibilities and to strengthen their participation in regional projects affecting them. Since 2001, Barcelona Provincial Council has therefore been drawing up a territorial information system, the project **SITxell (acronym in Catalan for Territorial Information System for the Network of Open Areas in the province of Barcelona)**, which contains a categorization and assessment of non-urban land based on the analysis of its ecological and socioeconomic characteristics.

In brief, the main objectives of the SITxell project are:

General objectives:

- *To provide **accurate, reliable and useful knowledge** about the ecological and socioeconomic values of natural areas to assist land use policies.*
- *To use a **multidisciplinary analysis tool**, based on a landscape ecology approach, to support spatial land planning and other specific land use decisions.*
- *To make decision-makers and land use planners at different political and territorial levels aware of the need for an **integrated approach to land use planning and management**.*
- *To develop a public and private consensus and partnership to publicize the **importance of ecosystems and the goods and services** they provide and the need to incorporate them into all land policies.*

Specific objectives:

- *To make use of a **Geographical Information System** (GIS) scheme, based on accurate multidisciplinary information and assessment, to support land planning processes at the Barcelona Provincial Council.*
- *To offer land-analysis information and **technical support to the municipal councils** of the Province of Barcelona, to be applied at the municipal planning level.*
- ***To collaborate with the Government of Catalonia**, to ensure that strategic regional planning is based on precise data on open areas and incorporates an ecological approach.*
- ***To communicate the benefits of healthy ecosystem** and functional landscapes, planned and managed from an integrated point of view, to the various (public and private) agents at the different levels (local, regional, State, European).*

Structure:

*SITxell is a land information system organized in **thematic modules**. These include the different aspects involved in the definition of intrinsic and strategic interest of open areas and they allow an analysis of the significance of these areas on the basis of their geological, botanical, faunal, ecological, social and economic characteristics, using both **basic parameters** and **complex indicators**. The conceptual structure of the system is as follows:*

1. ***Environmental Modules**. These include geology, hydrology, flora, vegetation and habitat, fauna, landscape ecology, cultural heritage and landscape.*
2. ***Land-use Modules**. These include socioeconomics, general and specific land policies and laws, urban planning, transport infrastructure and technical services.*

*Each module consists of several **layers of basic information** – some already existing, while others have been created from scattered information or newly generated –, and **layers of***

***specific evaluation**, which are the result of expert assessment and the weighting of various parameters by the project partners.*

In the frame of the Interreg IVC program supported GreenInfranet project, the SITxell project was introduced and selected as good practice to be transferred into the Hungarian spatial planning practice throw pilot action. This study introduces the results of the "best practice transfer" action, the Hungarian **Territorial Information System for Supporting Spatial Planning (TIS-SP)** serving the implementation of the green infrastructure concept and also summarizes the suggested steps for the further development of the system. The system was developed for two Hungarian micro-regions, using the spatial data and researches available within national conditions.

Territorial Information System for Supporting Spatial Planning (TIS-SP)

In accordance with the Catalonian example, the main tasks of the system to be developed are:

- to serve easily available information in the early phase of the decision making and planning processes,
- to serve unified, easy to understand territorial information on the ecological, landscape and socioeconomic values of a certain area,
- to help the integration of landscape and ecological aspects to the development process of spatial planning and policy making,
- to establish public and equally available database for all spatial actors,
- to give information on higher level and neighboring area's plans.

The structure of the ***TIS-SP***:

I. Indicators of the natural values

- **Nature protection information indicator**
  The indicator map represents the nature- and landscape protected areas which are protected by law in accordance with the restrictive power of the protection measures.
  The basic data of the indicator map are:
    - National Ecological Network,
    - Natura 2000 areas,
    - Nature protection areas,
    - Ex lege protected areas,
    - Zone of Areas of Special Landscape Protection.
- **Natural value indicator**
  The indicator determines the natural value of an open area.
  The basic data of the indicator map:
    - MÉTA research – Flora-based nature capital index,
    - biotics monitoring data.

II. Indicators of forestry and agricultural areas

- **Development restriction on agricultural and forest area**
  The indicator map represents the restrictions in terms of forestry and agricultural areas in a unified system.
  The basic data of the indicator map:
  - Zone of Excellent-quality Forest Areas,
  - Forestry areas and their primary function according to the National Forest Stand Database,
  - Zone of areas for afforestation,
  - Zone of Excellent-quality Arable Land,
  - Zone of Good-quality Arable Land,
  - I-II. class areas of grape- and fruit production site register,
  - Production sites with better quality than average (demarcation based on register maps)
- **Indicator of importance of forest areas**
  The indicator based on a unified evaluation of the importance of the assessed are for forestry.
  Data used for the indicator map:
  - Forests by primary function
  - Excellent quality forest area
  - Naturalness of forest
  - Suitability for afforestation
- **Indicator of importance of agricultural activities**
  The indicator based on a unified evaluation of the importance of the assessed are for agricultural activities.
  Basic data used for analysis of the agricultural areas:
  - Agricultural land use,
  - Soil suitability for plant production
  - Nitrate sensitivity
  - Estimated actual soil loss (erosion risk)
  - Soil sensitivity (regarding physical and chemical soil degradation)

III. Residential and industrial/commercial development target areas

- **Suitability indicators of residential and industrial/commercial areas**
  The map shows a development-oriented unified evaluation of open areas
  The basic data of the indicator:
  - The land use change processes (neighbourhood relations),
  - Physical suitability,
  - Accessibility,
  - Regulatory restrictions.
- **Residential and industrial/commercial development target areas indicator map**
  The map shows the modelled future development areas defined by regional demand

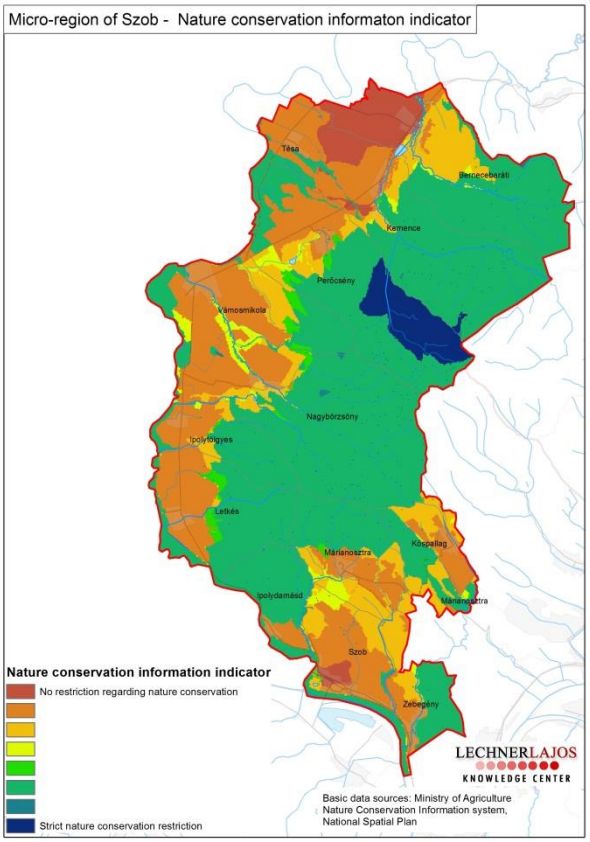
The basic data of the indicator:

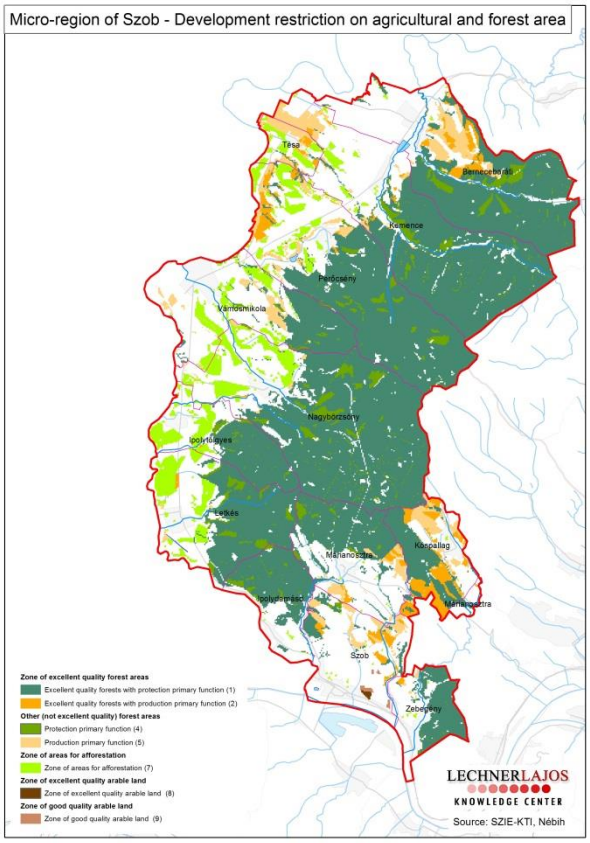
- the suitability indicators of residential and industrial/commercial areas,
- the evolution of the demand for 2030 for the settlement and economic areas determined on the basis of the scenario which was developed according to the actual socioeconomic trends and the accepted national developing plans

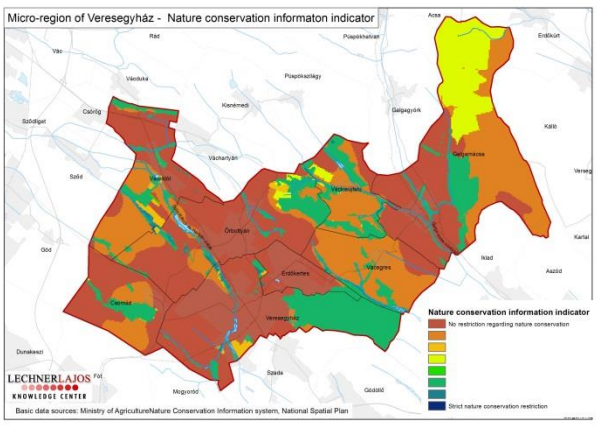
Results on the pilot areas

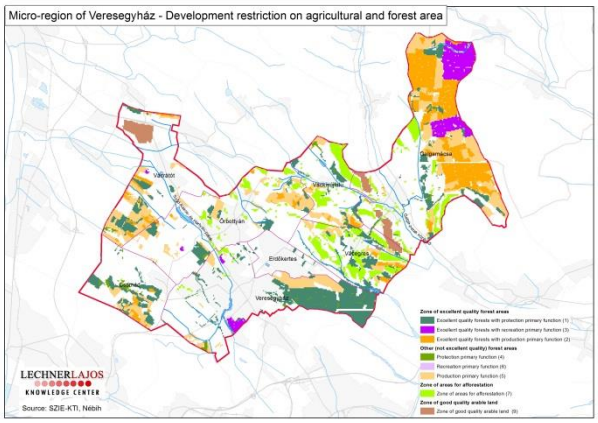
The territorial information system contains the 50x50 m rasterized result maps developed in the unified national grid for the seven indicators presented above for the Szobi and Veresegyházi micro-regions. The use of the unified grid makes it possible to expand the system and to examine further areas.

Two of the seven result maps (Nature protection information indicator, Development restriction on agricultural and forest area) summarize the regulations of the valid spatial plans and current sectoral legislations. These rules must be taken into consideration during development planning.
(in details:II.1.1. Nature protection information indicator II.2.1. Spatial planning and sector development restrictions in forest and agricultural areas ***)***

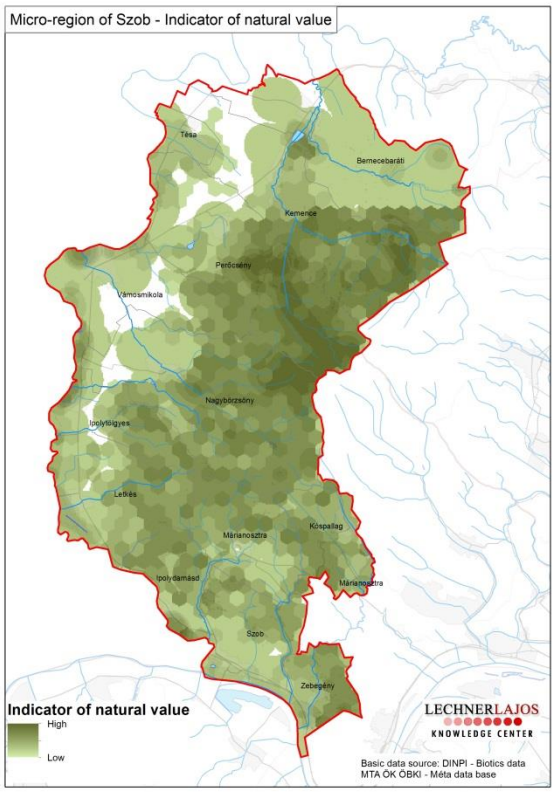


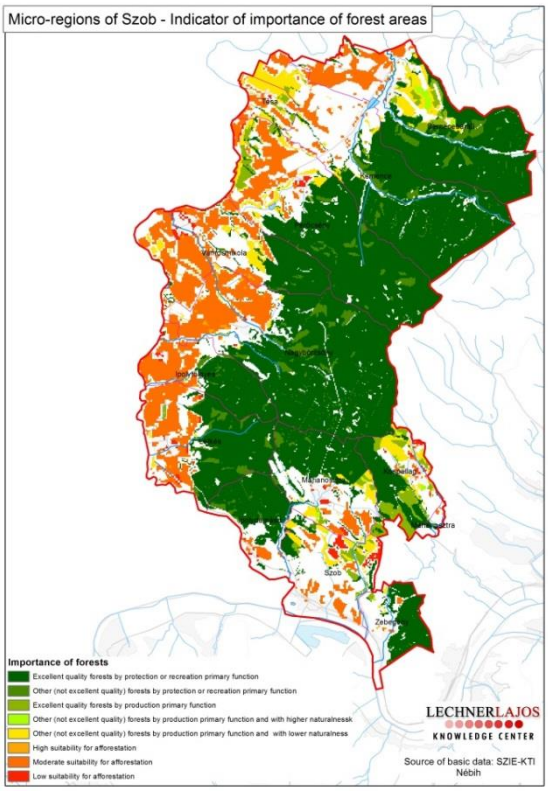


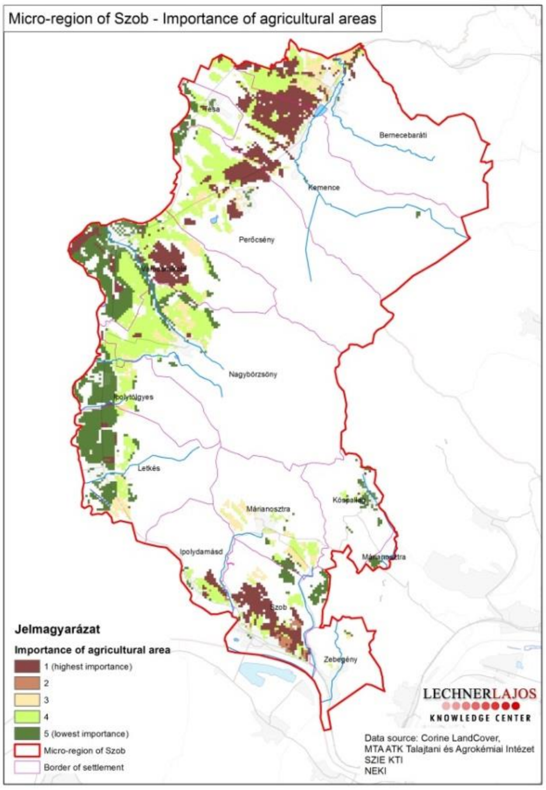


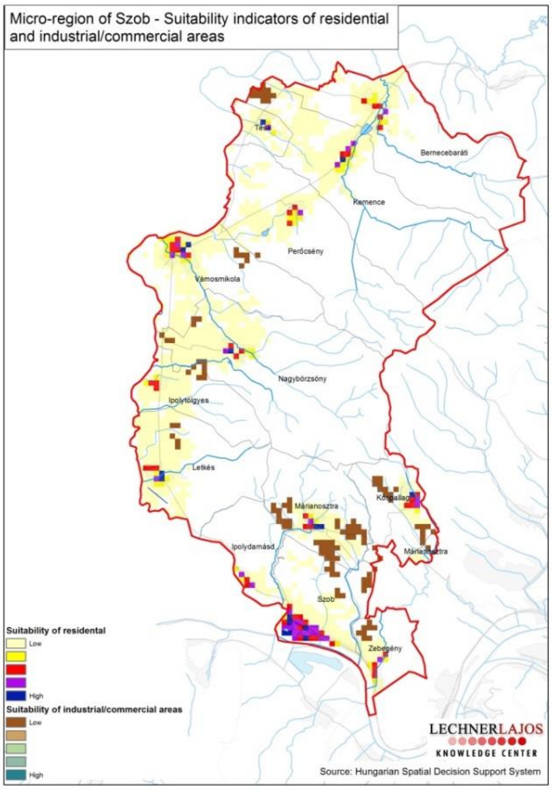


Four further indicator maps serve the spatial decision-preparation giving an evaluating scale according to one sectorial aspect. These maps represent the natural value, the forest- and agriculture-definiteness and the development competence of the open areas. The primary aim of the indicators is to help the preparation of the decisions with information.
(in details: II.1.2. Natural value indicator II.2.2. Indicator of importance of forest areas II.2.3. Evaluation of agricultural areas II.3.1. Suitability indicators of residential and industrial/commercial areas)






Micro-region of Szob - Importance of agricultural areas
Bernecebaráti
Kemence
Perőcsény
Nagybörzsöny
Ipolytölgyes
Letkés
Márianosztra
Ipolydamásd
Szob
Zebegény
Jelmagyarázat
Importance of agricultural area
1 (highest importance)
2
3
4
5 (lowest importance)
Micro-region of Szob
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Data source: Corine LandCover,
MTA ATK Talajtani és Agrokémiai Intézet
SZIE KTI
NEKI


Micro-region of Szob - Suitability indicators of residential and industrial/commercial areas
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Márianosztra
Ipolydamásd
Szob
Zebegény
Suitability of residental
Low
High
Suitability of industrial/commercial areas
Low
High
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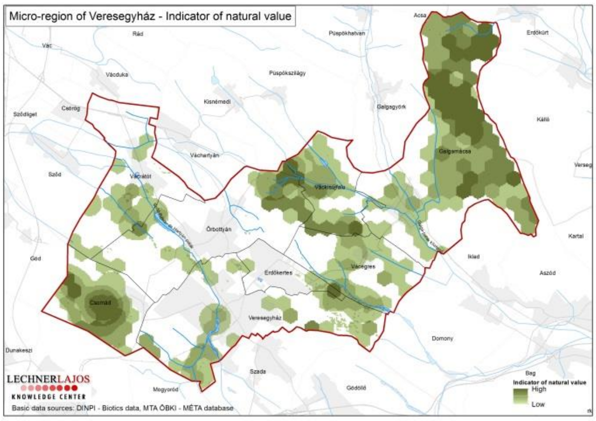
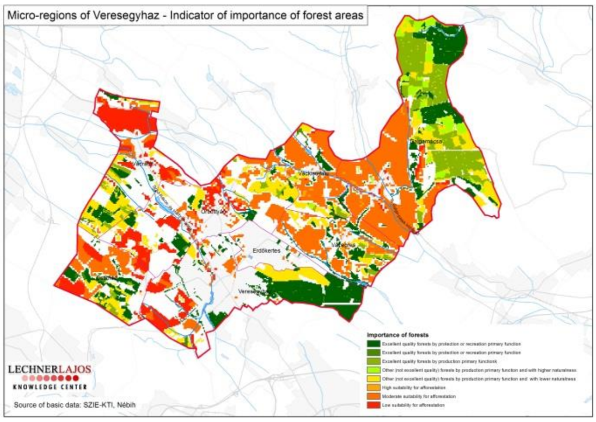
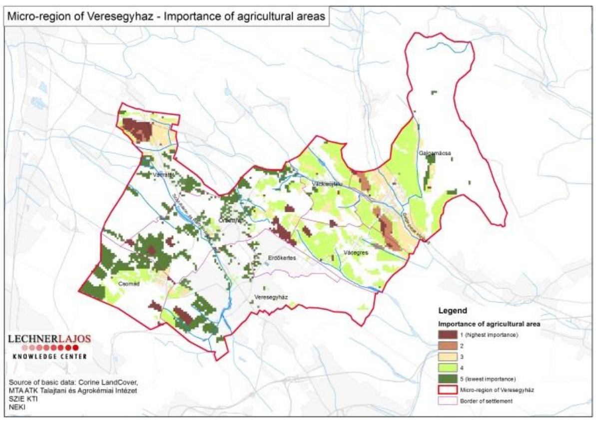
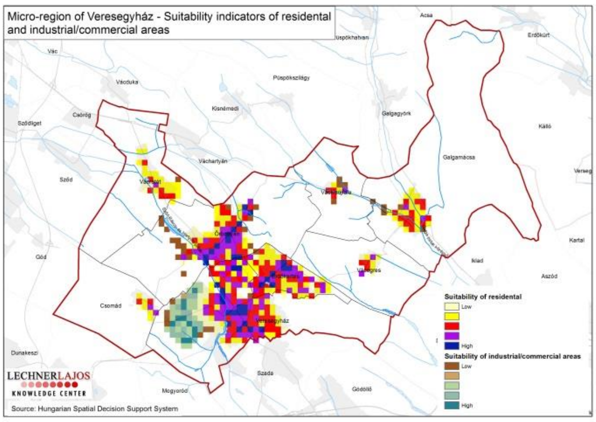
Source: Hungarian Spatial Decision Support System


Micro-region of Veresegyház - Indicator of natural value
LECHNERLAJOS
KNOWLEDGE CENTER
Basic data sources: DINPI - Biotics data, MTA ÖBKI - MÉTA database
Indicator of natural value
High
Low


Micro-regions of Veresegyház - Indicator of importance of forest areas
Importance of forests
LECHNERLAJOS
KNOWLEDGE CENTER
Source of basic data: SZIE-KTI, Nébih


Micro-region of Veresegyhaz - Importance of agricultural areas
Legend
Importance of agricultural area
1 (highest importance)
2
3
4
5 (lowest importance)
Micro-region of Veresegyház
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Source of basic data: Corine LandCover,
MTA ATK Talajtani és Agrokémiai Intézet
SZIE KTI
NEKI


Micro-region of Veresegyház - Suitability indicators of residental and industrial/commercial areas
Suitability of residental
Low
High
Suitability of industrial/commercial areas
Low
High
LECHNERLAJOS
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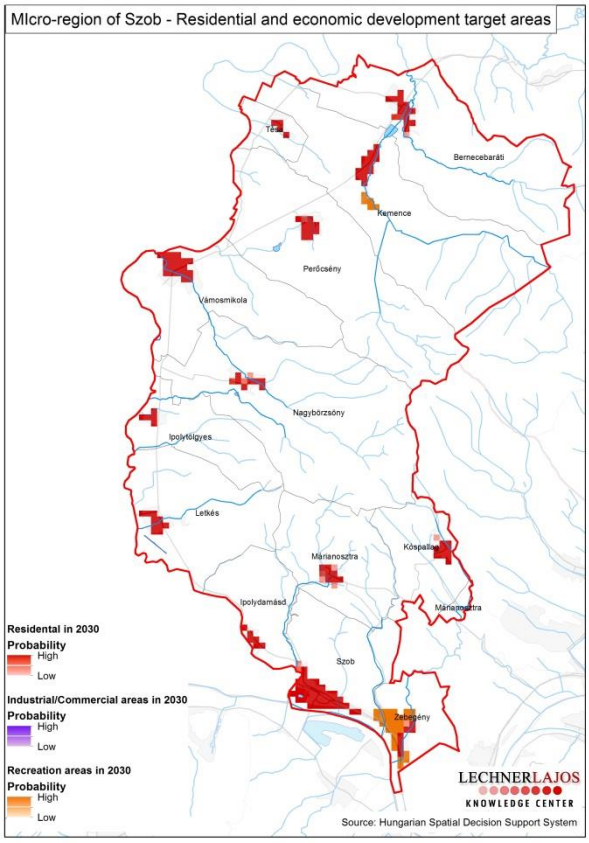
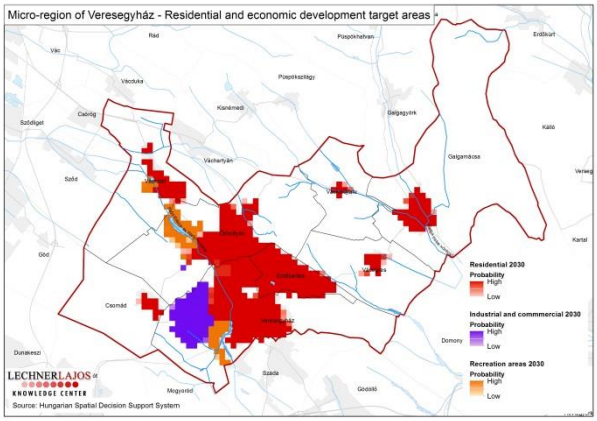
Source: Hungarian Spatial Decision Support System

The seventh indicator map of the information system is the Residential and economic development target areas indicator map which is a land use model for 2030 and was developed on the actual known trends, plans and regulations based scenario. The indicator map helps the local decision-makers to know and adapt the regional level development determined by national processes.
(in details: II.3.2. Residential and economic development target areas indicator map)





In accordance with the example of Barcelona we have developed the territorial information system for two micro-regions, in which we have developed in an unified approach and according to unified evaluating aspects the indicator maps concerning to the naturalness, forestry- and agricultural and developing competence.
In the frame of this work we have tested the system on two different but small micro-regions of the central-Hungarian region; however for the development of the information system it is necessary to collect data and testing the system on other and larger areas.

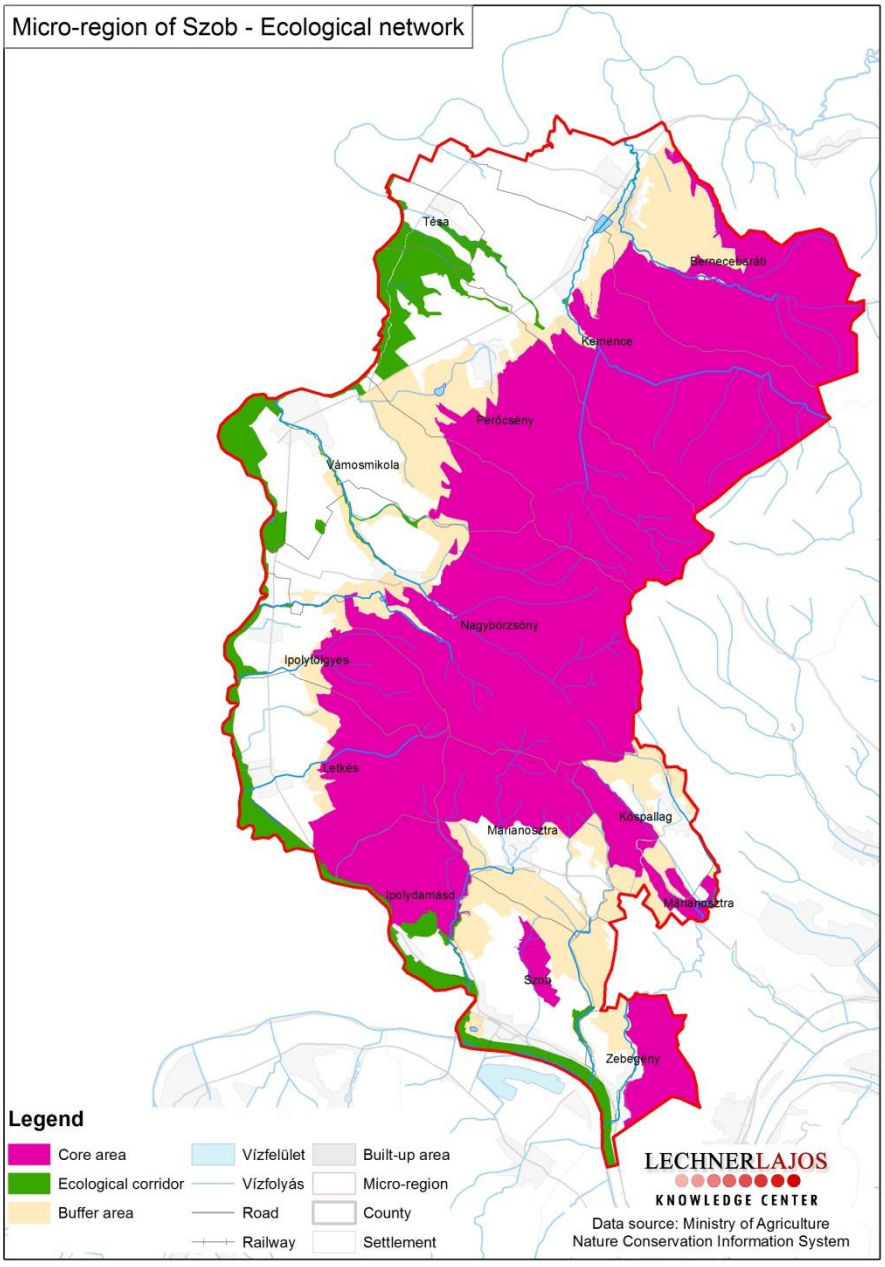
II. Elaboration of the indicators

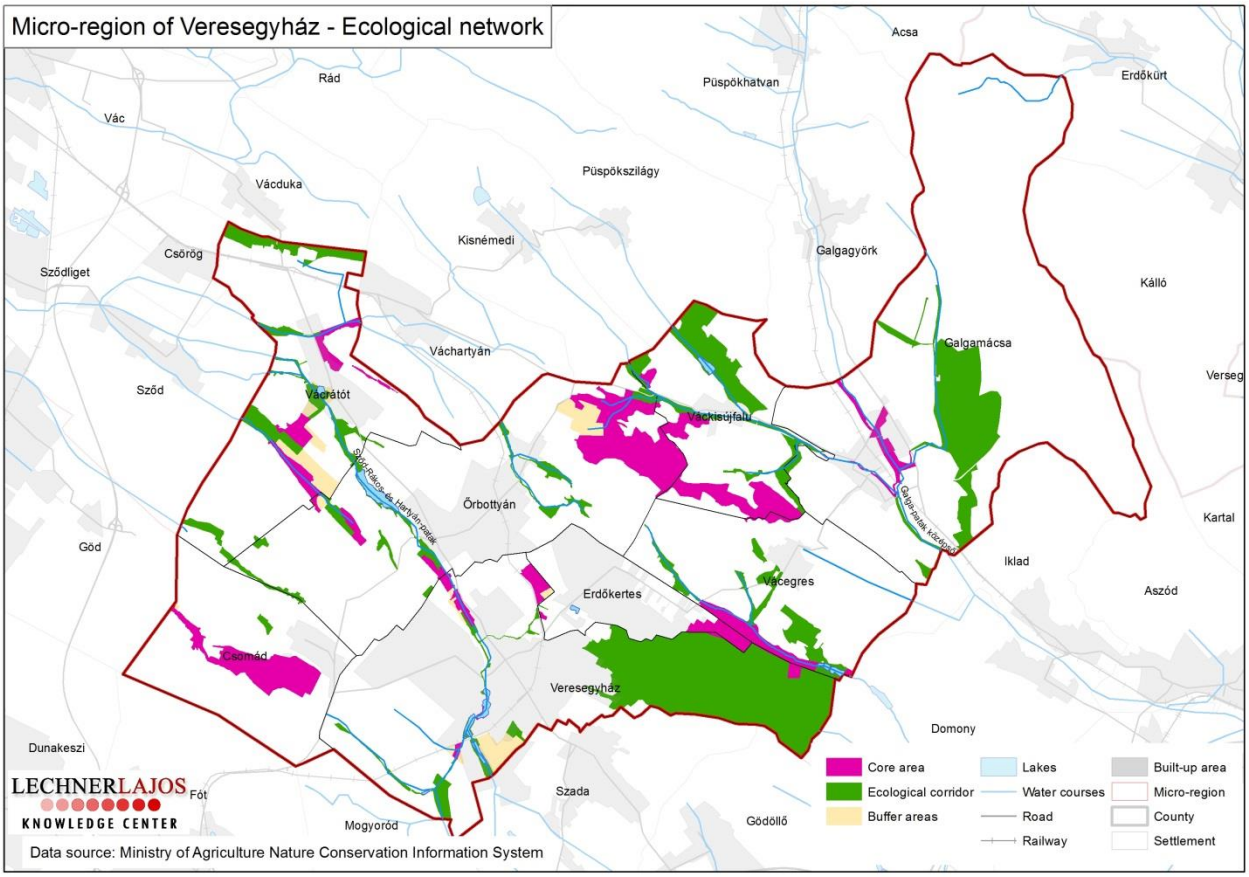
II.1. Indicators of natural values

II.1.1. Nature protection information indicator

National Ecological Network

Data source: National Spatial Plan (OTrT), Nature Conservation Information System




Micro-region of Veresegyház - Ecological network
Acsa
Rád
Püspökhatvan
Erdőkürt
Vác
Vácduka
Püspökszilágy
Kisnémedi
Csörög
Galgagyörk
Sződliget
Kálló
Váchartyán
Galgamácsa
Verseg
Sződ
Vácrátót
Váckisújfalu
Örbottyán
Kartal
Göd
Iklad
Vácegres
Aszód
Erdőkertes
Csomád
Veresegyház
Domony
Dunakeszi
Fót
Szada
Mogyoród
Gödöllő
Core area
Ecological corridor
Buffer areas
Lakes
Water courses
Road
Railway
Built-up area
Micro-region
County
Settlement
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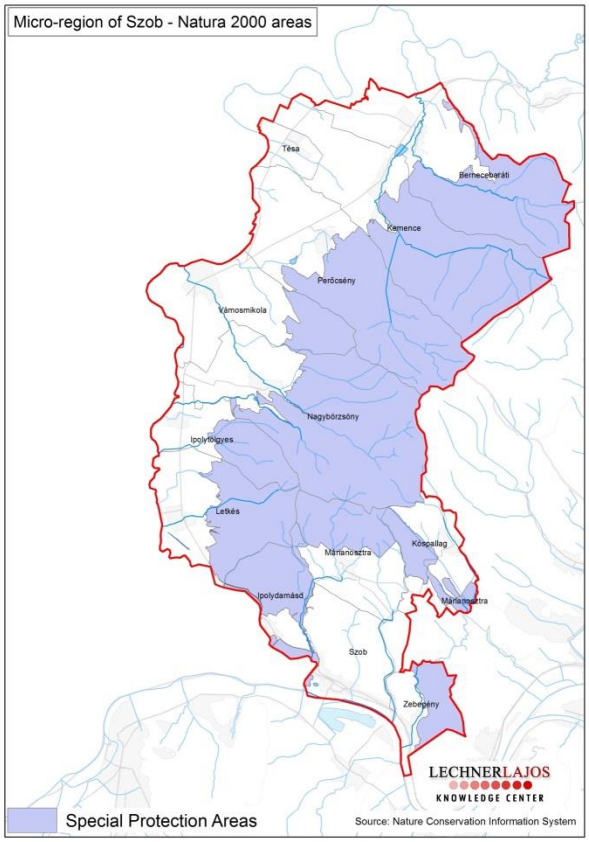
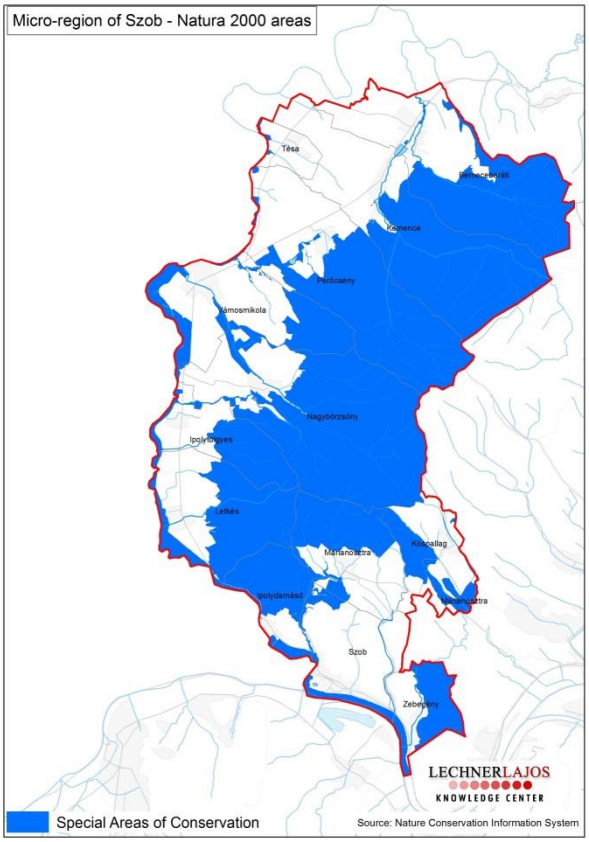
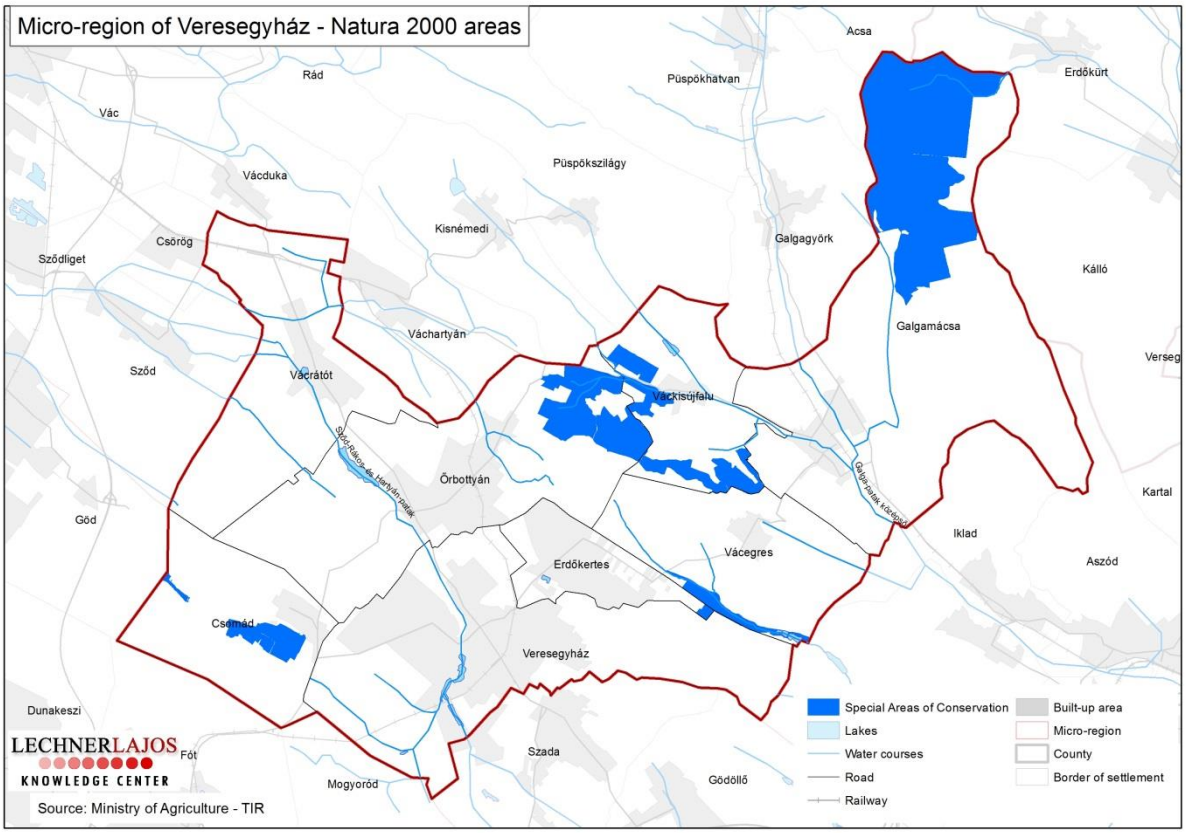
Data source: Ministry of Agriculture Nature Conservation Information System

Natura 2000 areas

Data source: Nature Conservation Information System





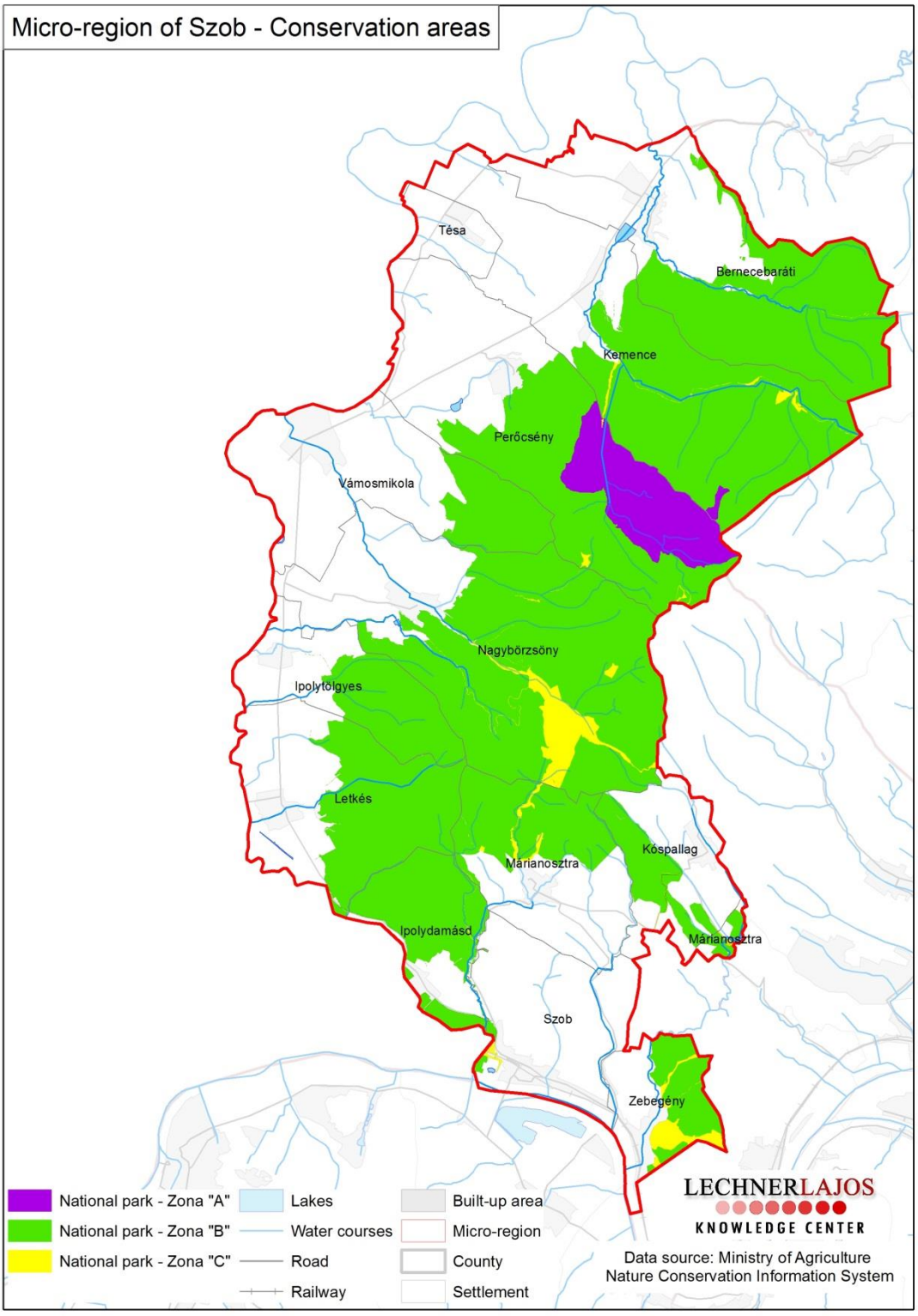


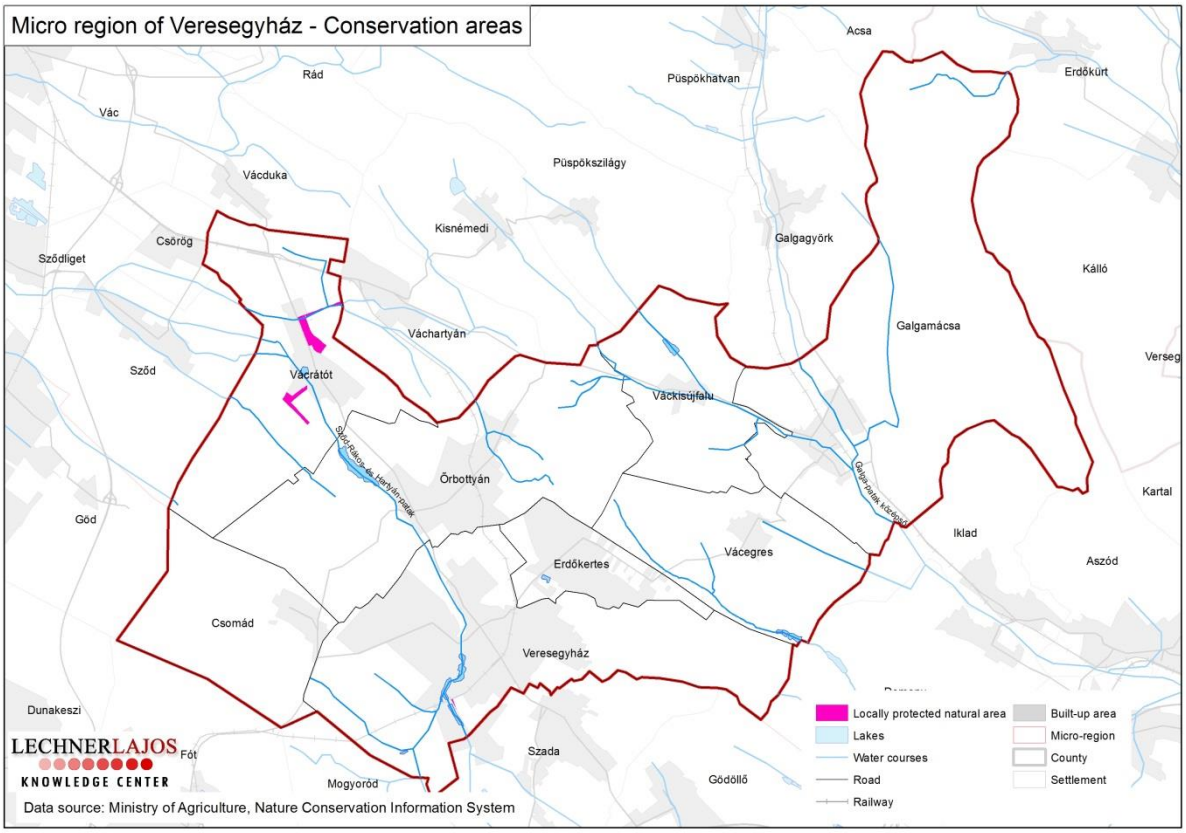
1

[1] There is no special protection area in the micro-region of Veresegyhaz

Protected Natural Areas

Data source: Nature Conservation Information System




Micro region of Veresegyház - Conservation areas
Acsa
Rád
Püspökhatvan
Erdőkürt
Vác
Vácduka
Püspökszilágy
Kisnémedi
Galgagyörk
Csörög
Sződliget
Kálló
Galgamácsa
Váchartyán
Sződ
Vácrátót
Vácszentlászló
Vácisújfalu
Örbottyán
Kartal
Göd
Iklad
Vácegres
Aszód
Erdőkertes
Csomád
Veresegyház
Dunakeszi
Fót
Szada
Mogyoród
Gödöllő
Locally protected natural area
Lakes
Water courses
Road
Railway
Built-up area
Micro-region
County
Settlement
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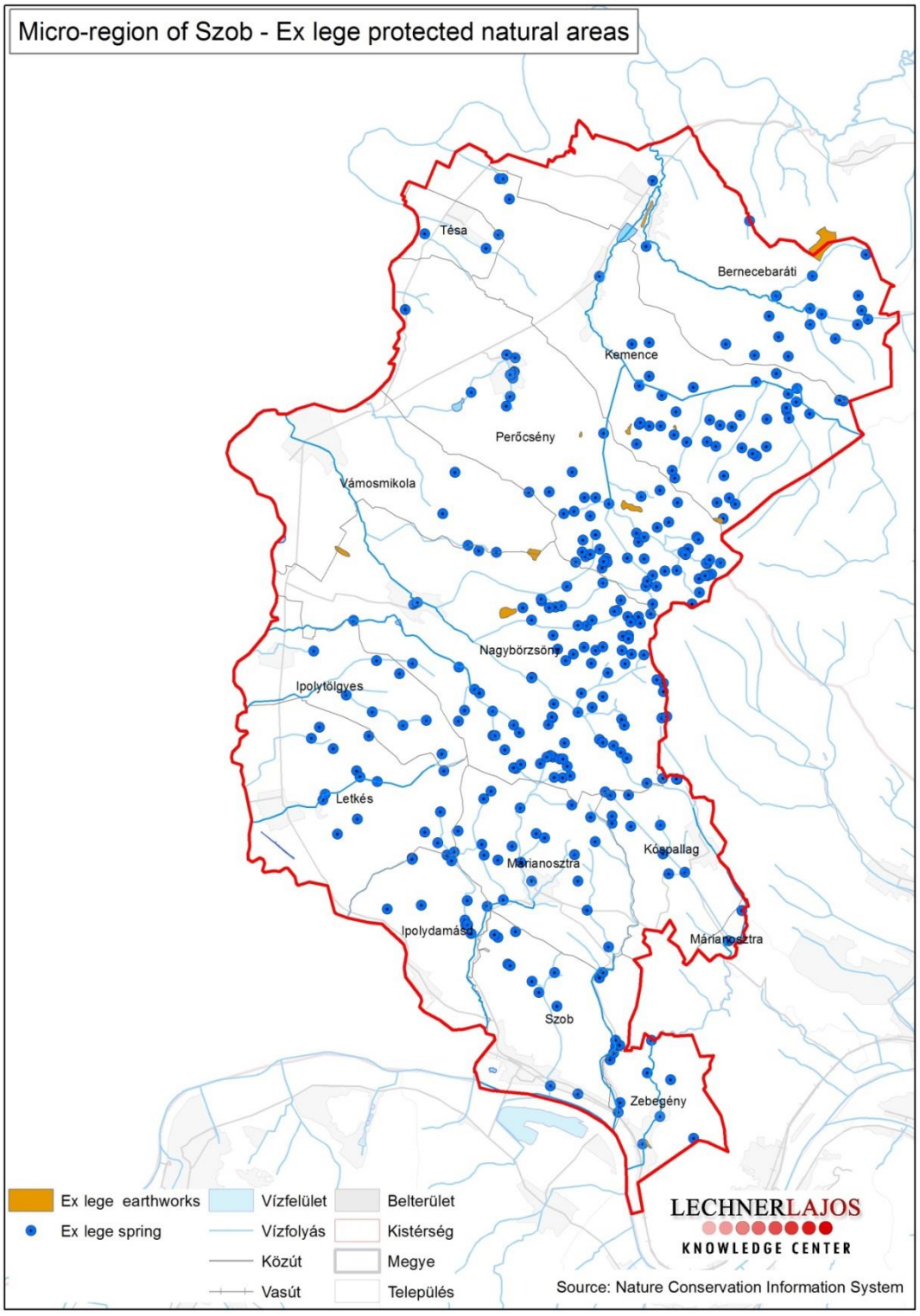
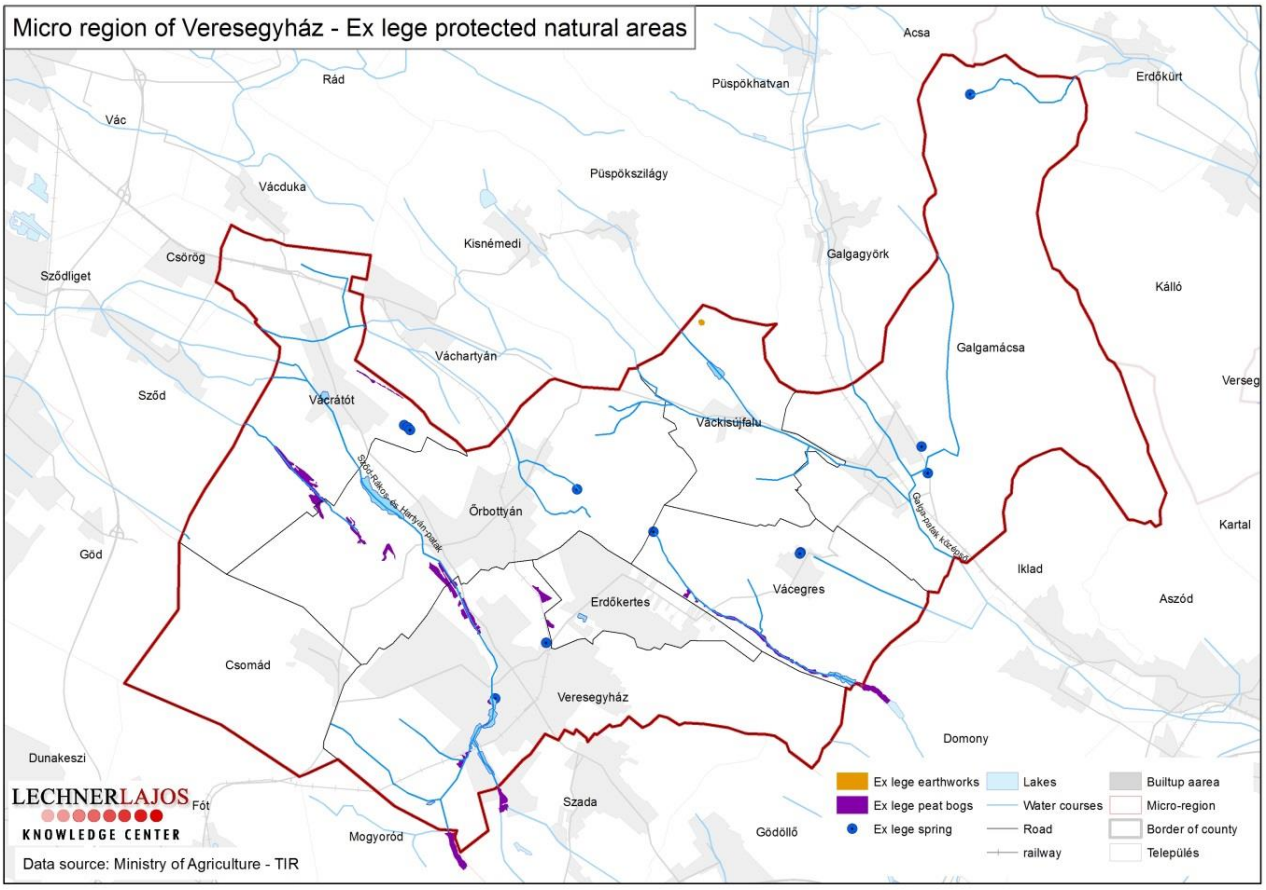
Data source: Ministry of Agriculture, Nature Conservation Information System

„Ex lege" protected natural areas

Data source: Nature Conservation Information System




Micro region of Veresegyház - Ex lege protected natural areas
Acsa
Rád
Püspökhatvan
Erdőkürt
Vác
Püspökszilágy
Vácduka
Kisnémedi
Galgagyörk
Csörög
Sződliget
Kálló
Váchartyán
Galgamácsa
Sződ
Vácrátót
Vácszentlászló
Örbottyán
Kartal
Göd
Iklad
Vácegres
Erdőkertes
Aszód
Csomád
Veresegyház
Domony
Dunakeszi
Szada
Fót
Mogyoród
Gödöllő
LECHNERLAJOS
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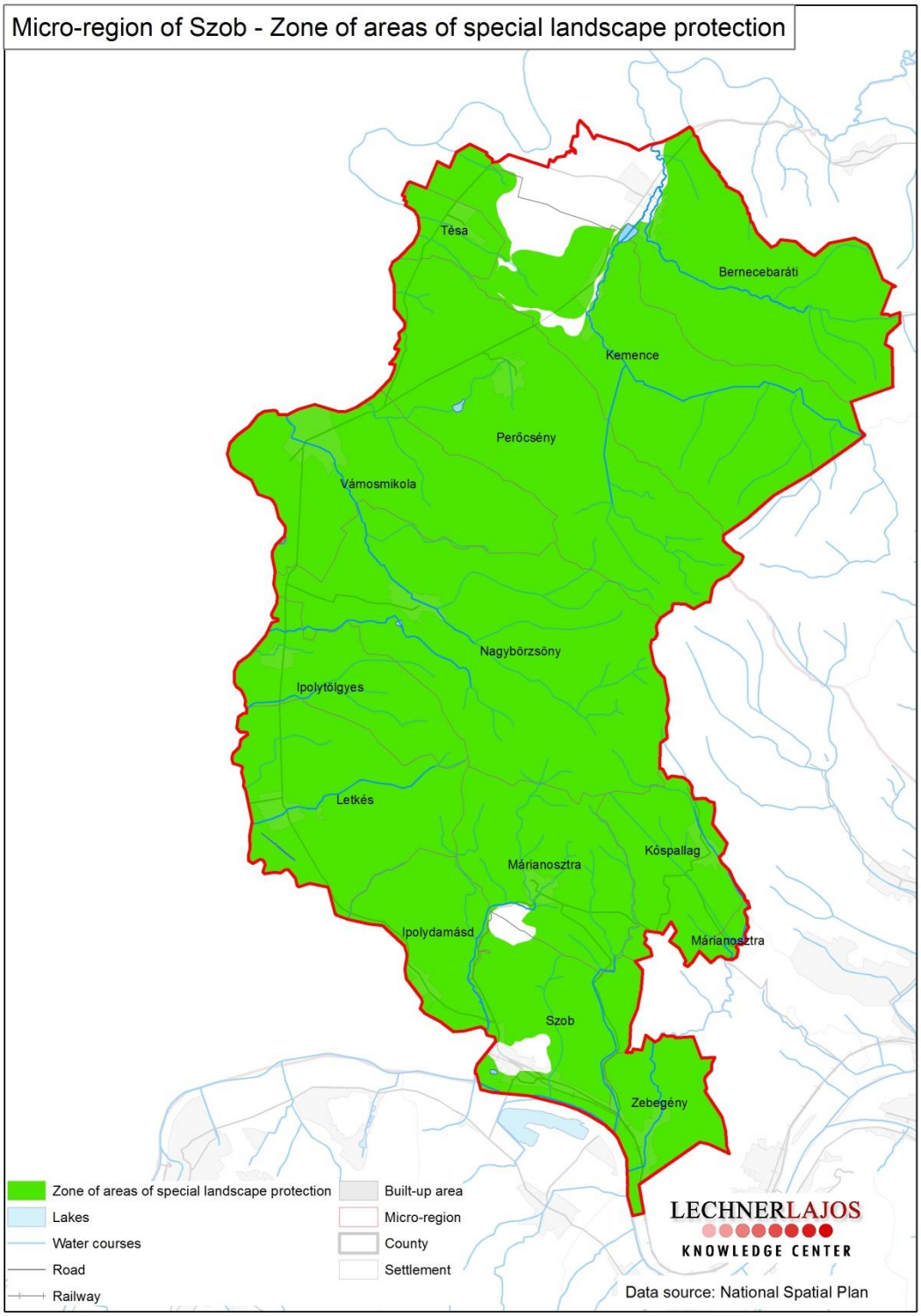
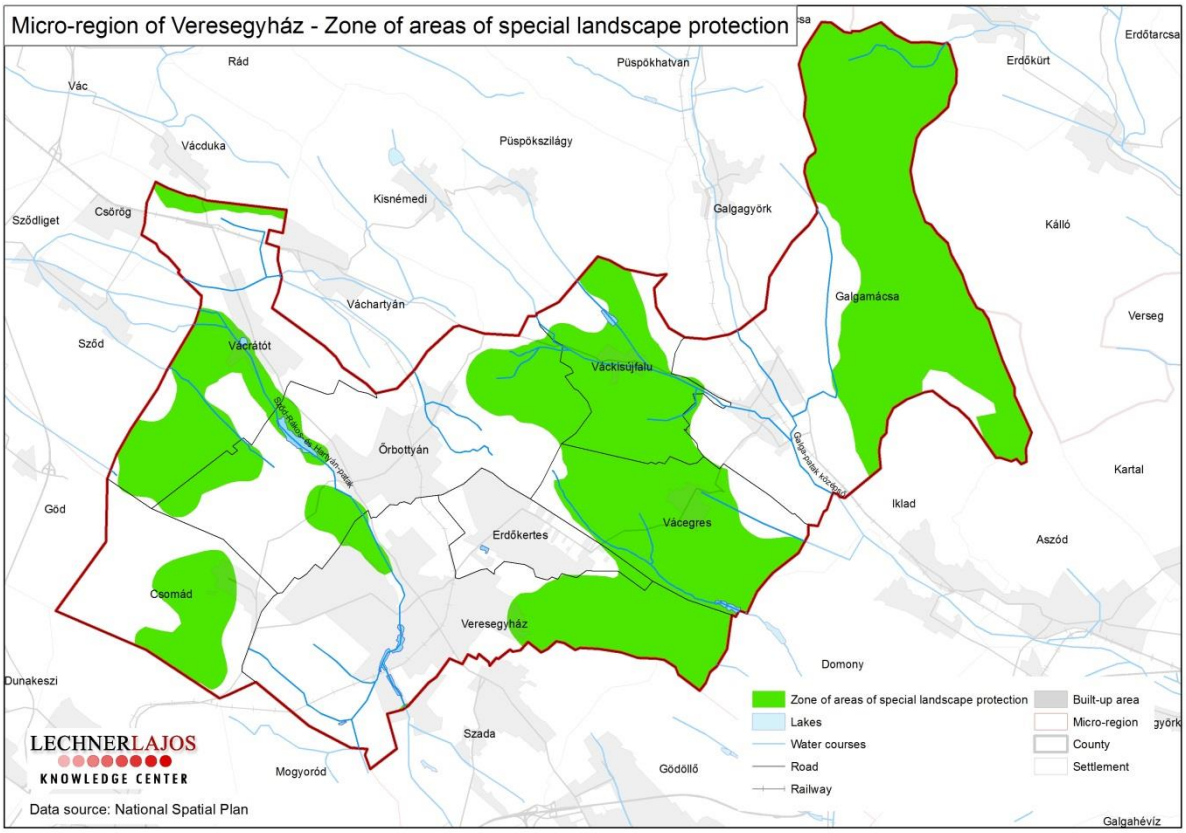
Data source: Ministry of Agriculture - TIR
Ex lege earthworks
Ex lege peat bogs
Ex lege spring
Lakes
Water courses
Road
railway
Builtup aarea
Micro-region
Border of county
Település

Zone of Areas of Special Landscape Protection

Data Source: National Spatial Plan of Hungary





Development of the nature conservation information indicator

The following table introduces the rules of spatial planning, urban development and master planning at certain protection categories.

Nature conservation category	**Nature conservation subcategory**	**Territorial and urban development aspects**	**Spatial and master planning aspects**	**Sequence according to the strength of protective restrictions**
Ecological network	Core area	Maintaining and further developing ecological network functions by developing green infrastructure elements	New built up area is strictly restricted	**3**
	Ecological corridor			
	Buffer zone		New built up area is weekly restricted	**6**

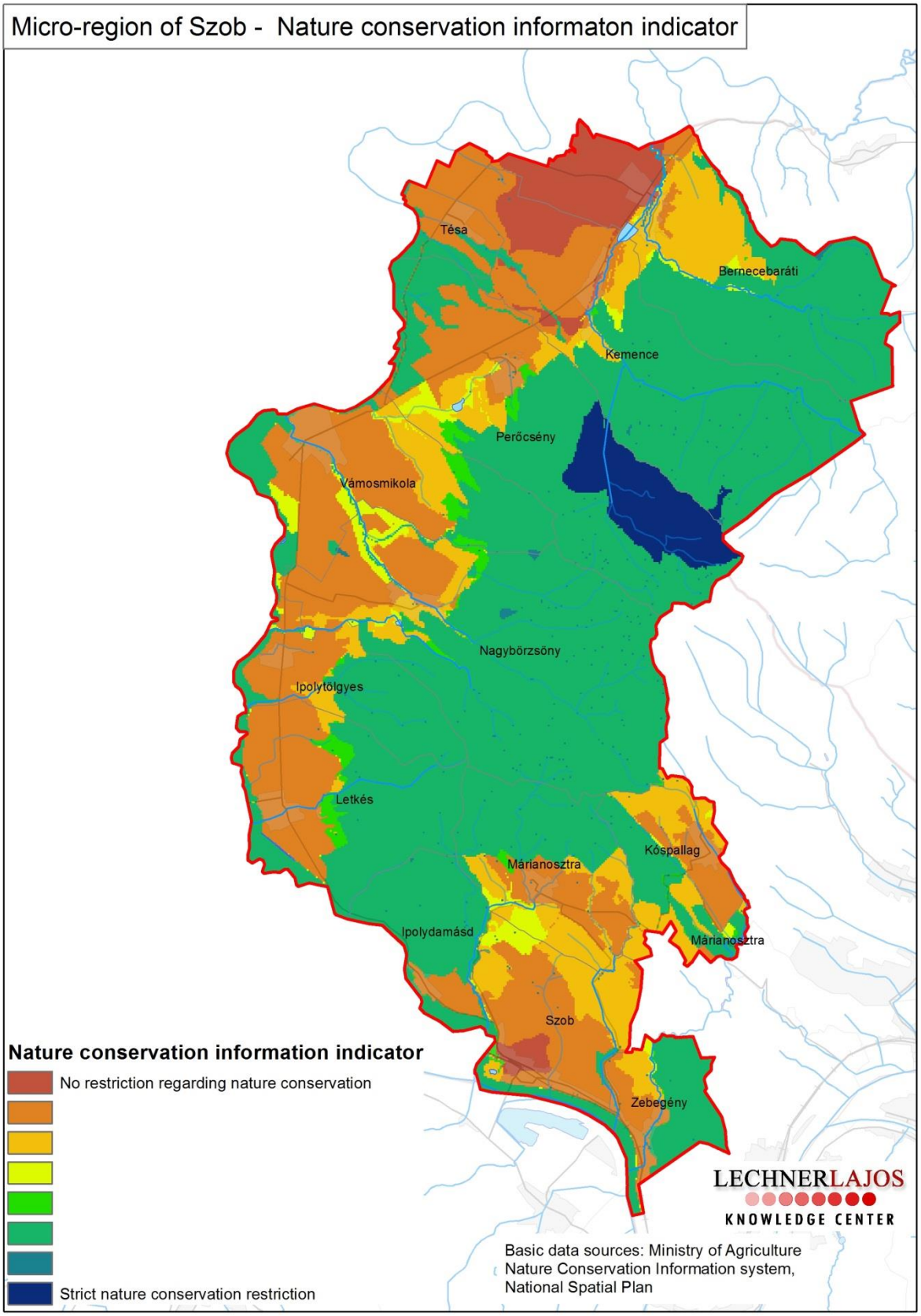
Nature conservation category	Nature conservation subcategory	Territorial and urban development aspects	Spatial and master planning aspects	Sequence according to the strength of protective restrictions
Natura 2000 areas	Special Protection Areas	Preservation, maintenance, and restoration of territories' conservation status by ensuring the necessary conditions of sustainable farming		**5**
	Special Areas of Conservation			
Conservation areas	National park: natural area (Zone „A")	It is prohibited to change the conditions (or consistency), and aspects of the protected natural area against the nature conservation aims.	If necessary, constructional, and parcel shaping prohibition, or other usage restrictions can be introduced	**1**
	National park: treated area (Zone „B")			**4**
	National park: demonstration area (Zone „C")			
	Landscape protection area			
	Protected natural areas			
	Natural monuments			
	Locally protected natural area			
„Ex lege" protected areas	natural areas	It is prohibited to change the conditions (or consistency), and aspects of the protected natural area against the	If necessary, constructional, and parcel shaping prohibition, or other usage restrictions can be introduced	**2**
	Natural monuments			

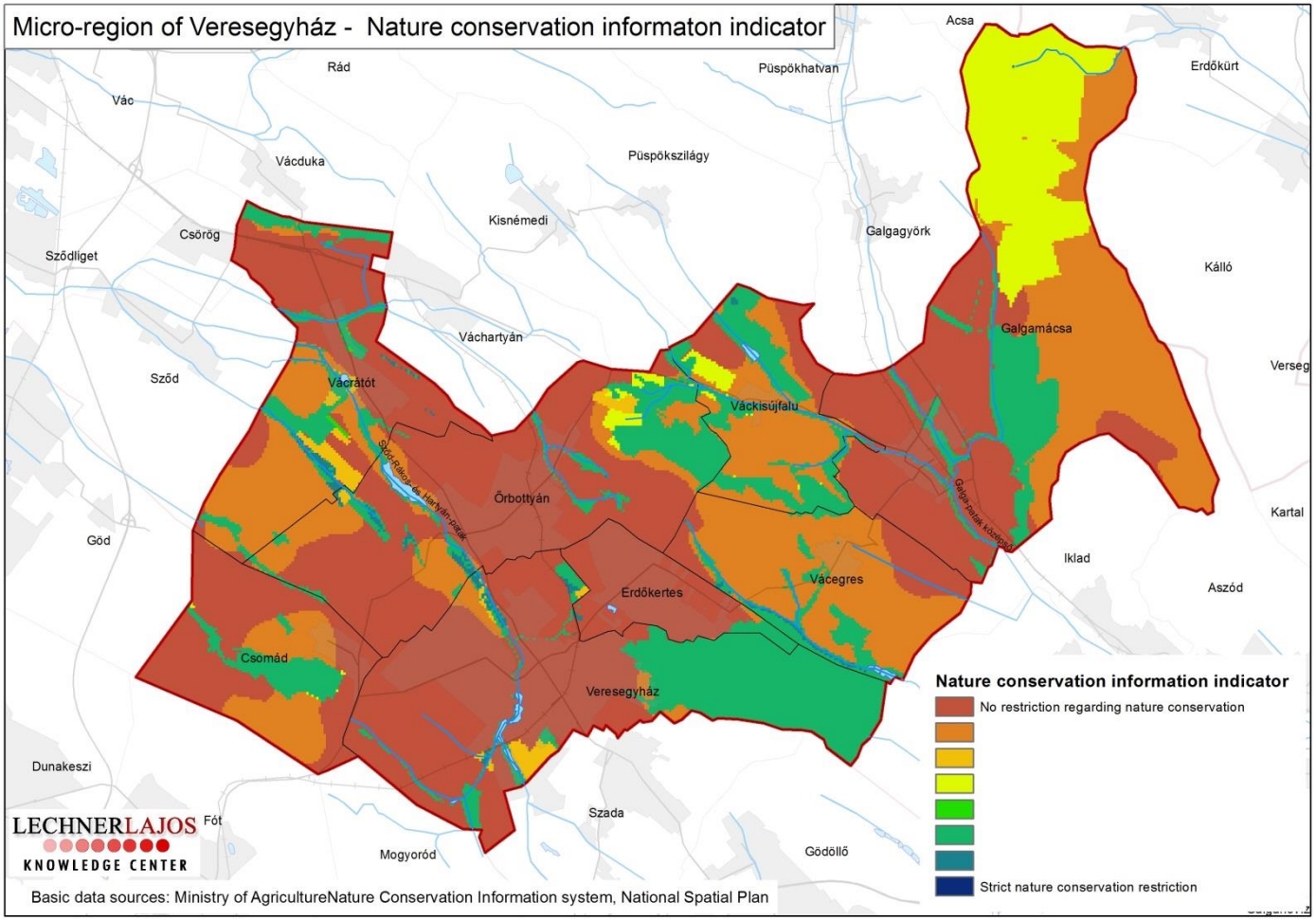
Nature conservation category	Nature conservation subcategory	Territorial and urban development aspects	Spatial and master planning aspects	Sequence according to the strength of protective restrictions
		nature conservation aims.		
Zone of Areas of Special Landscape Protection		Natural and semi-natural state of the landscape must be preserved. The subsistence of the aesthetic endowments and nature of the landscape, the natural systems, and unique landscape values must be kept.	Only those types of land use and construction zones can be assigned which shall not endanger the subsistence of landscape values. As for the construction zones, rules for landscape compatibility of buildings must be determined. Mining activity may be conducted in accordance with the regulation on mining areas. Utility lines and additional utility structures must be landscape compatible.	**7**

In some cases, the above mentioned categories are overlapping with each other, thus the strongest regulation of a given area proves to be the determining factor during the development of the final indicator on usage with emphasis on development perspectives. Accordingly, the specially protected natural areas are concerned with the strongest protective regulations (Zone „A", in this case), this is followed by „Ex lege" areas, then come the core areas and the ecological corridors of the ecological networks, Natura 2000 lands, buffer zones of ecological networks, and finally the zones of landscape protection priority areas.

According to the type of protective restrictions, rankings of the listed categories at conservation areas were scored between 1 and 7. Areas with the lowest points are affected by the strongest restrictions, while the higher points mean milder regulations, and developments are more and more allowed there. The establishment of the ranking method

is linked to small focal-group estimation, carried out by an expert team, and is subject to a further development process in order to acquire more precise data in future.
From the very beginning of the decision-making process, the evolved indicator provides a prudent and conflictless basis for selecting the areas of interest by the joint presentation of the different regulations.

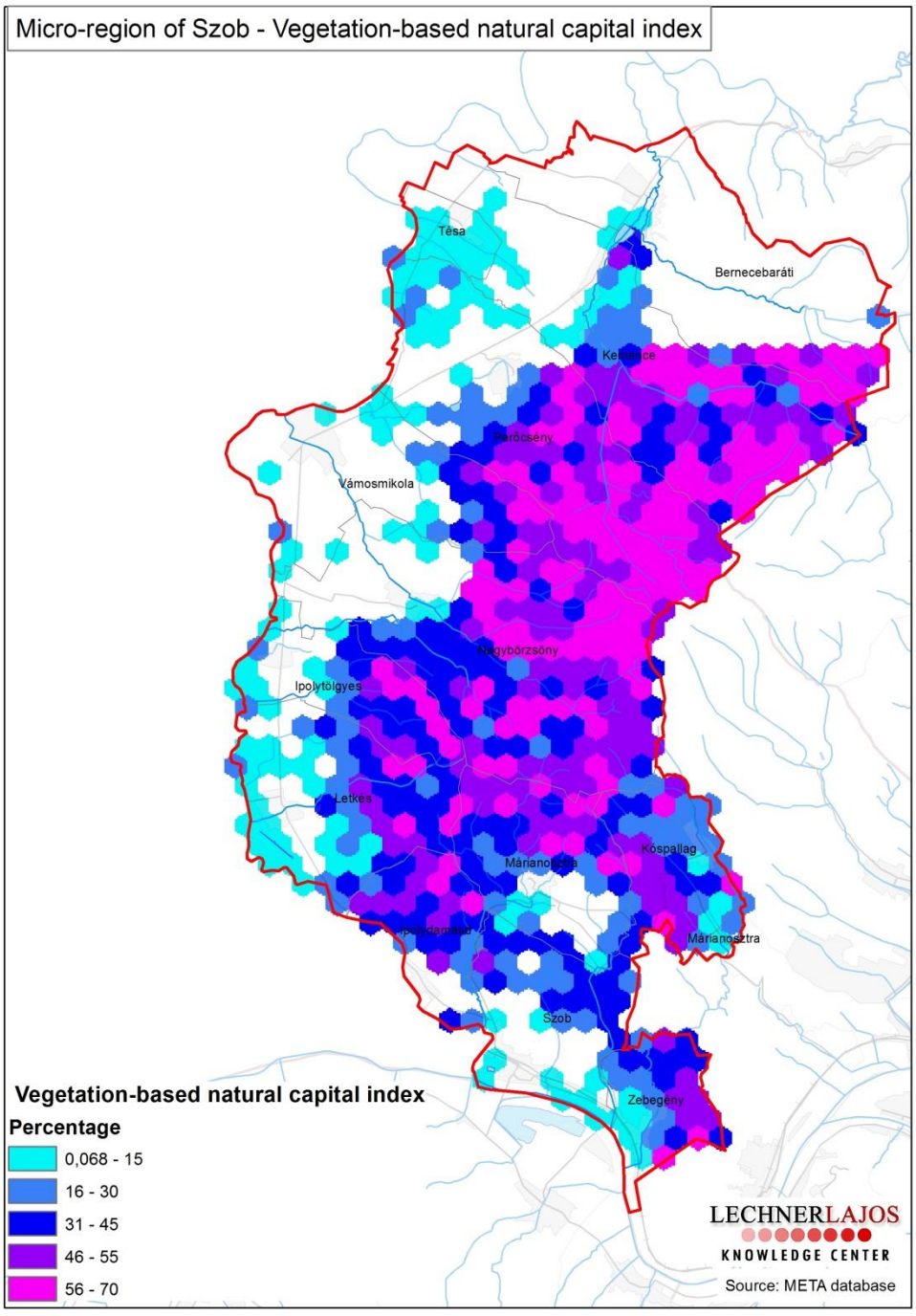

Micro-region of Szob - Nature conservation informaton indicator
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Nature conservation information indicator
No restriction regarding nature conservation
Strict nature conservation restriction
LECHNERLAJOS
KNOWLEDGE CENTER
Basic data sources: Ministry of Agriculture
Nature Conservation Information system,
National Spatial Plan

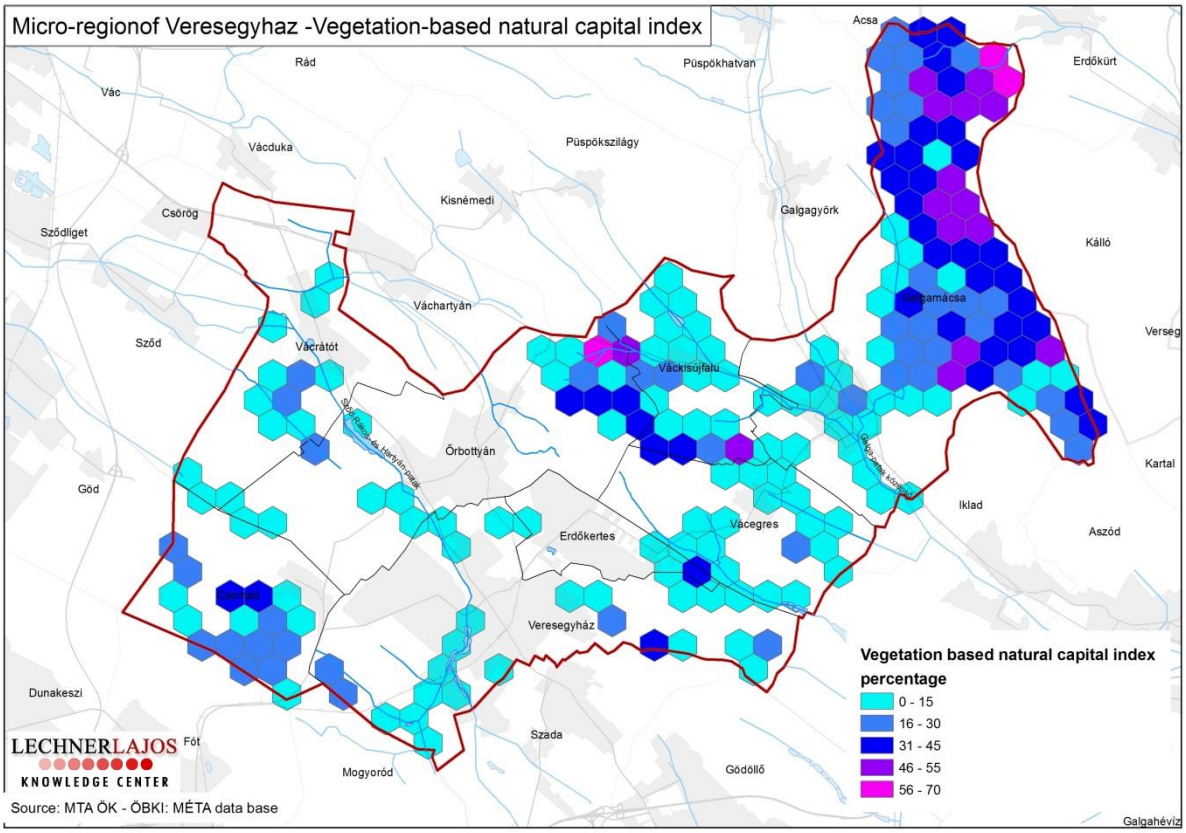

Micro-region of Veresegyház - Nature conservation informaton indicator
Acsa
Rád
Püspökhatvan
Erdőkürt
Vác
Vácduka
Püspökszilágy
Kisnémedi
Galgagyörk
Csörög
Sződliget
Kálló
Váchartyán
Galgamácsa
Sződ
Vácrátót
Váckisújfalu
Verseg
Örbottyán
Kartal
Göd
Iklad
Aszód
Vácegres
Erdőkertes
Csomád
Veresegyház
Dunakeszi
Fót
Szada
Mogyoród
Gödöllő
Nature conservation information indicator
No restriction regarding nature conservation
Strict nature conservation restriction
LECHNERLAJOS
KNOWLEDGE CENTER
Basic data sources: Ministry of AgricultureNature Conservation Information system, National Spatial Plan

II.1.2. Natural value indicator

Vegetation-based natural capital index

Data source: Hungarian Academy of Science- Institute of Ecology and Botany - MÉTA database





Biotics data

Data source: Nature Conservation Information System

Available biotics data
Biotics data of the study areas are based on the monitoring activity conducted between 2004 and 2012, and was provided by the Directorate of Danube-Ipoly National Park.

Type of biotics data	**Conservation classification**	**Recorded points – Szob micro-region**	**Recorded points – Veresegyháza micro-region**
Plant	Specially protected	88	497
	Protected	6001	16528

Type of biotics data	Conservation classification	Recorded points – Szob micro-region	Recorded points – Veresegyháza micro-region
	Protected according to Annex 7 [2]	848	0
	Not protected	1053	455
Plant data in all		**7990**	**17480**
Mollusc	Protected	161	0
	Not protected	354	0
Arthropoda	Specially protected	2	14
	Protected	523	178
	Not protected	667	1847
Fishes	Specially protected	5	0
	Protected	190	0
	Not protected	318	1
Amphibians and reptiles	Protected	577	17
	Not protected	2	0
Birds	Specially protected	351	34
	Protected	431	18
	Protected according to Annex 8 [3]	4	0
	Not protected	21	0
Mammals	Specially protected	112	1

[2] 13/2001. (V.9.) KöM decree – Annex 7.: Plants with significant conservation importance in the European Community

[3] 13/2001. (V.9.) KöM decree – Annex 8.: Animals with significant conservation importance in the European Community

Type of biotics data	Conservation classification	Recorded points – Szob micro-region	Recorded points – Veresegyháza micro-region
	Protected	154	1
	Not protected	9	3
Animal data in all		**3881**	**2114**
Biotics data in all		**11871**	**19594**

The available data determines some certain limitation factors which must be taken into account during further analysis:

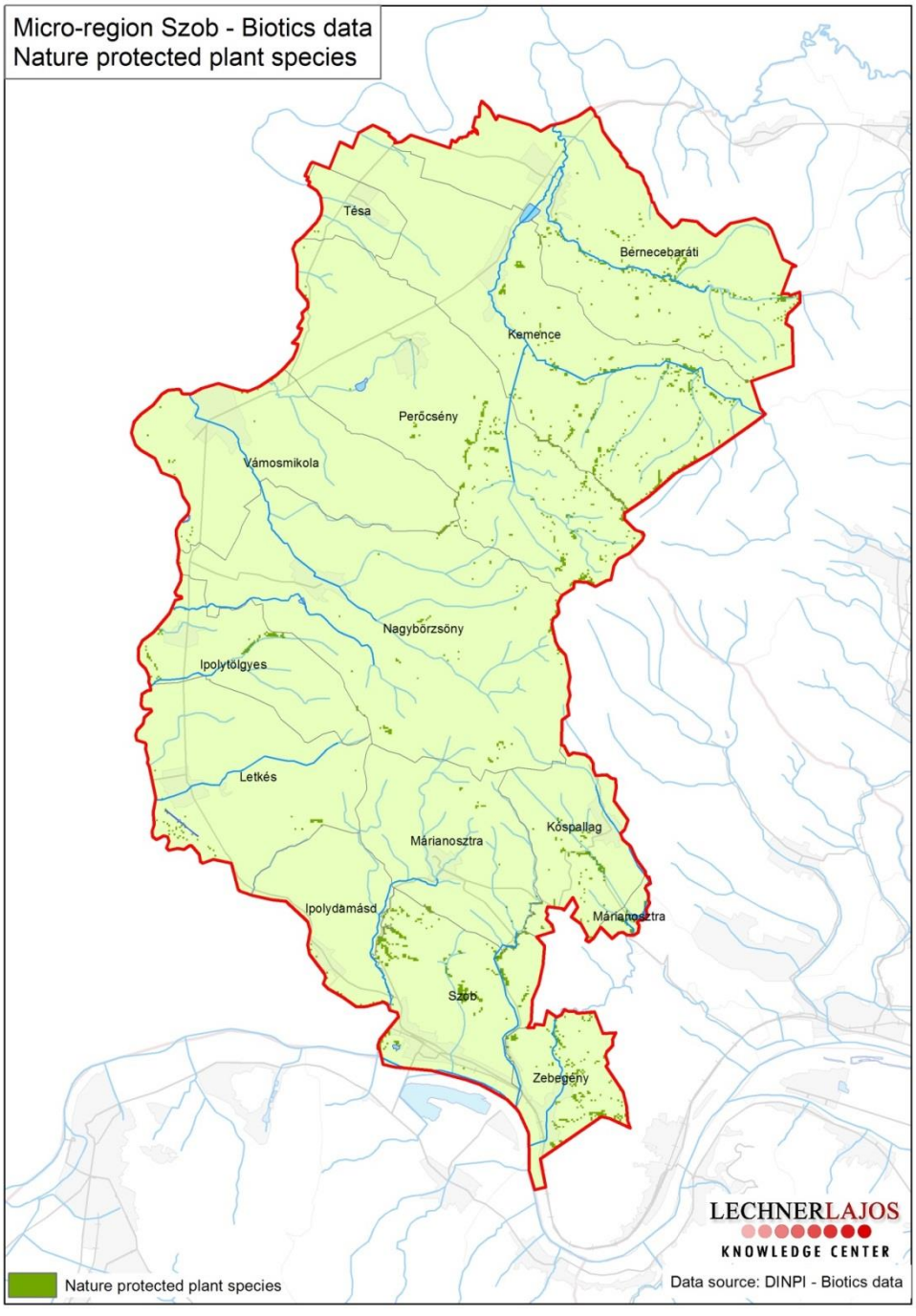
- The available data is originated from conservation areas, elements from ecological networks, and Natura 2000 lands. There was no data-recording on other types of areas. This may raise some new question, especially on the examined micro-regional level, since the bridging areas among the data-covered areas are easier to be handled during the national-level planning.
- Within the Veregyeháza micro-region the recorded biotics data on plants and arthropods are presumably overrepresented.

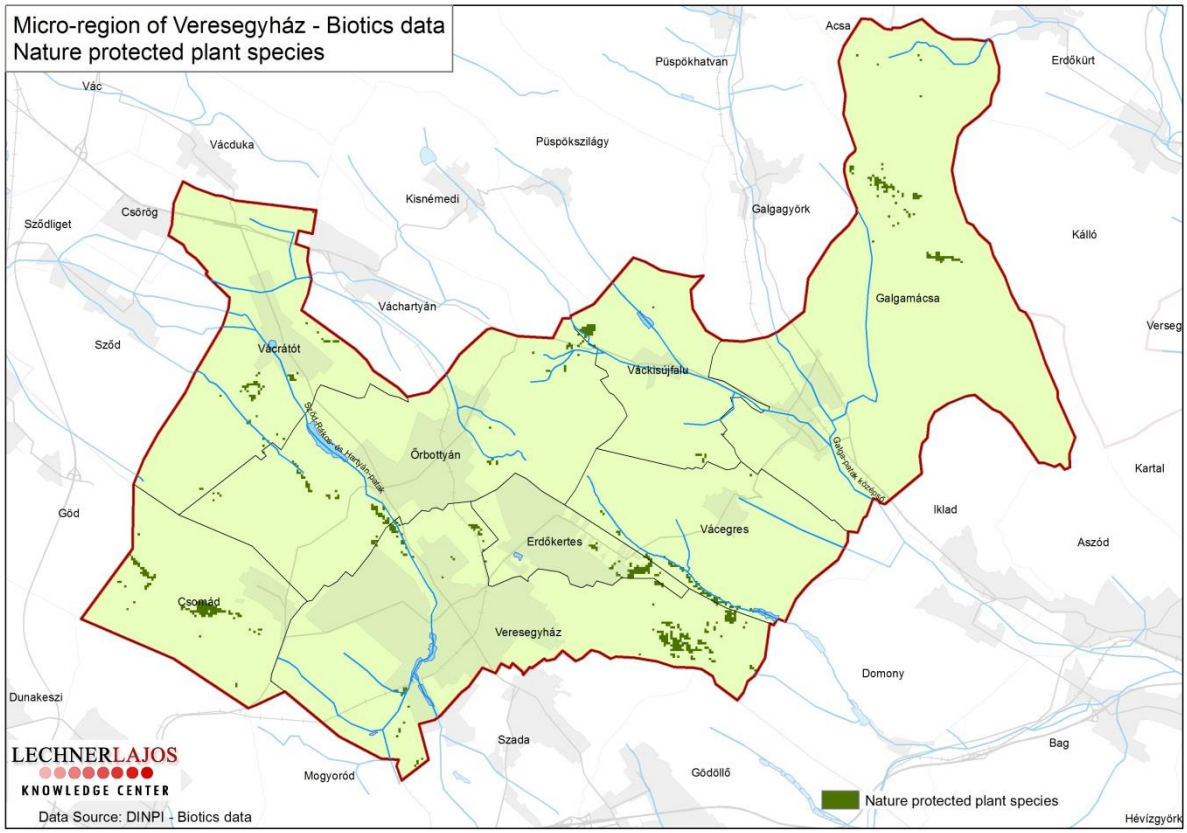
Development of the natural value indicator

The natural value indicator has been unfolded in virtue of the valuable species living on the study plots, and their derived distribution area. Base data of the indicator comes from the MÉTA programme, and is in linked with the vegetation-based natural capital index. The biotics data was collected by the experts of the Danube-Ipoly National Park in the framework of the National Biodiversity Monitoring Programme, or other monitoring activities.

Since the natural value index (developed in the framework of the MÉTA programme) meets the quality requirements, the derived map was taken as a basis in this context. Nevertheless, the detailed analysis of the biotics data on species groups and species goes beyond the frames of this paper. However, it is highly important to build in the available data into the system as these give the best picture on natural values of a given area. The primary purposes of the indicator are to share the information, raise awareness on the existence of possible important values, and the identification of special and important areas. This entails the fact that processing of the significant amount of biotics data is being conducted only on prime level. The main aim is the information provision of possible natural values for decision makers, and to represent a proposal on the methodology of displaying this information. It is recommended to scientifically process the biotics data by species groups and species. As for a next step, the natural values of the study area need to be assessed in detail (proposals on further development of the map based indicator that supports regional planning)

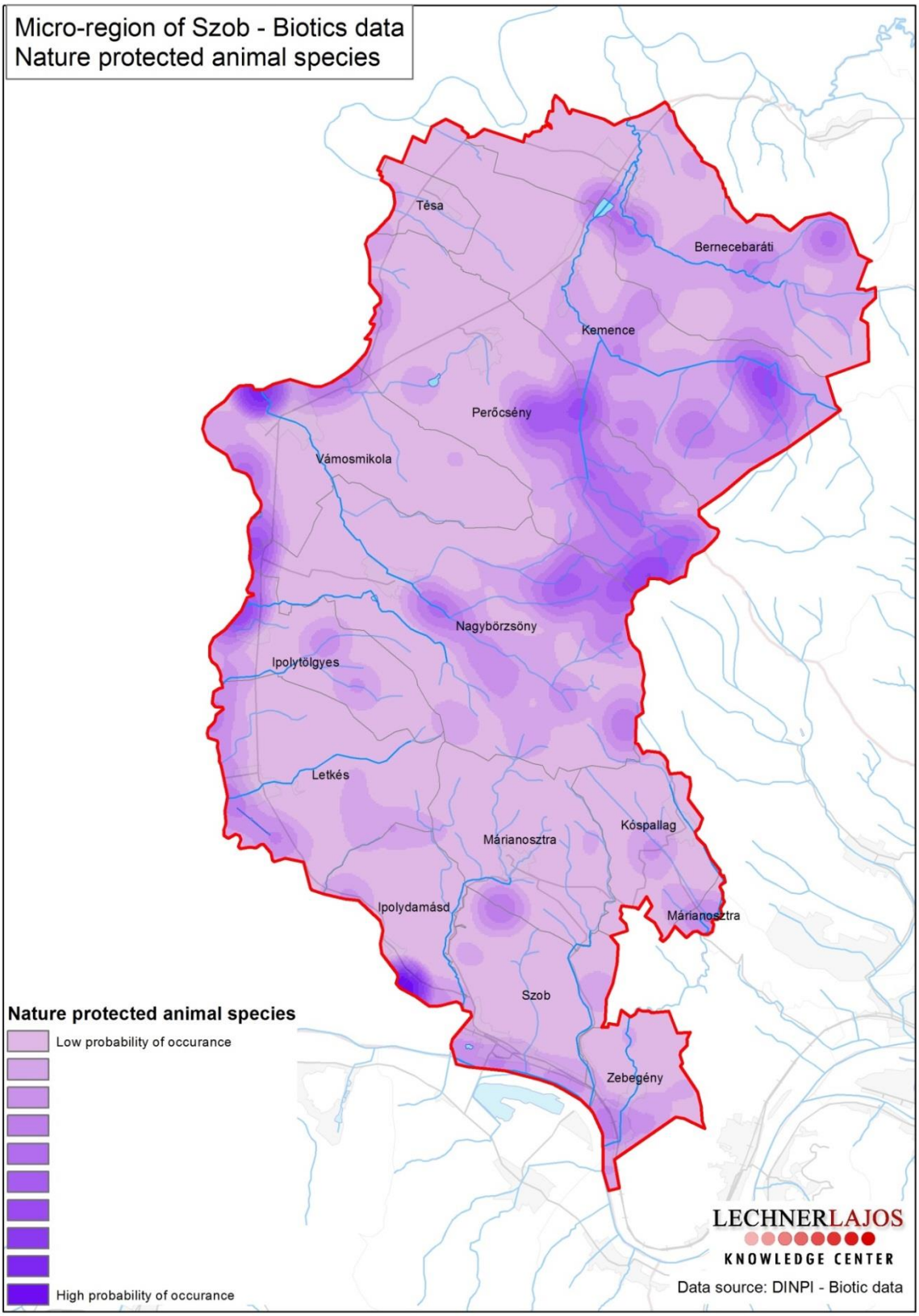
From the available biotics data, plant and animal species under conservation protection were selected for the analysis. Species without protection may also consist of invasive species which are degrading the natural values' quality of the given areas. Filtering these species and evaluation of non-protected species shall be part of an even more detailed research. (Proposals on further development of the map based indicator system that supports regional planning)

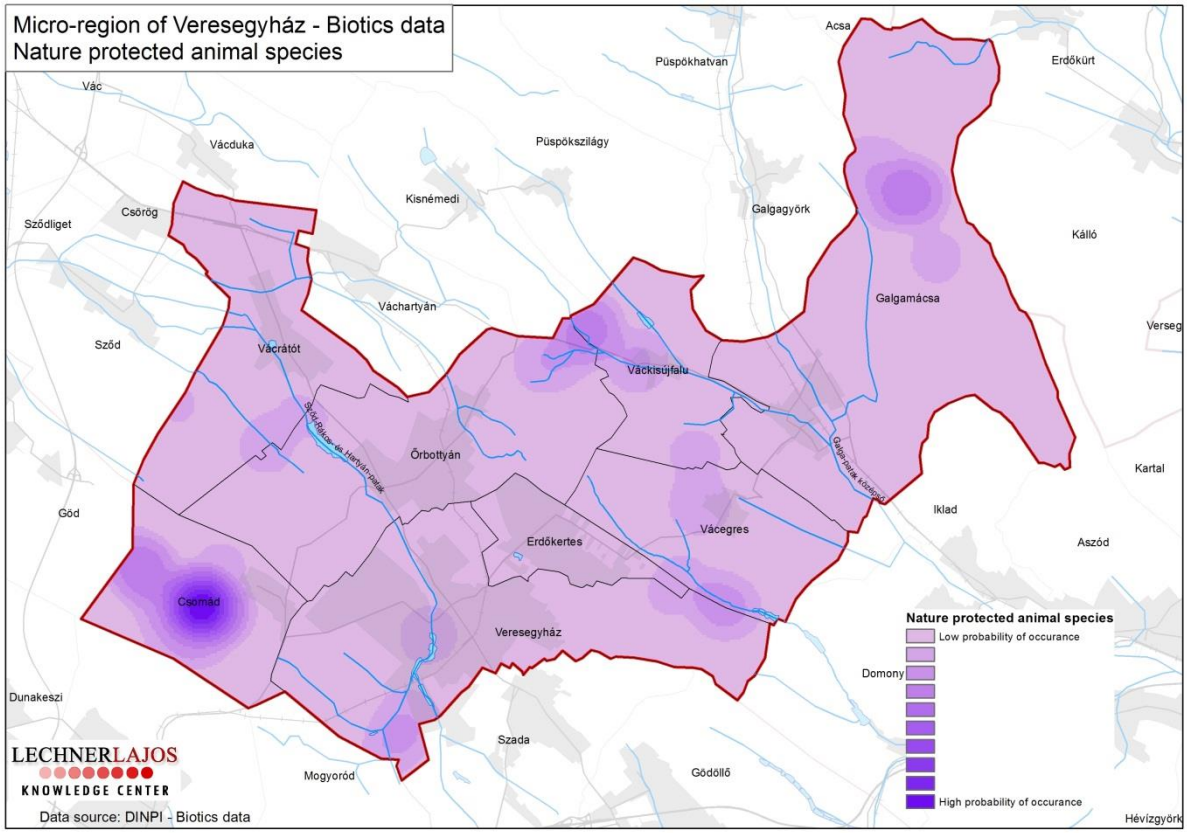




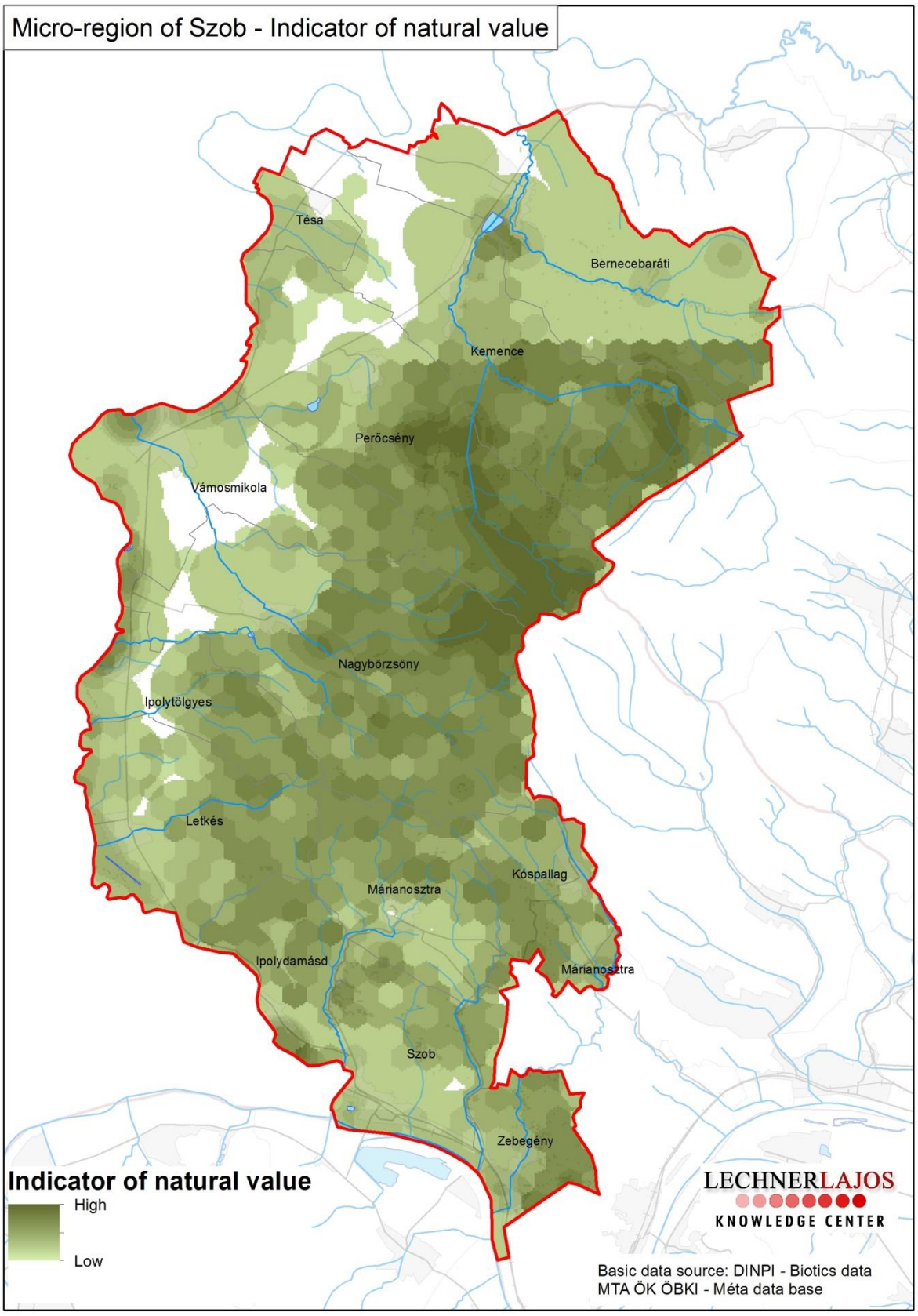
Consolidated occurrence maps shall be prepared on protected and specially protected species. While compiling the maps, we ignored the multiplicity of a unique point in the point-layer (multiple data assigned to unique points). The probability of occurrence was calculated by the widely used Kernel-home-range method. In case of probability maps the seeking radius were set to 1000 m generally instead of applying different radius for each species. This method will clearly need to be refined during further analyses, and if possible, by setting specific radius for each species.

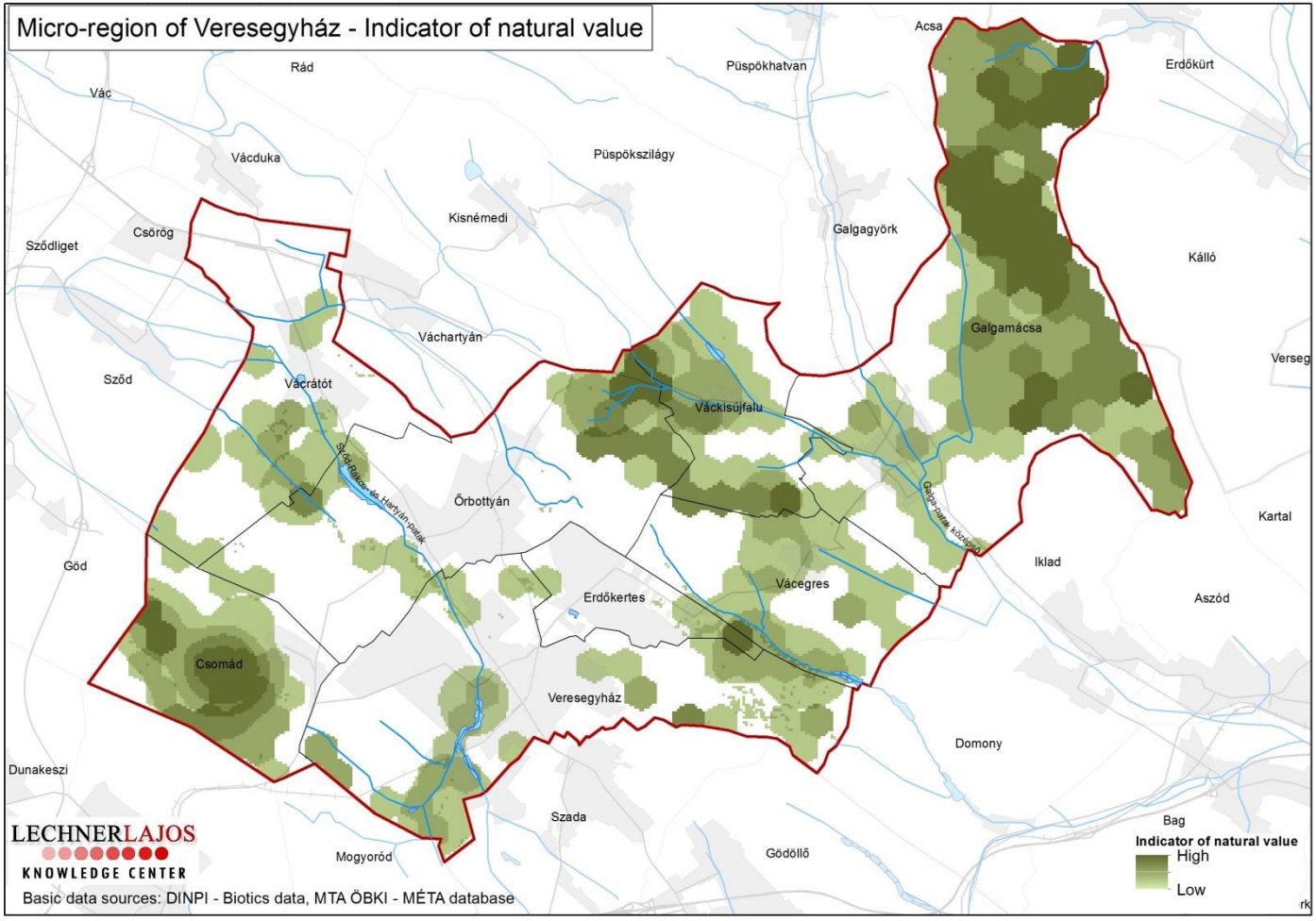
We applied the natural breakpoint classifying method at occurrence density maps, where we sorted the values into 10 classes.


Micro-region of Szob - Biotics data
Nature protected animal species
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Nature protected animal species
Low probability of occurance
High probability of occurance
LECHNERLAJOS
KNOWLEDGE CENTER
Data source: DINPI - Biotic data



Maps illustrating the natural value indicator are representing a consolidated evaluation of vegetation based natural capital index, and the probability of occurrence of plants and animals being under protection. The natural indicator map is a result of summing the three raster-based input maps by applying the „map algebra” tool.


Micro-region of Szob - Indicator of natural value
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Indicator of natural value
High
Low
LECHNERLAJOS
KNOWLEDGE CENTER
Basic data source: DINPI - Biotics data
MTA ÖK ÖBKI - Méta data base

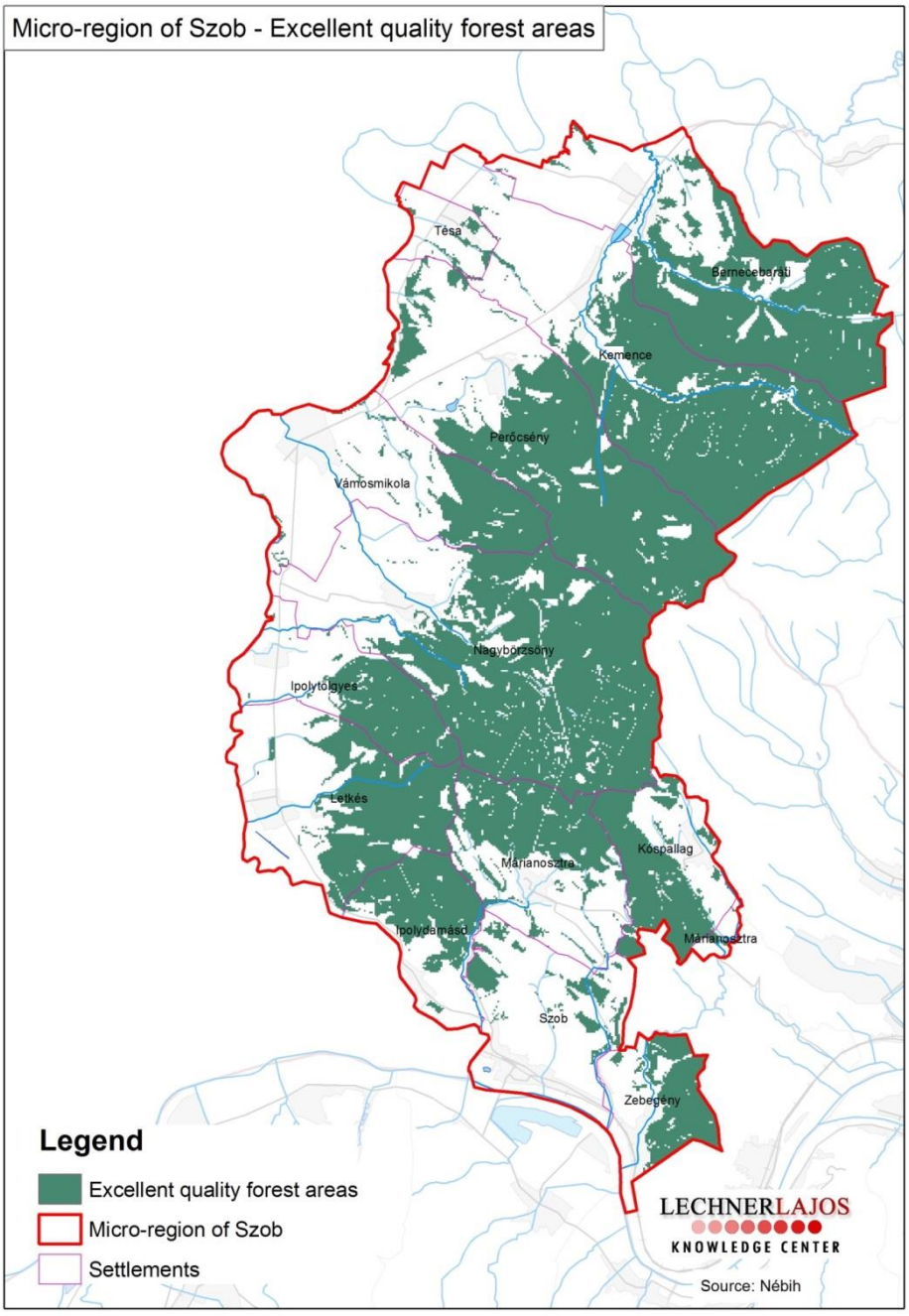

Micro-region of Veresegyház - Indicator of natural value
Rád
Vác
Vácduka
Csörög
Sződliget
Sződ
Göd
Dunakeszi
Csomád
Kisnémedi
Váchartyán
Vácrátót
Örbottyán
Erdőkertes
Veresegyház
Szada
Mogyoród
Gödöllő
Püspökhatvan
Püspökszilágy
Galgagyörk
Acsa
Erdőkürt
Kálló
Galgamácsa
Verseg
Vácisújfalu
Vácegres
Iklad
Aszód
Kartal
Domony
Bag
LECHNERLAJOS
KNOWLEDGE CENTER
Basic data sources: DINPI - Biotics data, MTA ÖBKI - MÉTA database
Indicator of natural value
High
Low

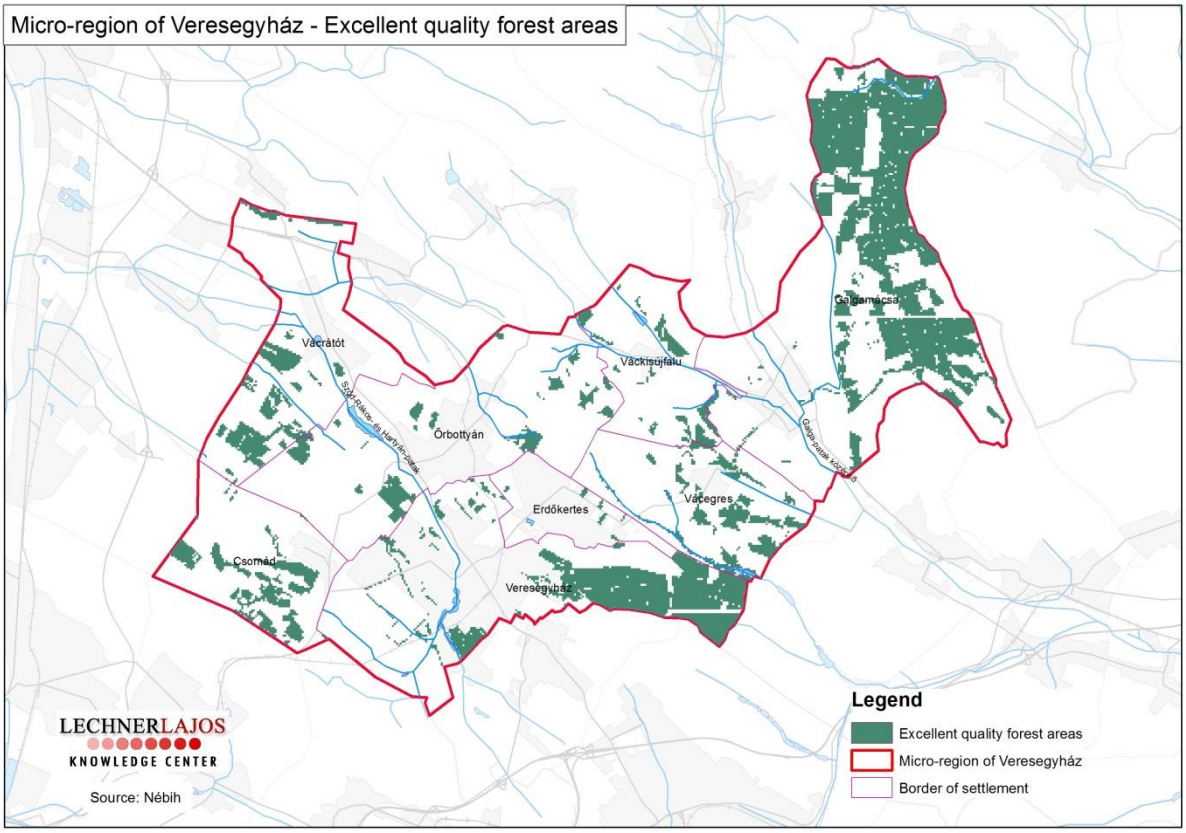
II.2. Analysis of forest and agricultural areas

II.2.1. Spatial planning and sector development restrictions in forest and agricultural areas

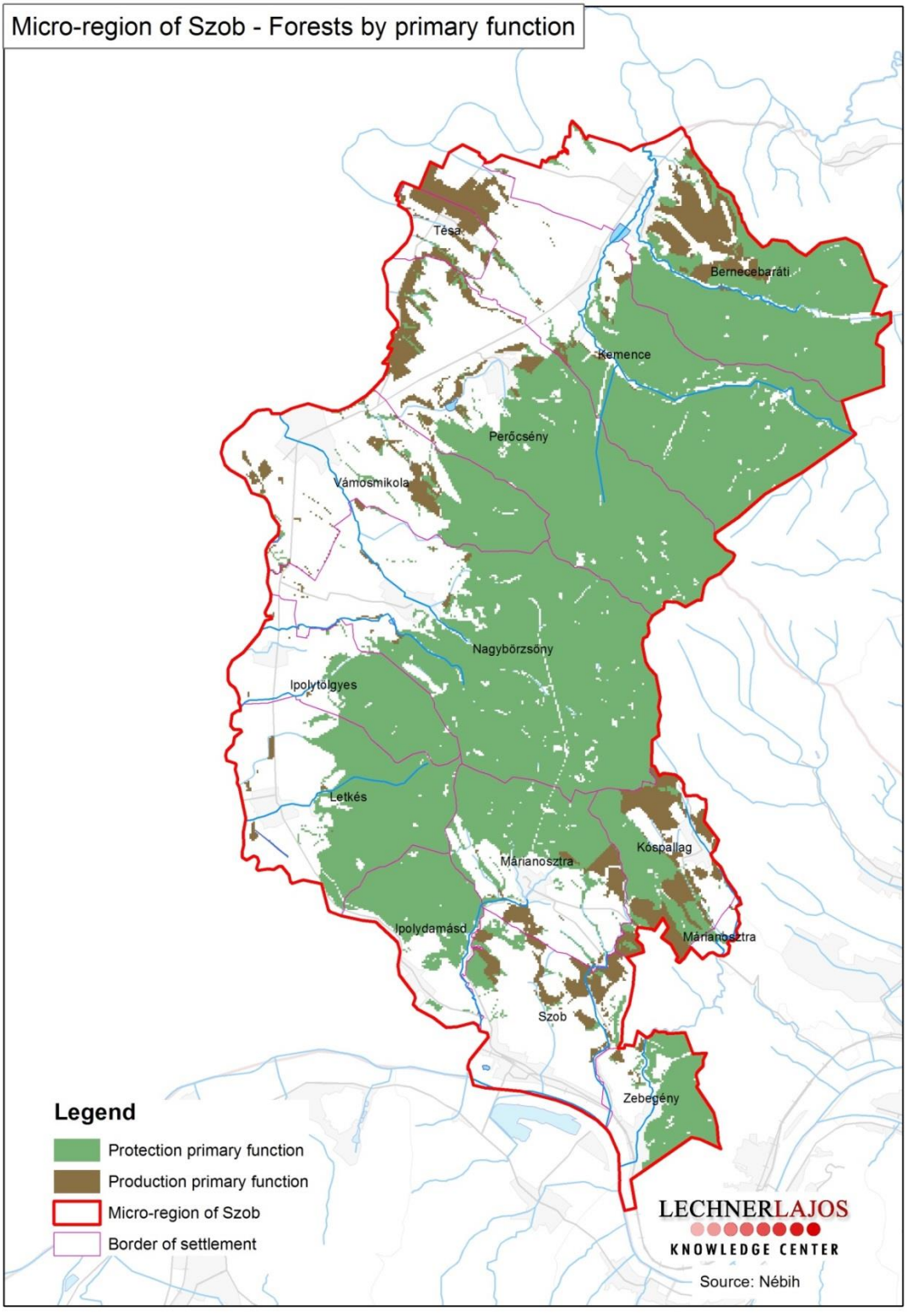
Development restrictions in forest areas

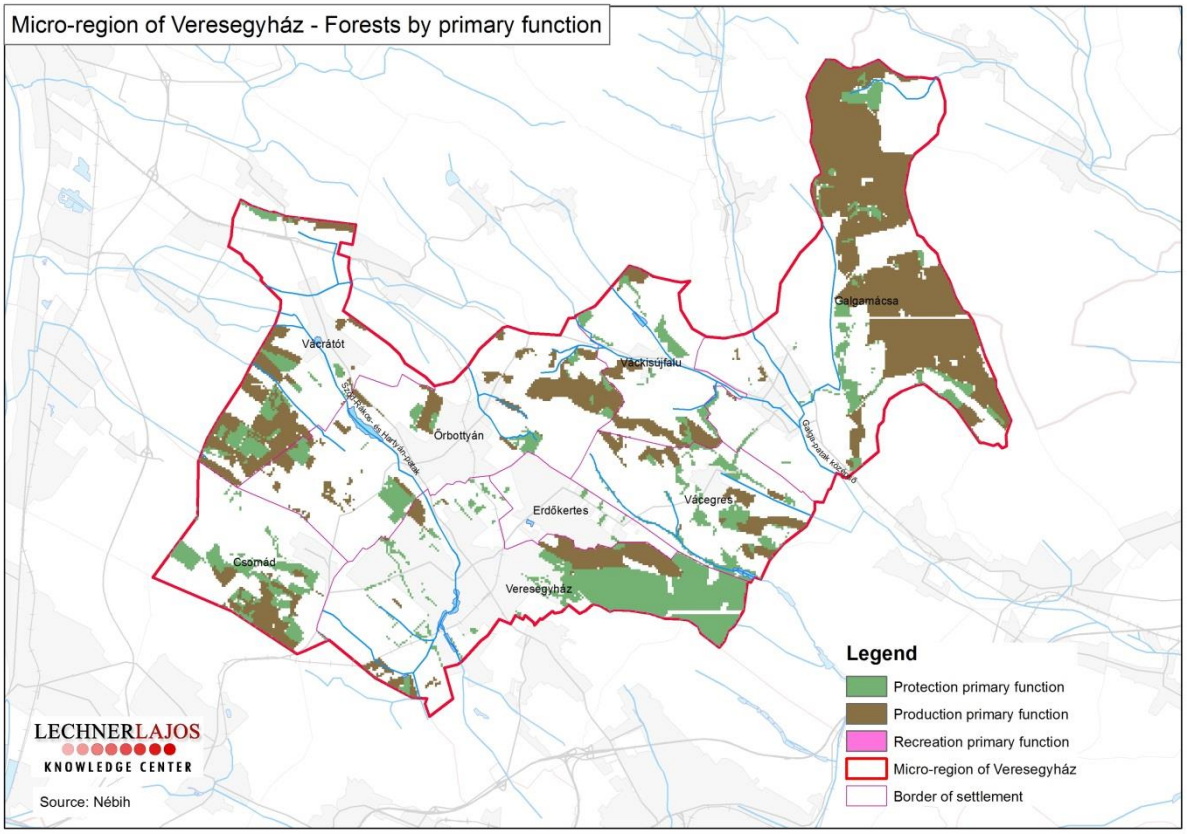
Zone of Excellent-quality Forest Area
Data source: National Forestry Database




Micro-region of Veresegyház - Excellent quality forest areas
Vácrátót
Csomád
Őrbottyán
Erdőkertes
Veresegyház
Váckisújfalu
Galgamácsa
Vácegres
LECHNERLAJOS
KNOWLEDGE CENTER
Source: Nébih
Legend
Excellent quality forest areas
Micro-region of Veresegyház
Border of settlement

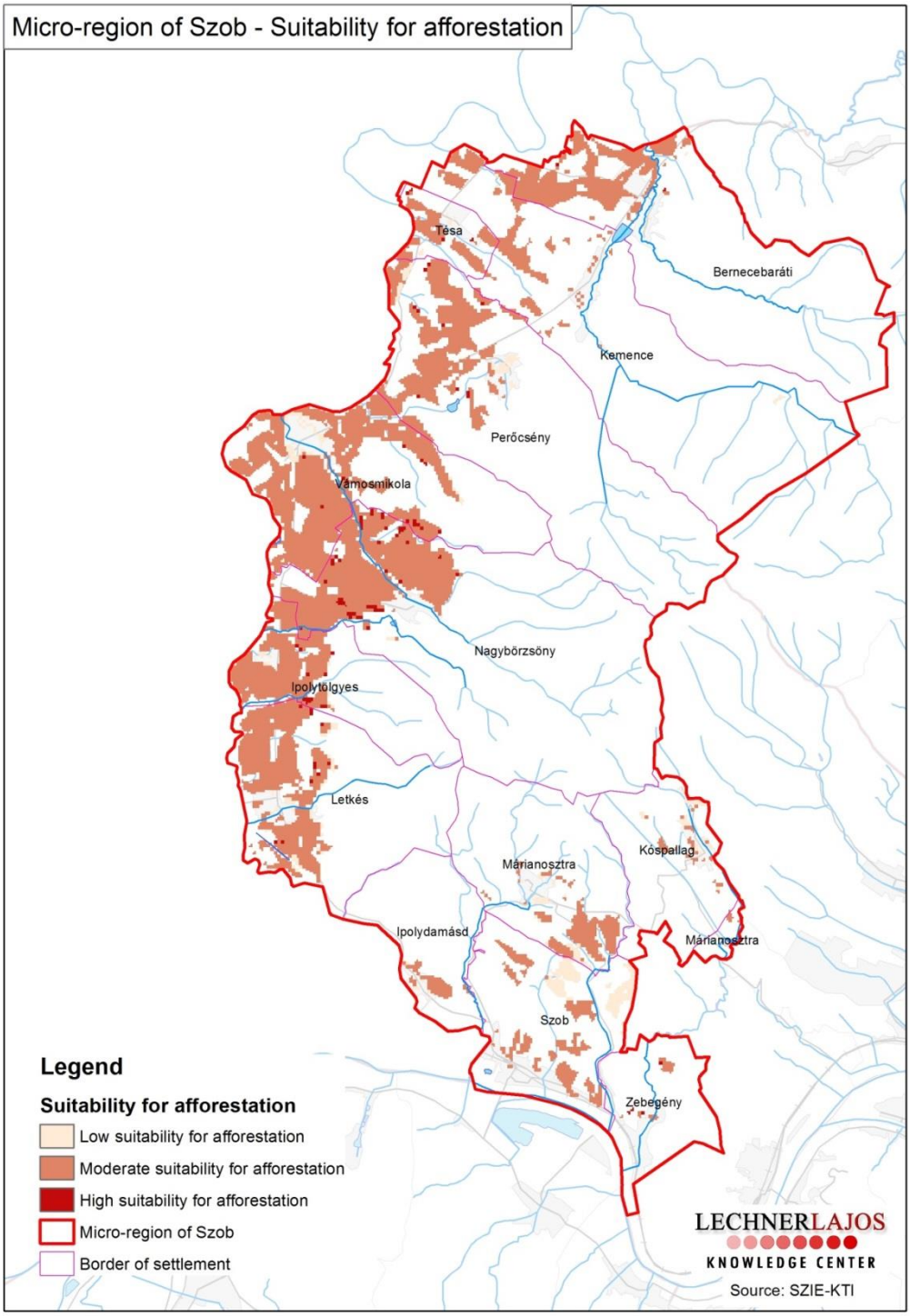
Forest areas and their purposes according to the National Forestry Database
Data source: National Forestry Database

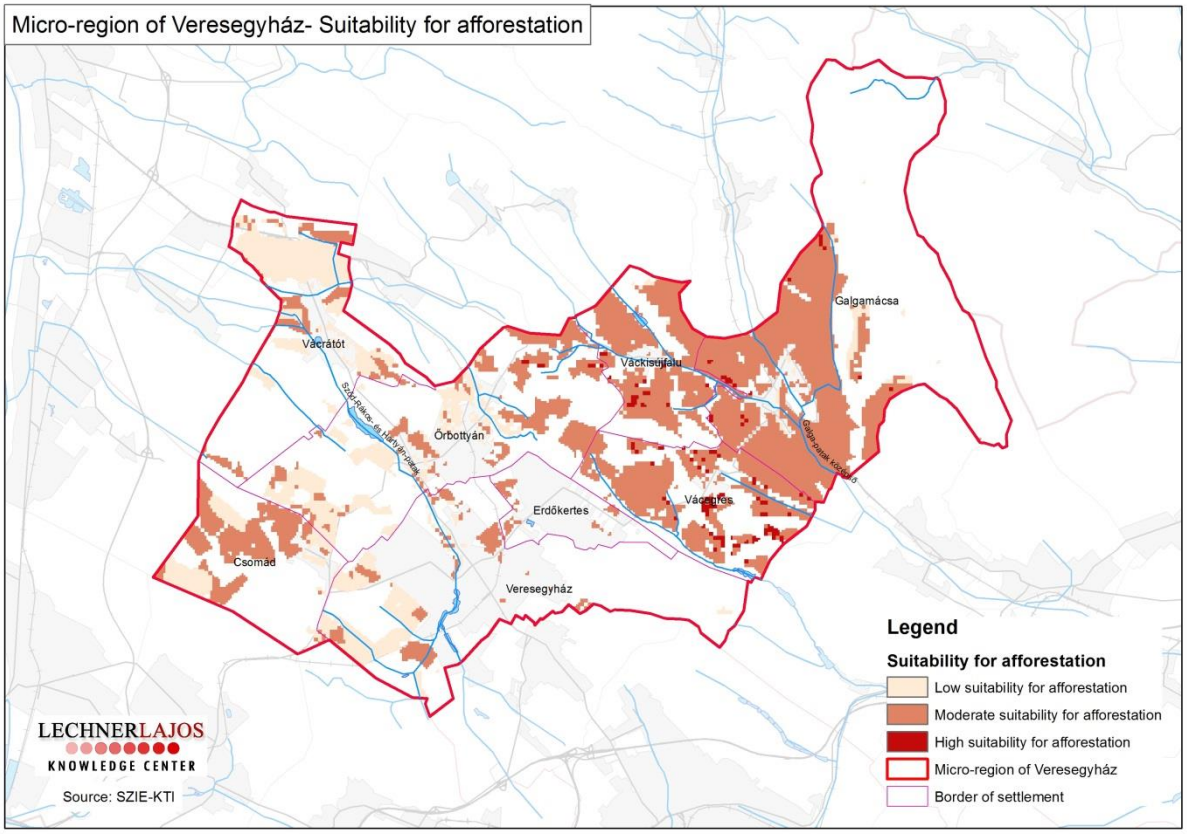



Micro-region of Veresegyház - Forests by primary function
Vácrátót
Örbottyán
Vácegres
Erdőkertes
Csomád
Veresegyház
Galgamácsa
Legend
Protection primary function
Production primary function
Recreation primary function
Micro-region of Veresegyház
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Source: Nébih

Zone of Areas for Afforestation

Data source: Szent István University, Faculty of Agricultural and Environmental Sciences - Gödöllő; Institute of Geodesy, Cartography and Remote Sensing (FÖMI) as data provider
Ecotype-based land use model





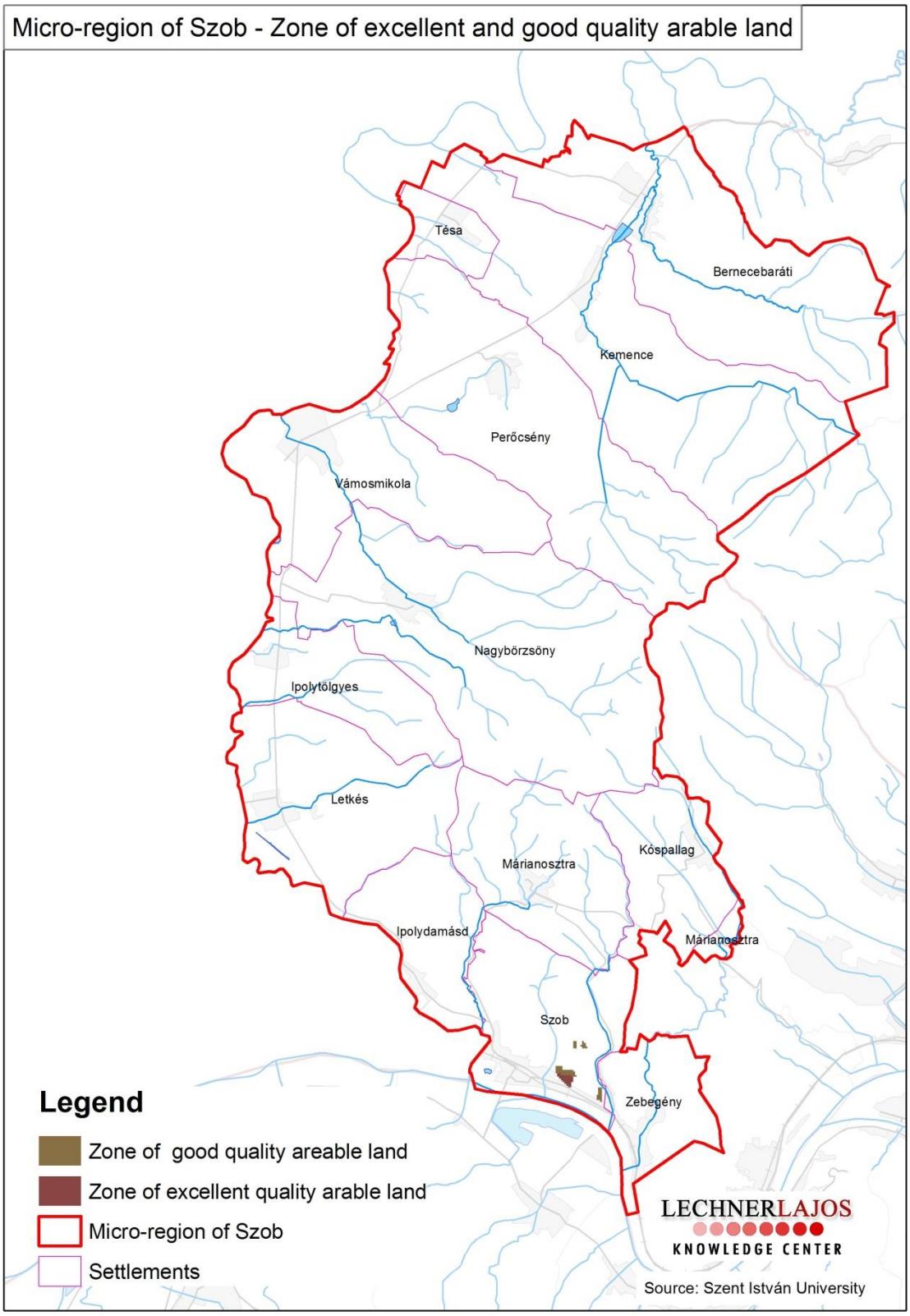
Development restrictions in agricultural areas

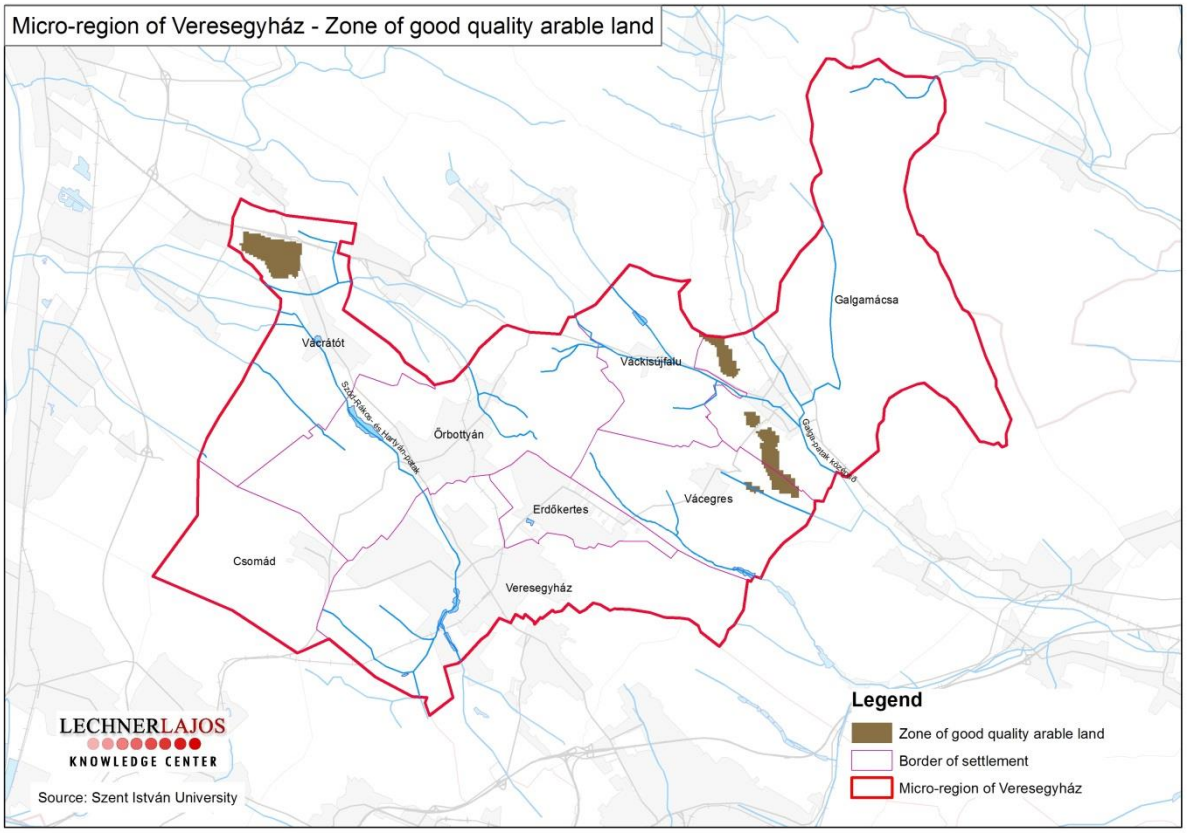
Zone of Excellent-quality Arable Land

Data source: Szent István University, Faculty of Agricultural and Environmental Sciences - Gödöllő; Institute of Geodesy, Cartography and Remote Sensing (FÖMI) as data provider Ecotype-based land use model

Zone of Good-quality Arable Land

Data source: Szent István University, Faculty of Agricultural and Environmental Sciences - Gödöllő; Institute of Geodesy, Cartography and Remote Sensing (FÖMI) as data provider Ecotype-based land use model


Micro-region of Szob - Zone of excellent and good quality arable land
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Legend
Zone of good quality areable land
Zone of excellent quality arable land
Micro-region of Szob
Settlements
LECHNERLAJOS
KNOWLEDGE CENTER
Source: Szent István University



Further spatial planning and sector restrictions

Besides the regulations specified in the two previous points, further restrictions are bounding the assignment of subject areas of territorial development, on both regional and local level. Some of these have already been formulated in the regulatory level. The regulation of National Spatial Plan of Hungary on vineyard-, and fruit-growing-cadastre, and arable lands with better than average quality - specified by the Land Law - are such cases. These databases cannot be utilized in systems supporting spatial planning due to their high prices, and the lack of digital processing (especially at the fruit-growing-cadastre). (Proposals on further development of the map based indicator system that supports regional planning)

I-II. classes of Vineyard-, and fruit-growing land cadastres

Data source: VINGIS database on vineyard-cadastre, and no digital database on fruit-cadaster

Land better than average quality (cadastral maps based limitation)

Data owner: Hungarian National Asset Management Inc.

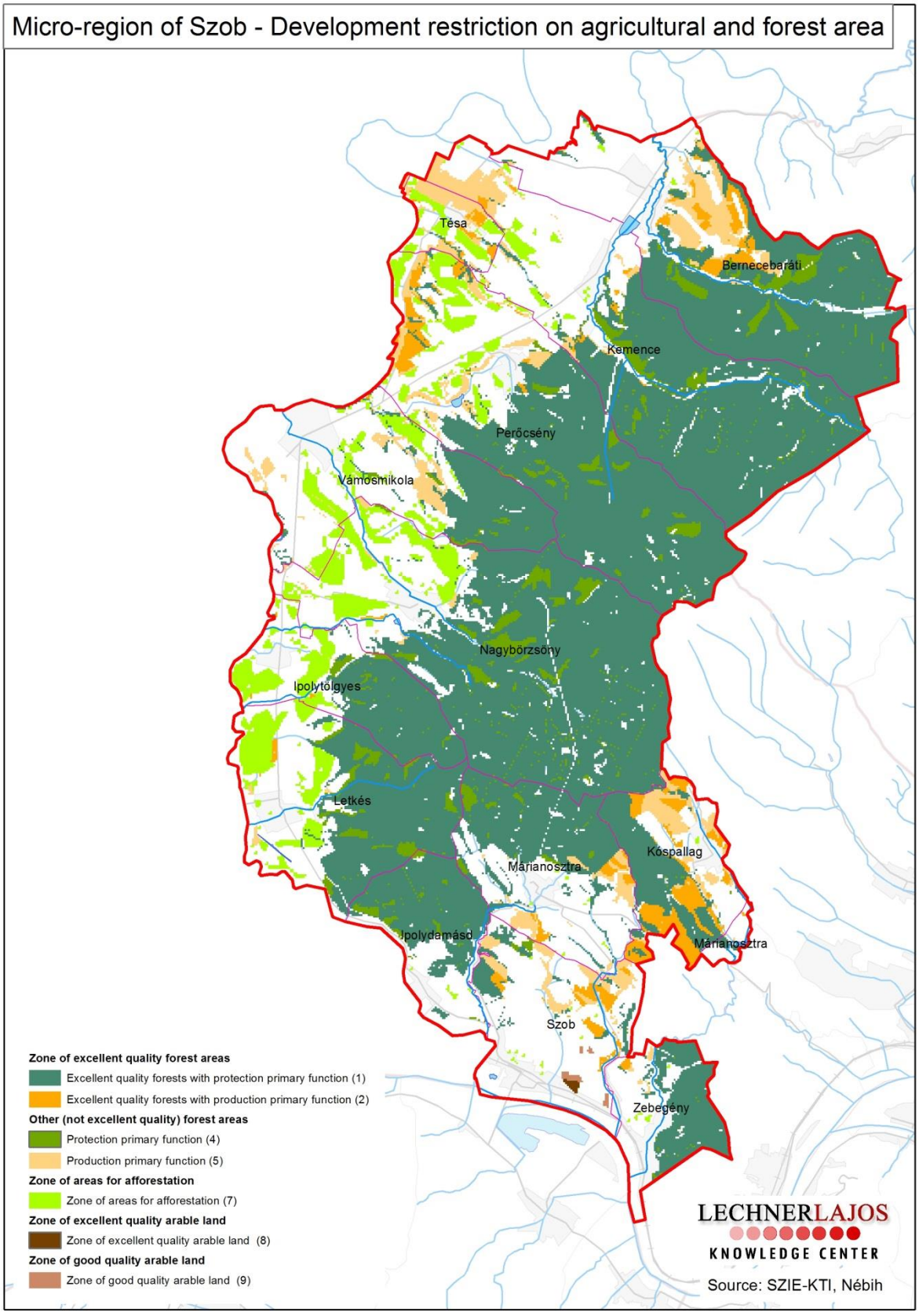
Area types formed according to spatial planning and sector restrictions on agriculture and forestry

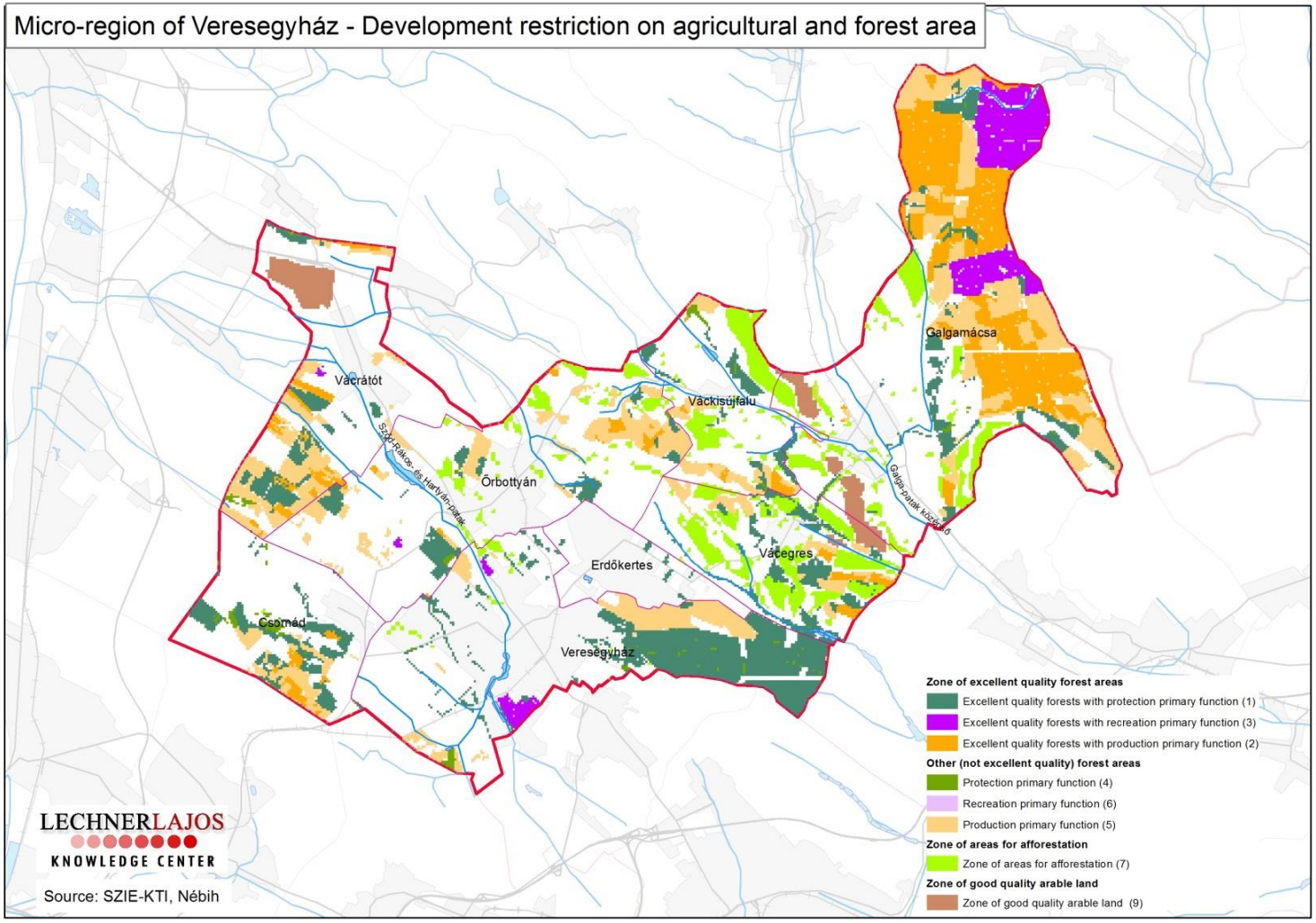
Regarding their austerity, 9 area types were evolved in the planning-supporting system in accordance with the above mentioned aspects. Six out of all affect forest areas (according to the forest database), and three of them are related to agricultural lands. The numbering of territory types is not a ranking; it is rather for distinguishing purposes. The representation of area types is informative, and sorting the available databases, and in the same time it makes the planners' work easier.

Development restrictions on agricultural and forest areas
(Summarizing table)

Area types	***Elements of area types***		***Regulation***	**Land use and development proposal**
Categories with regard to forest lands				
1.	Zone of Excellent-quality Arable Land	Defence primary function	Prohibition for designation of lands destined for construction. Forests with defence and public welfare functions may be subject to extensive constructions in case of public weal. Extensive constructions in case of having economic function.	In exceptionally, and strongly justified cases, small-scale development is allowed in accordance with the forest's functions
2.		Economic primary function		
3.		Public welfare primary function		
4.	According to National Forestry Database, but is not part of zones of Excellent-quality	Defence primary function	Prohibition for designation of lands destined for construction. Forests with defence and public welfare functions may be subject to extensive constructions in case of public weal.	In exceptionally, and strongly justified cases, small-scale development is allowed in accordance with the forest's functions Intensive constructions
5.		Economic primary function		

6.	Arable Land	Public welfare primary function	Extensive constructions in case of having economic function.	in case of having economic function at forests.
Categories with regard to agricultural lands				
7	Zone of Areas for Afforestation		Land-use guideline: areas part of the zone should be regulated as forest lands	Where possible, arable land-forest conversion
8.	Zone of Excellent-quality Arable Land		Limitations for designation of lands destined for construction.	Maintaining agricultural production, and agricultural developments
9.	Zone of Good-quality Arable Land		Land-use guideline: areas part of the zone should be regulated as agricultural lands	Maintaining agricultural production, and agricultural developments


Micro-region of Szob - Development restriction on agricultural and forest area
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Zone of excellent quality forest areas
Excellent quality forests with protection primary function (1)
Excellent quality forests with production primary function (2)
Other (not excellent quality) forest areas
Protection primary function (4)
Production primary function (5)
Zone of areas for afforestation
Zone of areas for afforestation (7)
Zone of excellent quality arable land
Zone of excellent quality arable land (8)
Zone of good quality arable land
Zone of good quality arable land (9)
LECHNERLAJOS
KNOWLEDGE CENTER
Source: SZIE-KTI, Nébih


Micro-region of Veresegyház - Development restriction on agricultural and forest area
Galgamácsa
Vácrátót
Vácisüjfalu
Örbottyán
Vácegres
Erdőkertes
Csomád
Veresegyház
Zone of excellent quality forest areas
Excellent quality forests with protection primary function (1)
Excellent quality forests with recreation primary function (3)
Excellent quality forests with production primary function (2)
Other (not excellent quality) forest areas
Protection primary function (4)
Recreation primary function (6)
Production primary function (5)
Zone of areas for afforestation
Zone of areas for afforestation (7)
Zone of good quality arable land
Zone of good quality arable land (9)
LECHNERLAJOS
KNOWLEDGE CENTER
Source: SZIE-KTI, Nébih

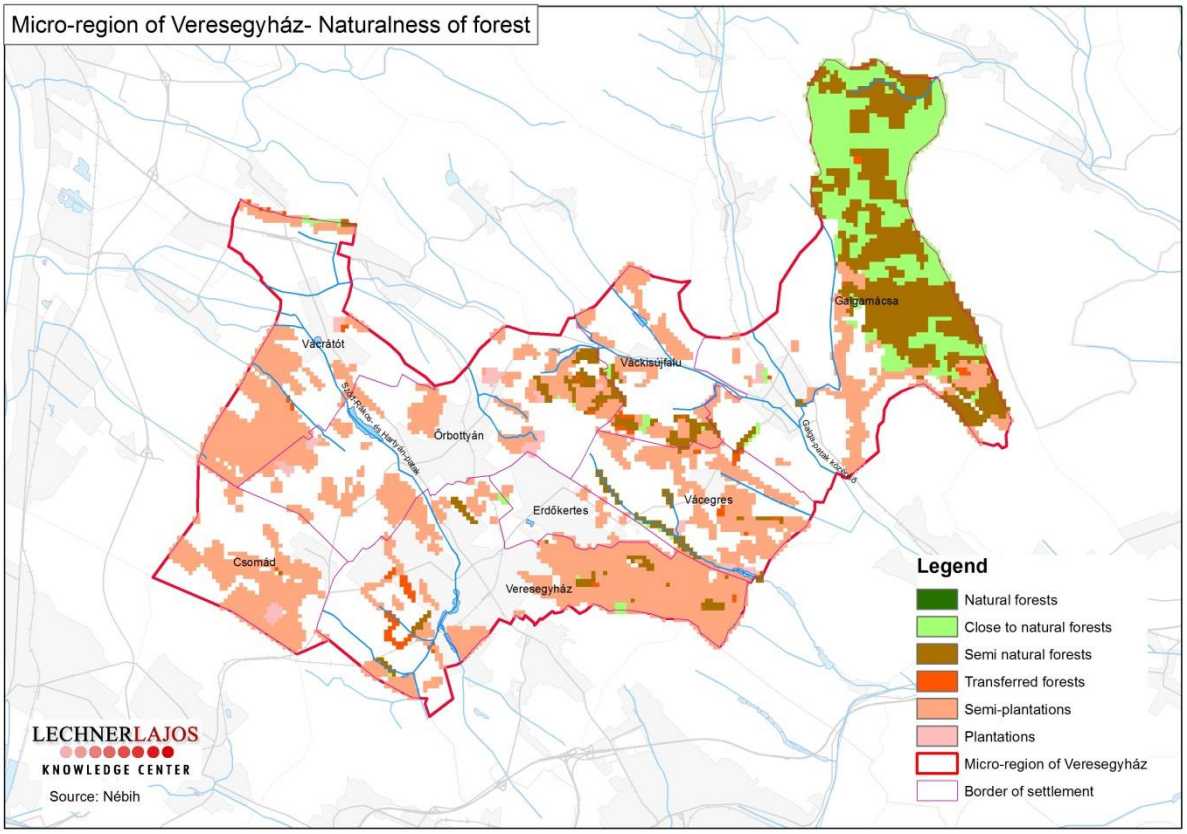
II.2.2. Indicator of importance of forest areas

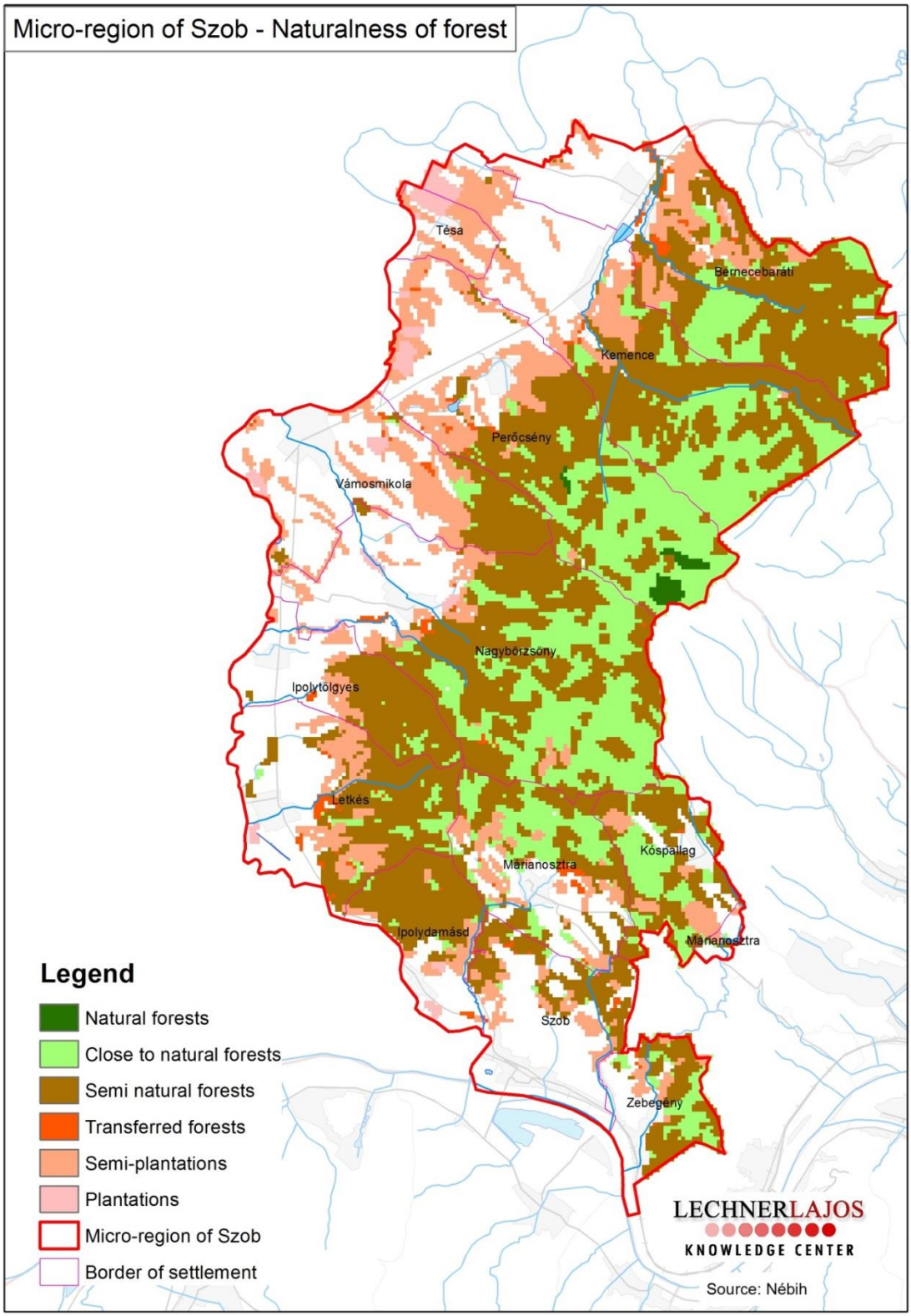
Basic data of forest area assessment

Forests by primary function
II.2.1. Spatial planning and sector development restrictions in forest and agricultural areas

Excellent quality forest area
II.2.1. Spatial planning and sector development restrictions in forest and agricultural areas

Naturalness of forests
Data source: National Forestry Database




Micro-region of Szob - Naturalness of forest
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Legend
Natural forests
Close to natural forests
Semi natural forests
Transferred forests
Semi-plantations
Plantations
Micro-region of Szob
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Source: Nébih

Suitability for afforestation

II.2.1. Spatial planning and sector development restrictions in forest and agricultural areas

Indicator related to the importance of forest areas

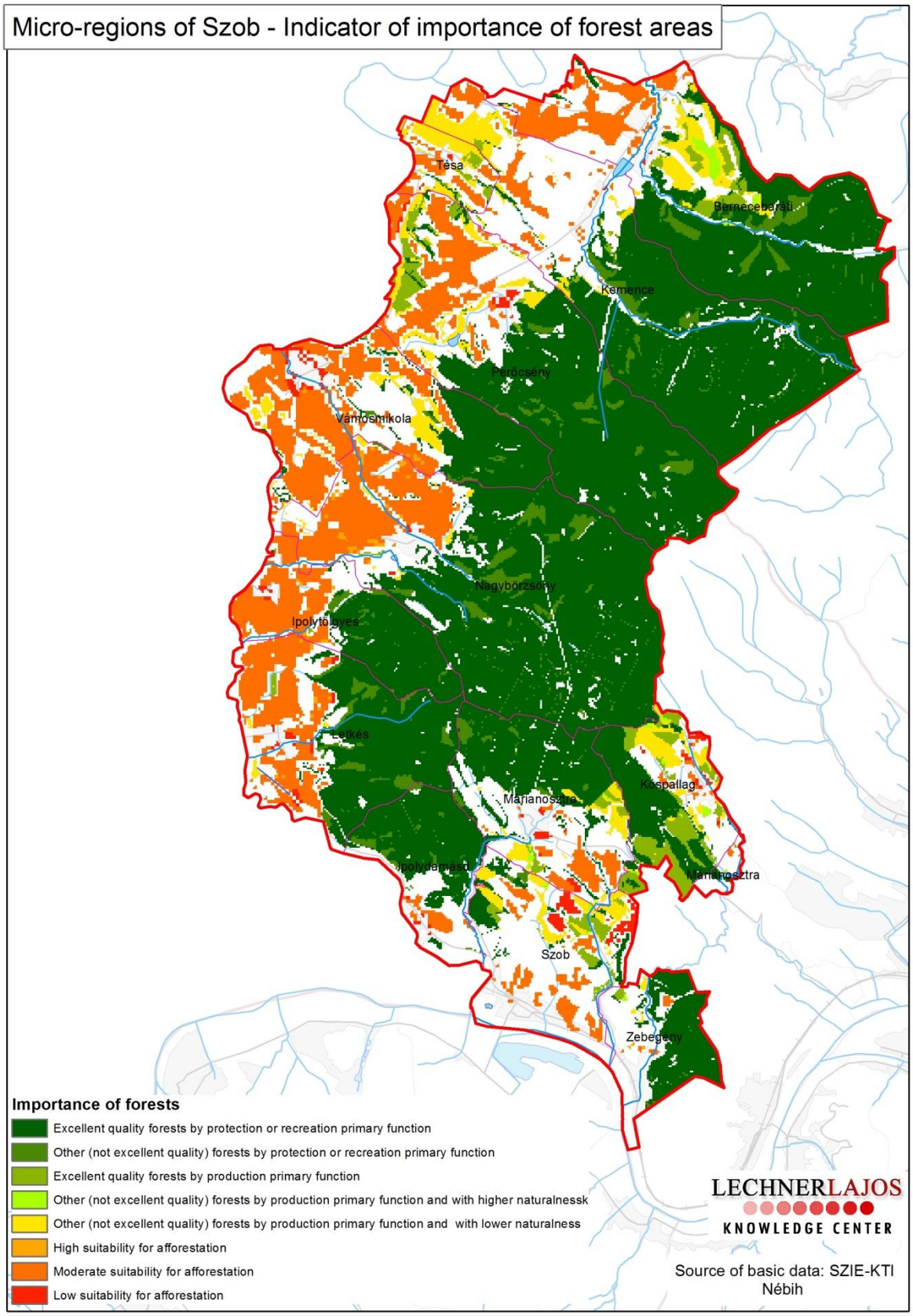
During the planning of landscape and land use the preservation and maintenance of forests is a basic requirement. Urban development on forest area or land use change of forest is possible only in strongly justified cases.
However in the Spatial planning Support System we made attempt to rank forest areas according to their importance. Because of the data availability problems more or less we used the same data (excellent quality forest area, primary function of forest) which were presented in the previous chapter. Besides the result of the afforestation suitability assessment was also included as a basic data. Furthermore we refine our assessment by data of naturalness of forest.

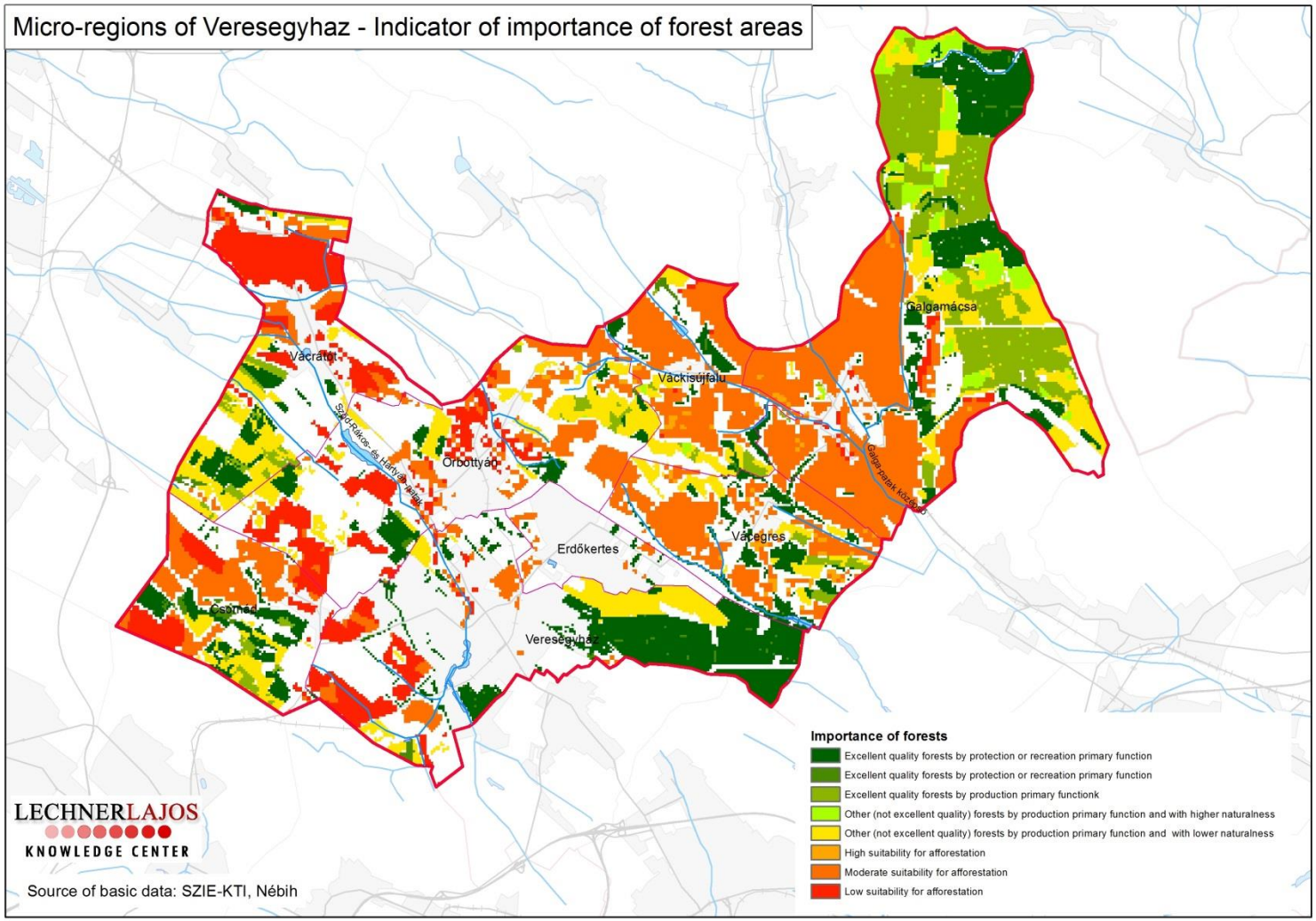
Based on the basic data 36 land types could occur in theory. This number came up by the combination of categories of basic data. From the 36 possible land types in the micro region of Szob 24, in the micro region of Veresegyház 23 were indentified.
Finally these land types were classified into 8 main categories. The rank of these categories presents the importance of the preservation of forest areas and the relevance of the limitation of urban sprawl.

Importance of forest areas	Categories of forest areas and areas suitable for afforestation
1.	Excellent quality forests by protection or recreation primary function
2.	Other (not excellent quality) forests by protection or recreation primary function
3.	Excellent quality forests by production primary function
4.	Other (not excellent quality) forests by production primary function and with higher naturalness
5.	Other (not excellent quality) forests by production primary function and with lower naturalness
6.	High suitability for afforestation
7.	Moderate suitability for afforestation

8.	Low suitability for afforestation

In the first four categories the development should by all means be avoided. In the fifths category - in strongly justified case - development is allowed. Regarding the areas suitable for afforestation the purpose is that development should be placed on those areas which are less suitable for afforestation areas.


Micro-regions of Szob - Indicator of importance of forest areas
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Marianosztra
Ipolydamásd
Szob
Zebegény
Importance of forests
Excellent quality forests by protection or recreation primary function
Other (not excellent quality) forests by protection or recreation primary function
Excellent quality forests by production primary function
Other (not excellent quality) forests by production primary function and with higher naturalnessk
Other (not excellent quality) forests by production primary function and with lower naturalness
High suitability for afforestation
Moderate suitability for afforestation
Low suitability for afforestation
LECHNERLAJOS
KNOWLEDGE CENTER
Source of basic data: SZIE-KTI
Nébih


Micro-regions of Veresegyhaz - Indicator of importance of forest areas
Galgamácsa
Vácrátót
Vácszentlászló
Őrbottyán
Vácegres
Erdőkertes
Csörög
Veresegyház
Importance of forests
Excellent quality forests by protection or recreation primary function
Excellent quality forests by protection or recreation primary function
Excellent quality forests by production primary functionk
Other (not excellent quality) forests by production primary function and with higher naturalness
Other (not excellent quality) forests by production primary function and with lower naturalness
High suitability for afforestation
Moderate suitability for afforestation
Low suitability for afforestation
LECHNERLAJOS
KNOWLEDGE CENTER
Source of basic data: SZIE-KTI, Nébih

II.2.3. Evaluation of agricultural areas

Basic data of evaluation of agricultural areas

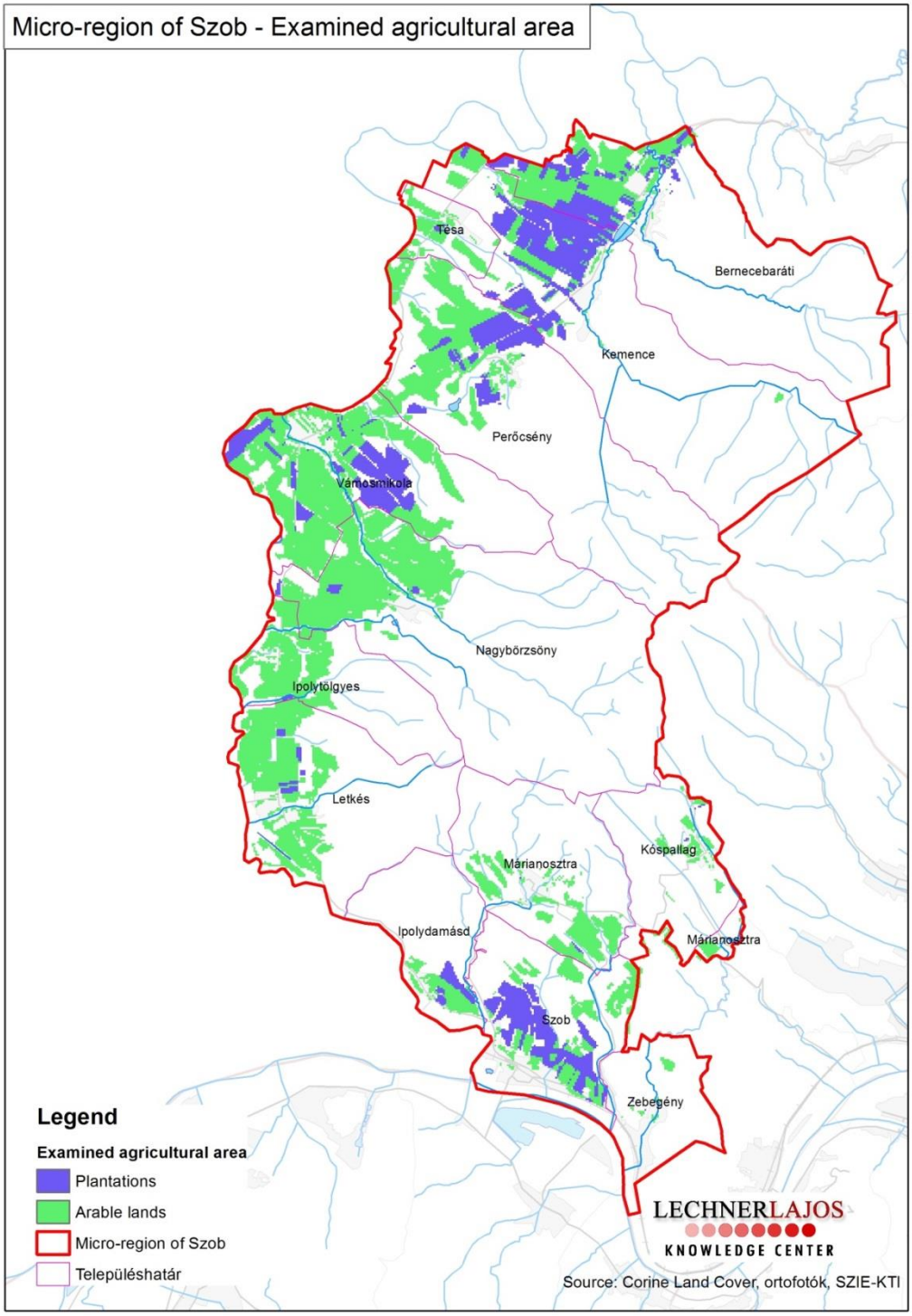
Arable lands are the most important target areas of both the development of green and grey infrastructure. To find the best places for urban development and to assist the development of green infrastructure - besides the assessment of natural assets - the evaluation of agricultural lands is a fundamental requirement.

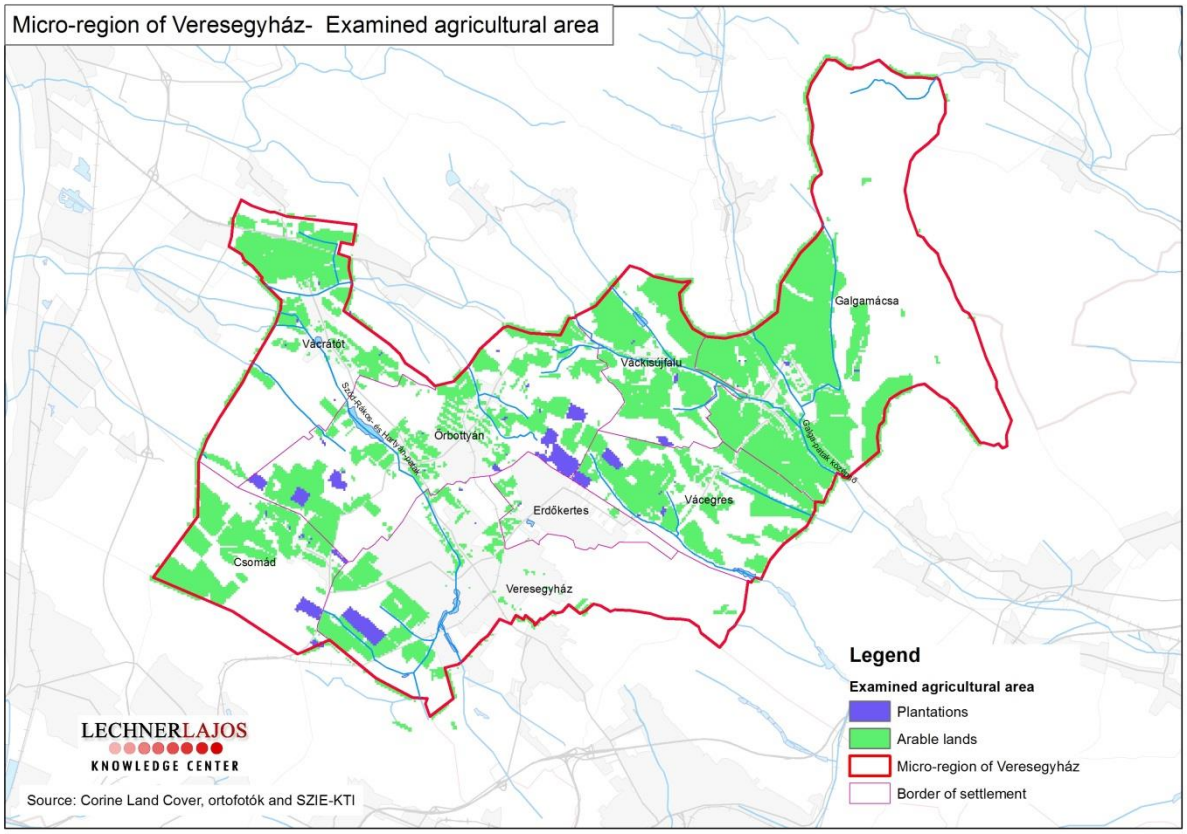
For the evaluation of agricultural areas the following aspects should be considered:

- Type of agricultural land use
- Soil and climate suitability for plant production
- Environmental sensitivity of agricultural areas
- Intensity and sustainability of agricultural cultivation
- Socio-economic aspects of agriculture

In the Spatial Planning Support System we could incorporate the first three aspects. The last two criteria were not used because of the lack of necessary data, and the disputes on data evaluation and application.

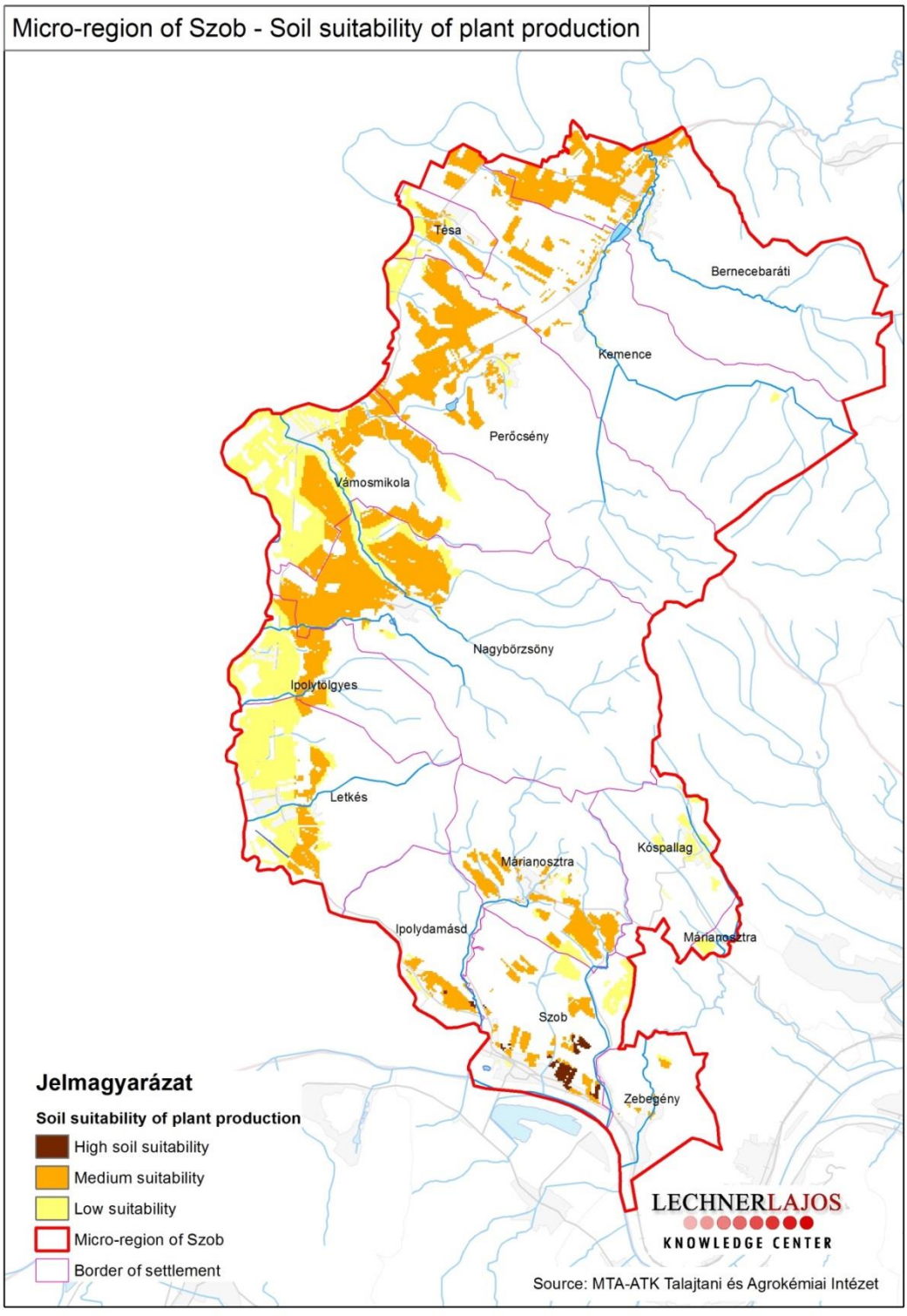
Agricultural land use
Database: EEA Corine land Cover modified by ortophoto-maps

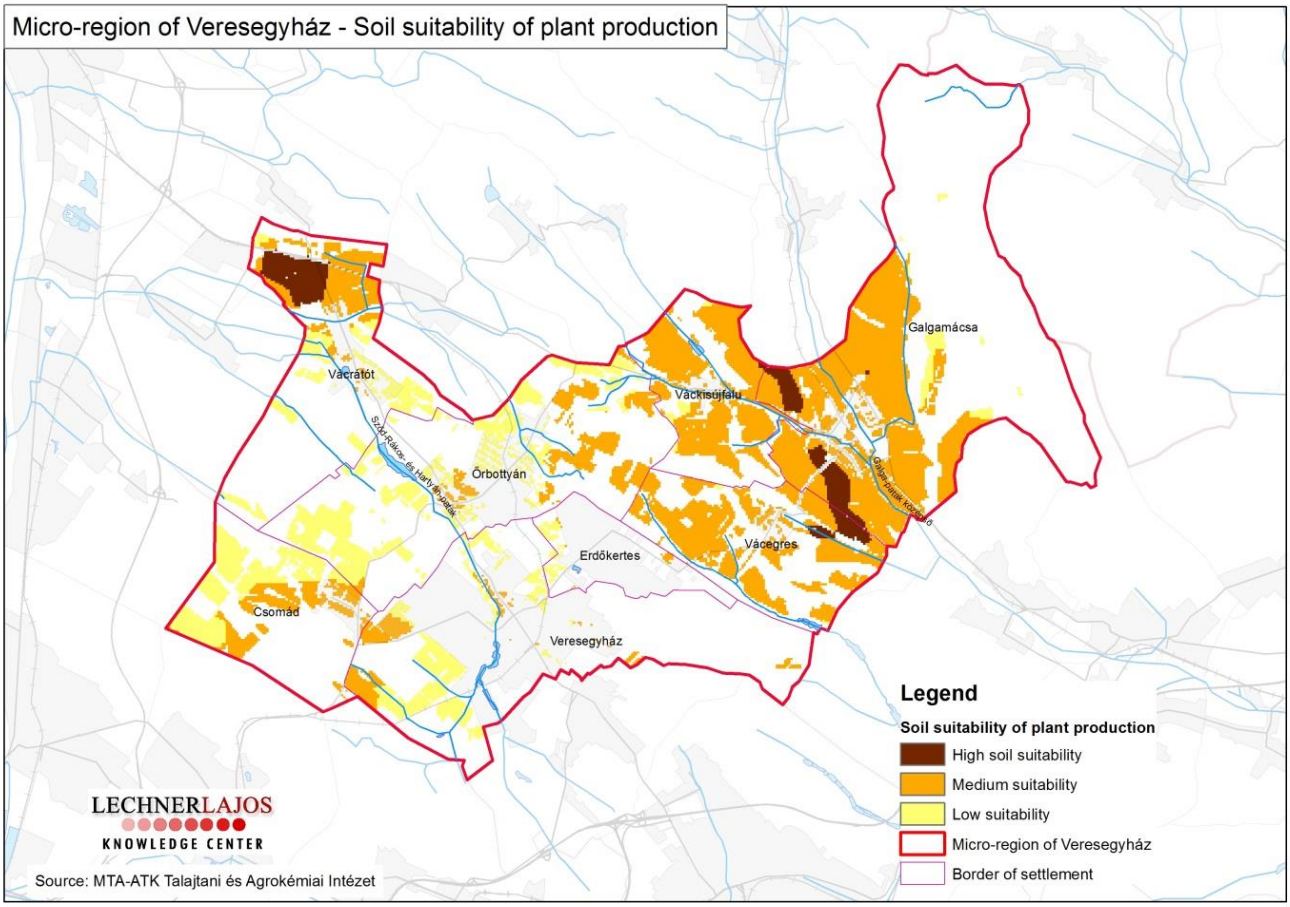



Micro-region of Veresegyház- Examined agricultural area
Galgamácsa
Vácrátót
Vácszentlászló
Őrbottyán
Vácegres
Erdőkertes
Csomád
Veresegyház
LECHNERLAJOS
KNOWLEDGE CENTER
Source: Corine Land Cover, ortofotók and SZIE-KTI
Legend
Examined agricultural area
Plantations
Arable lands
Micro-region of Veresegyház
Border of settlement

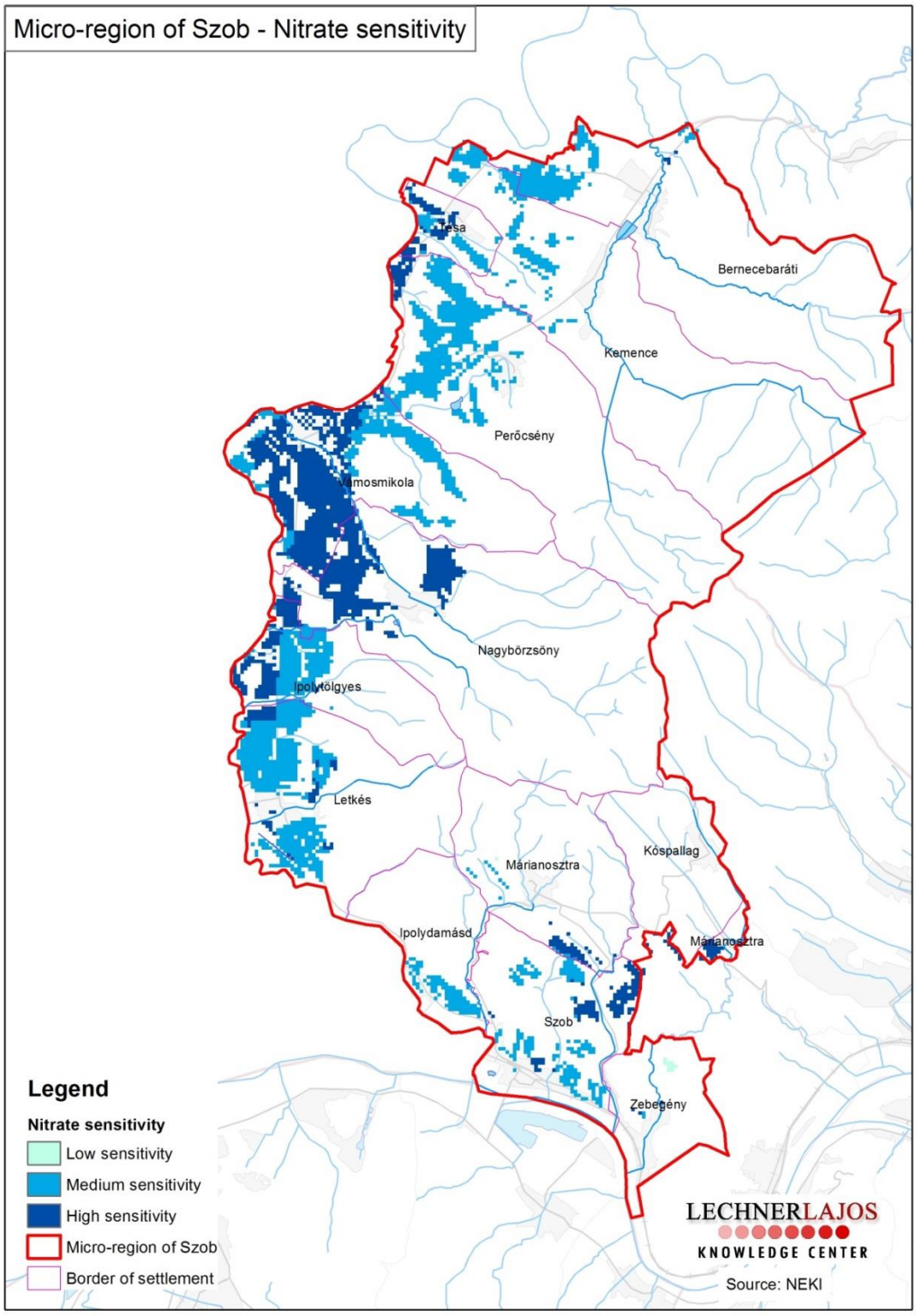
Soil suitability for plant production

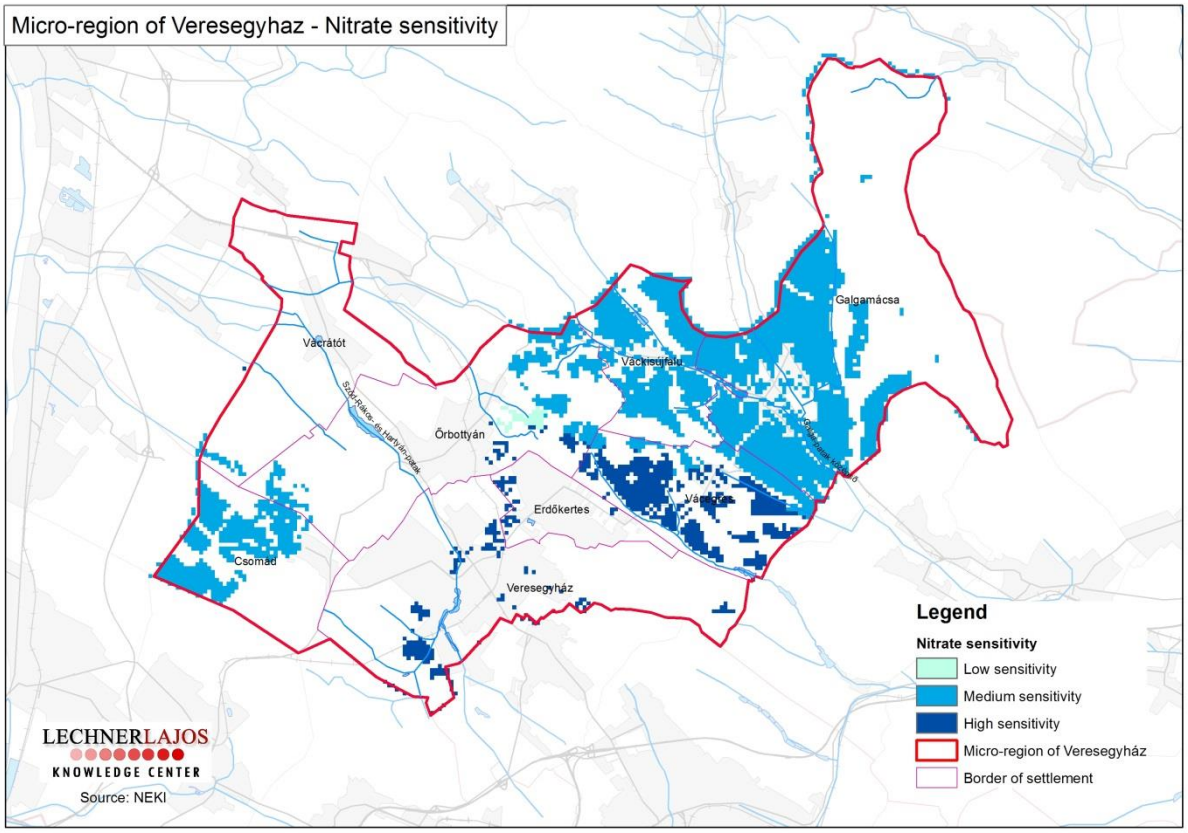
Dara source: Kreybig Soil Information System (so called DKTiR), based on large scale soil (S= 1: 25 000) maps created by Lajos Kreybig



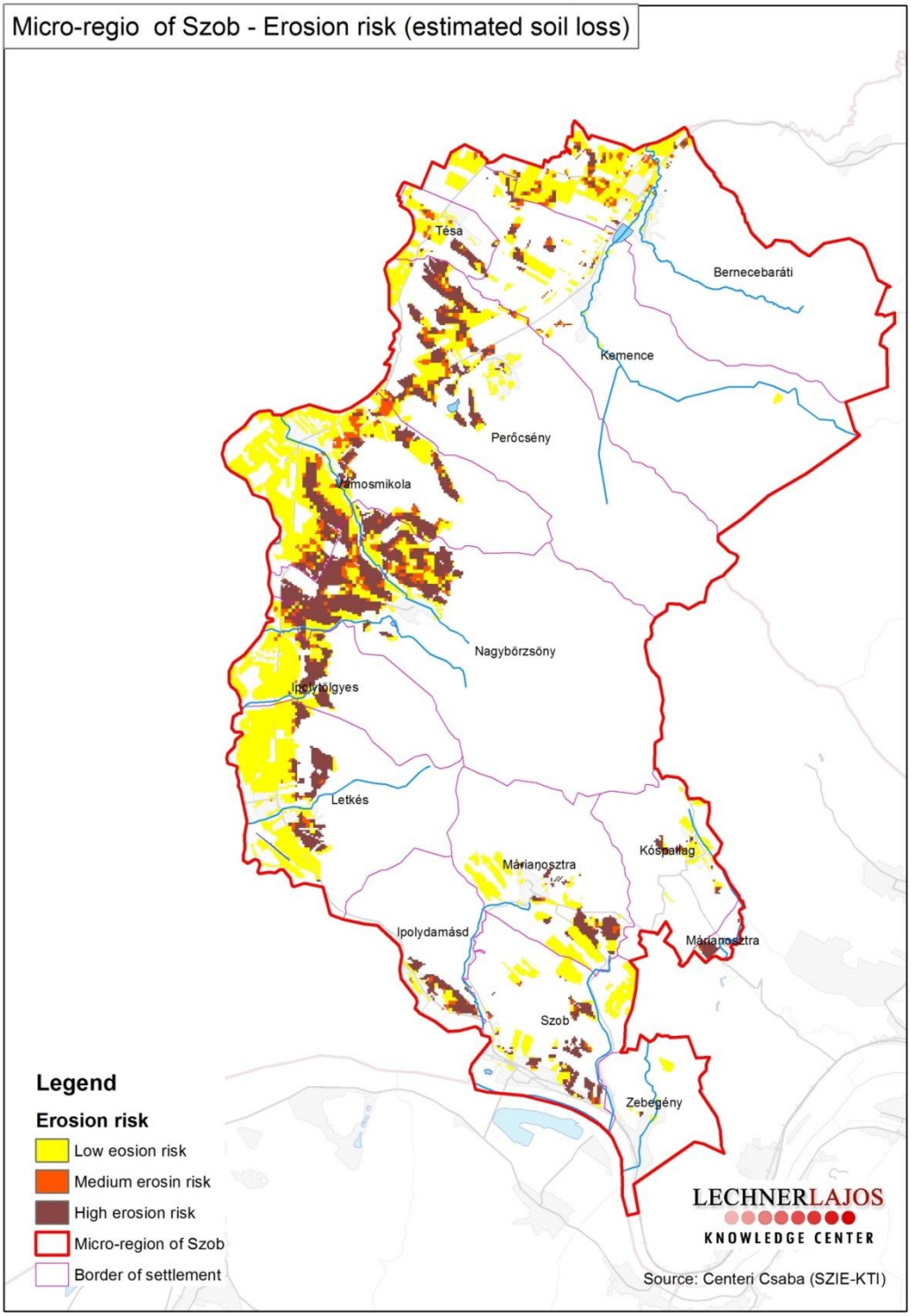

Micro-region of Veresegyház - Soil suitability of plant production
Galgamácsa
Vácrátót
Vácszentlászló
Örbottyán
Vácegres
Erdőkertes
Csomád
Veresegyház
Legend
Soil suitability of plant production
High soil suitability
Medium suitability
Low suitability
Micro-region of Veresegyház
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Source: MTA-ATK Talajtani és Agrokémiai Intézet

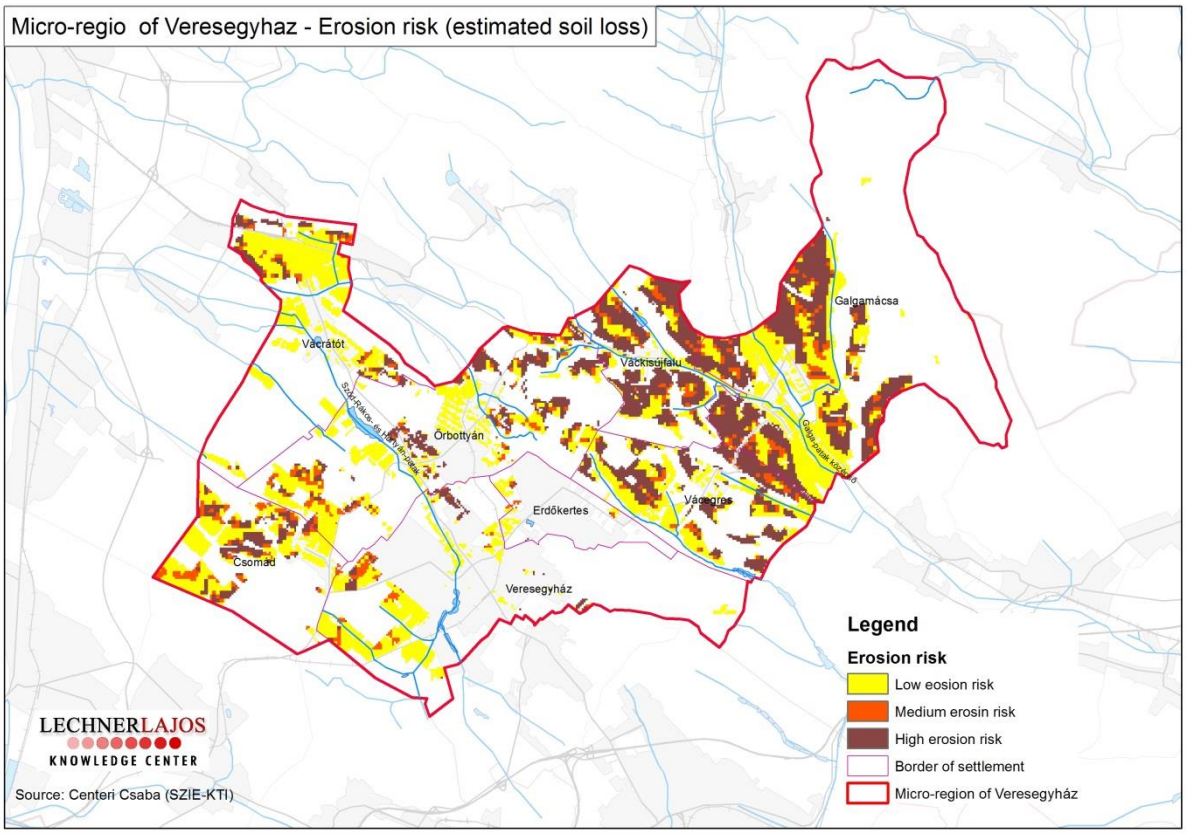
Nitrate sensitivity
Data source: National Institute for Environment



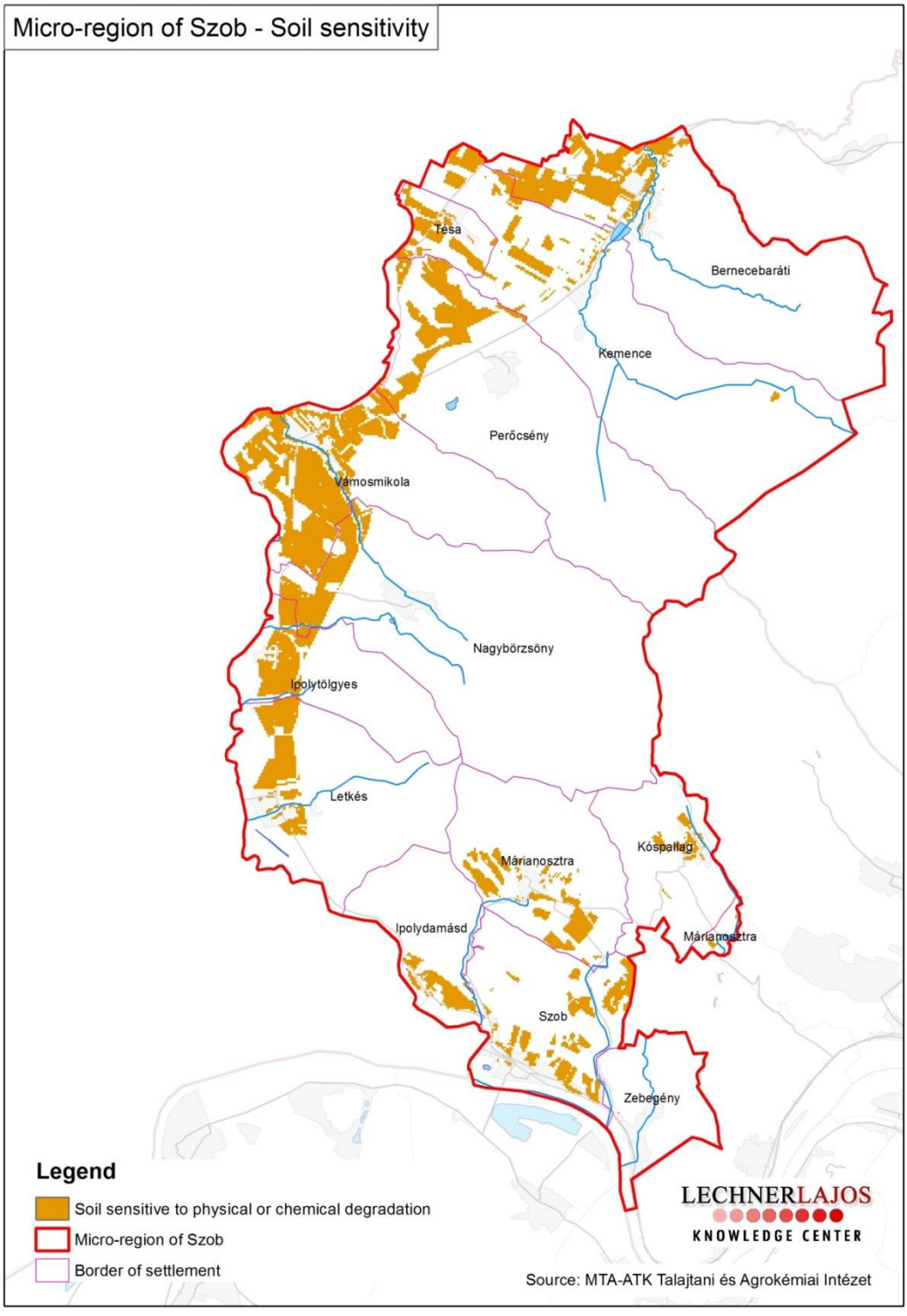

Micro-region of Veresegyhaz - Nitrate sensitivity
Vácrátót
Galgamácsa
Vácszentlászló
Őrbottyán
Erdőkertes
Csomád
Veresegyház
Legend
Nitrate sensitivity
Low sensitivity
Medium sensitivity
High sensitivity
Micro-region of Veresegyház
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Source: NEKI

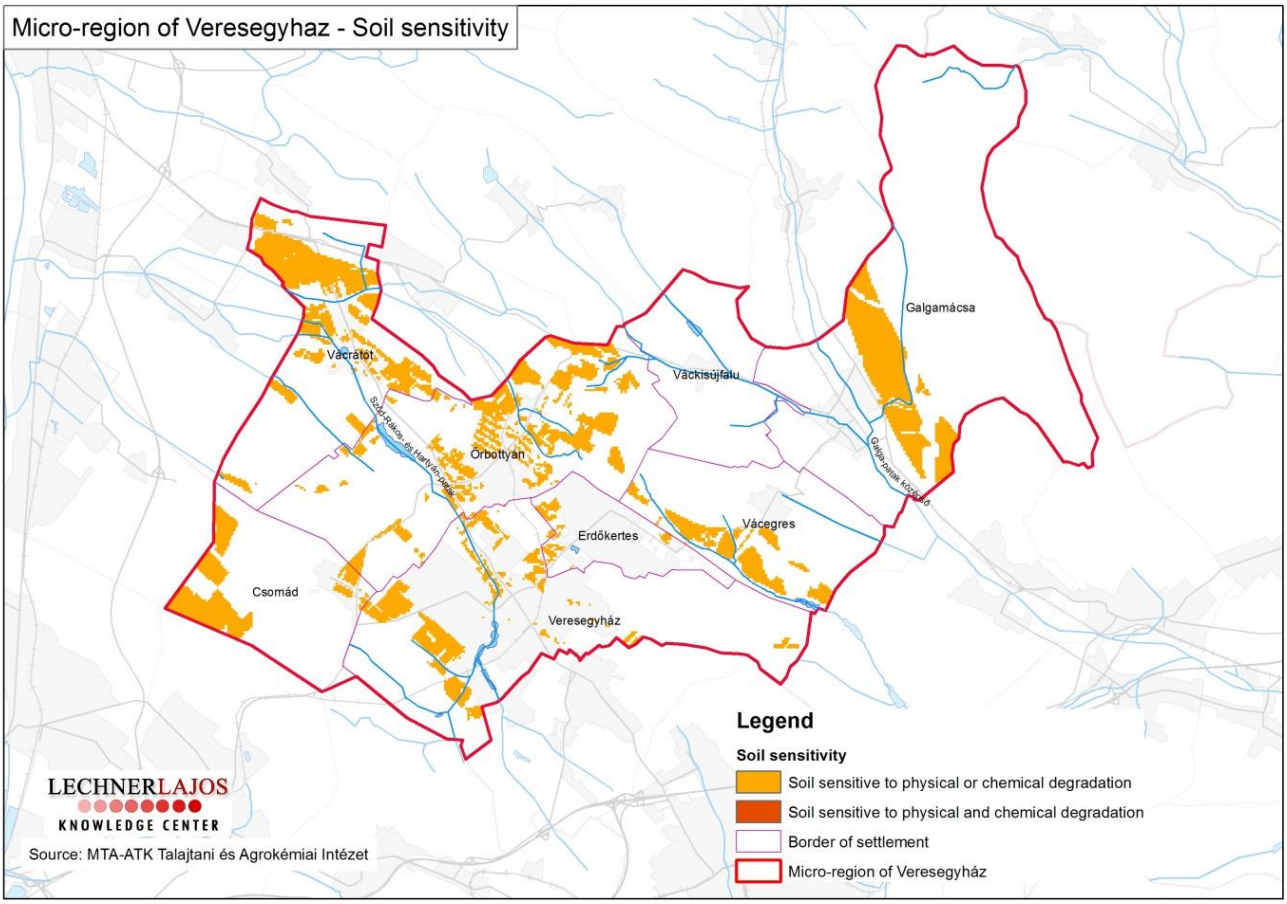
Estimated actual soil loss (erosion risk)
Data source: Szent István University Institute of Environmental and Landscape Management Department of Landscape Ecology and Nature Conservation (Csaba Centeri)




Micro-regio of Veresegyhaz - Erosion risk (estimated soil loss)
Galgamácsa
Vácrátót
Vácrátót
Örbottyán
Erdőkertes
Csomád
Veresegyház
Legend
Erosion risk
Low eosion risk
Medium erosin risk
High erosion risk
Border of settlement
Micro-region of Veresegyház
LECHNERLAJOS
KNOWLEDGE CENTER
Source: Centeri Csaba (SZIE-KTI)

Soil sensitivity (regarding physical and chemical soil degradation)
Dara source: Kreybig Soil Information System (so called DKTiR), based on large scale soil (S= 1: 25 000) maps created by Lajos Kreybig





Main category	Soil suitability	Environmental sensitivity (nitrate sensitivity, actual soil loss caused by erosion, soil sensitivity in terms of phisical and chemical degradation)	Importance of the maintanance of agricultural activities
Arable land with excellent and good plant-production suitability (based on soil characteristic), and with low	3 score	at most one out of three basic data reaches the maximum value 2 (the others are 0 or 1)	**1.(very high)**

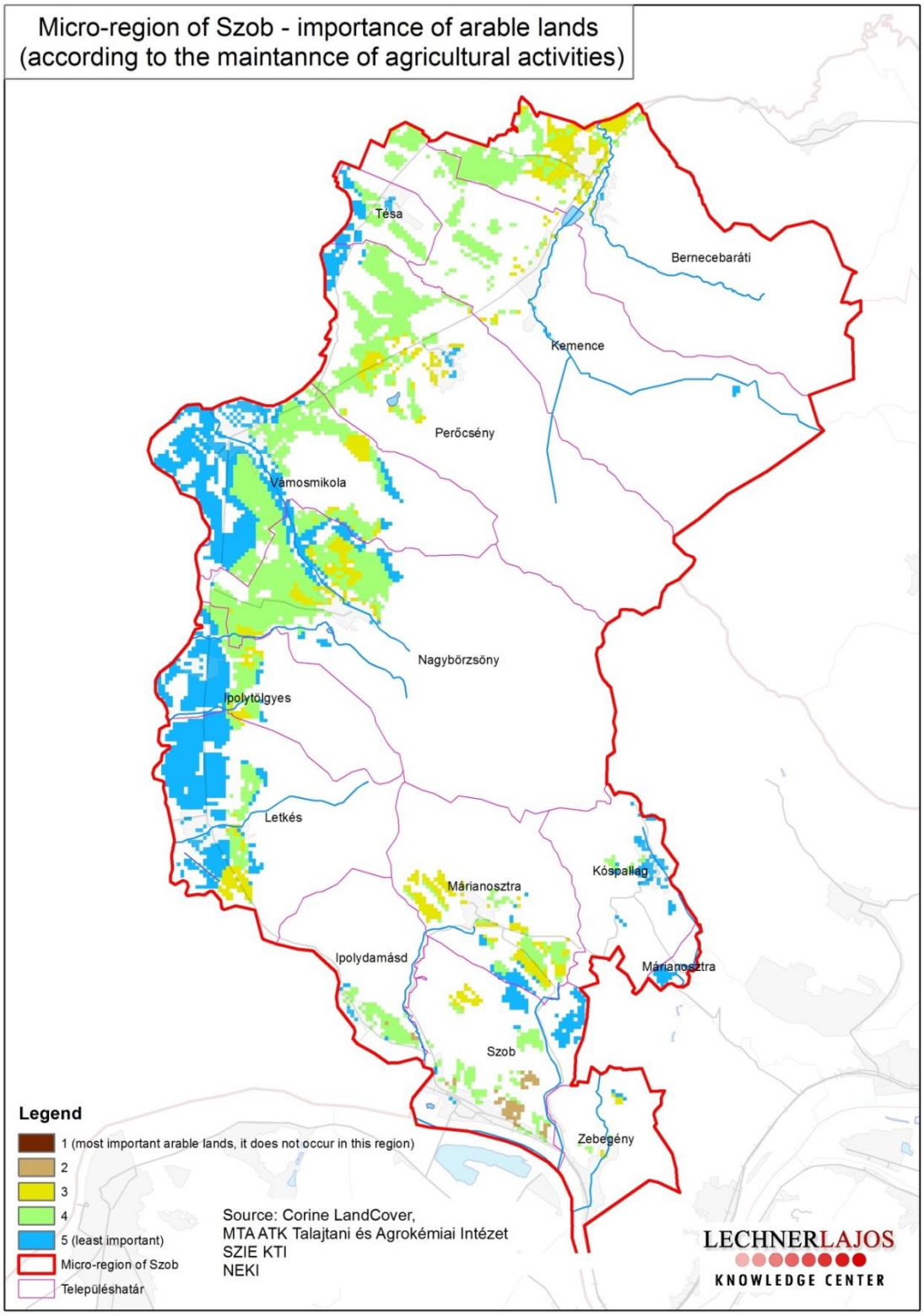
environmental sensitivity			
Environmentally senistive arable land with excellent and good plant production suitability (based on soil characteristic)	3 score	at least one out of three environmental senistivity basic data reaches value 3 or at least two out of three basic data reach at least valuue 2	**2.**
Arable land with medium plant production suitability (based on soil characteristic) and with low environmental sensitivity	2 score	at most one out of three aspects reaches the maximum value 2 (the others are 0 or 1)	**3.**
Environmentally senistive arable land with medium t production suitability (based on soil characteristic)	2 score	at least one out of three environmental sensitivity basic data value 3 or at least two out of three basic data reach at least value 2	**4.**
Arable land with poor plant production suitability (based on soil characteristic)	1 score	It was not differentiated according to sensitivity	**5. (very low)**

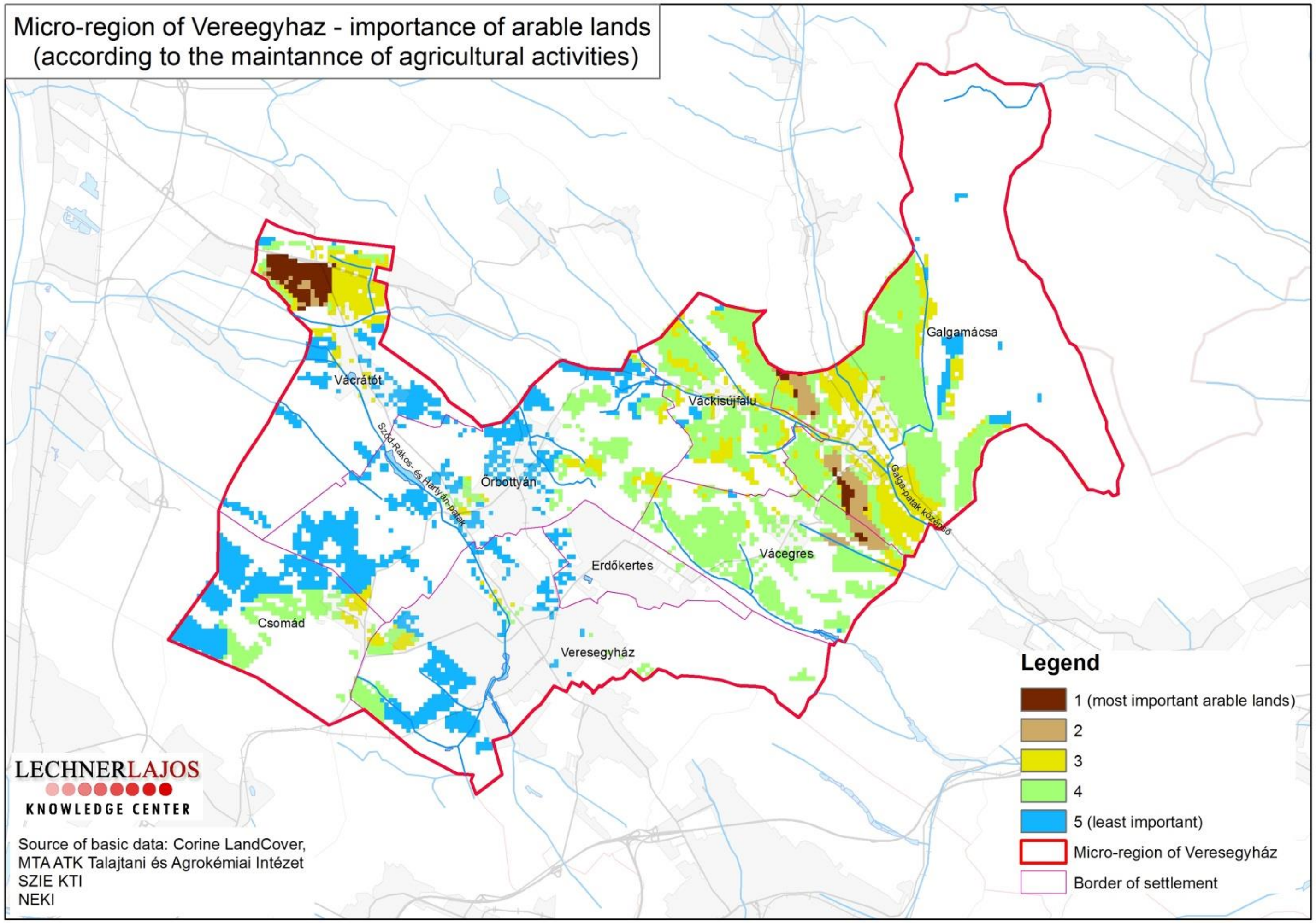
Categories of arable lands and their importance according to the maintenance of agriculture activities

Based on the previously introduced basic data, 108 land types could occur in theory. This number came up by the combination of categories of basic data (3x3x3x4= 108). From the 108 possible land types in the micro region of Szob 54, in the micro region of Veresegyház 60 were indentified.

According to the opinions of experts these land types were classified into five main categories. During the reclassification, the soil suitability criterion was prioritised and then

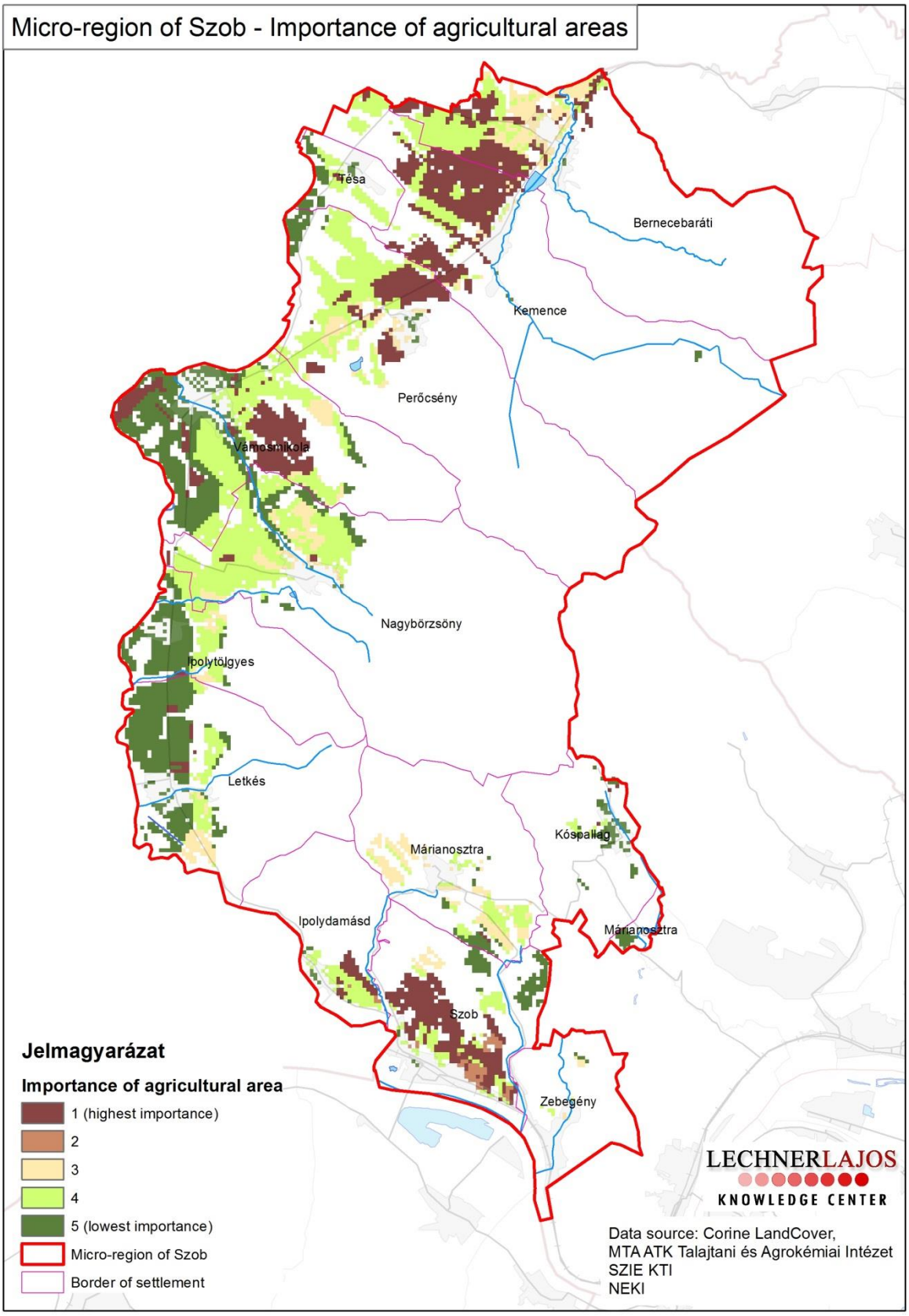
new categories were elaborated according to their environmental sensitivity. The main categories of arable lands are the following:

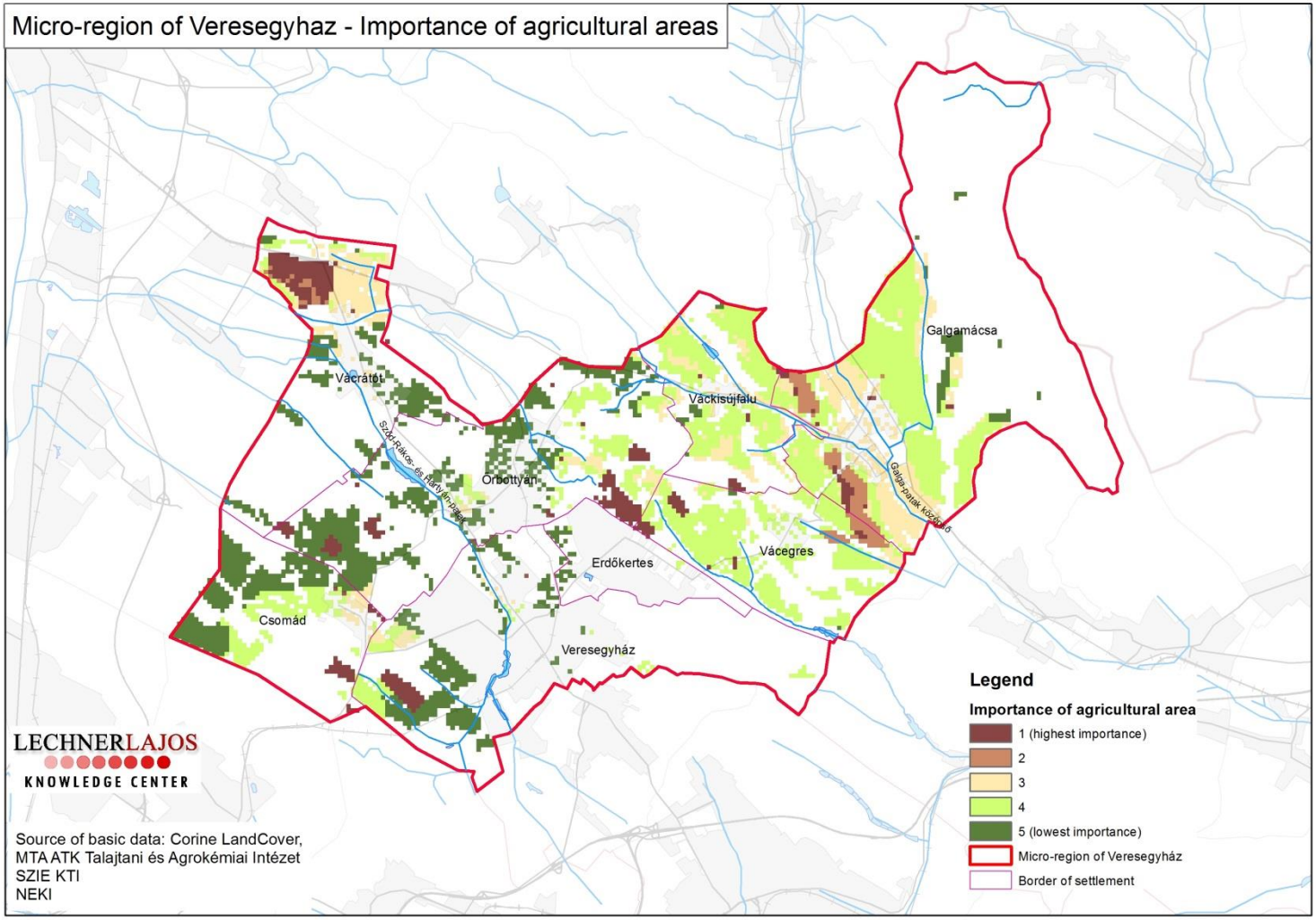



Micro-region of Vereegyhaz - importance of arable lands
(according to the maintannce of agricultural activities)
Galgamácsa
Vácrátót
Váckisújfalu
Szód-Rákos- és Hartyán-patak
Őrbottyán
Galga-patak közép
Vácegres
Erdőkertes
Csomád
Veresegyház
Legend
1 (most important arable lands)
2
3
4
5 (least important)
Micro-region of Veresegyház
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Source of basic data: Corine LandCover,
MTA ATK Talajtani és Agrokémiai Intézet
SZIE KTI
NEKI

Importance of agricultural areas according to the maintenece of the agricultural activities

The previously introduces assessment was elaborated only for arable lands. Regarding plantation we were not able to differentiate the areadue to the lack of necessery data. However in a discussion of experts, all of the plantation area in the case study were put into the the category (of the previously introducet categerisation of arable land) where the maintenance of agricultural activities are the most important. The reason is low (below 5%) share of plantation in Hungary, and these areas significantly contribute to the economic production and population retention capabilities.


Micro-region of Szob - Importance of agricultural areas
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Márianosztra
Kóspallag
Ipolydamásd
Márianosztra
Szob
Zebegény
Jelmagyarázat
Importance of agricultural area
1 (highest importance)
2
3
4
5 (lowest importance)
Micro-region of Szob
Border of settlement
LECHNERLAJOS
KNOWLEDGE CENTER
Data source: Corine LandCover,
MTA ATK Talajtani és Agrokémiai Intézet
SZIE KTI
NEKI


Micro-region of Veresegyhaz - Importance of agricultural areas
Galgamácsa
Vácrátót
Vácisüjfalu
Szőci Rákos- és Hartyán-patak
Orbottyán
Galga-patak közepső
Vácegres
Erdőkertes
Csomád
Veresegyház
LECHNERLAJOS
KNOWLEDGE CENTER
Source of basic data: Corine LandCover,
MTA ATK Talajtani és Agrokémiai Intézet
SZIE KTI
NEKI
Legend
Importance of agricultural area
1 (highest importance)
2
3
4
5 (lowest importance)
Micro-region of Veresegyház
Border of settlement

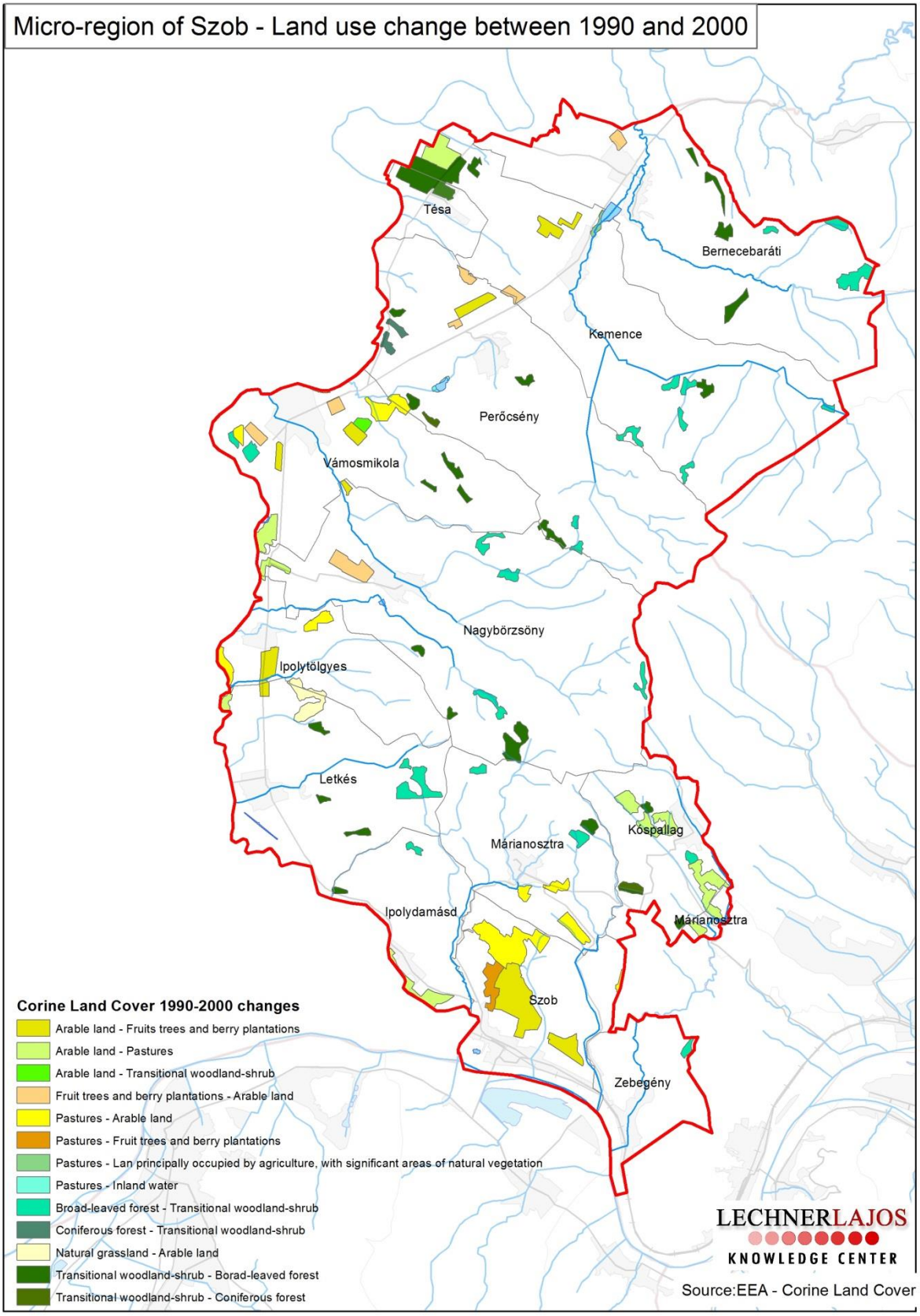
II.3. Residential and industrial/commercial development target areas

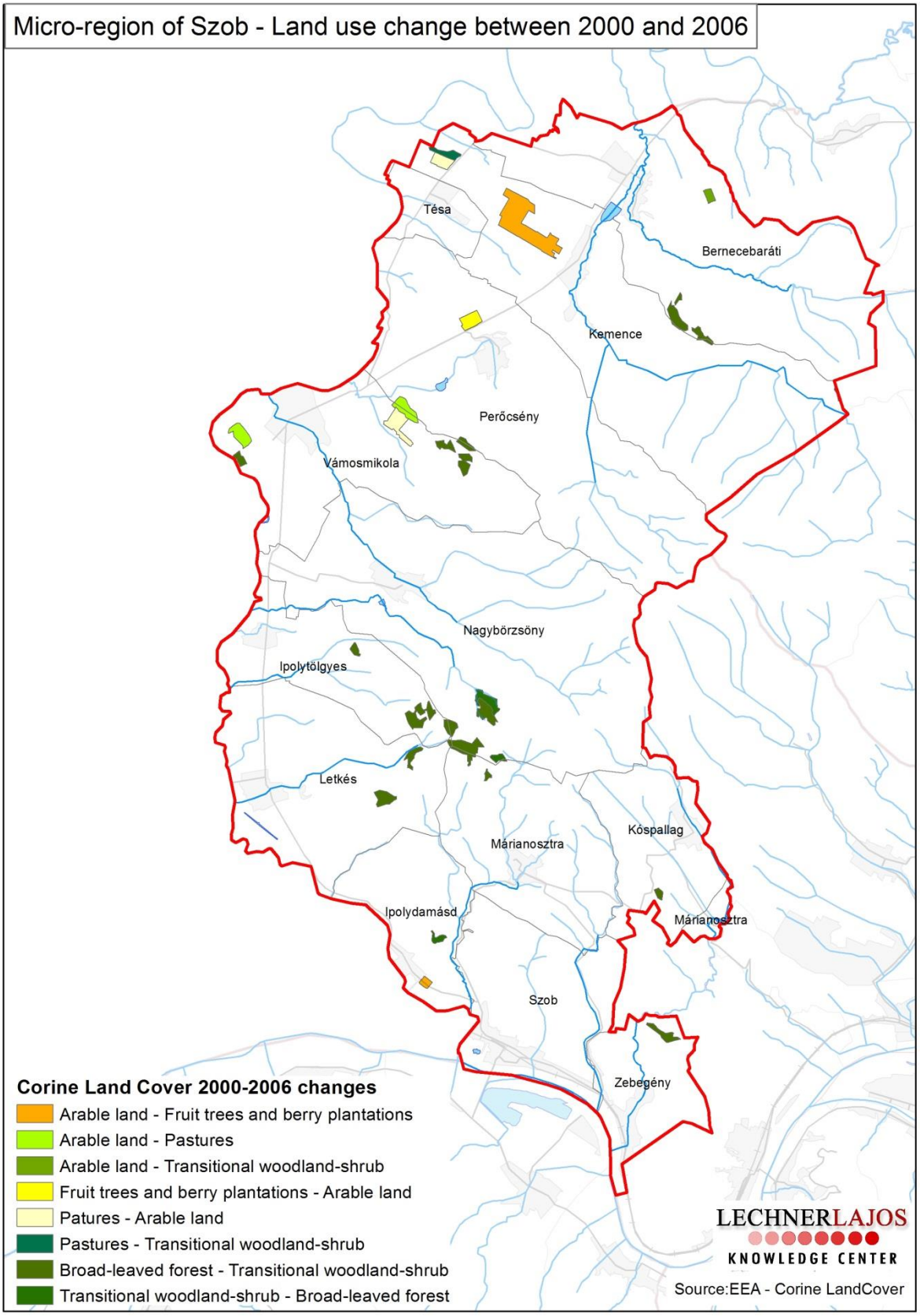
II.3.1. Suitability indicators of residential and industrial/commercial areas

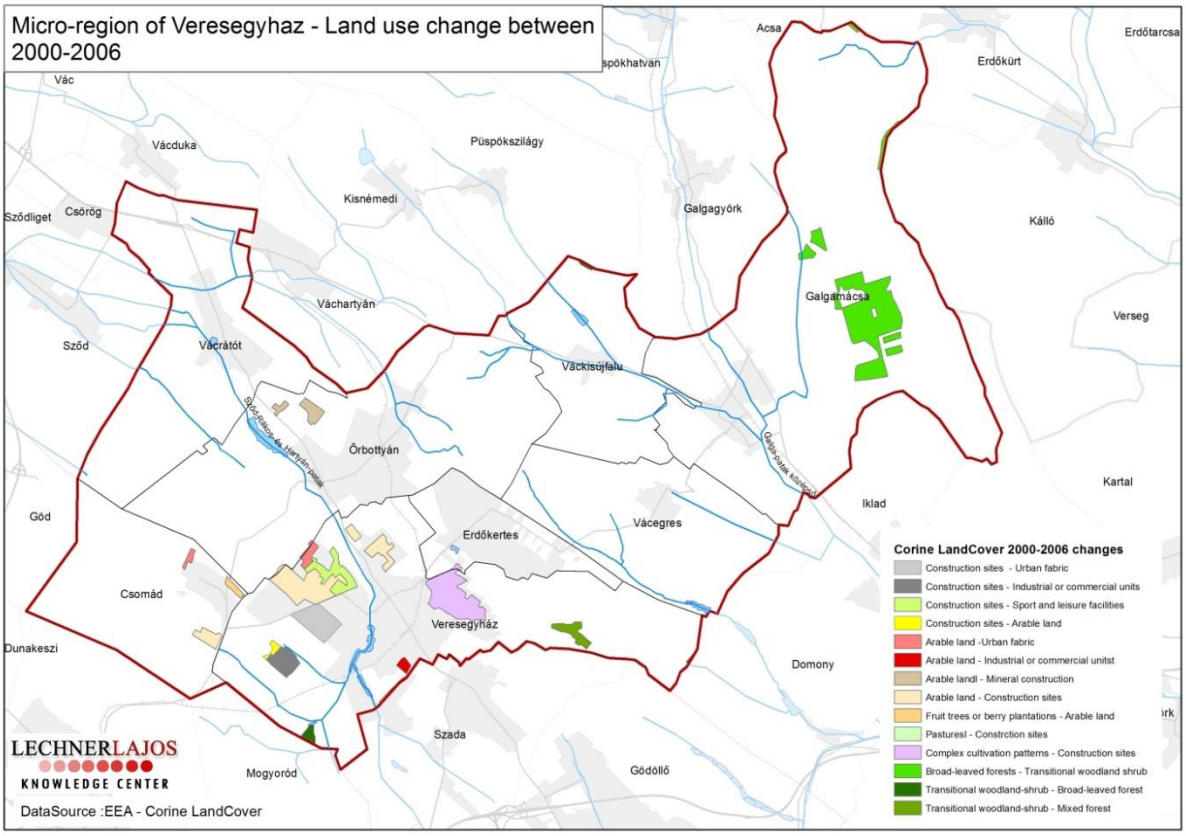
The most suitable areas for residential and industrial/commercial development have been designated based on the analysis of number of aspects. The investigations and the results were made on 250x250 m raster land-use maps.

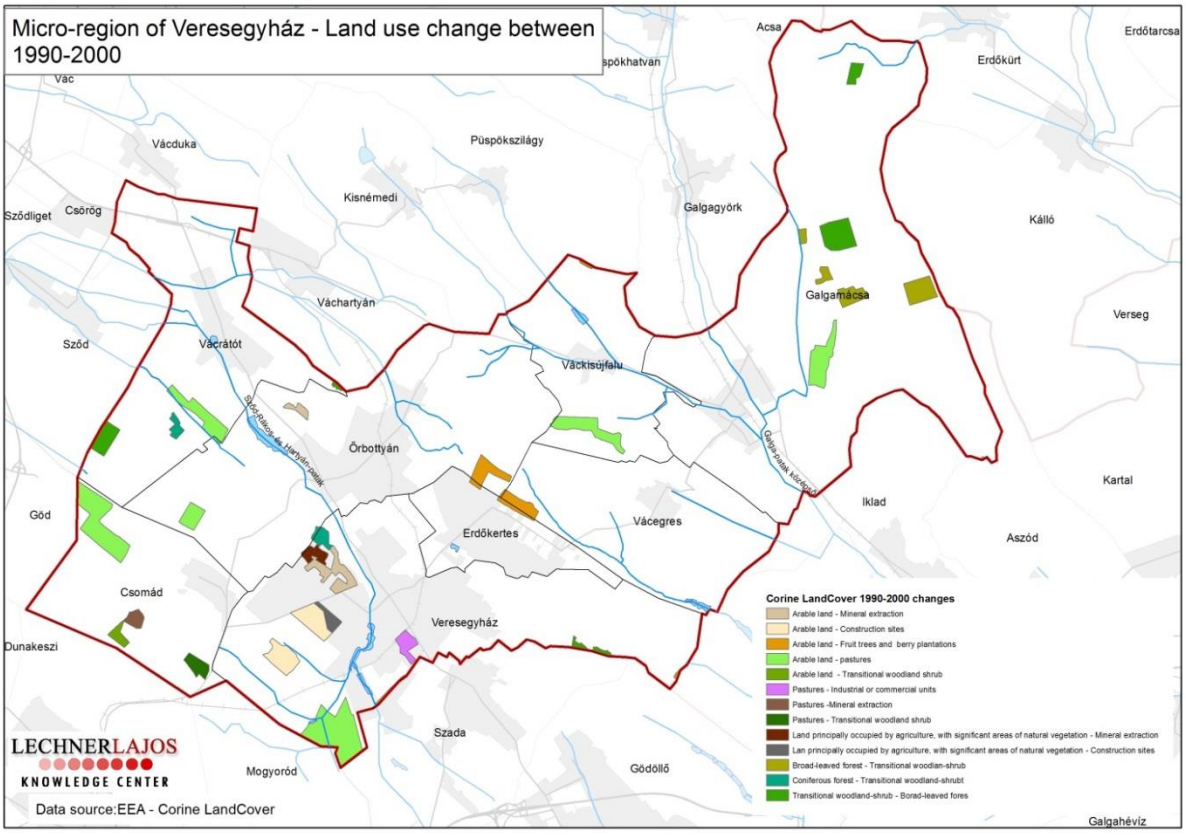
Land use change processes (neighbourhood relations)

By analysing time series data (1990-2000-2006) of the Corine Land Cover database, the direction of the increase of residential or industrial/commercial areas as well as the land-use change regularities can be determined. These latter show the permanency or inertia against change of various land-use types, as well as the interactions between the same or different neighbouring land-uses, which may be attractive, stimulating, repulsive effects.


Micro-region of Szob - Land use change between 1990 and 2000
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Márianosztra
Kóspallag
Ipolydamásd
Márianosztra
Szob
Zebegény
Corine Land Cover 1990-2000 changes
Arable land - Fruits trees and berry plantations
Arable land - Pastures
Arable land - Transitional woodland-shrub
Fruit trees and berry plantations - Arable land
Pastures - Arable land
Pastures - Fruit trees and berry plantations
Pastures - Lan principally occupied by agriculture, with significant areas of natural vegetation
Pastures - Inland water
Broad-leaved forest - Transitional woodland-shrub
Coniferous forest - Transitional woodland-shrub
Natural grassland - Arable land
Transitional woodland-shrub - Borad-leaved forest
Transitional woodland-shrub - Coniferous forest
LECHNERLAJOS
KNOWLEDGE CENTER
Source:EEA - Corine Land Cover

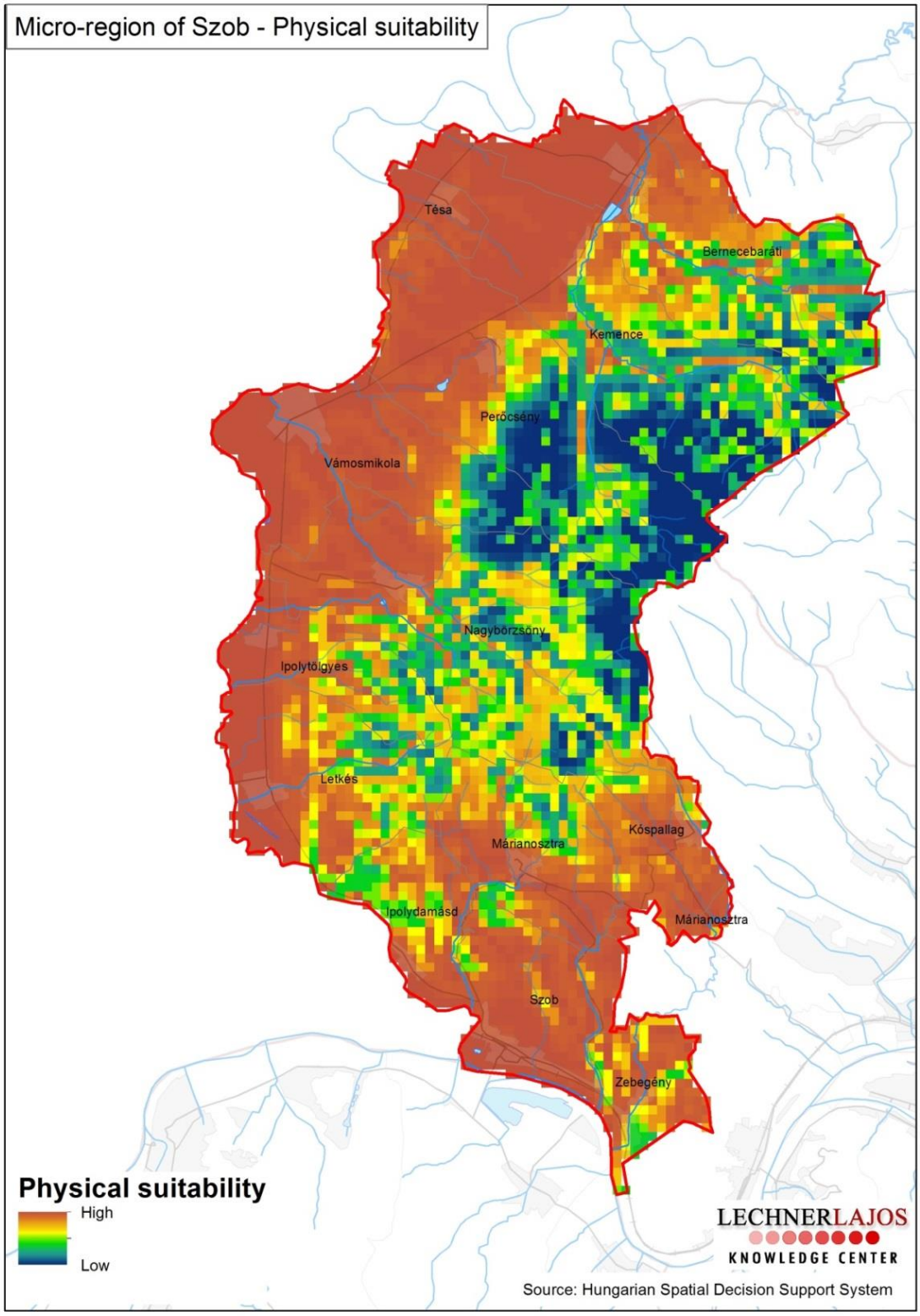

Micro-region of Szob - Land use change between 2000 and 2006
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Márianosztra
Kóspallag
Ipolydamásd
Márianosztra
Szob
Zebegény
Corine Land Cover 2000-2006 changes
Arable land - Fruit trees and berry plantations
Arable land - Pastures
Arable land - Transitional woodland-shrub
Fruit trees and berry plantations - Arable land
Patures - Arable land
Pastures - Transitional woodland-shrub
Broad-leaved forest - Transitional woodland-shrub
Transitional woodland-shrub - Broad-leaved forest
LECHNERLAJOS
KNOWLEDGE CENTER
Source:EEA - Corine LandCover

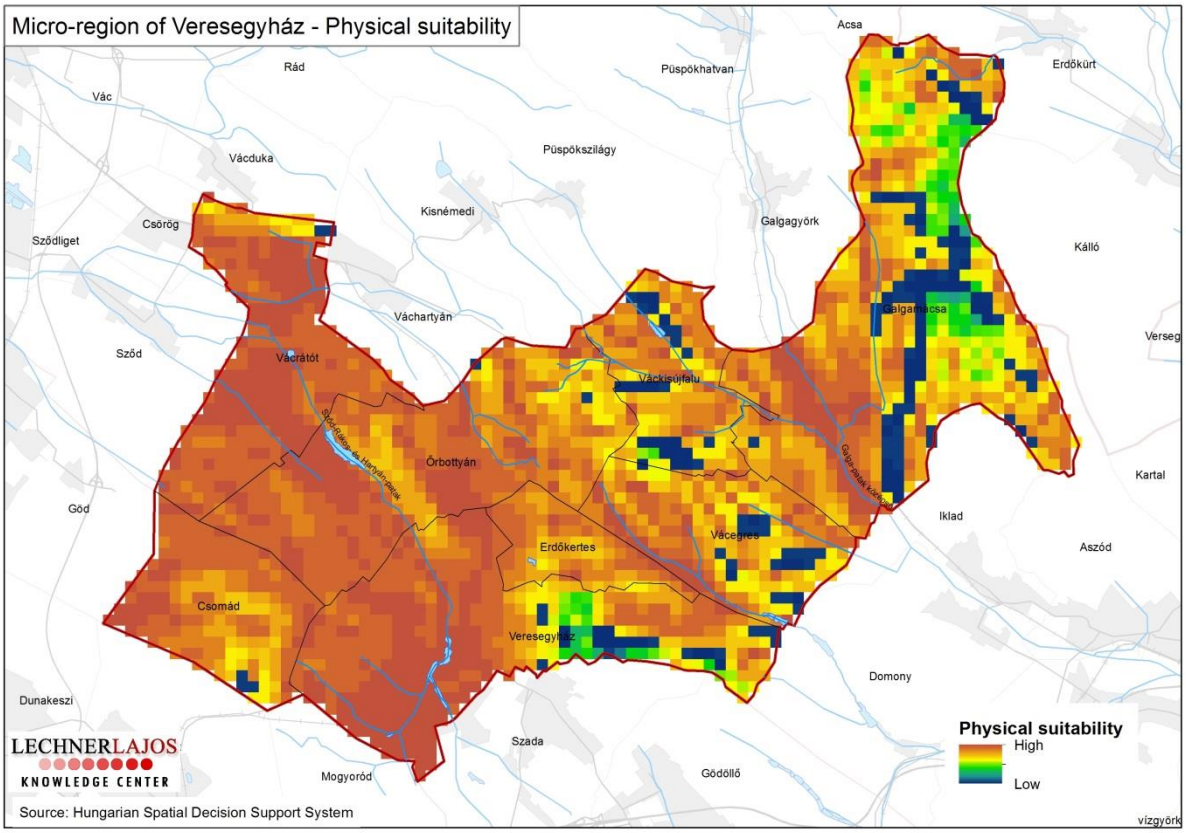

Micro-region of Veresegyhaz - Land use change between 2000-2006
Acsa
Erdőtarcsa
Erdőkürt
Vác
Vácduka
Püspökszilágy
Kisnémedi
Csörög
Sződliget
Galgagyörk
Kálló
Galgamácsa
Váchartyán
Verseg
Szód
Vácrátót
Vácisújfalu
Örbottyán
Kartal
Iklad
Göd
Erdőkertes
Vácegres
Csomád
Veresegyház
Dunakeszi
Domony
Szada
Mogyoród
Gödöllő
LECHNERLAJOS
KNOWLEDGE CENTER
DataSource :EEA - Corine LandCover
Corine LandCover 2000-2006 changes
Construction sites - Urban fabric
Construction sites - Industrial or commercial units
Construction sites - Sport and leisure facilities
Construction sites - Arable land
Arable land -Urban fabric
Arable land - Industrial or commercial unitst
Arable landl - Mineral construction
Arable land - Construction sites
Fruit trees or berry plantations - Arable land
Pasturesl - Constrction sites
Complex cultivation patterns - Construction sites
Broad-leaved forests - Transitional woodland shrub
Transitional woodland-shrub - Broad-leaved forest
Transitional woodland-shrub - Mixed forest


Micro-region of Veresegyház - Land use change between 1990-2000
Acsa
Erdőtarcsa
Erdőkürt
Vác
Vácduka
Püspökszilágy
Kisnémedi
Csörög
Sződliget
Galgagyörk
Kálló
Galgamácsa
Váchartyán
Verseg
Szód
Vácrátót
Vácisújfalu
Örbottyán
Kartal
Iklad
Göd
Erdőkertes
Vácegres
Aszód
Csomád
Veresegyház
Dunakeszi
Szada
Mogyoród
Gödöllő
Galgahévíz
LECHNERLAJOS
KNOWLEDGE CENTER
Data source:EEA - Corine LandCover
Corine LandCover 1990-2000 changes
Arable land - Mineral extraction
Arable land - Construction sites
Arable land - Fruit trees and berry plantations
Arable land - pastures
Arable land - Transitional woodland shrub
Pastures - Industrial or commercial units
Pastures -Mineral extraction
Pastures - Transitional woodland shrub
Land principally occupied by agriculture, with significant areas of natural vegetation - Mineral extraction
Lan principally occupied by agriculture, with significant areas of natural vegetation - Construction sites
Broad-leaved forest - Transitional woodlan-shrub
Coniferous forest - Transitional woodland-shrubt
Transitional woodland-shrub - Borad-leaved fores

Physical suitability

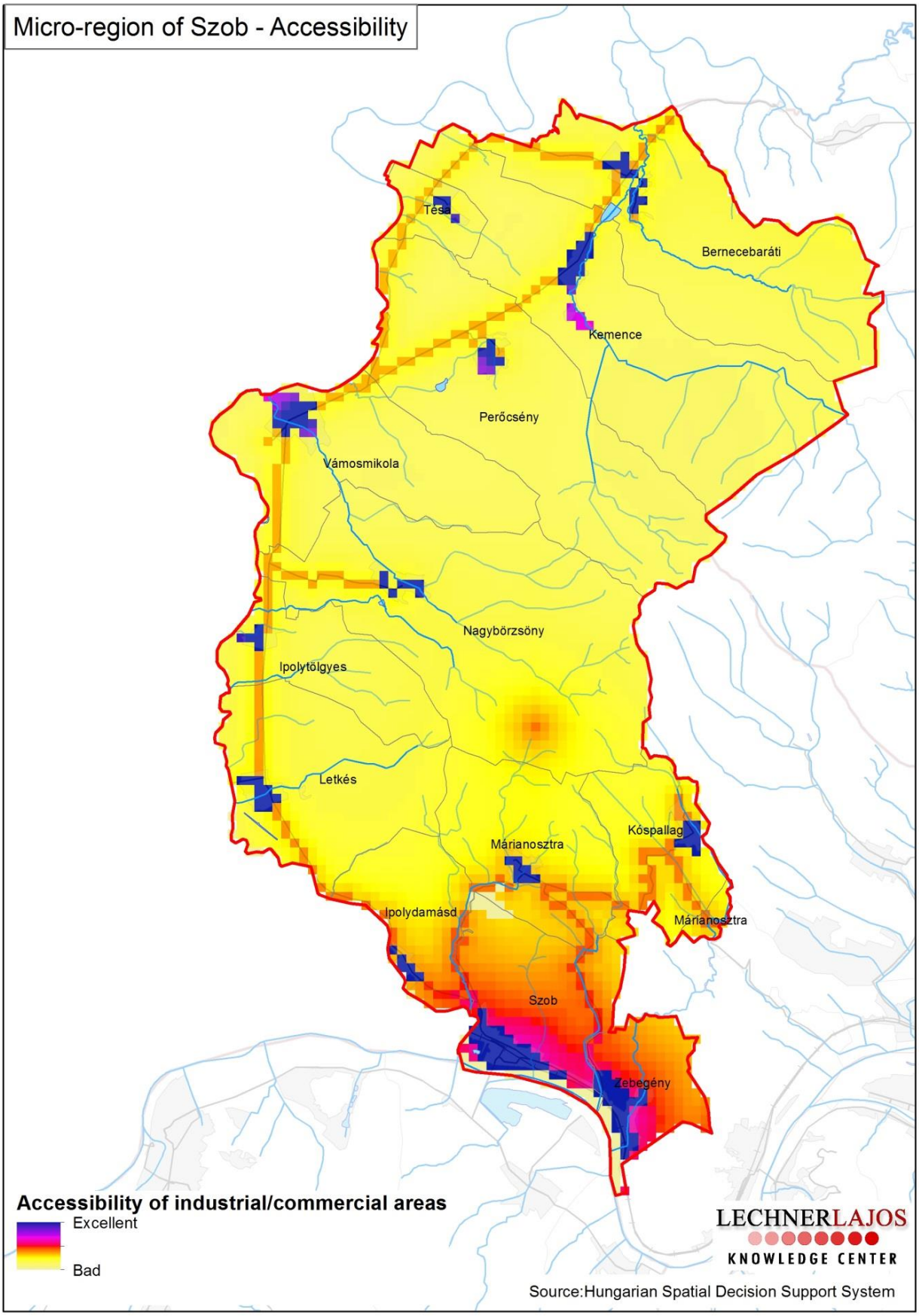
The least suitable sites for built-in areas were determined on the basis of topography and soil conditions.

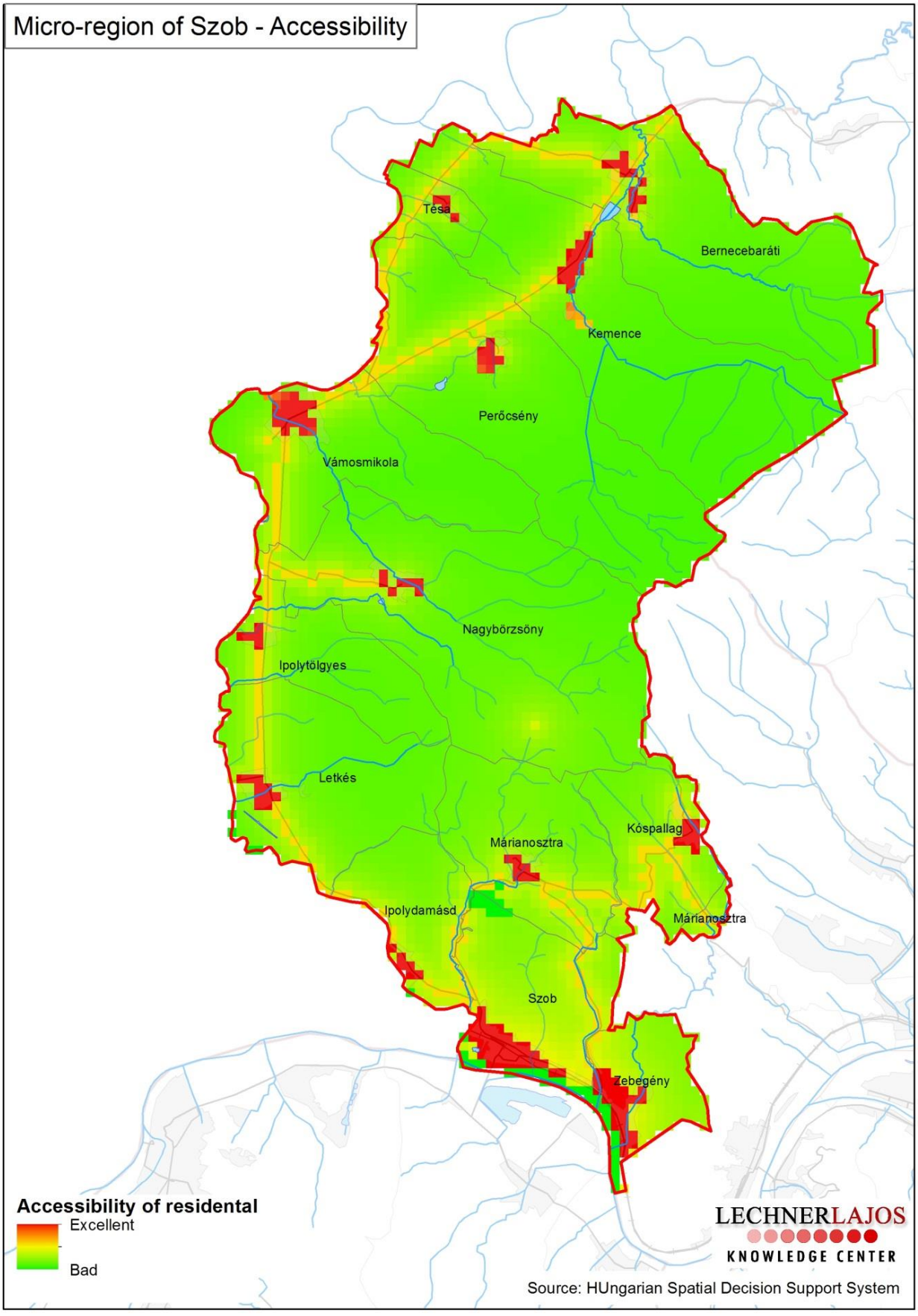


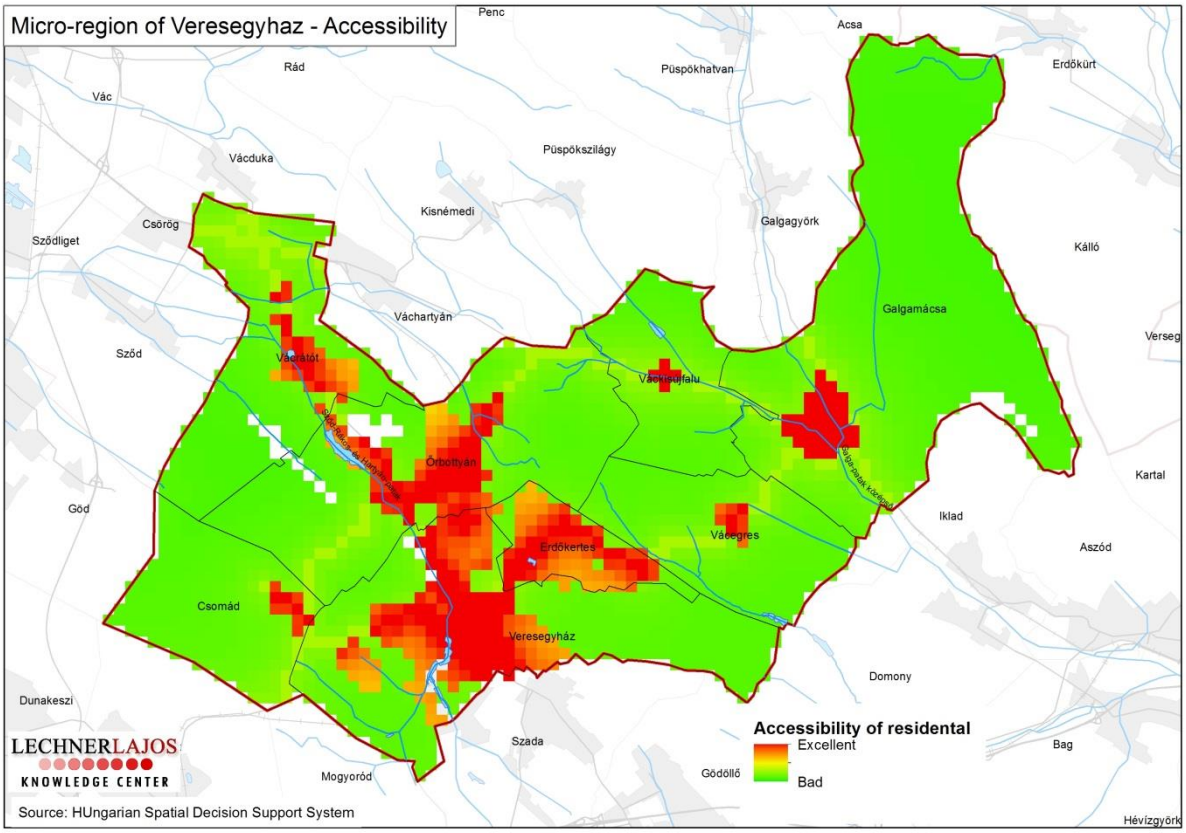


Accessibility

The most accessible residential or industrial/commercial areas can be defined based on the current and planned road network. The indicator has been developed on the basis of the examination of earlier processes as well as the role the road plays in the national roads network. The different rank roads provide different levels of accessibility to the areas, so that these areas having different significance concerning residential or economic development.


Micro-region of Szob - Accessibility
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Accessibility of industrial/commercial areas
Excellent
Bad
LECHNERLAJOS
KNOWLEDGE CENTER
Source:Hungarian Spatial Decision Support System


Micro-region of Szob - Accessibility
Tésa
Bernecebaráti
Kemence
Perőcsény
Vámosmikola
Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Accessibility of residental
Excellent
Bad
LECHNERLAJOS
KNOWLEDGE CENTER
Source: HUngarian Spatial Decision Support System


Micro-region of Veresegyhaz - Accessibility
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Mogyoród
Accessibility of residental
Excellent
Bad
LECHNERLAJOS
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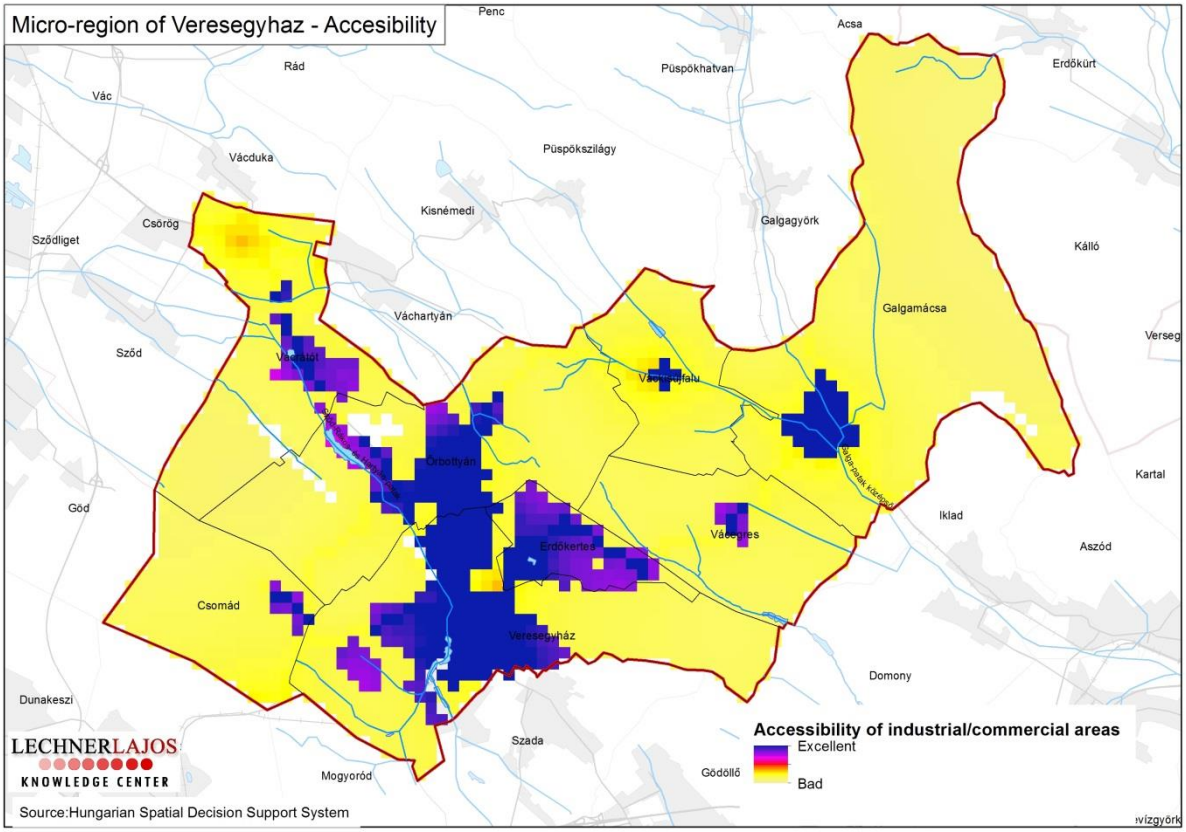
Source: HUngarian Spatial Decision Support System
Hévízgyörk


Micro-region of Veresegyhaz - Accesibility
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Veresegyház
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Gödöllő
Mogyoród
Accessibility of industrial/commercial areas
Excellent
Bad
LECHNERLAJOS
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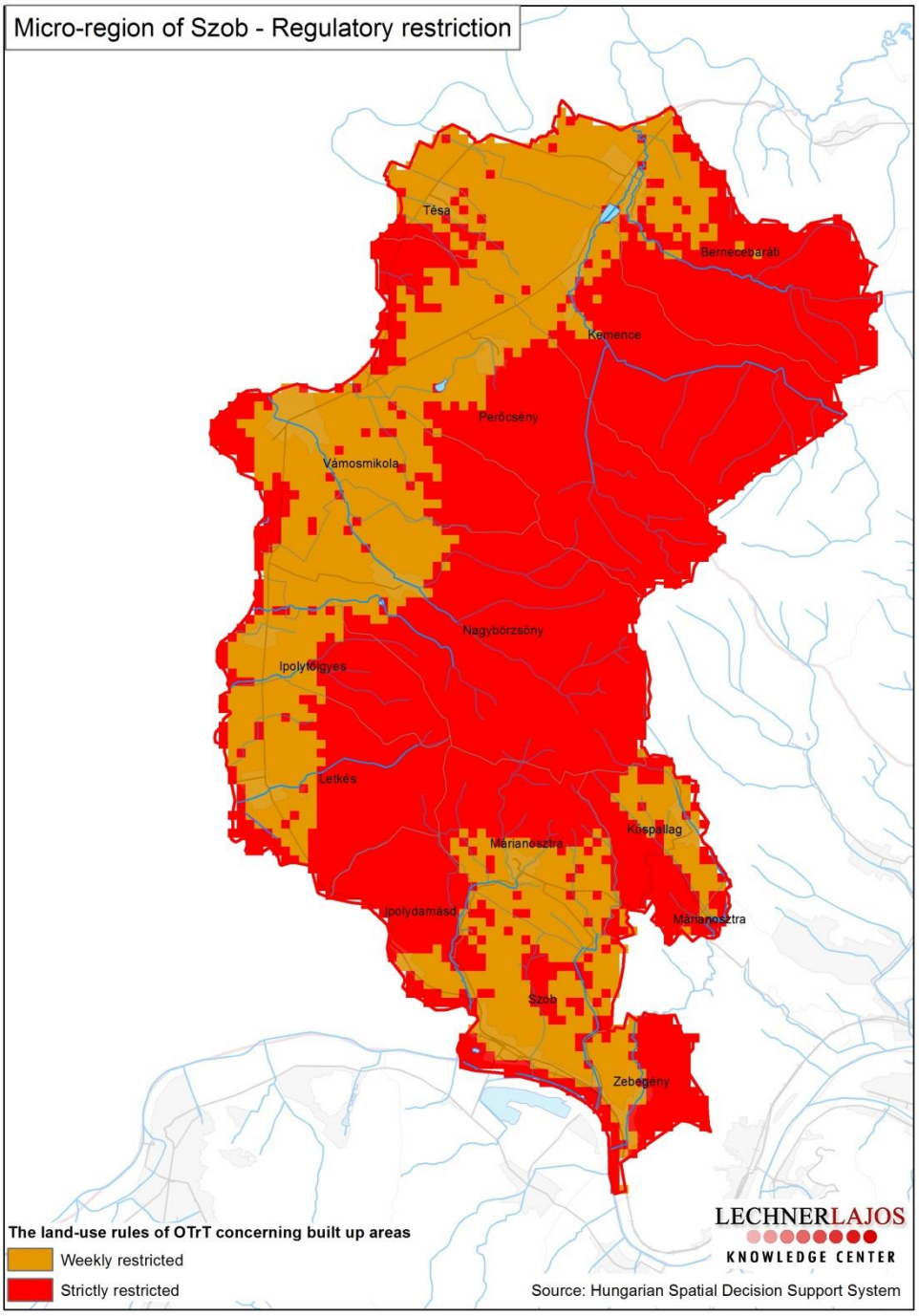
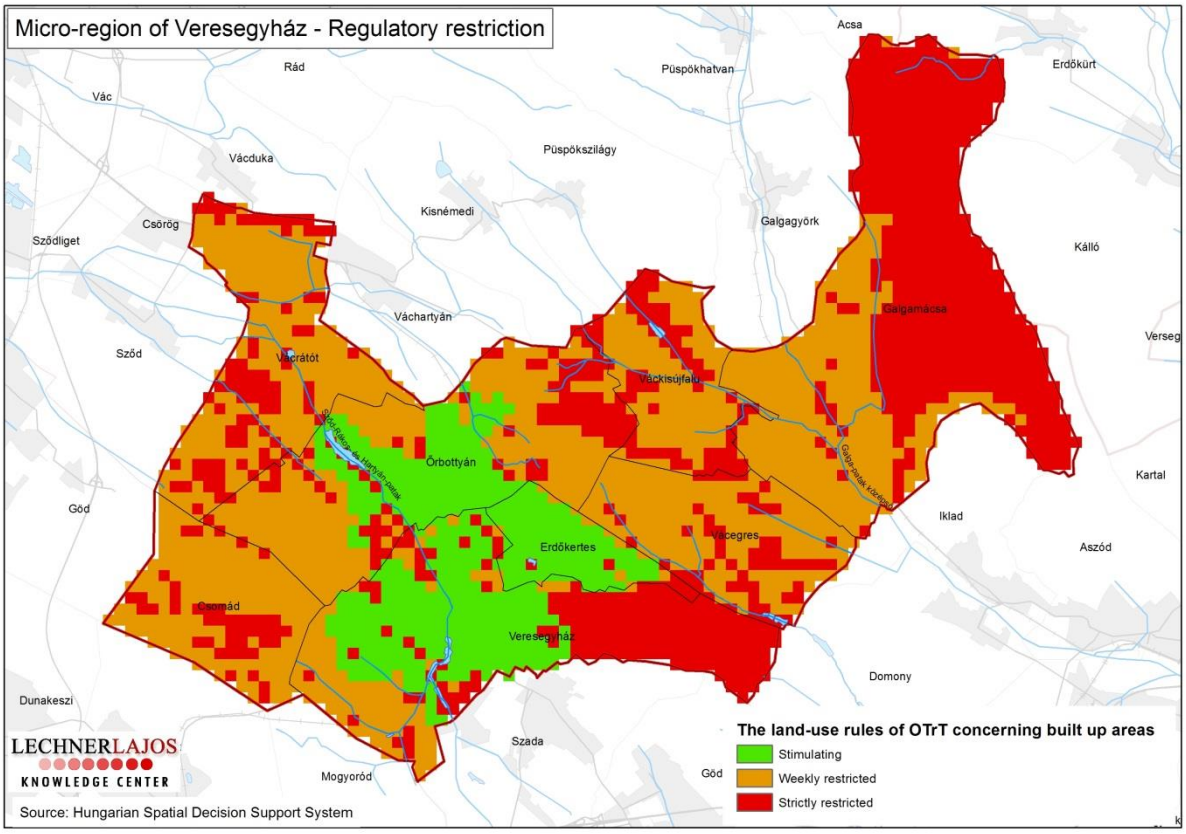
Source:Hungarian Spatial Decision Support System
ıvízgyörk

Regulatory restrictions

The location of the target areas for residential and economic developments is strictly regulated by the spatial planning regulation. In Hungary the land use categories and protection zones defined in the Parliamentary Act XXVI of 2003 on the National Spatial Plan (hereinafter OTrT) are decisive. The land-use rules of OTrT concerning built-in areas are either stimulating, permitting, subject to conditions or strictly prohibiting. In the spatial development plan the areas that are not subject to built-in restrictions are designated by drawing each rules and restrictions concerning development areas on the same map.





Drawing the suitability indicator map of residential and industrial/commercial areas

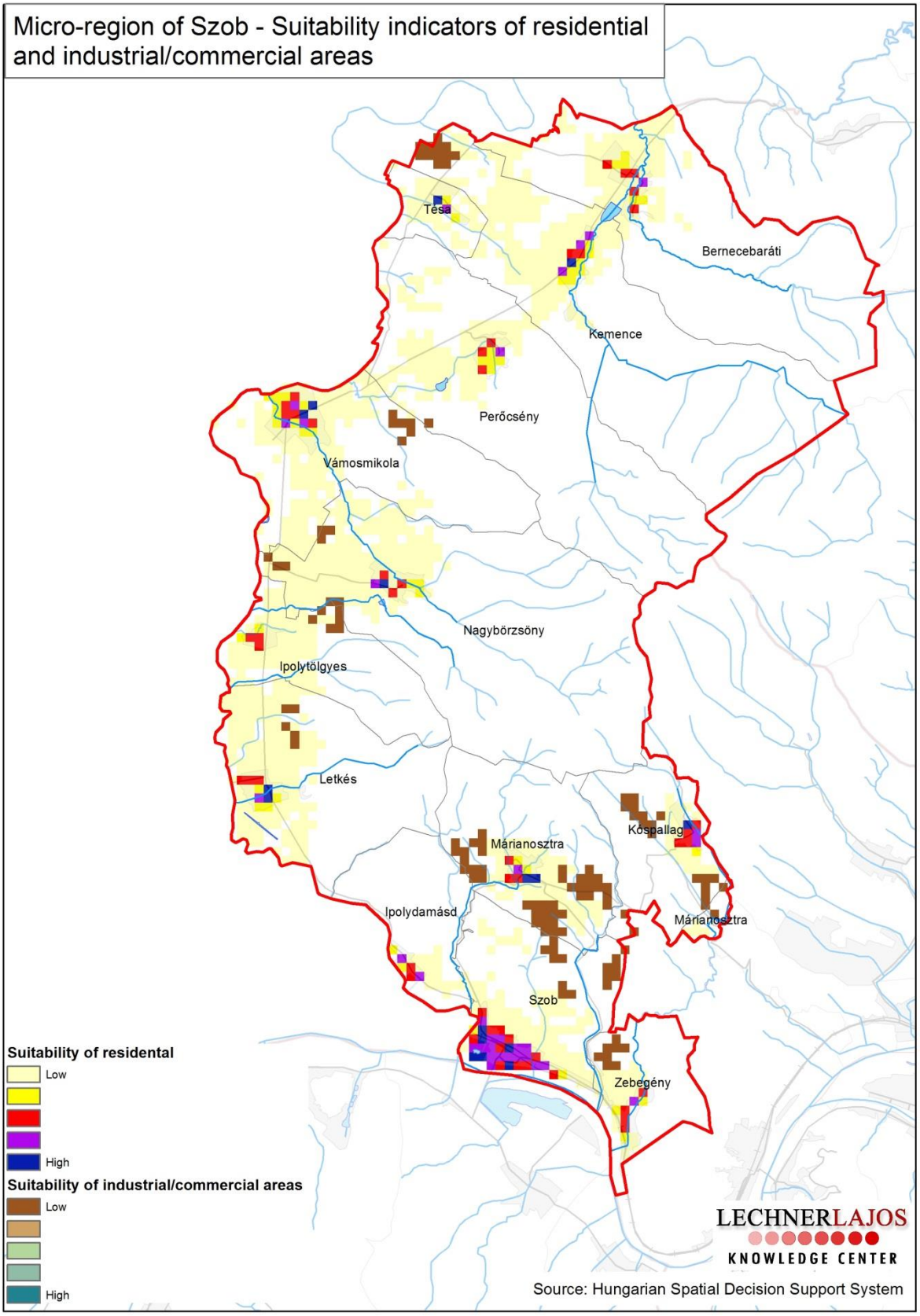
The residential and industrial suitability indicator map has been developed on the basis of a combined analysis of the land-use change processes (neighbourhood relations), physical suitability, accessibility and the regulatory restrictions.

The formula of the suitability indicator:

TP= (1+(-log(1-random)) ˆalpha)*N*if(N>=0; A*S*Z; 2-A*S*Z),

where:
N = neighbourhood relation
A = accessibility
S = physical suitability
Z = regulation

The suitability indicator map defines areas that in case social-economic needs emerge, might turn into built-in areas.


Micro-region of Szob - Suitability indicators of residential and industrial/commercial areas
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Nagybörzsöny
Ipolytölgyes
Letkés
Kóspallag
Márianosztra
Ipolydamásd
Márianosztra
Szob
Zebegény
Suitability of residental
Low
High
Suitability of industrial/commercial areas
Low
High
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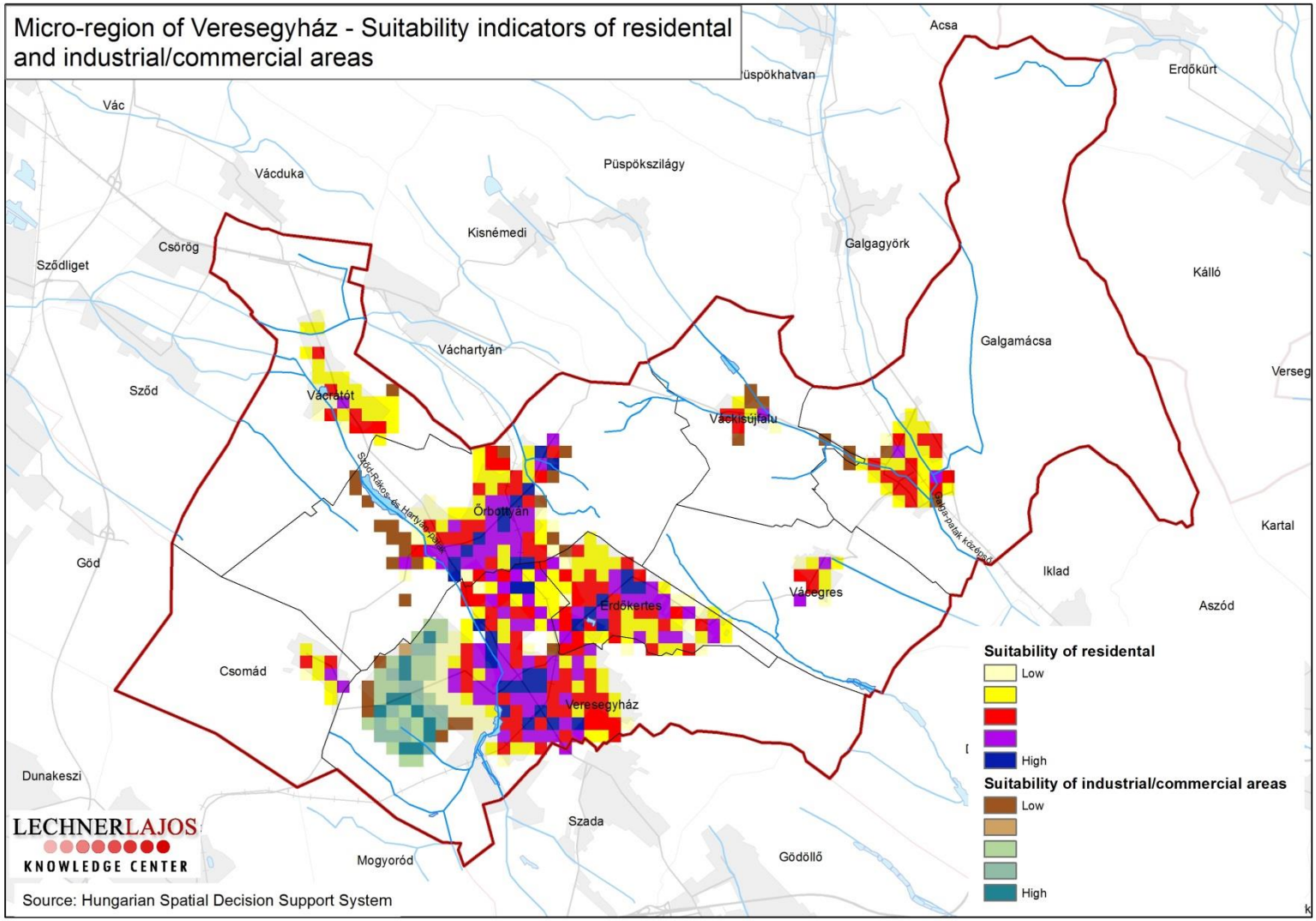
Source: Hungarian Spatial Decision Support System


Micro-region of Veresegyház - Suitability indicators of residental and industrial/commercial areas
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Dunakeszi
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Gödöllő
Suitability of residental
Low
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Suitability of industrial/commercial areas
Low
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LECHNERLAJOS
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Source: Hungarian Spatial Decision Support System

II.3.2. Residential and economic development target areas indicator map

At the designation of target areas for development, the territorial suitability and the socio-economic needs must be taken into account simultaneously. The territorial suitability indicator maps marked areas that are based on current land use, road networks, the physical features and the regulation the most suitable for built-up areas. Which suitable area will be converted into built-in area in the near future is strongly influenced by the socio and economic needs. The location of these new residential and industrial/commercial areas is defined by a land-use change modelling decision support system developed for Hungary. According to this decision support system the demand for residential, recreation and industrial areas in 2030 is modelled based on the following scenario:

- The need for residential and recreation areas is determined by the population data predicted for 2030 published by CSO Hungarian Demographic Research Institute.
- The need for economic development areas is determined by the development and employment objectives of OFTK[4]

A decision support modelling system locates the new built-in areas according to the territorial demand outlined by the socio-economic processes, taking into account the scale of the territorial suitability as well.
The proposed development target areas were modelled based on macro-regional - national level, county level – data and needs. Obviously each settlement defines the location and the timing of concrete development in their development and spatial plans.

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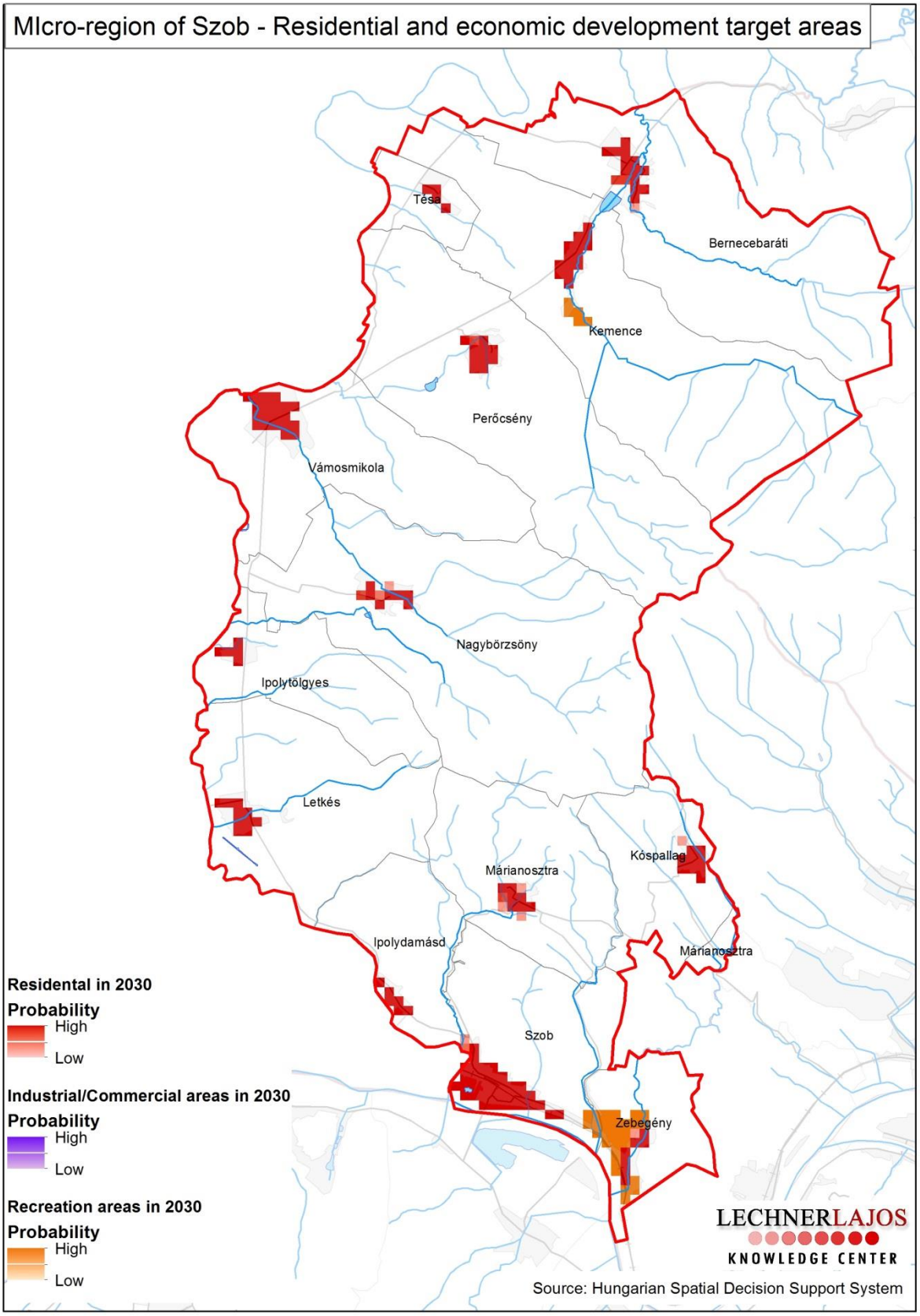
MIcro-region of Szob - Residential and economic development target areas
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Kóspallag
Ipolydamásd
Márianosztra
Szob
Zebegény
Residental in 2030
Probability
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Low
Industrial/Commercial areas in 2030
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Recreation areas in 2030
Probability
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LECHNERLAJOS
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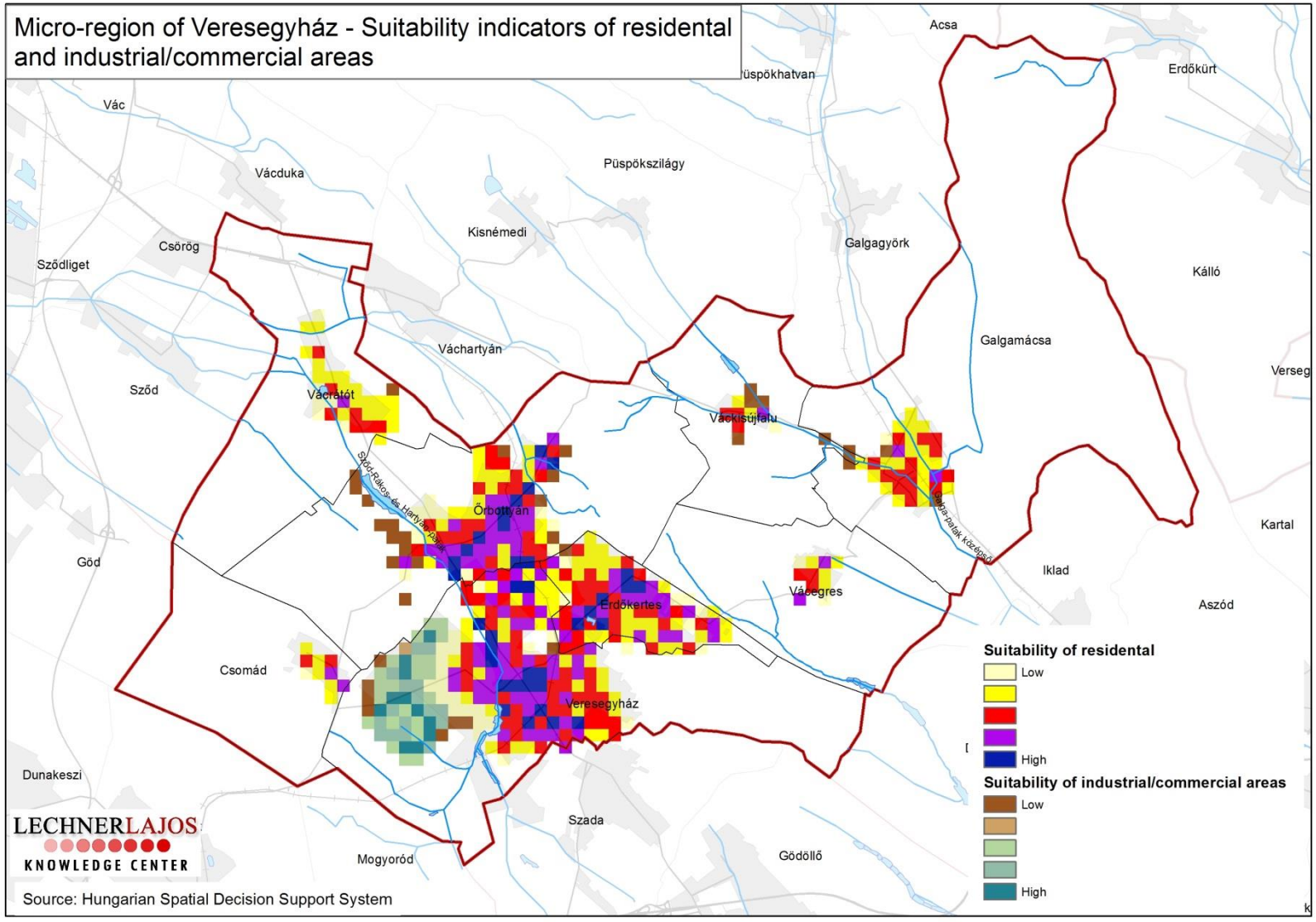
Source: Hungarian Spatial Decision Support System


Micro-region of Veresegyház - Suitability indicators of residental and industrial/commercial areas
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Suitability of residental
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High
LECHNERLAJOS
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Source: Hungarian Spatial Decision Support System

III. Proposals for further methodological improvement of the territorial information system to support spatial planning

III.1. Indicators of natural values

III.1.1. Further development of natural value indicator

Integrating further biodiversity data into the assessment method - Common Bird Monitoring Program

The Common Bird Monitoring (MMM) program is coordinated by the Monitoring Centre of the Hungarian Ornithological and Nature Conservation Association (MME), the field work participants are MME volunteer surveyors. Between 1999 and 2004, about 1,000 candidates joined the program. During this time-period 538 surveyor conducted spring surveys on 691 pilot area of a 2.5 x 2.5 km, on designated sampling points.

Currently the MMM is the only country-wide biodiversity monitoring program both in Hungary and in Middle-East Europe as well, which is - based on the adequate sampling method and the large area annual surveys – able to provide representative and direct regional and national scale data on the biodiversity changes of the main habitats (agricultural and forest habitats and artificial surfaces).5

During the pilot area surveys an attempt was made to assess and integrate MMM data into the indicator map, but this attempt failed. The reason of failure was that the application of country representative MMM data on micro-regional level needs further analysis. Having regard to the sampling obligations (see above), the difference in data availability between the intensively surveyed sample quadrats that failed into the selected micro-regions and the non-surveyed areas could have been solved only with the analysis of the data of the surrounding (bordering micro regions) sample quadrats, in this present study we did not do this. However, it should be stressed that by proper processing of MMM collected data and linking it to the MÉTA natural index maps, the elaboration of nationwide outstanding accurate biodiversity indicator maps would be possible.

Assessment of biotics data

For the evaluation of the existing biotics data a larger scale scientific research and evaluation is required. Proposed research, assessment criteria:

- The most serious challenge of biotics indicator maps is addressing the issue of areas with data gaps, as this can greatly distort the outcome. At this stage this investigation does not address this problem, but the proposals are based on the highest possible level analysis and display of existing data.
- Further challenge is the issue of representativeness of the data acquisition, since the surveys of this study are not yet able to handle to what extent some intensively surveyed area with plenty of datasets distort the final map. In extreme cases, you

[5] http://www.mme-monitoring.hu/prog.php?datid=56

may find that a high natural value area which is not visited by surveyors displayed on the indicator map with lower value than a more intensively surveyed but less valuable area. Indicator maps generated from different data sources (MÉTA, DINPI data, later MME) would be suitable to handle this problem.

- The non-protected biotics data should be evaluated, species with high nature value as well as the ones causing degradation should be screened. The weight of the non-protected species in the calculation of the natural value should be determined.
- Regarding plants it is recommended to work out a method which can be applied for delineation of point-type data and habitat.
- Concerning animals the lengths of the home range radius should be defined for groups of species as well as each species separately in order to be able to use the Kerner-home range method.

III.2. Assessment of forest and agricultural area

III.2.1. Complete assessment of the restrictions concerning forest and agricultural area

Utilisation of further digital data is needed for the refinement of the indicator:

- Consideration of I. and II. Class area (according to the vineyard cadastre) while setting up the indicator based on current restrictions. Integration of the FÖMI and VINGIS dataset into the system is needed for the above.
- Taking the National Fruit Habitat Cadastre I and II. Class areas into account in the production of the "indicator" responding to the current restrictions. This would require digitizing the paper-based fruit cadastre per fruit species.
- Taking into account the “better than average quality” areas according to the Land Act in the production of the "indicator" responding to the current restrictions.

III.2.2. Proposals for the development of forest assessment methodology

During the assessment of the pilot area some databases were not accessible or only partially and performing certain tests (e.g. evaluation of ecosystem services) was not possible. To incorporate Items not used in this study we propose the following.

Evaluation of forest ecosystem services (rather than their primary purpose)

- Evaluation of the role of forests in soil erosion mitigation (e.g. using the potential erosion map based on the USLE model)
- The role of forests in protecting air quality (use of complex indicators: subsidence rate of nitrogen oxides, the capacity of ecosystems to extract air pollutants, etc.).
- The role of forests in mitigating floods and water quality protection

Assessment of habitat suitability of forests

Detailed examination of habitat suitability of forests (soil, climate and topography). As a result, a more detailed categorization of forest areas becomes possible, so not only can you take into account that the forest area is excellent quality or not.

III.2.3. Proposals for the development of agricultural land evaluation methodology

Further studies are recommended for the development of the system after summarizing the experience of expert consultations and the analysis in the assessment of farmlands. The implementation of these was not possible on the field because of missing data and/or the lack of resources.

The multi-criteria analysis of grape and fruit growing areas

- habitat suitability (e.g. soil, relief, exposure),
- environmental sensitivity (e.g. erosion hazard, water resources)
- type of land use (organic farming, participation in other agri-environmental programs)

Incorporation of new database into the assessment of arable land

- in case of habitat suitability
  - climatic aspects (e.g. annual precipitation, growing season precipitation for major crop types etc.) based on *National Weather Service* data
  - drought indicators based on *National Weather Service* data
  - indicators of climate change (e.g. changes in the number of drought days etc.) based on *National Weather Service* data
- in case of assessment of land use
  - areas cultivated according to the conditions of organic farming (based on the Agriculture and Rural Development Agency MePAR database)
  - areas involved in other agri-environment schemes (based on the Agriculture and Rural Development Agency MePAR database)
  - Areas suitable for fruit and viticulture, currently utilized as arable land (on the basis of FÖMI VINGIS database and the paper-based database of the Research Institute of Pomology)

III.3. Standardization of methodology, the involvement of a wide circle of experts in the analysis

In all partial analysis and also in the synthesis we recommend the use of the Kindler-Papp method (or its foundation elements: Thurstone's paired comparisons, Guilford process). The full application of the method for each sub-index (even where we already have indicators) it is advisable to start from the basic data and to assess them with the involvement of a wide circle of experts.