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Department for Nature Conservation,
Vegetation- and Landscape Ecology

in cooperation with

Universität für Bodenkultur Wien

Institute of Landscape Development,
Recreation and Conservation Planning

University of Sopron

Institute of Forest Resource Management
and Rural Development

Man & Biosphere

Biodiversity and Ecosystem Services as scientific foundation for the sustainable implementation of the Redesigned Biosphere Reserve "Neusiedler See"

Final report

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1. Introduction

1.1. Problem identification

The biosphere reserve “Neusiedler See” was founded in 1977, three years after the concept of biosphere reserves was initiated by a Task Force of UNESCO's Man and the Biosphere (MaB) Programme in 1974. Currently it covers only the lake basin in particular the reed belt and the lake itself. This rather restrictive designation is excluding large tracts of land with smaller remnants of natural and semi-natural habitats interspersed with the surrounding agricultural landscape matrix. The small-scale cultural landscape types situated at the western lakeshore are completely excluded. This delineation is reflecting the ideas of the MaB-programme in the concept of the 1970s. But it is not congruent with the criteria of the Seville Strategy as outlined in 1995. Many other biosphere reserves in the world encounter similar problems, so that the MaB committee decided to withdraw the label of biosphere reserve by 2013 if a re-implementation will not have been applied for.

While the objective for achieving a sustainable balance between the sometimes conflicting goals of biosphere reserves is still the same, the context in which biosphere reserves operate has changed considerably. In 1991 the Convention on Biological Diversity has lead to establish an Advisory Committee for biosphere reserves. This Advisory Board developed a strategy for a modern kind of biosphere reserves and drew up the so called “Seville Strategy”. This broaden strategy tries to contribute to those changed frameworks. This means to include basic ecological and socio-economic assessments for zoning and defining conservation, reinforce scientific research and initiate development tasks (UNESCO, 1996).

Besides the foundation of the biosphere reserve in 1977, substantial progress in conservation efforts has been achieved by the designation of a RAMSAR site in 1982 and the successful establishment of Austria’s first national park in 1992. Both conservation areas are much larger than the biosphere reserve and complementing each other in area and management objectives. In addition, a large area of the whole region – including the western lakeshore and its surroundings – has been officially listed by UNESCO as world heritage site for cultural landscape in 2001.

The feasibility of transforming the first generation biosphere reserve Neusiedler See into a modern one which is compatible with the Seville Strategy was investigated in an forrunner research project (“Redesigning the biosphere reserve Neusiedler See”), conducted by the same interdisciplinary team. In this two years project the possibilities of re-defining and re-designing the biosphere reserve were studied in a transdisciplinary manner based on a SWOT analysis of the current situation in the “greater Neusiedler See region” from a socio-economical and conservation biological perspective. In the final results mainly realistic and politically agreed planning options for enlargement and re-designation of the biosphere reserve Neusiedler See were developed. As that project was designed to give a scientific basis to the decision makers to make up their mind, whether they would like to proceed with a state-of-the-art biosphere reserve, only a quick assessment procedure based on available geo-data and expert consultations was conducted.

1.2. Scientific concepts

In this follow up project one possibility to provide the knowledge basis to meet the needs of the Seville Strategy can be the concept of ecosystem functions, goods and services. This scientific concept has experienced increasing attention in the last years as it provides the means of documenting the importance and benefits of ecosystems and landscape for human society. One of the most relevant publications is the Millennium Ecosystem Assessment (2003) which provides the basic framework for assessing the interactions between ecosystems and humans, how these can be measured, evaluated and strengthened for future human well-being. There, ecosystem function and ecosystem services are defined as follows (page 210, 211):

***"Ecosystem function**: An intrinsic ecosystem characteristic related to the set of conditions and processes whereby an ecosystem maintains its integrity (such as primary productivity, food chain, biogeochemical cycles). Ecosystem functions include such processes as decomposition, production, nutrient cycling, and fluxes of nutrients and energy."*

***"Ecosystem services:** The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth. The concept "ecosystem goods and services" is synonymous with ecosystem services."*

Several authors have dealt with function- and service analysis (de Groot et al., 2002; de Groot, 2006), problems arising with this classification (Egoh et al., 2007; Wallace, 2007) and the implementation via stakeholders (Hein et al., 2006; Goldman et al., 2007, Havstad et al., 2007).

Innovative conservation assessment and planning may profit from this approach because it would allow an integrative evaluation of conservation areas and their contribution to human well-being (Chan et al., 2006; Egoh et al., 2007). Planning for nature conservation and other ecosystem services simultaneously may exhibit the differences in the potential landscape functions (Chan et al., 2006). We made use of and developed this approach in a way to display possibilities for a biosphere reserve in the region of Neusiedler See in trade-offs with local people and other stakeholders.

1.3. Landscape functions and services

An ecosystem may be considered as a unit within which an assemblage of living organisms interacts with each other and with its chemical and physical environment. Human beings benefit from these processes or structures within ecosystems that give rise to a range of goods and services called *'ecosystem services'* (Millenium Ecosystem Assessment, 2005). Haines-Young and Potschin (2010) provided an assessment framework for linking ecosystems to human well-being, which has been used in several projects, for instance, the TEEB project (TEEB, 2010) (Figure 1). The proposed diagram makes a distinction between ecological processes and functions as well as the provided services and the outputs considered for humans as benefits. Although the general structure of the suggested framework is widely agreed upon, the distinction between the terms *"function"*, *"service"* and *"benefit"* is still under discussion (see Hermann et al., 2011). Another approach is to define functions, services and benefits at landscape scale to integrate the concept into land management decisions (Bastian & Schreiber, 1999; de Groot et al., 2010; Willemen et al., 2010). As local people define their environment more as a "landscape" than as an "ecosystem" the term "landscape services" is preferred as a specification (rather than an alternative) of ecosystem services (Termorshuizen & Opdam, 2009).

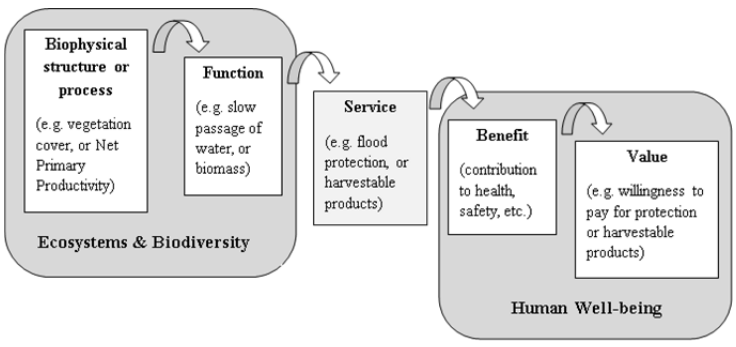


Figure 1: framework for linking Ecosystems & Biodiversity to Human Well-being (after Haines-Young and Potschin, 2010).

In **our project** we will refer to the concept of **Landscape functions**, which can be defined as the

"capacity of ecosystems to provide goods and services that satisfy human needs, directly and indirectly" (de Groot, 1992).

We do not focus on single ecosystems, but we take the entire landscape into account. Most landscapes provide a multitude of functions and are subject to many possible land uses. The function analysis translates the ecological complexity into a limited number of landscape functions at the landscape element or biotope scale, which, in turn, provide a range of goods and services at landscape scale (Figure 2, Figure 3).

Landscape services are, in our definition,

"*all goods and services that landscapes provide for sustaining life. It includes potentials, materials and processes of the nature (e.g. raw materials, biomass, biodiversity etc.) and services of cultural elements and constructions that come into being through human creation (e.g. buildings, settlements, infrastructure etc.).*"

(Definition formulated by Éva Konkoly-Gyuró for the BIOSERV project).

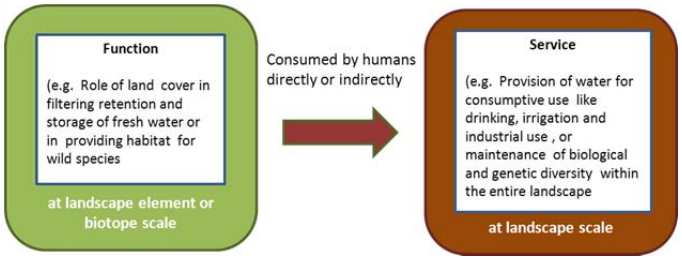


Figure 2: The concept of landscape function and service used in BIOSERV.

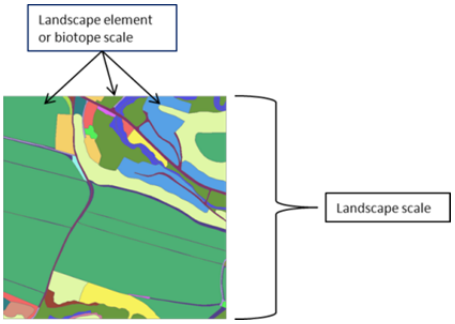


Figure 3: Landscape element or biotope scale vs. landscape scale.

Although the debate of the distinction between "function", "service" and "benefit" and how to put the concepts into practice, is still going on (Hermann et al., 2011), a wide range of authors has attempted to provide a systematic typology and comprehensive framework for integrated assessment and valuation of ecosystem goods and services (see Daily, 1997; de Groot et al., 2002; MEA, 2005; de Groot, 2006; Boyd & Banzhaf, 2007; Fisher & Turner, 2008). The Millennium Ecosystem Assessment (MEA, 2003) provided a simple typology of services that has been widely taken up in the international research and policy literature (TEEB, 2010). However, due to the fact that ecosystem services and functions can be defined in different ways depending on scale and perspective (Daily, 1997) and because of the different aims of assessments, other more extensive and detailed categorisations have been developed (e.g. Bastian, 1997; Perez-Soba et al., 2008; Bakkera and Veldkamp, 2008; Verburg et al., 2009).

In **our project** the classification of landscape functions and services are mainly based on de Groot (2006). Landscape functions and their related services are grouped into five primary categories:

1. *Regulation functions and services*

These functions relate to the capacity of cultural landscapes to regulate essential ecological processes and life support systems through biogeochemical cycles. They maintain a "healthy" ecosystem at different scale levels and provide important pre-conditions for all other functions. Whereas a range of regulation functions exist, our project only incorporates those that provide direct and indirect services to humans (such as maintenance of clean water, soil and prevention of soil erosion).

2. *Habitat functions and services*

Natural as well as cultural landscapes provide refuge and reproduction habitat to wild plants and animals and thereby contribute to the maintenance of biodiversity (e.g. genetic diversity as evolutionary potential). The availability or condition of this function depends on the physical components of the ecological niche. As the requirements differ for different species groups they can be defined in terms of the carrying capacity and spatial needs (minimum critical biotope size) of the natural biotope type.

3. *Provision functions and services*

Photosynthesis and nutrient uptake by autotrophic organisms convert energy, carbon dioxide, water and nutrients into a wide range of living biomass. This biomass in turn can be used by humans as food (concerning edible wild plants and animals), raw materials, energy resources and/or genetic resources.

4. *Information functions and services*

Due to their individual characteristics, natural as well as cultural landscapes provide opportunities for reflection, spiritual enrichment, cognitive development, recreation and aesthetic experiences.

5. *Carrier functions and services*

These functions only refer to cultural landscapes. As most human activities (e.g. cultivation, habitation, and transportation) require a suitable substrate (soil) or medium (water), the use of these functions implies conversion of the natural system into an either semi-natural or artificial system.

Table 1 gives an overview of the functions and services applied in our project. The first column provides a list of the main functions and their sub-functions and the second column describes the functions in detail. The third column sets examples of specific services consumed at the landscape scale.

Table 1: Functions and related services of cultural landscapes used in the project BIOSERV (mainly adapted from de Groot et al. 2002 and de Groot, 2006); functions with * are defined in detail below.

Functions	Definition	Services (examples)
Regulation function		
Local climate regulation	Influence of biotope type on local climate (mainly buffer function)	Maintenance of a favourable local climate (e.g. temp., moisture etc.) for e.g. human habitation, health, cultivation
Disturbance prevention	Influence of landscape structure on environmental disturbances	Storm protection and/or flood prevention (e.g. flood detention basin, shelter belt)

Water regulation	Role of biotope type in regulating runoff and river discharge	Drainage and natural irrigation
Water supply	Filtering, retention and storage of fresh water	Provision of water for consumptive use (e.g. drinking, irrigation and industrial use)
Soil retention	Role of vegetation root matrix and soil biota in soil retention	Maintenance of arable land; prevention of damage from erosion/siltation
Soil formation	Weathering of rock, accumulation of organic matter	Maintenance of natural productive soils
Nutrient regulation	Role of biota in storage (buffer) and recycling of nutrients (e.g. N, P and S)	Maintenance of healthy and productive ecosystems
Pollination	Role of biota in movement of floral gametes (is there any suitable habitat available for pollinators?)	Pollination of wild plant species and crops
Habitat function		
Refugium function	Suitable living space for wild plants and animals	Maintenance of biodiversity, in particular
* Nursery function	Suitable reproduction habitat	Maintenance of commercially harvested species
Provision function		
Food	Conversion of solar energy into wild edible plants and animals	Maintenance of edible wild plants and fungi (not cultivated), game and fish
Raw materials	Conversion of solar energy into biomass	Material for human constructions (building and manufacturing), like lumber, fuel and energy wood
Genetic resources	Genetic material and evolution in wild plants and animals	Improve crop resistance to pathogens and pests and maintenance of old cultivated plants
Medicinal resources	Variety in chemical substances in natural biota	Drugs and pharmaceuticals
Information function		
Aesthetic information	Attractive landscape features	Enjoyment of scenery (scenic roads, housing etc.
Recreation	Variety in landscapes with (potential) re-creational uses	Travel to natural ecosystems for eco-tourism and (re-creational) nature study
Cultural and artistic information	Variety in natural features with cultural and artistic value	Use of nature as motive in books, film, painting, folklore, national symbols, architect, advertising, etc
Spiritual and historic information	Variety in natural features with spiritual	Use of nature for religious or historic purposes (i.e. heritage value of natural ecosystems and features)
Science and education	Variety in nature with scientific	Use of nature for scientific

	and educational value	research
Carrier function		
Habitation	Providing suitable space for human living	Living space (ranging from small settlements to urban areas)
* Cultivation	Providing suitable substrate for cultivation (actual available)	Cultivated food and fodder
Energy conversion	Providing suitable substrate or medium for energy conversion	Energy facilities (solar, wind and water)
Mining	Providing suitable substrate for mining	Minerals, oil, gold
* Waste disposal	Providing suitable substrate for waste disposal	Space for solid waste disposal
Transportation	Providing suitable substrate or medium for transportation	Transportation by land and (water)
Tourism-facilities	Providing space and facilities for human activities related to tourism and recreation	Tourism and leisure activities (e.g. outdoor sports)

* Cultivation

The cultivation function provides food and raw materials from cultivated land and aquaculture, especially cultivated plants and domesticated animals.

* Nursery function

The nursery function provides habitats for juveniles of certain species as it is a suitable reproduction-habitat, e.g. for the maintenance of commercially harvested species. Many ecosystems provide nursery areas to species which, as adults, are harvested elsewhere for either subsistence or commercial purposes (de Groot et al. 2002).

* Waste disposal

This function provides space for whether potential or real solid waste disposal (de Groot, 2006). It is important that the area provides a permanent store of the waste for the duration of its biological and chemical activity.

1.4. Potential landscape functions

Addressing the issue of the potential of the landscape is very much driven by the reference scale which needs to be set. One way would be to look at former time points and compare land use systems and related land consumption (amongst others Prinz et al., 2010; Frondini et al., 2011). This implies that former land use was oriented at the potential of the landscapes. Another way (and maybe even more straightforward) is to exclude land use at all and try to derive the potential of the landscape regardless any human activity.

Cambridge Dictionary Online defines "**Potential**" as "*someone's or something's ability to develop, achieve or succeed*" (http://dictionary.cambridge.org).

Adapting the projects' definition of landscape functions (de Groot, 1992) therefore to …

Potential Landscape functions: "the ability of the landscape to achieve the sustainable provision of goods and services that satisfy human needs, directly and indirectly".

…we want to address the question to what extent the landscapes in the project region are able to provide certain landscape functions and compare this potential as reference with the actual landscape functions derived as described in detail in the aforementioned chapters.

Not all landscape functions and services have a possible reference, f.ex. What would be the potential for tourism facilities or what is the potential of aesthetic information? Due to this reason, we will select those functions that can be assessed by the potential land cover, i.e. that **kind of cover which would establish on specific site conditions without human interaction**. Zampieri & Lionello (2010) stressed with their work the fact that Land Cover Types are closely connected to vegetation types, as vegetation together with urban areas, lakes, glaciers and ice caps are the characterising key elements of the land surface.

This concept very much refers to the concept of Potential Natural Vegetation (PNV), originally described by Tüxen (1956) and further developed by several authors described in detail by Chiarucci et al. (2010):

- Kowarik (1987): PNV of a given area could be irreversibly affected by major human interventions; he recommended avoiding the construction of PNV on artificial man-made habitats and keeping them as blank areas or marking them as areas with great anthropogenic alterations.
- Peterken (1996): *Potential Naturalness* (vegetation that would result if human influences were removed and the resulting succession took place in a single instant); *Future Naturalness* (vegetation that would eventually arise from existing forests if human influence was completely and permanently removed)
- Leuschner (1997): concept of *Potential Site-adapted vegetation* (PSV); taking into account all succession-related changes in soil and nutrient stocks
- Chytrý (1998): *Potential Replacement Vegetation* (PRV); hypothetical vegetation in equilibrium with climate and soil factors currently affecting the area with external factors (air pollution, management)

The PNV concept is very much disputed in literature and its applicability questioned by several authors (Chiarucci et al., 2010; Loidi et al., 2010; Zerbe, 1998). The main criticism is focused on the hypothetical nature of the concept and its related methodological problems:

- PNV is more a theoretical concept than a true prediction of the future.
- PNV is a static concept – it assumes that one final stage in vegetation succession is reached under stable conditions; however ecosystems rarely experience stable conditions.
- Most phytosociological data consist of subjective samples of vegetation, which do not allow for generalization about repeatable vegetation units. On the other hand, modern vegetation science largely acknowledged to this problem and sampling of vegetation plots has become more and more statistically based in the last years.
- Choice of spatial scale is a crucial factor; vegetation units are typically defined using small grain whilst PNV concept applies at much larger grains.
- A true validation of the inferences of PNV is not possible.

Zerbe (1998) also expressed his opinion that PNV is overrated as a basis for practical planning purposes and suggests using the actual real vegetation as a meaningful alternative. However, he acknowledged the usefulness of PNV to give biotic information in addition to geology, climate, soil and water conditions on a small scale.

On the other hand, many other studies document the applicability of the concept, mostly to provide the reference of potential distribution pattern of vegetation communities with the objective to develop reference lines for climate change studies (e.g. Franke & Köstner, 2007; Zampieri & Lionello, 2010), to provide a biogeographic classification (Vuerich et al., 2001) or to complement decision support (Brzeziecki et al., 1993; Liu et al., 2009 amongst others.)

In principle, there are two ways of approaching the potential distribution of vegetation communities: (i) equilibrium vegetation or biome models (e.g. Haxeltine & Prentice, 1996) where ecological and physiological processes are simulated until an equilibrium with climate variables are reached; and (ii) statistical models applying relationships between site variables and observational data (Brzeziecki et al., 1993; Franke & Köstner, 2007; Liu et al., 2009; Miller & Franklin, 2002; Vuerich et al., 2001; amongst many others).

To apply models of (i) large computational efforts and detailed ecophysiological process knowledge are required and deliver results on a global scale. For a larger scale in national or regional studies, the application of (ii) seems appropriate with the implication to base the models on an ample statistically valid vegetation data base.

Validation of the models can either be achieved by dividing the original dataset into training data and test data or taking external independent validation data, and thus getting an accuracy measure. The latter are often existing (field-based) PNV maps which are compared with the model outcome (Lapola, 2008; Liu et al., 2009; Tichy, 1999). This might be problematic, as existing PNV maps usually were drawn on a different scale and generalisations had been conducted or these maps were developed solely by expert-knowledge and not data-driven.

In this context, we want to follow a more straight-forward, pragmatic approach where on the one hand, statistical relationships of existing vegetation data cannot be used (because of too little field data on natural vegetation in the area) but on the other hand, geodata on ecologically relevant site conditions can be applied to develop vegetation-site relationships. These relationships between community types and their environment are often presented as graphical ecological schemes ‘ecograms’ (Brzeziecki et al., 1993; Ellenberg, 1988). In this context, we want to avoid using the term Potential Natural Vegetation because we are not able to use classical methods of calculating PNV. Thus PNV might be misleading and we introduce here the term “Constructed Vegetation Types”.

We aim at mapping ecologically homogeneous units each of them populated by a specific vegetation type and to present a map of Constructed Vegetation in the region of Neusiedler See. Based on this map, we want to further develop the assessment of the potential landscape functions to use them as reference lines for specific actual landscape functions.

1.5. Research questions

The overall research object of the present project is the identification, measuring and communication of the ecological, socio-cultural and economic values of the region for the implementation of a redesigned biosphere reserve following Seville standards.

To allow a thorough function-analysis, data on landscape, land use and regional socio-economic data were used to answer the following research questions linked to the described background:

- → In which way is it necessary to adapt the basic concept of ecosystem functions, goods and services for acknowledging the bio-physical and socio-economic situation of the Neusiedler See/Fertőregion?
- → Which attributes of landscapes need to be analysed in order to allow the assessment of landscape functions and ecosystem services?
- → What are the potential landscape functions of the Neusiedler See region and how do they differ from the actual ones?
- → To what extent is it possible to communicate the applicability of landscape functions and ecosystem services to the residents and stakeholders of the Neusiedler See region in order to promote a sustainable development in the region and to have a bottom up-support during development?
- → How can the expected benefit of a new generation biosphere reserve for natural, cultural and economical values of the region be measured and communicated in order to facilitate the implementation-process of a redesigned biosphere reserve?
- → How can the redesigned biosphere reserve Neusiedler See become part of an international network of biosphere reserves, where are potential partners and what would be the issues for specific co-operation and exchange programmes?

The concept of the Landscape functions was an appropriate instrument to display the umbrella function and the conservation effectiveness of a potential redesigned biosphere reserve.

2. Material and Methods

2.1. Area description: Wider investigation area, municipalities

2.1.1. Location

The wider investigation area is situated on both sides of the border between Hungary and Austria. The extent of the following municipalities in Table 2 defines the area of the investigation area:

Table 2: Austrian and Hungarian municipalities of the investigation area of the present project:

Municipalities Austria	Municipalities Hungary
Andau	Asalag
Apetlon	Ágfalva
Breitenbrunn	Agyagosszergény
Deutsch Jahrndorf	Bösárkány
Donnerskirchen	Csorna
Frauenkirchen	Farád
Gols	Fertőboz
Halbturn	Fertőd
Illmitz	Fertőhomok
Jois	Fertőrákos
Klingenbach	Fertőszéplak
Mönchhof	Hegykö
Mörbisch am See	Hidegség
Neusiedl am See	Jánossomoria
Nickelsdorf	Kapuvár
Oggau	Osli
Pamhagen	Rábatamási
Podersdorf am See	Sarród
Purbach am Neusiedler See	Sopron
Rust	Szárföld
Schützen	Várbalog
Siegendorf	Veszkény
St. Andrä am Zicksee	
St. Margarethen im Burgenland	
Tadten	
Wallern im Burgenland	
Weiden am See	
Winden am See	
Zurndorf	
Zagerdorf	

Altogether an area of 2 015 km² is covered (1 120.8 km² Austrian part and 894.2 km² Hungarian part; Figure 4).

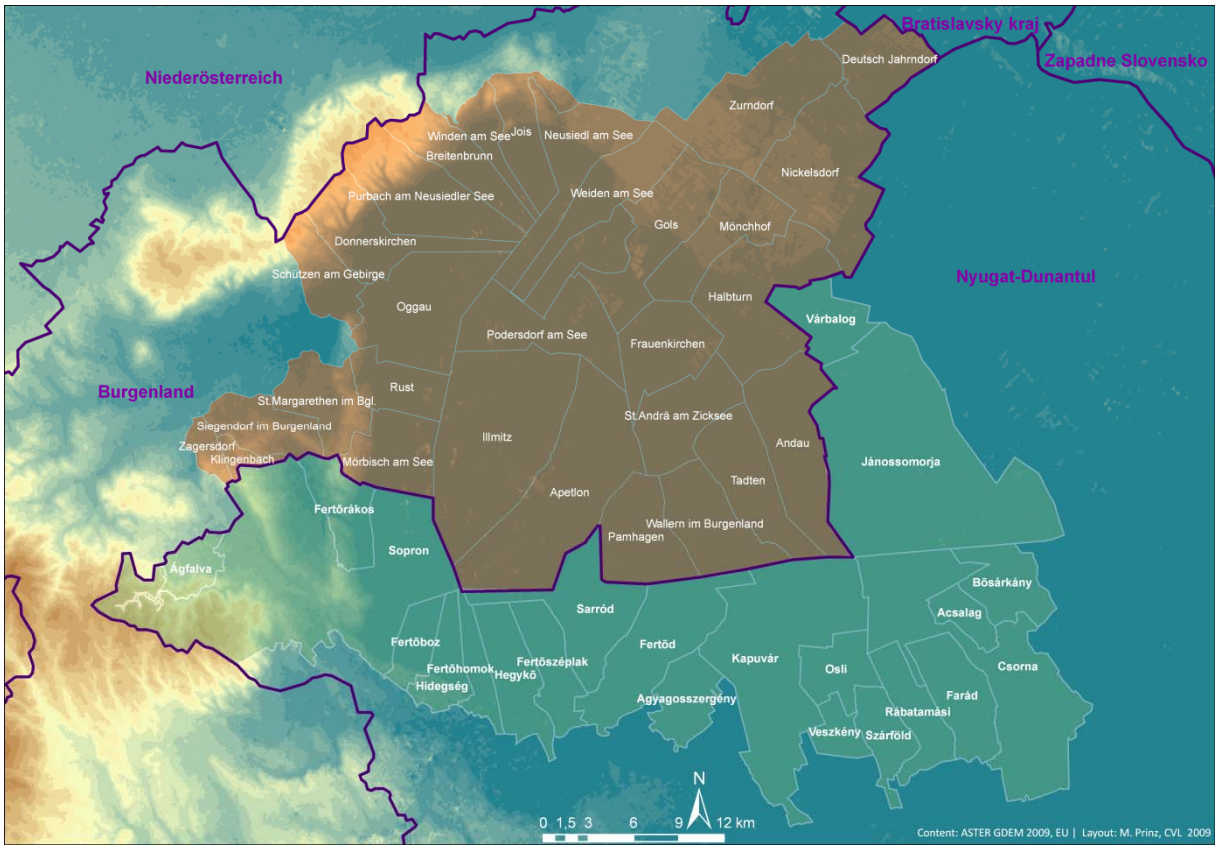


Figure 4: Map of the Austrian and Hungarian investigation area, names of municipalities indicated in white.

2.1.2. General description – natural conditions Austrian part

The trans-frontier region of Neusiedler See is part of the Small Hungarian Plain in Central Europe representing the westernmost extension of the Pannonian Basin. It is dominated by the Neusiedler See which lies in a flat basin bordered to the west by uplands. The southern Hungarian part (Fertő) is mainly lowland with gentle hills on the western side. The northern part which belongs to Austria has contrasting western and eastern sides: the former is formed by the pronounced slope zone of a low mountain ridge, whereas the latter, the Seewinkel, represents the lowest land in Austria. In 2001, the whole region Neusiedler See/Fertő was designated an UNESCO World Heritage Site.

The region is characterised by a hot, dry Pannonian climate with an annual precipitation of 700-800 mm and annual mean temperature of >9°C. In a relatively small area, plants and animals with Alpine, Asiatic and Mediterranean affinities, as well as northern species, are present, resulting in high species diversity. Although its origin can be traced to tectonic movements in the mid-Tertiary, the final shape of the landscape relates to the late Quaternary, when Tertiary sediments were partly covered by glacial clay, sand and loess deposits during glacial periods.

Today two main economy sectors dominate the area: on the one hand intensive agriculture particularly crop-growing, wine growing and greenhouse-vegetable gardening and on the other hand, especially around the lake and focused on rather small places, tourism. The Neusiedler See is one of seven the most popular tourist destination in the eastern part of Austria. In the last decades the typical lake tourism changed to a more diversified tourism based on the nature, national park, cycling and other sports activities, cultural traditions and events.

Nowadays the main problem is the growing conflict between these two utilisation claims caused by increasingly required land for their uses, additionally interfering with nature conservation issues.

2.1.3. General description – natural conditions Hungarian part

The continental lake basin between the Alps and the Carpathians is a north-western overhang of the Small Pannonian Plain at the foothills of the Leitha Mountains and the Rust Hills. The low-lying area encircled by hills and terraces of the immense gravel bed of the Danube was once interconnected with the former Hanság marshland. Today artificial channels interlace the reclaimed lowland, stabilising the water level of the lake and the ground water.

The Hungarian name Fertő(morass) well characterises the shallow lake, which in fact has only a partly open water surface, a large proportion of its territory, especially on the southern Hungarian part, being covered by reed. Lake Fertőand a series of small satellite waters on the eastern part at 'Seewinkel' (lake angle) constitute the westernmost alkali lakes in Europe. The semi-natural zone around them still forms Europe's second largest reed wetland vegetation. This is one of the most important bird refuges in Central Europe, both for breeding and migratory birds, promoting traditional land-use practices (e.g. reed harvesting and fishing). Beyond the wetlands the area is still extremely rich in habitats, as it is a transition zone between the mountain ridges and the lowland of the Pannonian basin. From the unique dry alkaline steppe up to the closed deciduous forests a series of different vegetation types result in high biodiversity. The rare 'Leitha limestone', supplying a good and an attractive white-beige building material, has been exploited in quarries since Roman times, together with the sulphurous springs. Due to the bio-cultural richness of this landscape, nationally and internationally protected areas, including the national parks in Austria and Hungary, Ramsar sites, biosphere reserves and Nature 2000 sites, are predominant here, crowned by the cross-border cultural landscape being classified by UNESCO on its World Heritage List.

2.1.4. Landscape history in brief (Konkoly-Gyuró, 2009)

The most ancient remnants of human settlement around the Fertő/Neusiedler Lake originate from the New Stone Age. Since that time inhabited and depopulated periods have alternated in the landscape history, depending mostly on the presence of water. According to the natural dynamic of the shallow steppe lake, dry and water-rich times have followed one another. The German name 'Neusiedler' (new settler) originates from a wave of resettlement after a dry and depopulated period. Inhabitants of this region learned to live with and from the waters over several thousand years, despite the water level oscillation of the lake and the connected marshland.

The area was part of the 'Comitatus Soproniensis' within the Austro-Hungarian Monarchy before the First World War. Given the natural conditions, Hungary was predestined to be the main food producer of the empire. In the second half of the 19th century the growing population and the enlarged market in Europe initiated increasing and more intensive agricultural production. This was the age when the water reclamation commenced with great force; the dried-out marshlands and grasses were rapidly turned into arable land. Nevertheless, the drawbacks of this reclamation became evident. Lake Fertő lost its natural 'watershed' and a rapid reed expansion took place with the risk of drying out becoming evident. On the connected marshland the dry peaty soil also needed water supply, thus a new channel system was constructed to assure water availability and the constant water level of the lake. The new recreational facilities built mostly by the north-eastern part of the lake around the turn of the 19th-20th century also required a stable water level. New infrastructure developments planned by engineers resulted in a totally transformed, modern landscape in the lowlands. In contrast, the land use structure on the hilly borderland of Lake Fertő remained more or less intact even later during the 20th century, despite the huge political changes.

After the First World War the new political division of east-central Europe resulted in a border being drawn through the lake, dividing the basin into two parts. Since then the northern lake basin has belonged to Austria and the southern one to Hungary. Despite the disintegration of the Monarchy, the traditional coexistence and cooperation of the micro landscapes and people, land use

forms and markets around the lake were only really disturbed after the Second World War when Hungary came under the sphere of influence of the Soviet Union and the Iron Curtain was established.

Villages on the western borderland along the Iron Curtain lost their population because of the political and economic constraints. The area became a 'sleeping landscape' not freely accessible for everyone. Land use statistics show an increase in grassland, reed, fallow land and woods. Owing to the peripheral situation, a considerable part of the region retained or regained its semi-natural condition, predominantly the low-lying areas of the lake and the flat grasslands. Gradually these have been brought under nature conservation. While in Austria tourism and the recreational function of the landscape became increasingly significant around the whole lake using the potential of the water, the perfect cycling opportunities, the cultural heritage and the good quality vines, this had minor importance in Hungary, where almost only the small-scale utility gardens of the citizens of Sopron served for so-called 'active' recreation and only one access point to the lake's open water was built at Fertőrákos. Due to the clear blossoming of a number of leisure and economic activities during the past two decades, following the political changes and the opening of Austrian border, the differences between the Austrian and Hungarian side have been diminishing, though they have not disappeared.

2.2. Project specific approach

In the present project, the basic framework of ecosystems functions and services will be adapted for the analysis of the Neusiedler See region to stress the importance of this multi-functional landscape providing services not only to the local people but also to many visitors, highlighting the differences in the three utilisation claims of (1) agriculture, (2) tourism and recreation and (3) nature conservation and landscape management. In order to overcome the problem of spatial scale of ecosystem services (Hein et al., 2006), we evaluate functions of the landscapes as such, integrating ecosystems over a larger area.

In the scientific field of landscape ecology, pattern and process is an important paradigm (Forman & Godron, 1986; Forman, 1995). Thus, spatial pattern is linked to the ecological or landscape functions (Forman, 1995; Gustafson, 1998; Wrbka et al., 2004; Blaschke, 2006 and others). This holds also true for the investigation area of Neusiedler See, where the given spatial structure will be linked to its ecological and landscape functions.

In principle, this step will be guided by the hierarchical concept of "primary – secondary – tertiary landscape structure" (O'Neill et al., 1986; Ružicka & Miklos, 1990), an approach that tries to systematically assign any landscape attribute to the biophysical (= primary landscape structure, referred to as "PLS"), the land-management / socio-economic (= secondary landscape structure, referred to as "SLS") and the planning / policy (= tertiary landscape structure/TLS) domain. In this concept, parameters like climate, topography and bedrock are the main drivers of land cover which cannot be altered very easily and are therefore assigned as PLS. Land use produced through human interaction with PLS can be changed quite rapidly e.g. from forest to pasture. Hence, it is the second hierarchical level. Landscape policy and / or planning, administrative boundaries are in general not apparent in land cover and are very dynamic. These aspects are assigned to the lowest level of the concept – the TLS. The focus of the project will be on the first two domains, PLS and SLS, whereas

TLS is difficult to grasp in data and not very robust over time and will therefore be neglected. PLS displays the potential of the landscape for certain functions and uses, open to the decisions of people how to use the land. Assessing the potential landscape functions via PLS is mainly driven by scientific data. On the contrary, SLS describes the actual landscape functions, what people are really doing with and in the landscape and therefore can only be evaluated adequately with a participatory process.

The concept of ecosystem functions and services connects the development of landscape and ecosystem with the socio-economic development in a region. In the sense of the Seville Strategy for biosphere reserves it can be used to evaluate the landscape potentials for different options in economic and regional development around the Neusiedler See. The socio-economic system is divided in two interacting systems – economy and living space. In the project only two economic sectors which are very closely linked to landscape (and ecosystem services) will be analysed: agriculture and tourism.

For the redesigning of an unknown already existing biosphere reserve an effective participation of regional stakeholders (decision-makers, local authorities, representatives of land user groups and landowners, …) as well as the local population has to be considered. Dealing with environmental matters all relevant user and interests groups should be identified and involved as well as all relevant sources of information, including traditional and local knowledge, should be considered. Scientific expertise is simply not enough when local peoples´ needs have to be recognised and answered. Moreover, local people are the best experts in connection with knowledge on local conditions. Participation processes can stimulate creative potential and often lead to surprisingly simple and innovative solutions.

Beside these a number of socio-scientific reasons account for the need for participatory and collaborative approaches to natural resource management, as well as for its various benefits: the shift in management from single-resource and single-species emphasis to an ecosystem-based focus integrating ecological, economic and socio-cultural aspects, as demanded by the biosphere reserve concept, further increases complexity. If environmental resource management fails to take into account the human and social dimensions, sustainable development will be difficult to achieve.

The involvement of the local people, interests groups, stakeholders etc. in the decision-making process has to be seen as a major predisposition for identification with decisions and with the acceptance of the project outcome (Lexer, 2004). Otherwise, there may be distrust and as well as refusal of local people and the decision makers against the reanimation of the biosphere reserve. Scientific confirmed approaches and results are worthless, if they lack the support of the people who are expected to apply it. Participation processes are the starting basis for a co-operative balancing of competing interests, collaborative learning and joint decision-making, which is in favour of sustainable solutions (Kollmann et al., 2003).

Following these arguments, and in order to reanimate the biosphere reserve idea based on the Seville Strategy, a participatory approach involving local people, regional stakeholders and regional experts as well as decision makers were applied throughout all major phases of the project, ranging from information gathering to a collaborative development of potential landscape function and of an international and intraregional network for long term socio-ecological research und monitoring. The stakeholder process used all major stages of participation: information, consultation and collaboration.

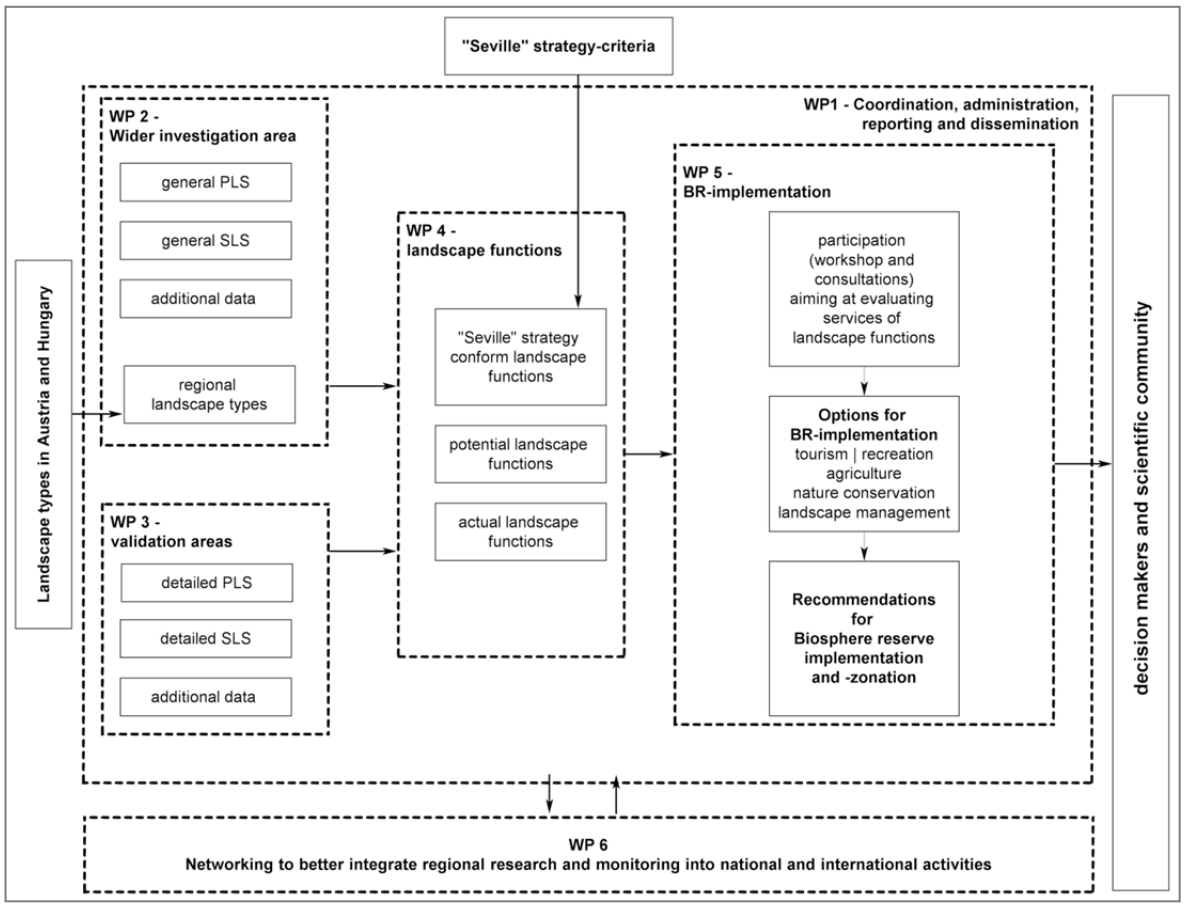


Figure 5: Overview of the different workpackages (WP) carried out in the project and their main relationships

Figure 5 visualises the conceptual approach of the present project. Next to workpackage (WP) 1 where the administrative responsibilities were located, the project consisted of five other WPs. WP2 was dedicated to the harmonisation of the landscape types in the transboundary region and the acquisition of data on primary and secondary landscape structure. This information yielded in a sampling design for more detailed data on the local and regional level which were necessary to derive the potential and the actual landscape functions and services in WP4. Together with the Seville-strategy, we worked on a participatory basis on options and recommendations for the re-design of the biosphere reserve. During the whole duration, continuous collaboration with research community was maintained in order to provide a solid basis for the implementation of a LTSER-site in the region Neusiedler See / Fertő.

2.3. Utilisation claims

2.3.1. Agriculture

As a world-wide trend, land cover change, in particular conversion to cropland has left its marks in this region. Typically for this part of the Burgenland is the rapid landscape change from a huge swampy or dry area into conventional farm land. This has led to an almost levelling of primary resources especially water supply. Therefore, during the last decades utilisation transformed the former groundwater-dominated area east of the Neusiedler See to an intensively used agricultural steppe. In order to understand better the processes behind the possible impacts on the agricultural developments of the regions, we investigated (1) the climatic and (2) soil conditions, (3) the

agricultural structures, (4) changes in the landscapes, (5) agricultural production, (6) situation of forestry, (7) problems associated with agriculture and (8) projects in the investigation area. The following description focuses first on the Austrian part of the investigation area, followed by the Hungarian part.

2.3.1.1. Agricultural conditions in the Austrian project region

Climate

The Neusiedler See has a substantial impact on the local climate and offers beneficial conditions for the regional agriculture. Acting as a big reservoir of warmth it has a damping influence on the course of temperature during the day, prevents frost in spring and autumn and reduces fluctuations of temperature in summer (Heimerl et al., 1989). Temperatures in winter are not that extreme either as earth radiation is prevented by frequent persistent fog (Schiefermeyer, 1989). Strong evaporation and correlating high air humidity are beneficial to agricultural production as well.

The area around Neusiedler See is one of the warmest and sunniest areas in Austria with very low rates of precipitation (Schiefermeyer, 1989). Moreover, frequent winds are an additional promoter of aridity (Leeb, 1992). In order to survive periods of drought in summer, many plant species take a rest and start a second period of growth in autumn (Umweltbundesamt, 1994, quoted in Haider, 2004, p. 16). Due to the earlier cultivation in spring and the extended summer, the vegetation period in this area therefore amounts to more than 250 days (Heimerl et al., 1989).

The area around Neusiedler See is well known for its many hours of sunshine. However, this also implies the danger of heat and aridity for the farmers due to which a 40% loss of crop was recorded in 2001. In dry summers farmers have to spend one third of their working capacity on irrigation (Fally, 2002).

Soil

In the area around Neusiedler See two main soil types are dominant: black earth and saline soil. Black earth deriving from sand, loess and loess-like material is classified into chernozem, parachernozem and wet black earth. Due to black earth, which is in most cases characterised by huge humus A-levels and thus high fertility, this region is also called Austria's second granary.

Apart from black earth there is saline soil south of the line Podersdorf – St. Andrä – Andau, which is classified into solonchak and solonetz. Moreover there is also smonitza (black earth-like riverside soil), rendzina and brown earth as well as all transitional soil types from half-bog soil to dried up half-bog (Schiefermeyer, 1989).

Structures of the Burgenland agriculture

Historical overview

In the 10th century the area around Neusiedler See became part of the Hungarian confederation. In the 11th, 12th and 13th centuries it was settled with mostly Bavarian farmers and was economically and culturally connected to Vienna and its surroundings (Hanisch, 1975). During the Austro-Hungarian Empire the Burgenland already played an important role as supplier of agricultural products (Hubacek & Bauer, 1997).

The revolution of 1848 led to the abolition of feudalism and therefore to a significant change in the agricultural development of the Empire. The former subjects gained the right of property and disposal of their urbarial land. Nevertheless the majority of land remained in the hands of great landowners (Steiger, 1996). After the annexation of the Burgenland to Austria in 1921, 30 581 small-

scale farmers in the Burgenland only owned 24.3% of cultivated area whereas slightly more than a dozen of great landowners held 23.2% (Schlag, 1981, quoted in Steiger, 1996).

Due to the system of dividing inherited land between all heirs prevailing in Hungary (in contrast to Austria, where the land was given to the eldest son), property in the Burgenland was split up into small-scale and micro-scale farms. In order to overcome the traditional types of farming, consolidation was already carried out at the end of the 19th century. According to the political order of supplying the Austrian people with food after World War II and the intention of improving the economic conditions of the farmers (and thus productivity), consolidation was carried out till the end of the 1980s especially in communities with high proportions of farmland. In this connection the possibility of upgrading farms by selling them parts of large estates was often combined with consolidation, which increased the income basis for the farmers. Since the 1980s consolidation has been carried out not only for reasons of efficiency but also for reasons of landscape conservation by increasing the area of grassland and the amount of shelter belts within. In the district of Neusiedl am See 30.2% of arable land has been consolidated until the end of the 1980s, in the district of Eisenstadt-Umgebung[1] 38.6% (average for the whole of the Burgenland: 34.5%).

Despite structural measures the Burgenland has still got a higher amount of scattered farmland than the rest of the Austrian regions. In the northern part the farm size structure shows the greatest contrasts – with the highest portion of both small-scale and large-scale farms (especially Seewinkel and Parndorfer Platte) (Steiger, 1996). In 1990 farms smaller than 2 ha accounted for an average of 39.68% in the project communities (Burgenland: 27.17%), with Purbach (63.77%) and Oggau (61.62%) showing the highest figures. Farms of 20 ha or above accounted for 12.44% on average (Burgenland: 11.68%), with Deutsch Jahrndorf (58.57%) and Zurndorf (56.67%) showing the highest figures (ÖSTAT, 1992).

A further effect of the system of dividing inherited land common in Hungary in former times was that in many areas nowadays there are unfavourable preconditions for full-time farming (Wutschitz, 1995).

However, there was still a relatively high portion of full-time farming in the 1970s in special crop areas such as the Seewinkel. In 1976, the vegetable and wine growing area of the Seewinkel-Lackenzone was the only area in the Burgenland with 50% full-time farms[2] (Arnold, 1979). In 1990, full-time farms in the project communities with at least 50% of working time spent in the agricultural enterprise accounted for an average of 38.03% (Burgenland: 25.46%), with St. Andrä am Zicksee (62.09%) and Frauenkirchen (58.62%) showing the highest figures. Part-time farming with less than 50% of the working time spent in the agricultural enterprise accounted for 61.44% (Burgenland: 73.45%), with the highest figures in Klingenbach (83.33%) and Siegendorf (82.24%) (ÖSTAT, 1992).

Table 3 shows a significant reduction in the number of full-time farmers between 1960 and 1990. The total amount of farms decreased dramatically within this period as well (by nearly a third).

Due to high economic growth, rapid technical progress in agriculture and limited sales chances for agricultural products there was a structural change during the post-war years which proceeded much faster in the Burgenland – especially in the 1960s and 1970s – than in the other Provinces and led to a decrease in the number of farms (Wutschitz, 1995). The portion of persons employed in agriculture and forestry declined continuously during the last century in the Burgenland as well as in the whole of Austria. Up to the 1960s agriculture was the most important sector of employment: in 1920 agriculture accounted for about 90% of the total of employees, in 1950 for about two-thirds, but already in 1970 for only less than 30% (Feigl, 1996, quoted in Hubacek & Bauer, 1997).

[1] In Steiger, 1996 referred to as district of Eisenstadt

[2] Meaning in this context: at least 90% of working time is spent in agricultural enterprise

A further problem is the unfavourable age structure: in 1990, more than 10% of the farms were led by pensioners where the succession can generally be defined as uncertain (Hubacek & Bauer, 1997).

Table 3: Development of full-time farming and part-time farming in the district of Neusiedl am See, 1960 – 1990

	Total of farms	Full-time farms	Full-time farms in %	Part-time farms	Part-time farms in %
1960	7,661	4,988	65	2,673	35
1970	7,068	4,045	57	3,023	43
1980	5,937	2,846	48	3,091	52
1990	5,381	2,269	42	3,112	58

(Source: ÖSTAT 1960, 1973, 1982, 1992 quoted in Hubacek & Bauer, 1997, adapted)

The farm structure survey carried out in 1990 resulted in the following distribution of full-time farms and part-time farms, as shown in Table 4.

Table 4: Number of total farms, full-time farms, part-time farms and agricultural enterprises run by legal persons in the Burgenland, the district of Neusiedl am See, Eisenstadt-Umgebung and Rust in 1990

	Total of farms	Full-time farms	in %	Part-time farms	in %	Agricultural enterprises run by legal persons	in %
Burgenland	26,421	6,727	25	19,406	73	288	1
District of Neusiedl am See	5,417	2,269	42	3,112	57	36	1
Free City of Rust	120	64	53	55	46	1	1
District of Eisenstadt-Umgebung	3,450	943	27	2,493	72	14	0,4

(Source: ÖSTAT, 1992, adapted)

The contribution of agriculture to the Burgenland's gross regional product also decreased from 39.2% in 1961 to 9.4% in 1989. During the 1970s agriculture in the Burgenland had to face losses in market shares due to competitive weaknesses in many fields: low level of education of the farmers, lack of facilities of applied research, shortcomings of consolidation, information, cooperation and organisation as well as a weak marketing system (ÖROK, 1994).

Current situation of farm structures

As already mentioned above, the size of agricultural enterprises in the Burgenland nowadays is far beyond the Austrian average. The Burgenland shows an average of 25 ha, but it has to be considered that 80% of the enterprises do not reach this figure (Scheiber, 2007). In 2004, 3,170 agricultural enterprises (out of a total of 11,753) were not able to participate in an ÖPUL-action as they did not meet the minimum requirement of 2 ha of land owned (Scheiber, 2007).

According to INVEKOS-GIS (BMLFUW, 2008) there are 1,840 farms in the project communities, which are mainly characterised by small sizes. 45% of the farms (834) are of 0 to 10 ha in size, 23% (428 farms) of 10 to 25 ha. 26% (485 farms) show a size of 25 to 100 ha, only 5% of more than 100 ha (see Table 5).

Table 5: Number of farms in project communities according to size in 2008

Farm size	Number of farms	Farms in %
0-5 ha	530	29
5 - 10 ha	304	17
10 - 25 ha	428	23
25 - 50 ha	262	14
50 - 100 ha	223	12
100 - 250 ha	74	4
250 - 500 ha	7	0
500 – 1,000 ha	11	1
> 1,000 ha	1	0
Total	1,840	100

(Source: INVEKOS GIS, 2008, adapted)

The latest farm structure survey, carried out in 1999[3], resulted in the following distribution of full-time farms and part-time farms, as shown in Table 6: in the whole of the Burgenland, full-time farming accounted for 23%, part-time farming for 74%.

The district of Eisenstadt-Umgebung shows similar figures: 24% full-time and 74% part-time farms. In the district of Neusiedl am See, however, there is a higher portion of full-time farms (37%), part-time farms accounting for 62%. In Rust there is even a portion of 49% full-time farms.

Table 6: Number of total farms, full-time farms, part-time farms and agricultural enterprises run by legal persons in the Burgenland, the district of Neusiedl am See, Eisenstadt-Umgebung and Rust in 1999

	Total of farms	Full-time farms	in %	Part-time farms	in %	Agricultural enterprises run by legal persons	in %
Burgenland	16 081	3 707	23	11 914	74	460	3
District of Neusiedl am See	3 927	1 466	37	2 417	62	44	1
Free City of Rust	98	48	49	45	46	5	5
District of Eisenstadt-Umgebung	2 098	502	24	1 559	74	37	2

(Source: Statistik Austria, 1999, quoted in Amt der burgenländischen Landesregierung, 2009)

Change in the landscape

The proximity to major cities, especially Vienna, led to the fact that changes in the northern part took place about 20 years earlier than in the southern part. Relatively large management units were created, resulting in landscapes which lost their original appearance to a great extent by the regulation of waterways and consolidation (Gerger & Schauer, 1995). Up to the first half of the 20th century, large parts of the Seewinkel were pastures and grasslands used for rough grazing or the production of hay. Substantial parts, however, also were marshy and therefore not suitable for agricultural purposes (Hubacek & Bauer, 1997).

Already before World War II, vast areas of rough grazing land, peaty meadows, wet meadows and acid grasslands were turned into cropland and vineyards especially in the district of Neusiedl am See.

[3] After 1999 only sample surveys have been carried out

Between 1926 and 1936 a total of about 7 200 ha of such areas were cultivated in the Burgenland with three quarters of them located in the district of Neusiedl am See (Steiger, 1996).

Figure 6 and Table 7 show this significant change in the landscape which took place in the district of Neusiedl am See between 1930 and 1990.

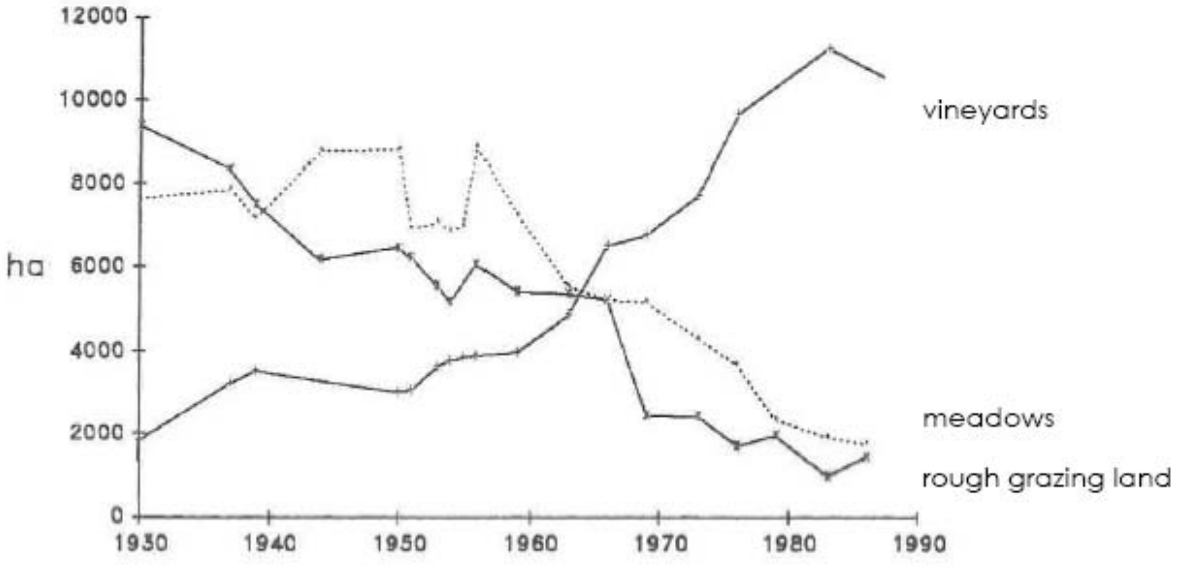


Figure 6: Development of vineyards, meadows and rough grazing land in the district of Neusiedl am See between 1930 and 1990

(Source: Nemeth, 1991)

Table 7: Rough grazing land, meadows and vineyards in the district of Neusiedl am See in 1953 and 1990 in ha

	Rough grazing land	Litter meadows	Permanent meadows of one cut	Permanent meadows of more than one cut	Vineyards
1953	5,937	751	5,974	352	3,368
1990	721	617	1,124	346	11,288

(Source: Burgenländische Landesregierung, 1954; ÖSTAT, 1992)

In order to expand food production after World War II, wetland habitats in the Seewinkel (Lacken, wet meadows and wet rough grazing land) were drained by the installation of canals. The largest areas which were drained were located in the Hansag. The Hansag (the Austrian part is called Waasen) happened to be the largest low moor in Austria, in which fishing was still practised before the first wave of drainage in the middle of the 19th century (Supper, 1990).

Serving as a transitional zone between land and water, the wet meadows reach their greatest width in Jois and Oggau. During the past centuries they were regularly cut and grazed until left fallow from the 1960s onwards, due to the decrease in livestock husbandry. It was only thanks to several grazing projects that they could be restored during the past few years (Zech, 2003).

Agricultural production

According to INVEKOS-GIS (2008) there are 57,192 ha of agricultural area in the project communities, the biggest part of it being cropland with 78% (44,593 ha), followed by vineyards with

11% (6,244 ha) and grassland with 5% (2,978 ha). As pointed out in Table 8, the largest agricultural areas in relation to community size can be found in Deutsch Jahrndorf with 85% (2,319 ha), Tadten with 83% (2 991 ha) as well as Frauenkirchen (2,550 ha), Halbturn (4,406 ha) and Pamhagen (2,641 ha) with 80% each. In the communities of Mörbisch, Purbach, Breitenbrunn, Oggau, Rust and Donnerskirchen this relation accounts for less than 25%.

Table 8: Agricultural area and community size of each project community

Name of community	Agricultural area in ha	Community size in ha	Agricultural area in % of community size
Mörbisch	179	2,850	6
Purbach	562	4,584	12
Breitenbrunn	489	2,580	19
Oggau	1,022	5,219	20
Rust	421	2,001	21
Donnerskirchen	750	3,390	22
Illmitz	2,487	9,186	27
Neusiedl am See	1,658	5,720	29
Podersdorf	1,374	4,173	33
Jois	869	2,590	34
Schützen am Gebirge	719	2,120	34
Winden	495	1,350	37
Weiden	1,262	3,250	39
Klingenbach	192	482	40
St. Margarethen	1,315	2,650	50
Siegendorf	1,333	2,310	58
Apetlon	5,007	8,220	61
Andau	3,099	4,730	66
Gols	2,933	4,223	69
Nickelsdorf	4,373	6,070	72
Mönchhof	2,440	3,360	73
St. Andrä am Zicksee	2,392	3,170	75
Zurndorf	4,236	5,430	78
Wallern	2,679	3,390	79
Pamhagen	2,641	3,310	80
Halbturn	4,406	5,520	80
Frauenkirchen	2,550	3,190	80
Tadten	2,991	3,610	83
Deutsch Jahrndorf	2,319	2,740	85

(Source: INVEKOS GIS, adapted, BMLFUW, 2008)

As shown in Table 9 the most common type of field utilisation is winter corn (15,985 ha), followed by root crops (14,341 ha), wine (6,261 ha), spring corn (4,137 ha), temporary grassland (4,059 ha) and extensive grassland (3,842 ha).

Table 9: Field utilisation in project communities

Field utilisation	ha
winter corn	15,985
root crops	14,341
wine	6,261
spring corn	4,137
temporary grassland	4,059
extensive grassland	3,842
leguminosae	2,270
unknown	2,068
fallow land	1,154
Ecological valuable	1,078
special crop	831
vegetables	559
others	213
forestry	134
fruits	132
pasture	58
land planting	31
landscape element	19
intensive grassland	18
horticulture	2

(Source: INVEKOS GIS, 2008, adapted)

Organic farming

In 2006, 10.75% of the farms listed in INVEKOS GIS were organic farms. In the Burgenland as a whole 730 farms were managed according to the production standards of organic farming, with 244 of them being located in the district of Neusiedl am See and 62 in Eisenstadt-Umgebung. Organic farms hold a share of 16.7% (25,616 ha) in the total of subsidised arable land in the Burgenland (Amt der burgenländischen Landesregierung, 2008).

Crop growing

Historic overview

The cultivation of **cereals** in the Burgenland was of significant importance already before World War II (together with grain maize making up 67% of cropping land in 1936); in those days, though, there was still a large area of field forage growing in the northern part due to the higher livestock husbandry. After World War II an increase in the area used for cultivating cereals took place, especially in the northern Burgenland (together with grain maize accounting for 77% of cropping area in the district of Neusiedl am See in 1959) (Steiger, 1996). In the rural areas of the Parndorfer Platte (23,000 ha), Seewinkel (30,000 ha) and Leithagebirge-Neusiedler See (8,000 ha), the cultivation of cereals dominated the cropland at the end of the 1970s with more than 90%, with spring barley accounting for 40-70% of the cropland just around Neusiedler See (Arnold, 1979). With 12,425 ha, winter wheat had the biggest share (23%) in the cropland of the district of Neusiedl am See in 1990,

accounting for 38% of the Burgenland winter wheat area, followed by winter barley with 8,905 ha (=16%, that is 68% of the Burgenland winter barley area) (ÖSTAT, 1992).

Compared to the other provinces, the Burgenland's cultivated area for **potatoes** has proportionally decreased to the greatest extent since the interval between the two World Wars, due to several diseases and pests as well as low marketing chances. The highest decrease is registered in the area of the Parndorfer Platte and in the Seewinkel, mainly because potatoes are no longer important for pig fattening (Steiger, 1996). In 1990 the cultivated area for potatoes accounted for 11 ha (1953: 1,753 ha) in the district of Neusiedl am See, 32 ha in the district of Eisenstadt-Umgebung and 1 ha in Rust (ÖSTAT, 1992; Burgenländische Landesregierung, 1954).

The cultivation of **feeding beet** has also decreased mainly in the northern part of the Burgenland since the interval between the two World Wars, where the sharp reduction of livestock husbandry and the preference for the cultivation of sugar beet completely displaced the feeding beet especially in the Seewinkel, the Parndorfer Platte and in the area of Neusiedler See. The intensive cultivation of **sugar beet** was triggered by the sugar factories Hirm and Siegendorf in the mid 1880ies. Three quarters of the sugar beet cultivation area are concentrated in the northern Burgenland, especially in the Seewinkel, where about half of the Burgenland produce is harvested on 13% of cropping area (Steiger, 1996). In 1990 the cultivation area for sugar beet accounted for 2,337 ha in the district of Neusiedl am See and 760 ha in the district of Eisenstadt-Umgebung, those for feeding beet, Swedish-turnip and feeding carrot for 24 ha and 6 ha respectively (ÖSTAT, 1992).

Until the end of the 1970s **oil crop** cultivation in the Burgenland was only of very little significance (less than 1% of cropping area). Due to the rising surplus production of cereals, incentives were created to promote the production of alternative fruits, and the cultivation areas of oil and protein plants reached their highest share of cropping area (23%) in 1994 (Steiger, 1996). In 1990, 1,456 ha were planted with sunflowers for oil production in the district of Neusiedl am See (=33% of the Burgenland sunflower cultivation area), 480 ha in the district of Eisenstadt-Umgebung (ÖSTAT, 1992).

Current situation

As shown in Table 10, the cultivation area for winter corn in the region under discussion accounted for 15,985 ha in 2008 whereas spring corn was cultivated on 4,137 ha. As pointed out in Figure 7, the largest cultivation areas for **cereals** are located in Halbturn (2,065 ha – 37.4 % of area of municipality) Nickelsdorf (2,006 ha – 33%) and Zurndorf (1,779 ha – 32.8%). Besides, areas of more than 1,000 ha can be found in Frauenkirchen (1,159 ha – 36.3%) as well as Pamhagen (1,125 ha – 34%), Mönchhof (1 028 ha – 30.6%), Wallern (1,007 ha -29.7%) and St. Andrä am Zicksee (1,004 ha -31.7%) (INVEKOS GIS, BMLFUW, 2008).

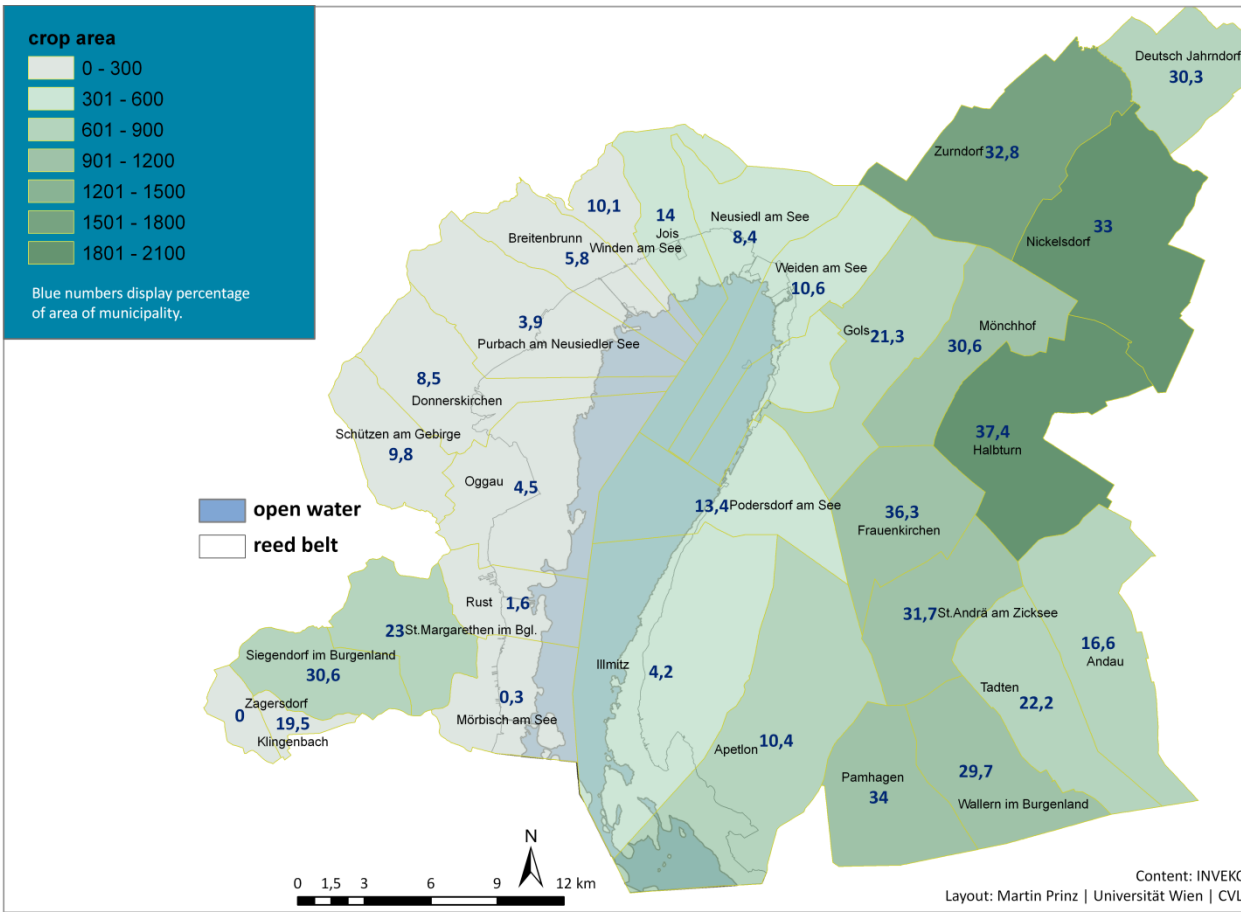


Figure 7: Crop area of each project community in 2008: Blue numbers display percentage of area of municipality

Leguminosae are cultivated on 2,270 ha, with Nickelsdorf showing by far the highest portion (515 ha), followed by Halbturn (326 ha), Zurndorf (216 ha) and Pamhagen (187 ha).

Root crops are cultivated on 14,341 ha, with areas of more than 1 000 ha being located in Halbturn (1,333 ha) as well as Zurndorf (1,295 ha), Nickelsdorf (1,203 ha), Tadten (1,146 ha), Deutsch Jahrndorf (1,120 ha) and Wallern (1,014 ha).

Special crops are cultivated on 831 ha, with Weiden (154 ha), Frauenkirchen (133 ha), Podersdorf (81 ha) and St. Andrä am Zicksee (71 ha) showing the highest portion.

Table 10: Cropping areas in the 29 communities under discussion (in ha)

	winter corn	spring corn	special crops	leguminosae	root crops	total
Halbturn	1,589	476	43	326	1,333	**3,766**
Nickelsdorf	1,582	425	15	515	1,203	**3,740**
Zurndorf	1,387	392	43	216	1,295	**3,333**
Frauenkirchen	925	234	133	101	838	**2,231**
Wallern	815	192	34	102	1,014	**2,156**
Deutsch Jahrndorf	507	325	32	77	1,120	**2,061**
Tadten	680	119	17	66	1,146	**2,028**
Mönchhof	874	154	13	32	898	**1,972**
Gols	790	108	31	71	860	**1,859**
St. Andrä am Zicksee	829	175	71	81	686	**1,842**
Andau	611	173	7	27	980	**1,798**
Pamhagen	910	215	23	187	446	**1,781**
Apetlon	618	238	6	18	507	**1,387**
Siegendorf	514	191	7	56	242	**1,010**
Podersdorf	435	126	81	39	274	**955**
St. Margarethen	543	68	4	75	182	**872**
Neusiedl am See	354	123	54	66	227	**824**
Weiden	334	11	154	93	208	**801**
Illmitz	305	79	41	4	152	**580**
Jois	280	81	11	10	57	**440**
Oggau	198	38	1	70	128	**436**
Schützen am Gebirge	170	38	2	0	215	**425**
Donnerskirchen	205	84	0	0	86	**375**
Purbach	178	0	0	2	65	**246**
Breitenbrunn	128	21	4	28	45	**227**
Winden	111	27	0	2	65	**205**
Klingenbach	81	13	0	1	48	**143**
Rust	25	9	5	5	20	**63**
Mörbisch	6	3	0	0	0	**9**
total	**15,985**	**4,137**	**831**	**2,270**	**14,341**	**37,565**

(Source: INVEKOS GIS, BMLFUW, 2008, adapted in ha)

Vegetable growing

Historic overview

The northern Burgenland is one of the most important regions of field vegetable farming in Austria and delivers four fifth of the whole vegetable produce in the Burgenland. The first major period of expansion took place in the 1920s, since after the end of the Austro-Hungarian Empire Hungarian areas of vegetable growing were lost for the supply of Vienna. The main zone of cultivation was the lakeside area around the town of Neusiedl am See. In this area, 20-30 million pieces of the Neusiedler Grundsalat were harvested each year. Additionally, tomatoes, cucumbers, onions and celeriac were being cultivated. In Neusiedl am See there was also the most important area of

growing marjoram in Austria with a yearly harvest of 15,000 – 20,000 kg. In 1937 production met 60% of the domestic marjoram demand. A second, smaller vegetable growing area was located in the Seewinkel, where especially in the lakeside area between the level of Weiden and Apetlon early vegetables were cultivated. In 1932/33 the pick pea was introduced there and rapidly spread around the whole Seewinkel. Moreover, bush beans, carrots, parsley, onions, tomatoes, cucumbers, peppers and melons were grown in this area. In Mörbisch there was an important cultivation of green beans. During World War II the area for vegetable growing increased considerably (in the district of Neusiedl am See it amounted to 600-800 ha). From the mid 1960ies onwards the cultivation of marjoram began to decline rapidly due to the beginning of specialisation and industrial vegetable growing. During the 1970ies the main cultivation area for field vegetables shifted from the lakeside area to the middle and eastern Seewinkel; with this cultivation accounting for 5-6% of the cropping area, Seewinkel is at present the centre of the Burgenland's field vegetable growing (Steiger, 1996). The intensive field vegetable cultivation in the area of the Seewinkel also made it possible for the small-scale farmers to exist and is thus responsible for a high ratio of full-time farming (Arnold, 1979). In 1990 field vegetables were grown on 591 ha in the district of Neusiedl am See, which is 92% of the Burgenland field vegetable growing area (ÖSTAT, 1992).

Current situation

As already mentioned above, field vegetable growing has significant importance in the region and is mainly located in the middle and eastern Seewinkel (especially in Wallern, Tadten and St. Andrä). The most important products are pickled cucumbers, peppers and tomatoes (Schiefermeyer, 1989).

According to INVEKOS-GIS (BMLFUW, 2008), vegetables are grown on 559 ha in the communities under discussion, with St. Andrä am Zicksee (152 ha) having the largest area, followed by Andau (123 ha), Podersdorf (74 ha), Wallern (61 ha), Tadten (42 ha), Apetlon (39 ha), Pamhagen (36 ha) and Frauenkirchen (26 ha).

Fruit growing

Historic overview

The favourable climatic and soil conditions as well as the proximity of the Viennese market are prerequisites for intensive and profitable fruit growing. The districts of Neusiedl am See and Eisenstadt-Umgebung are mainly suitable for cultivating stone fruit (cherries, apricots, peaches and plums as well as increasingly apples). Until the 1950s, also almond trees were cultivated in the vineyards of the lake communities. On the slope of the Leithagebirge, cherry-, apricot- and almond-trees were some sort of side products of the vineyards (Steiger, 1996). After World War II the planting of early plums was promoted in the Seewinkel, and there were the first intensive fruit plantations of peaches. For 97% of all fruit growing establishments in the Burgenland, fruit cultivation in the form of orchards was exclusively used for self-supply; it was only in the case of very successful harvests that it was also sometimes connected with subsidiary earnings (Arnold, 1979). Since the 1960s fruit growing has decreased in the districts of Eisenstadt-Umgebung and Neusiedl am See, since the fruit trees hamper the mechanised management of the vineyards in the course of the switch to high-training systems and the harvest – especially of the cherries – is too labour-intensive (Steiger, 1996). In 1990 there were 24 ha of extensive fruit plantations in the district of Neusiedl am See (= 4% of the Burgenland area of extensive fruit plantations) as well as 147 ha of intensive fruit plantations (= 20% of the Burgenland area of intensive fruit plantations) (ÖSTAT, 1992).

Current situation

In the investigated communities fruits are cultivated on a total of 132 ha. The largest area is located in Pamhagen with 39 ha. St. Andrä am Zicksee and Wallern take second place with 21 ha each, followed by Neusiedl am See (12 ha), Tadten and Podersdorf (with 10 ha each).

Wine growing

Historic overview

The region around Neusiedler See offers excellent natural preconditions for wine growing: the lake has a damping influence on the course of temperature during the day and reduces late frosts in spring; moreover, due to its strong evaporation and correlating high air humidity the poor evaporation offers enough water-supply. The long periods of sunshine and the drought in summer have an additional positive effect. Regarding soil wine has only modest demands although soil influences the wine in quality.

Due to the facts mentioned above the northern Burgenland has one of the most important and intensive wine growing areas of Austria, supplying about 40% of the Austrian wine produce. Wine growing has determined the agriculture of the region under discussion and has a long tradition, as discoveries from the Celtic and Roman era prove (e.g. remains of a Roman wine press in Winden). In 1600 the Burgenland-West Hungarian area of wine growing reached its highest extension. At that time, wine was cultivated on 500 yokes each (about 288 ha) in Purbach, Breitenbrunn, Jois, Gols and St. Margarethen. As shown in Table 11, Eisenstadt-Umgebung and Neusiedl am See are the only districts in which – compared to 1600 – the wine growing area increased significantly until 1960, while the other districts showed a sharp decrease (Steiger, 1996).

Table 11: Development of wine growing area 1600 – 1960 in the districts of Neusiedl am See and Eisenstadt-Umgebung

Districts	1600		1960	
	Wine growing area in ha	In % of total area	Wine growing area in ha	In % of total area
Neusiedl am See	1,200	10	3,800	38.5
Eisenstadt-Umgebung	2,300	18	4,150	42

(Source: Steiger, 1996)

In the 16th and 17th centuries Rust, Neusiedl am See and Jois played a leading role in the long-distance wine trade, and their wine was drunk at court (Steiger, 1996). The Seewinkel, which is quite a young wine growing area compared to the western and northern parts of the Neusiedler See region, experienced its first period of expansion of wine cultivation in the middle of the 19th century (1865: 800 ha), with a concentration on the Wagram (=precipice of the Parndorfer Platte) (Arnold, 1979). At the end of the 19th century there was a sharp decrease in the Burgenland wine production due to grape phylloxera introduced from America. The vineyards on the eastern side of Neusiedler See and in parts of the Lacken area, however, proved phylloxera-immune due to the composition of the sandy soils.

After the annexation to Austria, several measures led to a further boom and a quality increase in wine cultivation: the installation of special vineyards for the production of root-stocks (at first established in Winden and Rust), the creation of varietally pure vineyards in order to achieve even yields (cultivation of the varieties Muskat Ottonel, Neuburger, Traminer, Grüner Veltliner), tillage, maintenance works, fertilising and pest control. Mainly in the district of Neusiedl am See there was a sharp increase in wine cultivating areas in the last years before World War II, with a mere 706 ha (district of Eisenstadt-Umgebung: 1,319 ha) in 1912 as opposed to 3,341 ha (district of Eisenstadt-Umgebung: 3,776 ha) in 1936 (Steiger, 1996).

From the 1950s onwards the training of the vine to stakes almost exclusively used so far has been continually replaced by high-training systems due to the development of training on wire trellis. The machinery which could now increasingly be used reduced labour costs and thus improved the profitability of wine cultivation. Between 1960 and the end of the 1980s there was a tremendous extension of the wine growing areas mainly in the Seewinkel (with a yearly rise of more than 15%

between 1953 and 1980), which became the Burgenland's largest wine cultivation area (1980: 8,600 ha) followed by the traditional main wine cultivation area Leithagebirge – Neusiedler See (7,000 ha).

Until the late 1980s, the development of wine growing was characterised by a dual development: a great expansion in sites suitable for wine growing with a tendency of increasing concentration and specialisation (a major part of the companies gave up livestock husbandry (see chapter below), and a withdrawal from the sites less favourably located in the middle and southern Burgenland (Steiger, 1996). The greatest expansion was achieved in the comparatively young wine growing community of Apetlon, whose vineyards increased more than tenfold in size between 1950 and 1977, followed by the traditional wine growing area of Illmitz, where the area quintupled (Löffler, 1982 quoted in Hubacek & Bauer, 1997).

In 1985 the sales of the so-called "Prädikatswein" nearly came to a standstill after cheap wine was mixed with diethylene glycol and sold as this kind of high-quality wine. Moreover, there were price collapses in the 1980s due to oversupply caused by several years of high yields. In order to avoid these surpluses and keep prices permanently on a level that secures livelihood, wine growing has slightly decreased since 1990 and the production of high-quality wine is becoming even more important (Steiger, 1996).

Table 12 shows the development of the wine growing area in the districts of Neusiedl am See and Eisenstadt-Umgebung as well as the Burgenland as a whole which was characterised by a tremendous increase until the 1990s.

Table 12: Development of wine growing area in ha in the districts of Neusiedl am See and Eisenstadt-Umgebung as well as the Burgenland as a whole between 1946 and 1992

	1946	1959	1967	1984	1987	1992	Increase between 1946 and 1992 in %
District of Neusiedl am See	2,525	3,942	6,890	11,088	11,235	10,402	312
District of Eisenstadt-Umgebung	3,305	4,240	5,413	6,643	6,568	5,704	73
Total of Burgenland	7,132	9,911	14,515	20,891	20,986	19,231	170

(Source: Wohlfarth, 1995)

Current situation

According to INVEKOS-GIS (2008), wine is cultivated on 6 261 ha in the region under discussion. As shown in Figure 8, the largest areas are located in Gols (827 ha – 19.6% of area of municipality) Illmitz (599 ha – 6.5%), Pamhagen (549 ha – 16.6%) and Apetlon (514 ha – 6.3%), followed by Halbturn (420 ha – 7.6%), Andau (374 ha – 7.9%), Mönchhof (330 ha – 9.8%) and Rust (304 ha – 15.2%). In Zurndorf, Nickelsdorf, Klingenbach and Deutsch Jahrndorf wine growing only accounts for less than 20 ha in each community.

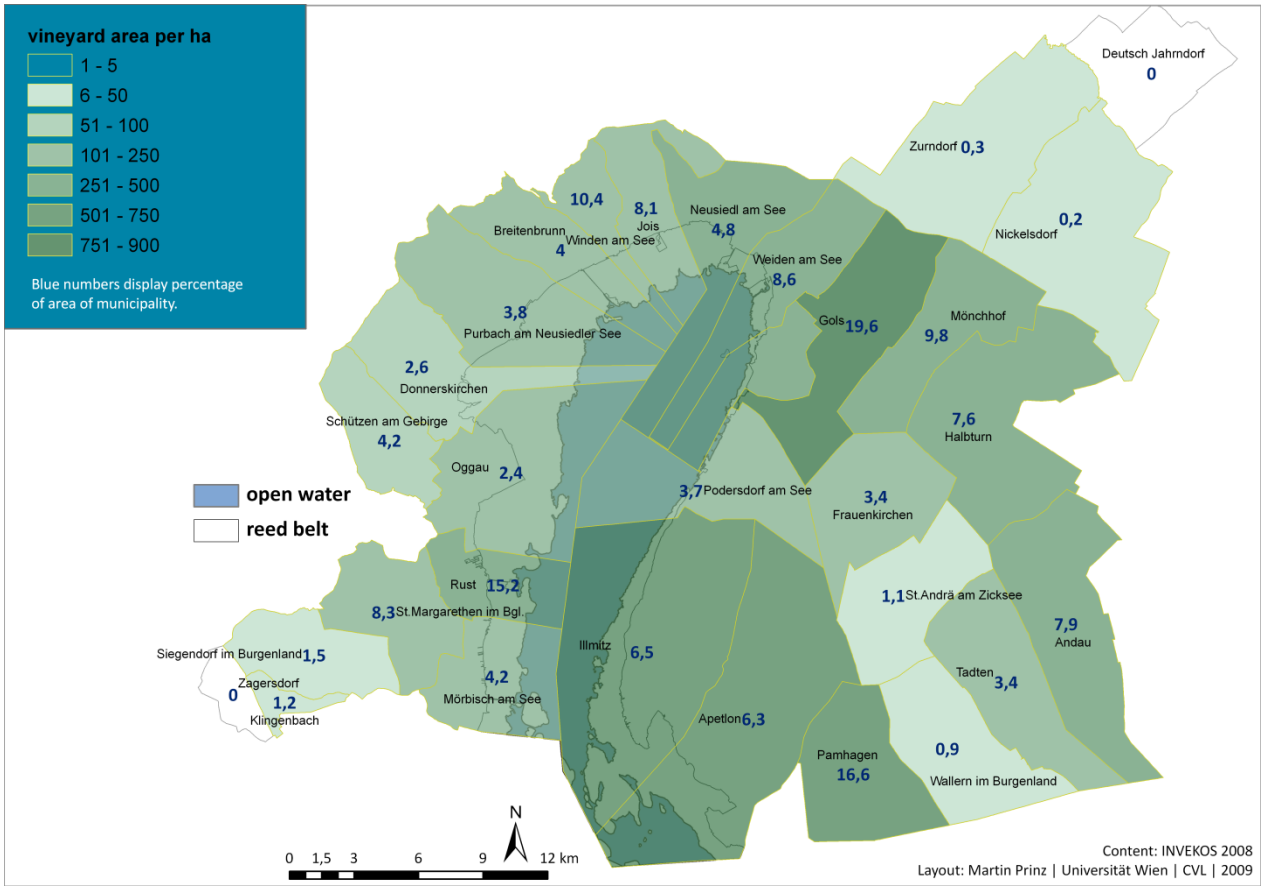


Figure 8: Vineyard area of each project community in 2008: Blue numbers display percentage of area of municipality

Small-scale wine producing holdings are typical of the region and many of them are run by the family or part-time (Scheiber, 2007).

In the districts of Neusiedl am See and Eisenstadt-Umgebung more varieties of white wine are cultivated than of red wine. In Neusiedl am See there is a total of 7,825 ha, with 3,719 ha (48%) of red wine and 4,107 ha (52%) of white wine. In Eisenstadt-Umgebung wine is cultivated on 3,614 ha, with 1,599 ha (44%) being used for red wine and 2,015 ha (56%) for white wine (Bezirksweinbaukataster quoted in Amt der burgenländischen Landesregierung, 2007). Among the most important varieties there are Veltliner and Welschriesling as well as Zweigelt and Blaufränkischer.

Livestock husbandry

Historic overview

For centuries herds determined the appearance of the area around Neusiedler See. Cattle track, browse and fertilisation have influenced the composition of plant communities, formed the soil and set a limit to the spread of reed inland (Heimerl et al., 1989). In 1921 the number of livestock in the Burgenland was low due to extensive management and World War I. In the following years there was a strong incentive to raise the stock due to favourable sales potential especially in Vienna, until further losses of livestock were incurred in World War II (Steiger, 1996). After the war each community in the Seewinkel still had its own horse-, cattle-, pig- and goose-herds, which were driven daily during the warm season. This extensive form of livestock husbandry allowed the existence of pastures and meadows. From the 1950s onwards the draught animal power was soon replaced by

tractors, with the driving of the herds as well as livestock husbandry itself gradually being given up. In Apetlon alone the remaining herds were still driven until the early 1960s. Since the dairy cattle common until then was replaced to a great extent by fattening cattle, the demand for pastures and meadows declined (Supper, 1990).

Horse keeping and horse breeding in the Burgenland were very important during the 1920s due to bad traffic and market conditions. The district of Neusiedl am See was the most prominent area for horse breeding, with 7,249 horses counted in 1923 (the rest of the Burgenland showed 10,514 horses). The breeding of the horses took place on rough grazing land, and they were used as both riding and work horses. The district of Neusiedl am See and some adjacent communities of the district of Eisenstadt-Umgebung were an area wholly devoted to warm-blooded horse breeding. After a decline in horse breeding from 1951 onwards – as a result of fewer mounted army and police officers as well as less motorisation in industry, trade and agriculture – there was a rise again from the mid 1980ies onwards due to sports, leisure and tourism (Steiger, 1996). In the districts of Neusiedl am See (432 horses), Eisenstadt-Umgebung (187) and Rust (5) 44% of the Burgenland horse stock were located in 1990 (ÖSTAT, 1992).

In **cattle breeding** diversity of races was dominant until the end of the 19th century, when it was influenced by Hungarian law promoting the breeding of "Schweizer Fleckvieh-Gebirgs-Hornviehrassen". In 1924 the „Fleckvieh rotbunter Farbe" was the only breed approved by Burgenland's first animal breeding law. In the 1930s the district of Neusiedl am See showed the highest number of cattle on a holding with about ten cows. The dairy industry was at first adjusted to the self-supply of the producers. Production for the market started between 1890 and 1900, caused by the great demand for food resulting from the rapid development of Vienna. Due to World War I, however, the number of cattle declined and the agricultural co-operatives were closed down. In 1921 there was a great lack of milk and dairy products in Austria which was an incentive for increasing the production, and the number of cows rose rapidly. 63% of all cows were kept by small-scale farmers. Already in 1925, however, the market was saturated and the price for milk began to fall. This resulted in the exclusion of some parts of the Burgenland from the supply of fresh milk due to long transport distances to Vienna which resulted in worse quality and therefore even lower prices. Only in the northern Burgenland, thanks to its proximity to Vienna, could the supply of fresh milk be sustained. Due to World War II the Burgenland dairy industry incurred great losses, the milk market performance, however, could be increased rapidly by subsidies (Steiger, 1996). Nevertheless, from 1959 onwards there was a decline in the milk supply of the districts of Neusiedl am See and Eisenstadt-Umgebung. At the same time there was a great expansion of the wine growing area. Wine growers, who until then had also been dairy farmers, gradually left livestock husbandry. In the course of the 1960s and 1970s farm rationalisation took place: there was a change from multi-purpose farming to several- or single-purpose farming in which livestock husbandry ranked last. Intensive cultivation like wine growing or field vegetable growing does not match with labour-intensive livestock husbandry. The northern Burgenland share in the total Burgenland milk production was reduced, with dairy industry being intensified in the southern districts (Steiger, 1996). In 1978 there were a mere 8,000 cattle including 1,500 cows in slightly more than 900 farms in the area around Neusiedler See, on the Parndorfer Platte and in the Seewinkel (Arnold, 1979). In 1990, 14% of the Burgenland cattle stock were located in the districts of Neusiedl am See (4 025 cattle), Eisenstadt-Umgebung (2,894) and Rust (86) (ÖSTAT, 1992).

In **pig production** there was also a rapid increase after the annexation to Austria. Following a further rise in the 1970s – concentrated in the middle and southern Burgenland – there has been a continuous decline since that time (Steiger, 1996). In the northern Burgenland the Wulkabecken was the centre of intensive pig keeping in the 1970s, with the comparatively highest average numbers per piggery (17 pigs for slaughter and young pigs per farm). The western and northern parts of the Parndorfer Platte also formed a quite intensive pig keeping area, with its 53% of pig-keeping farms being an unusually high figure for the northern Burgenland (Arnold, 1979). In the districts of Neusiedl

am See (11,377 pigs), Eisenstadt-Umgebung (9,779) and Rust (5), 16% of the Burgenland pig stock were located in 1990 (ÖSTAT, 1992).

Sheep breeding plays a rather minor part in the Burgenland. It was only in the north that, in the 19th century, there was a major keeping of wool sheep, extensively using the rough grazing land. This was especially carried out by great landowners who turned the old Meierhöfe into numerous sheep farms. In the district of Neusiedl am See there were 50,000-60,000 sheep in the 19th century. After the World War I the number of animals declined sharply as the price for wool was low and the meat could not be utilised. The sheep breeder most important at that time was the Fürst Esterhazysche Gutsverwaltung (Prince Esterhazy's Estate Management) in Apetlon (wool sheep breeding and sheep cheese production). After a low in the 1960s there was a rise in sheep stock. Nowadays sheep breeding is mainly used by part-time farmers for the utilisation of remaining grassland and marginal lands with a concentration, however, in the south (Steiger, 1996). In 1990 there were 460 sheep in the district of Neusiedl am See and 210 in the district of Eisenstadt-Umgebung, which makes up 18% of the Burgenland sheep stock (ÖSTAT, 1992).

Reasons for the high **poultry stock** in the Burgenland are the intensive cultivation of cereals and the many small-scale farms. Until the end of the 1960s goose keeping was a Burgenland speciality with a share of more than 25% in Austrian stock. These were sold mainly on the Viennese market (Steiger, 1996). In the district of Neusiedl am See fowl keeping was dominant at the end of the 1970s with the production concentrating on broilers (=73% of the Burgenland broiler production) (Arnold, 1979). In 1990 this portion only amounted to 2.5% (ÖSTAT, 1992).

Current situation

Also in 2008 livestock husbandry shows a sharp decline in stocks and stock keeping farms although the farms are increasing in size. Alternative forms of production like keeping suckler cows or sheep are becoming more and more important and will play an essential role in landscape conservation (Amt der burgenländischen Landesregierung, 2008).

Breeding **cattle** is also characterised by declining numbers of farms and stock, with an ongoing trend towards specialisation and expansion of holdings (Burgenländische Landwirtschaftskammer, 2008). As pointed out in Table 13, there are 2,107 cattle in the 29 communities investigated (year of application: 2008, as of 4/5/2009). Apetlon shows by far the highest number of cattle (1 066), followed by Gols (262), Illmitz (144), Donnerskirchen (112) and Frauenkirchen (110). The remaining communities all show less than 100 cattle.

The number of **horses** in the communities under discussion amounts to a total of 635. Illmitz shows the highest figures (196 horses), followed by Apetlon (108) and Podersdorf (91). The remaining communities all show less than 50 horses.

In the region investigated there is a total of 14,356 **chickens and turkeys**, with Gols showing 5,916 chickens and Tadten 5,000 turkeys. Furthermore there are 1,640 chickens in Neusiedl am See and 841 in Frauenkirchen. The communities also show 309 **geese** and 124 **ducks**.

There are 2,076 **pigs** in the 29 communities, with the highest numbers to be found in Apetlon (871), Deutsch Jahrndorf (512) St. Magarethen (283) and Wallern (138).

953 **sheep** and 170 **goats** are kept in the communities investigated, with most of the sheep to be found in Tadten (399), St. Andrä (167), Halbturn (134) and Oggau (121). Goats are mainly kept in St. Andrä (81) and Gols (31).

Cattle, horses, sheep and donkeys are often used in the conservation areas: the conservation area Sandeck-Neudegg, for example, is being conserved among others by the pasture of Hungarian Steppenrinder, water buffalos and white donkeys (Fally, 2002).

Table 13: Number of livestock in project communities

community	Cattle	Sheep	Goats	Chickens and turkeys	Geese	Ducks	Horses	Pigs	Fattening rabbits	Breeding rabbits	Total
ANDAU	0.00	0	0	8	2	0	26	0	0	0	**36.00**
APETLON	1,066.15	0	5	119	11	8	108	871	0	1	**2,189.15**
BREITENBRUNN	69.15	0	0	0	0	0	2	3	0	0	**74.15**
DEUTSCH JAHRNDORF	0.00	8	0	25	253	20	0	512	0	0	**818.00**
DONNERSKIRCHEN	111.92	0	0	0	0	0	0	0	0	0	**111.92**
FRAUENKIRCHEN	110.08	0	3	841	6	11	43	88	0	0	**1,102.08**
GOLS	262.23	34	31	5 916	3	6	39	15	15	3	**6,324.23**
HALBTURN	20.15	134	11	6	0	0	35	47	0	0	**253.15**
ILLMITZ	143.54	0	0	27	0	0	196	36	0	0	**402.54**
JOIS	18.31	0	0	0	0	0	0	0	0	0	**18.31**
KLINGENBACH	3.54	0	11	30	0	0	5	5	0	0	**54.54**
MÖNCHHOF	24.38	0	0	79	0	0	13	0	9	2	**127.38**
MÖRBISCH AM SEE	21.62	0	0	0	0	0	0	0	0	0	**21.62**
NEUSIEDL AM SEE	0.00	0	0	1 640	0	0	0	0	0	0	**1,640.00**
NICKELSDORF	19.08	2	2	88	2	3	16	43	0	0	**175.08**
OGGAU	4.92	121	0	20	0	0	6	29	0	0	**180.92**
PAMHAGEN	13.15	0	0	190	0	0	0	6	20	6	**235.15**
PODERSDORF AM SEE	0.00	0	7	15	0	0	91	0	0	0	**113.00**
PURBACH AM NEUSIEDLER SEE	0.00	0	0	0	0	0	1	0	0	0	**1.00**
RUST	23.77	0	0	0	0	0	0	0	0	0	**23.77**
SANKT ANDRÄ AM ZICKSEE	0.00	167	81	98	17	45	0	0	0	0	**408.00**
SANKT MARGARETHEN IM BURGENLAND	29.15	64	8	97	7	2	34	283	25	4	**553.15**
SCHÜTZEN AM GEBIRGE	0.00	11	0	0	0	0	0	0	0	0	**11.00**
SIEGENDORF	0.00	0	0	0	0	0	4	0	0	0	**4.00**
TADTEN	52.69	399	0	5,000	0	0	1	0	0	0	**5,452.69**
WALLERN IM BURGENLAND	32.31	13	0	111	5	14	3	138	0	0	**316.31**
WEIDEN AM SEE	0.00	0	6	5	3	15	10	0	0	0	**39.00**
WINDEN AM SEE	19.08	0	5	0	0	0	0	0	0	0	**24.08**
ZURNDORF	62.15	0	0	41	0	0	2	0	0	6	**111.15**
Total	**2,107.38**	**953**	**170**	**14, 356**	**309**	**124**	**635**	**2,07 6**	**69**	**22**	**20,821.3 8**

(Source: ÖPUL, 2008 adapted)

There are a total of 20 821 animals in the project communities, with poultry making up 69%. A high livestock (more than 1,000 animals) can be found in Frauenkirchen (1,102), Neusiedl am See (1,640) and Apetlon (2,189), with Tadten (5,457) and Gols (6,324) showing the highest figures.

Livestock husbandry plays a minor part, however, in Purbach, Siegendorf, Schützen, Jois, Mörbisch, Winden, Andau, Weiden, Klingenbach and Breitenbrunn (with fewer than 100 animals in each community).

Reed

About 6,000 ha of the reed belt of Neusiedler See are Esterhazy property. Up to the 1980s reed was used as fodder and litter for the livestock husbandry round the lake (then still important) and as plaster base in stucco work. After World War II it was also temporarily used as insulating material in the construction industry. The former great importance for roofing is increasingly rediscovered. The reed belt has a vital filtering and cleaning effect on the water body – absorbed nutrients and pollutants, however, have to be withdrawn from the lake by the removal of reed (Steiger, 1996).

Forestry

Farm woodland

In the Burgenland farm woodlands are of less importance than in most other Provinces. At the end of the 1970s, 96% of all north Burgenland farms that included woodland had a micro-scale woodland of less than 5 ha, which was generally split up into several separated parts. Thus they could not usually supply the market each year, but used the wood primarily for their own requirements. The extensive lack of woodland in the north-east, however, is not caused by the climate but by forest clearing and permanent human land-use (Arnold, 1979).

Forestations

In the course of so-called welfare forestations in the district of Neusiedl am See after World War II, action was taken for the first time in Europe in order to ensure the systematic wind protection of a landscape sparsely wooded and endangered by erosion with shelter belts. For the production of the plants needed, the provincial forest arboretum Weiden am See was founded (Hanisch, 1975). Until the end of the 1970s about 2,000 ha of shelter belts were planted in the Seewinkel and on the Parndorfer Platte (Arnold, 1979).

Problems of agriculture in investigated area

As a consequence of the competitive pressure agriculture had been exposed to during the last decades, large areas of grazing land were turned into cropland or vineyards. This did not only lead to changes in the appearance of the landscape. Apart from the monotony offered now by the former well-structured landscape, the growing use of fertilisers and pesticides is a negative consequence of the intensive management which causes increasing damages to the soil, agglomeration of nitrate in ground water as well as the input of nutrients and toxins into the lake. Due to the decrease of livestock husbandry stable manure was increasingly replaced by commercial fertiliser. A further environmental problem is the enormous consumption of ground water for the irrigation of the cultivated areas (Leeb, 1992; Schiefermeyer, 1989).

Projects in investigated area

During the past few years projects regarding grazing were carried out especially in the northern Burgenland in order to conserve the typical structures of dry grassland with its remarkable plant and animal wildlife and to prevent overgrowing with grass and bushes. In the course of one of these projects a targeted nature conservation area management by different types of grazing will be carried out in the National Park Neusiedler See – Seewinkel. The borders of the Lacken, the wet meadows overgrown with reed and the fallow sandy soils will be grazed by a herd of grey cattle, a herd of Aberdeen-Angus cattle, a herd of white donkeys as well as two herds of horses. (Source: http://www.a-v-l.at/projpanorama.html)

2.3.1.2. Agricultural conditions in the Hungarian project region

Climate

The climate of the area around Sopron shows continental, sub-Mediterranean and – above all – Atlantic influences with an annual precipitation of 646 mm and annual mean temperature of 9.9°C. The lowest precipitation level is to be found in February, the highest in June. The highest amount of winds in Hungary is recorded in this region with the characteristic north-westerly winds of Lake Fertő. Meteorological records dating back to 1400 show a significant increase in aridity over the last decades. Temperatures rise and precipitation decreases – especially during the summer months, thus increasing the risk of drying out and flood. Due to the growing duration and intensity of sunshine – caused among others by less clouds and a diminishing ozon layer – spruce forests in the Sopron area are reduced and wine-growing is supported (Berki et al, 2009).

Soil

The soil of the Hungarian investigation area shows very high diversity due to the various reliefs. The greatest part of the Sopron mountains has brown forest soil (with a little clay in it). On this type of soil there are mostly forests – as to the west of Sopron –, but east of Sopron there are tillage areas as well. In the Sopron basin, which is lying between the Fertőhill area and the Sopron mountains, there are fertile meadow soils favourable for plough land. In the area of Ágfalva there are wine-growing lands on the brown forest soil. Eastwards on the Fertőhills we can find rendzina and brown soil beside the brown forest soil. In the Fertőbasin there are fens of relatively low fertility and marshy meadow soils which are mostly used for tillage. The brown soil in the area of Balf and Fertőrákos offers the possibility of wine growing. In the area of Kapuvár there is meadow soil which is used for tillage. In the area of Csorna the fertility of the marshy meadow soil is decreasing as it is used only for meadows and pastures. At the eastern border of the Hungarian investigation area a great amount of organic substance is accumulated and the underground water level is high. Here on the meadow soil there is partly tillage, partly wooded or grass-covered land, on the higher reliefs we can find productive black earth, which is capable for tillage (Marosi & Somogyi, 1990).

Changes in the landscape from an agricultural aspect

In the 20th century the Neusiedl-Hanság area went through several processes, which had significant impact on agriculture. From these processes probably the most specific are the operations of reclaiming, which have been going on between the beginning of the 20th century and the 1960's and have caused a significant decrease of open-water surfaces in the area. At the same time a process started – which mainly focused on Hanság – in which the former wetlands and inland water areas were replaced by arable lands and agricultural cultivation. The existing draining system still has a significant effect on the water balance of the area and therefore on the options of farming.

However, in the second half of the century the extension of arable lands shows a decreasing trend. On the one hand, it is a consequence of the habitat restoration activities on the former cultivated lands, on the other hand, the arable lands have decreased because of the Iron Curtain, which is why the cultivation on these agricultural fields next to the state border was terminated. These areas are now the so precious, natural greenbelt zones.

A significant role in the decline of agricultural areas certainly plays the fact that this region is classified as several conservation areas (National park, Ramsar area, Biosphere reserves, Natura 2000, World Heritage) and it highly bears on the situation of farmers.

Important changes have occurred in connection with the wine growing as well. The region has always been famous for its wine and has a long tradition of viticulture, which was a principal source of livelihood in the area. Today the abandonment process of vineyards can be observed, which is

bound up with the agricultural support system: the wine growers are then supported if they don't produce. The farmers are not interested in wine growing any more, the demand is lower too, so therefore they give up the vineyards and this influence is also evident in the landscape. It is endangering with the disappearance of traditions in cultivation and living as well.

There is also a decreasing trend in the reed-management, which – together with the viticulture – also has a long tradition in the area. Today, the harvest of reed has declined significantly and the use of the harvested reed has narrowed.

The number of kitchen gardens also has changed, they almost have been disappeared from the region. Nowadays we can only find some kitchen gardens next to family houses but many of them are changing into ornamental gardens.

2.3.2. Tourism & Recreation

2.3.2.1. Tourism development in the Neusiedler See/Fertő Region

Neusiedler See is one of the most popular tourist destinations in the eastern part of Austria. The total number of beds amounts to 21,620 2010 (Statistik Austria, 2011)[4]. In the last decades the typical lake tourism changed to a more diversified tourism based on the nature, national park, cycling and other sports activities, cultural traditions and events. The development of tourism was oscillating and by trend declined. While the tourist arrivals in the statistical region of Neusiedler See in Austria[5] from 1981 to 2010 grew by 70.7 % (from 270,514 to 461,829 arrivals), the number of overnight stays decreased by 3.3 % (from 1.438,353 to 1.390,442 overnight stays). Consequently, the average length of stays shortened from 5.3 to 3.0 days. The highest number of overnight stays was achieved in 1991 and 1992 (more than 1.5 million) and the lowest number in 1997 (1.194,908) and in 2006 (1.224, 425). Since 2006 the trend was positive. From 2006 to 2010 the overnight stays in the Neusiedler See region increased by 13.6 % (Amt der Burgenländischen Landesregierung, Landesstatistik, 2011). Annual variations of tourism demand are results of different weather conditions in the summer season. **Fehler! Verweisquelle konnte nicht gefunden werden.** shows the different tourism development in the municipalities.

In the Austrian part of the wider investigation area, currently about 1.280,000 overnight stays are registered (reporting communities, 2010, Amt der Burgenländischen Landesregierung, Landesstatistik 2011). The spatial distribution of tourism shows an extreme concentration on the lake. About 70 % of overnight stays are realised in the communities with lake resorts: Mörbisch, Rust, Breitenbrunn, Neusiedl/See, Weiden, Podersdorf and Illmitz (see Figure 10). Bigger tourist centres in the Seewinkel area are only the VILA VITA Pannonia Hotel and Holiday Resort (commune of Pamhagen) and the St. Martins Therme & Lodge (municipality of Frauenkirchen). For seven municipalities, statistical data are not available (no reporting communes).

[4] The number of beds refers to the districts of Eisenstadt, Eisenstadt-Umgebung, Rust and Neusiedl am See.

[5] The statistical region is a little bit larger than the wider investigation area of the BIOSERV Project (with Eisenstadt, Trausdorf/Wulka, Bruckneudorf). On the other side some of the communes in this area did not report tourism data to the office of Statistic Austria (no reporting commune or not every year) because the tourism is very low there.

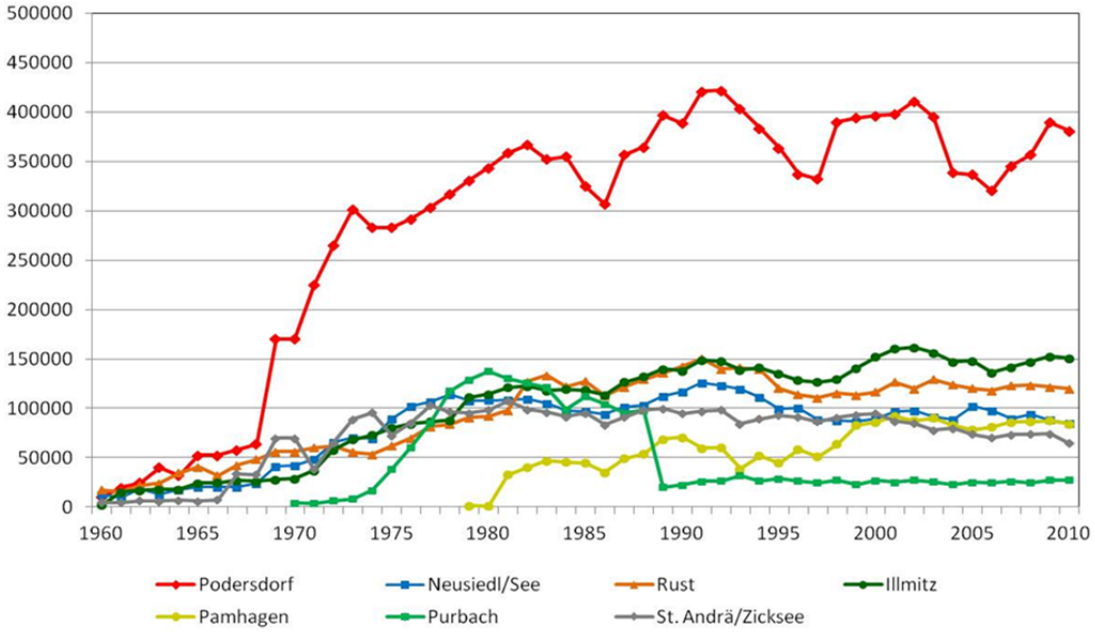


Figure 9: Overnight stays of selected communes in the Neusiedler See Region 1960 to 2010

Source: Amt der Burgenländischen Landesregierung, Landesstatistik, 2011

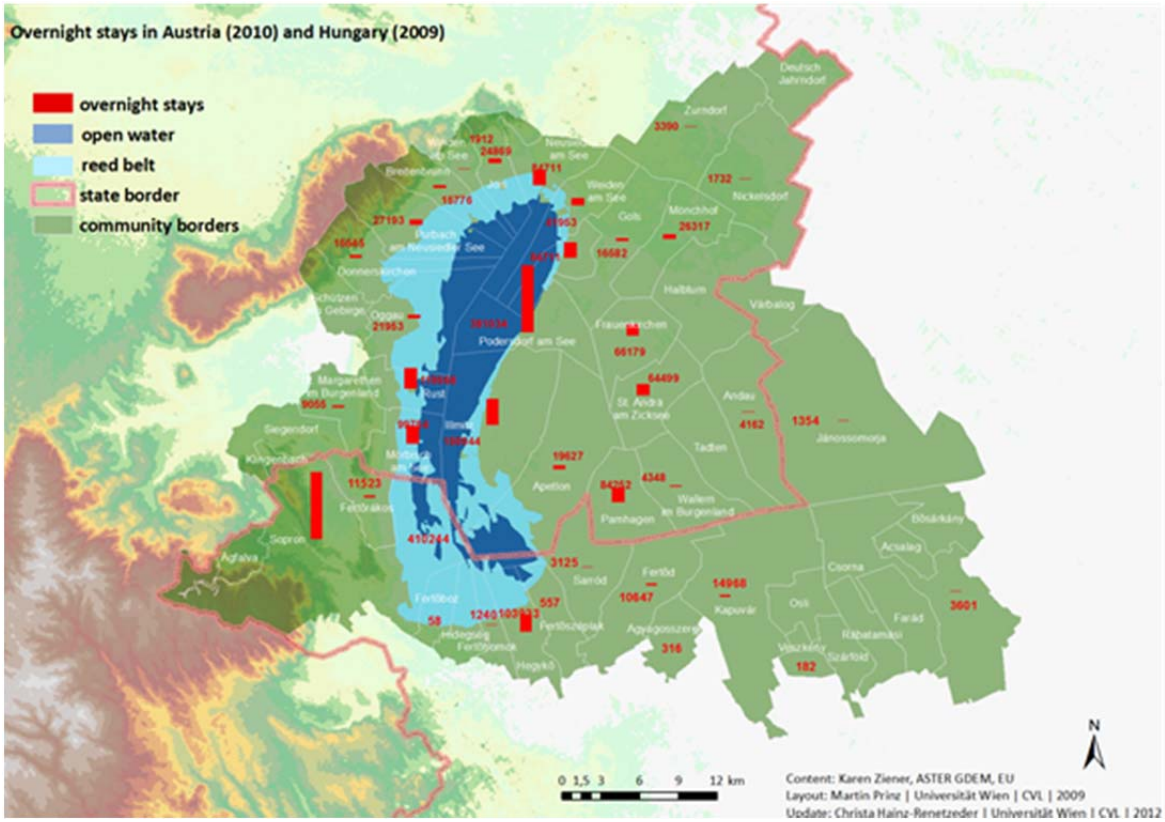


Figure 10: Overnight stays in the Neusiedler See/FertőRegion 2009/2010

Source: Amt der Burgenländischen Landesregierung, Landesstatistik 2011, Hungarian Central Statistical Office

The Hungarian part of the wider investigation area includes the area of Sopron, the southern shore of Lake Fertőand the Hanság area. The statistical regions Sopron-Fertőd, Kapuvár-Beled, Csorna and Mosonmagyaróvár are considerably larger than the investigation area so that the data are not meaningful. A tourist region or destination Lake Fertőlike on the Austrian side doesn't exist. Therefore the tourism development will be characterised related to the Hungarian investigation area. The total number of beds is about 7,000 (2009). More than half of them are situated in Sopron. In 2009, in public and private accommodations together, 205,836 tourist arrivals and 561,748 overnight stays were registered.6 The average length of stay is only 2.7 days. The biggest town Sopron is also the biggest centre of tourism with 410,244 overnight stays (73 % of the Hungarian investigation area). In second place is Hegykő (103,933 overnight stays and 19 %). The tourism development in the last ten years was very dynamic (see Figure 11). But, while in Sopron the overnight stays differed from year to year, with ups and downs, in Hegykő the number of overnight stays increased continuously. Because of development in the sector of thermal bath and health tourism the overnight stays in Hegykő rose from about 6,000 (1998) to more than 100,000 (2009). Besides that, only three communities had more than 10,000 overnight stays – Fertőrákos, Fertőd and Kapuvár (all data Hungarian Central Statistical Office). In particular in the Hanság area, tourism plays a minor role until today.

6 In the last years for communes with low accommodation capacity, arrivals and overnight stays (private and public accommodations) are not mentioned so that the total number is probably higher than in statistics.

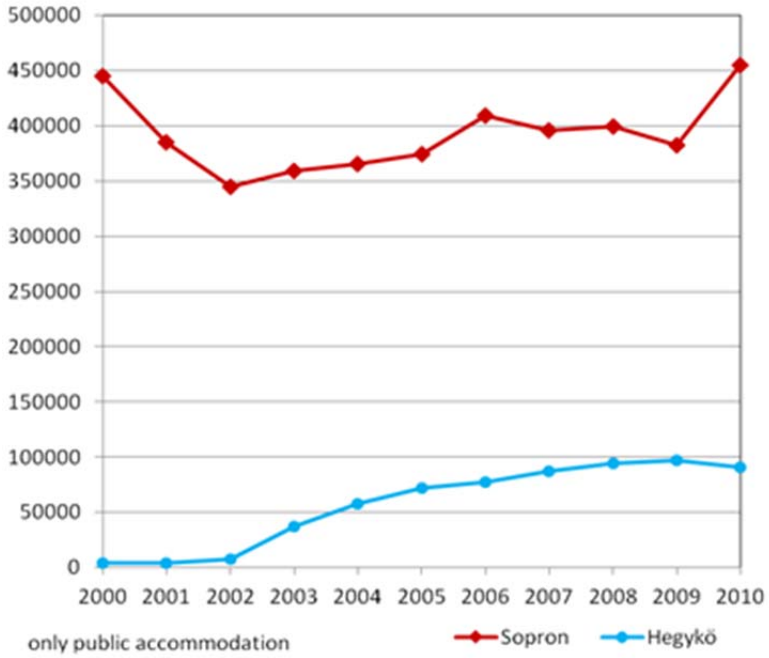


Figure 11: Overnight stays of selected communes in the Lake FertőRegion 2000 to 2010

Source: Hungarian Central Statistical Office

2.3.2.2. Recreation and leisure time activities of local people and one-day visitors

In contrast to the tourism sector, recreation and leisure time activities of local people and one-day visitors are not really quantifiable. Censuses of cyclists, hikers or visitors in main outing centres are very costly and area-wide not possible and questionings show only a sample of an unknown totality of recreationists. Moreover, it is very difficult to distinguish between holiday guests and daily visitors or local recreationists because both groups use the same tourist infrastructure (e.g. bathes, cycling trails, sport centres, restaurants).

2.3.2.3. Leisure activities of tourists and motives of holidaymakers

The surveys in the previous projects in the Austrian part of the region (2006; 588 questionnaires) and the Hungarian part of the region (2007/2008; 325 questionnaires) gave an insight into the interests and activities of tourists, including one-day visitors. The percentage of one-day visitors in the sample was 30 % in Austria and 21 % in Hungary. The one-day visitors in the Austrian part came mainly from Vienna and Lower Austria.

The activities of tourists showed differences between the Austrian and Hungarian side of lake (see Figure 12). In Austria, the activities were dominated by the categories “To relax” and “Being in nature” (only in Austria asked). The longer duration of stay, the higher percentage of these both activities is. Furthermore visits of restaurants and taverns (so-called Heurige) and cycling belonged to the main tourist activities (at least 60 % of respondents). Among the one-day visitors the percentage of restaurants and cycling is a little bit lower (about 54 %). Bird watching / nature photographing was in autumn more relevant (55 % of respondents in autumn survey) and bathing in summer (70 % of respondents in summer survey).

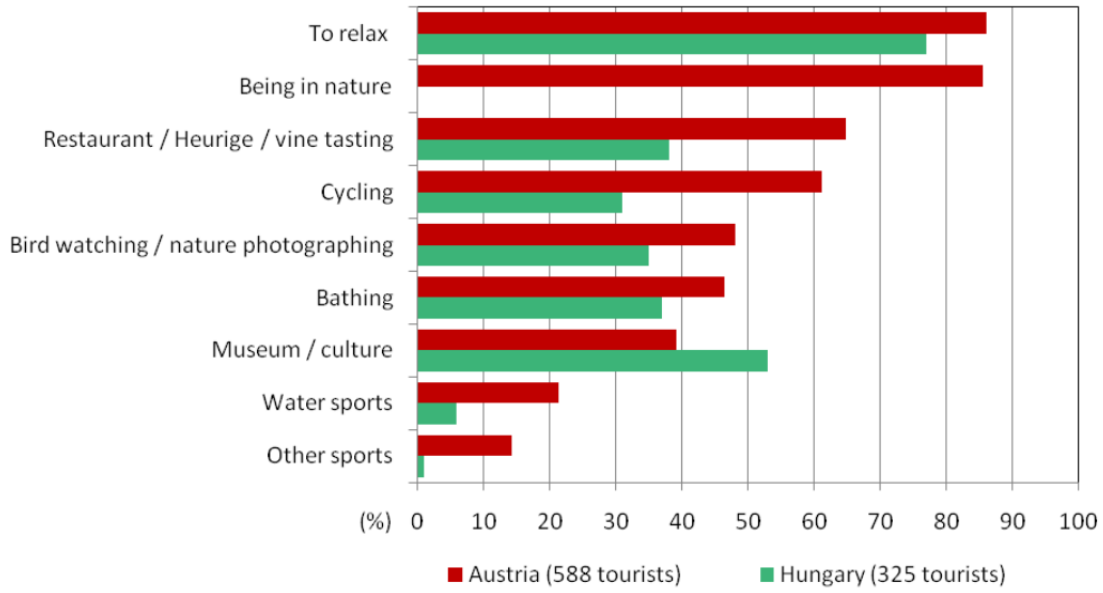


Figure 12: Leisure acticvities of tourists in the Neusiedler See/FertőRegion 2006-2008

Source: Surveys of tourists within the MAB-Projects Redesigning Biosphere Reserve Neusiedler See 2006 and the OMAA-Project 2007/08

In Hungary, only to relax and visits of museum and culture was mentioned from more than half of the tourists. Among the one-day visitors these percentages are still higher (85 % and 64 %). In particular, the percentage of restaurants, cycling and water sports are far smaller than in Austria. Only museum/culture plays in the Hungarian part of the region a bigger role than in the Austrian part. Besides the lower percentages in Hungary result from the fact that the respondents mentioned less activities, in Austria on average 4.7 activities per respondent, in Hungary only 2.8.

The analysis of relations between the activities and landscape perception of tourists in Austria showed that tourists and recreationists did several activities and perceived the landscape in different ways. Those landscapes which were used for tourist activities and recreation got a higher importance. Tourists with interest for museum and culture, for example, mainly evaluated the importance of Esterhazy castles high. Bathing and water sports were connected with a high importance of the lake while the other image factors were mostly important or not important. Visits of restaurant and tavern were primarily related with wine and wine-growing. In Hungary, in particular, bird watching is related with high importance of the lake, the wide read belt, nesting areas for birds and cattle meadows. Cycling as well as interests for museums and culture involves above-average valuations of all landscapes for the image of Lake FertőRegion.

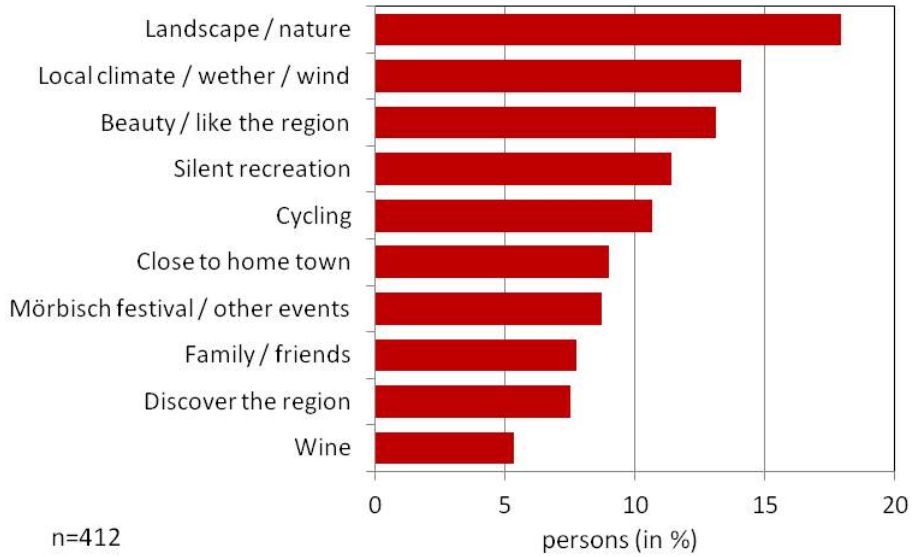


Figure 13: Main motives of overnight guests in the Austrian part of Neusiedler See/FertőRegion 2006

Source: Surveys of tourists within the MAB-Projects Redesigning Biosphere Reserve Neusiedler See

The motives of holidaymakers for visiting the Neusiedler See/Fertőregion were asked by means of an open question. In Austria 412 respondents mentioned 629 motives (average 1.5). The main motives with a percentage of 5 % or more are shown in Figure 13. Landscape and nature rank first followed by climate / weather and the beauty of landscape. Silent recreation, cycling, the Mörbisch festival or other cultural events are important too. But there is a wide range of further motives. They extend from activities, events and attractions like bathing, water sports over wine and gastronomy or national park to social-cultural motive like tradition, family or friends, people, emotions or the small distance to the home town. The main motives of holidaymakers underline the orientation of tourists to nature and landscape, silence and recreation as well as the importance of cycling and cultural events.

In Hungary, 262 respondents mentioned 335 motives (average 1.5). The main motive of holidaymakers was to discover the region because the percentage of first time visitors in the sample was higher than in Austria. The beauty of landscape, nature, recreation and active movement also belong to the main motives. More important than in the Austrian survey are business travels (see Figure 14).

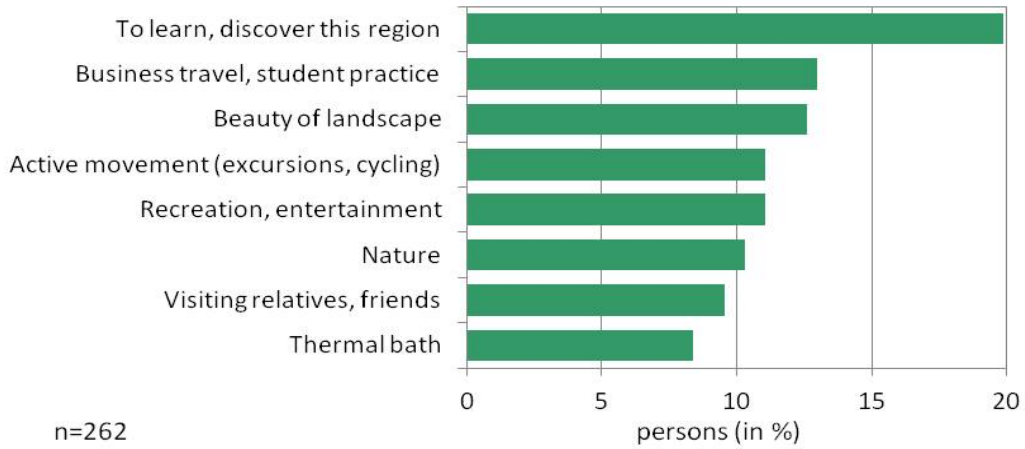


Figure 14: Main motives of overnight guests in the Hungarian part of Neusiedler See/Fertőregion 2006/2007; Source: Surveys of tourists within the OMAA-Project 2007/08

Tourists as well as locals in Austria and Hungary valuated the image factors of the region partly similar and partly different (see Table 14). In Austria the lake and wine or wine-growing were mentioned as main image factors. In the open question, also landscape factors like nature or birds and recreational or touristic factors were frequently mentioned. Beyond that, more than 10 % of the tourists mentioned climate, birds, emotion, water and tourism and more than 10 % of the locals nature, emotion / sense of home, landscape and nature protection or management. On average, tourists described the regional image with 2.7 and locals with 2.4 factors. In the valuation of given image factors (closed question) the ranking of tourists and locals was nearly the same: after lake and wine followed nesting and recreational areas for birds in the Seewinkel area, the National Park Neusiedler See – Seewinkel and the Pannonian character of the Austrian part of the region. So the regional image on the Austrian side of the lake is determined through lake, wine/wine-growing, tourism and tourist activities, birds, national park, Pannonian character of landscape and the regional and landscape diversity.

Table 14: Main image factors in the Neusiedler See/FertőRegion 2006/2007

Part of region	Question	Tourists	Locals
Austrian 588 tourists, 606 locals	open (main image factors)	**Wine, wine-growing** (41 % of resp.) – Active recreation, sports – **Lake** – Nature – Silent recreation (all more than 20 % of resp.) *average: 2.7 factors per person*	**Lake, reeds** (34 % of resp.) **– Wine, wine-growing** – Tourism – Active recreation, sports – **Birds** (all more than 16 % of resp.) *average: 2.4 factors per person*
	closed (part of very important)	**Lake** (72 % of resp.) – **Wine and wine-growing** – **Nesting and recreational areas**, – National Park, – Pannonian character of the region (all more than 46 % of resp.)	**Wine, wine-growing** (78 % of resp.) – **Lake** – **Nesting and recreational areas**, – National Park, – Pannonian character of the region (all more than 55 % of resp.)
Hungarian 325 tourists, 312 locals	open (main image factors)	**Lake Fertő, reeds** (65 % of resp.) – **Birds** – **Culture, cultural heritage** – Place names – Nature (all more than 14 % of resp.) *average: 2.2 factors per person*	**Lake Fertő, reeds** (58 % of resp.) – Landscape – Nature protection / management – **Birds** – **Culture, cultural heritage** (all more than 12 % of resp.) *average: 2.0 factors per person*
	closed [1)] (part of very important)	**Lake** (88 % of resp.) – **Nesting and recreational areas** – **World heritage** – National Park Fertő-Hanság – **Castles and museums** (all more than 58 % of resp.)	**Lake** (86 % of resp.) – **Nesting and recreational areas** – **World heritage** – **Castles and museums** – National Park Fertő-Hanság (all more than 56 % of resp.)

resp. – respondents

[1)] image factors which are only characteristic for the Austrian part, not given in Hungary

boldface: image factors which were highly valuated in several questions in Austria resp. Hungary

Source: Surveys of locals and tourists within the MAB-Projects "Redesigning Biosphere Reserve Neusiedler See 2006" and the "OMAA-Project 2007/08"

Although the lake is only accessible in Fertőrákos in the Hungarian part of the region, the lake with its wide reed belt is clearly the main image factor (locals and tourists). In the view of locals the regional image is further characterised by the combination of nature or landscape aspects (including birds) and cultural aspects (open question). Nature protection and management took third place after lake and landscape. In contrast to the Austrian side of the lake, tourism, recreation and wine were not among the five main image factors. In the image descriptions of tourists, nature and landscape aspects, active and silent recreation as well as culture and wine-growing are more balanced. The number of mentioned image factors per person averaged 2.2 for tourists and 2.0 for locals. In the valuation of given image factors, within the combination of natural and cultural aspects World heritage Neusiedler See/Fertőand National Park Fertő-Hanság played an important role.

2.3.2.4. Tourism strategies in the Neusiedler See/FertőRegion

Since 1997 the Neusiedler See Tourism Association (Neusiedler See Tourismus GmbH – NTG) is responsible for the promotion and the development of the tourism in the Neusiedler See Region. The partners in this regional marketing association are the local tourism associations of the communities in the Neusiedler See Region and the Regional Tourism Association Leithaauen-Neusiedler See comprising seven communities in the northern part of the region. Currently, this Neusiedler See tourism destination covers 33 communities (NTG, 2010). The marketing of the Neusiedler See

Tourism Association is focused on year-round tourism and recreational offers and the label "Pannonian". As such, specific offers for all seasons are arranged as four booklets: Pannonian Spring, Pannonian Summer, Pannonian Autumn and Pannonian Winter.

Since more than 10 years Neusiedler See Tourismus GmbH offers the Neusiedler See Card for all guests who stay overnight in one of the over 750 partner accommodation facilities during the season (in 2012 from March 30th to October 28 th). The gratuitous guest card enables a free entrance into lake resorts, free and indoor swimming pools, museums and concerts, free participation in guided tours and excursions, free travel on the rail and bus lines in the Neusiedler See region including local bus transport (Gmoa-Bus) and half-price travel on ferries. In addition, many bonus partners in the Neusiedler See region, in other parts of Burgenland, Lower Austria and the neighbouring Hungary and Slovakia give price reduction (website of Neusiedler See Tourismus – Neusiedler See Card). The number of participating partner companies and the number of issued cards (2011: about 197,000, T.A.I. 10.2.2012; *Pannonische Erfolgsstory als "Role-Model"*) increased continuously.

The marketing strategy of Neusiedler See Tourism Association bases upon five core areas: NATURE, CULTURE, SPORTS, WINE & CUISINE and HEALTH.

- The first core area NATURE is related to the unique natural and cultural landscape which surrounds Neusiedler See, the various protected areas, in particular the National Park Neusiedler See – Seewinkel, the RAMSAR wetland and the NATURA-2000 areas, as well as the UNESCO World Heritage Site, the Natural Park Neusiedler See-Leithagebirge and the Biosphere Reserve Neusiedler See. Visitors can take part in a range of excursions, not only in the national park. In the Seewinkel area, bird watching has a long tradition as tourist activity, which has been extended since the foundation of national park. In 2010 the first Pannonian Bird Experience took place in Illmitz.

- The second core area of tourist strategy is CULTURE. Every year numerous cultural festivals and events attract the visitors to the Neusiedler See Region, for example the Mörbisch Lake Festival, the Opera Festival St. Margarethen, the International days of Haydn in Eisenstadt and the Nova Rock Festival in Nickelsdorf. Beyond that a diverse cultural programme is presented in the communities of the Neusiedler See Region. Other attractions are museums, exhibitions and galleries like the Halbturn Castle, Mönchhof Village Museum, the Kittsee Palace Ethnographical Museum, the Diocesan Museum and the Burgenland Provincial Museum in Eisenstadt as well as churches like the Cathedral of St Martin in Eisenstadt and the Basilica in Frauenkirchen.

- The Core area of SPORTS and activities include water sports like sailing, windsurfing and kite surfing, bathing and recreation in the lake resorts as well as numerous activities away from the water, for example riding, Nordic Walking and golf. Cycling is one of the main recreational activities in the Neusiedler See Region with a 500 km-long cycling route network. The most known cycling route is the Neusiedler See Cycle Path (B10) which runs around the lake. Alternatively this route can be shortened by taking the cycle-ferry between Illmitz and Mörbisch.

- Wine & Culinary Pleasures compose the forth core area of NTG marketing strategy. The wine-growing area covers around 8,300 hectares. The diversity of soil types means that grape varieties abound. Traditional white wines are, for instance, Müller-Thurgau, Grüner Veltliner and Welschriesling, Pinot Blanc and Chardonnay, and red wines St. Laurent, Zweigelt and Blaufränkisch. Therefore in 1991 the Austrian Wine Academy was established in Rust. Apart the wine a range of regional products are offered in the Neusiedler See Region, for example fish, meat from the Mangalitza pig and Hungarian Grey cattle breeding in the national park. Another attraction of the region is the interaction between restaurateurs and wine-makers in local taverns (so-called Heurige) which serve wine and home-made food.

- The fifth marketing core area focuses on the development of the region as wellness destination including health, vitality, well-being and joy of life. The offers of various facilities like the Kurhaus Marienkron in Mönchhof, the Vila Vita Hotel in Pamhagen and the Beauty-Vital-Residenz

Dolezal in Neusiedl am See are enhanced through the new St. Martins Therme and Lodge located near Frauenkirchen (website of Neusiedler See Tourism GmbH – English version, NTG, 2007).

On the Hungarian side of Neusiedler See/Fertő, a counterpart of Neusiedler See Tourismus GmbH does not exist. The Lake Fertőregion does not emerge as a separate marketing unit. The Hungarian lake shore is part of the Western-Transdanubia tourist region (Sütő, 2008). The tourism marketing of the Hungarian tourism and the Western-Transdanubia region is focused on single destinations like Sopron or Fertőd. Tourist information offices (Tourinform) are located in Sopron, Fertőd (Fertő-táj) and Mosonmagyaróvár (website of Tourinform).

Despite the different organisational structure cross-border cooperation in the field of tourism increases. In the last decade a number of INTERREG and ETC projects with more or less tourist aspects are realised, for example

- Recom – Regional Cooperation Management HU-AT, 2007-2012, partners: Regional Management Niederösterreich, Wien City Administration: European Affairs, Regional Management Burgenland GmbH, Office of the Styrian Provincial Government: Regional and Municipal Development, West-Transdanubian Regional Development Agency,

- Tourist-Net – Tourism without borders in West-Pannonia – Burgenland: Together is easier!, 2008-2012, partners: Verein zur Förderung des burgenländischen Gastgewerbes, Vas County Chamber of Commerce,

- GreMo Pannonia – Cross-border mobility Burgenland – West-Hungary, 2008-2011, partners: Office of the Burgenland Provincial Government, Győr-Sopron-Ebenfurt Railway Co., Transport Association Eastern Region (VOR) mbH, ÖBB-Postbus GmbH,

- Fertő-Hanság mobil – Environmentally friendly mobility Fertő-Hanság, 2010-2014, partners: Office of the Burgenland Provincial Government: Spatial Planning, municipalities Kapuvár, Frauenkirchen, Tadten and Wallern, Neusiedler Seebahn GmbH, National Park Management Neusiedler See – Seewinkel,

- PaNaNet - Developing and establishing a network of nature and national parks in Burgenland and West-Hungary, 2008-2013, partners: Regional Management Burgenland GmbH, Neusiedler See – Seewinkel, Fertő-Hanság, Őrség and Balaton-Uplands National Park Managements (website creating the future: Cross-border Cooperation Programme Austria – Hungary, 2007-2013).

2.3.2.5. Touristic nodes in the Neusiedler See/FertőRegion

Touristic nodes show the spatial tourism structure in the region. They combine not only the tourist supply and demand they also include local recreationists and on day visitors. These nodes are linked via touristic paths and routes (tourist facilities, offers) as well as the activities of tourists and recreationists (walking, hiking, cycling, by car, by boat).

The concept of touristic nodes

The idea of touristic nodes goes back to a project about the assessment and development of protected areas, recreation and leisure areas in the mid-nineties (Barsch & Saupe, 1994). The development of this concept was carried out in connection with a conflict analysis in six national park and biosphere reserve regions in Germany and Austria by Ziener (2003). The definition and graduation of touristic nodes relate to nature and landscape oriented recreation and leisure activities.

Touristic nodes are all touristic places with tourist facilities, regular performances and events, which were used by tourists and local recreationists (at least seasonal).

The nodes are source and destination areas of tourist activities and mainly connected with settlement areas. Only in specific cases, landscape areas like viewpoints or bathing areas without buildings can be defined as a touristic node if there is corresponding number of users. The touristic nodes are the result of a complex valuation of tourist supply and demand as well as the intraregional tourist functions.

The intention of the creation of touristic nodes was to get a better basis for the description and analysis of tourism, recreation and leisure time activities in a region. Usually only numbers of beds or overnight stays and the individual tourist facilities are presented. Through this complex inclusion of all tourist and leisure facilities and a partially completion through visitor or user information, day-visitors as well as recreationists are integrated. Touristic nodes and linear tourist infrastructure like hiking and cycling routes form the spatial structure of a tourism region. In the next step by means of touristic nodes and lines the visitor flows or action spaces of tourists and recreationists can be described and analysed. Because of the concentration to nature or landscape oriented recreation only relations between nodes and not within a node will be analysed (Ziener, 2003; Ziener, 2005).

Table 15: Criteria for the graduation of touristic nodes

	big nodes	**middle nodes**	**small nodes**
Characte-ristics	*main touristic centres and/or main destinations for outings in the region*	*average and expected supply in the region*	*only few touristic offers*
Accommo-dation facilities	big to very big capacity of accommodations (normally more than 1,000 beds) and varied overnight accommodations (hotel business, private rooms, camping, sanatoriums ...)	middle to big capacity of accommodations (normally 250 to 1,000 beds) and different overnight accommodations (hotel business, private rooms, camping, sanatoriums ...)	low or no capacity of accommodations (normally up to 250 beds) mostly only private rooms, apartments or single hotels/guesthouses
Recreation and leisure facilities	varied tourist facilities and regular offers (specialisation is possible) *and/or* typical or supra-regional attractions of cultural landscape, specific tourist or recreational offers	regional broadness and/or deepness of tourist facilities and offers *and/or* typical or supra-regional attractions of cultural landscape	few touristic facilities or offers *and/or* attractive elements of cultural landscape Minimum requirement: open gastronomic facility (including chalet and wine tavern) or other tourist facility respectively regular offers (in the season) or holiday homes with in total about 100 beds
Function within the region	main touristic centres or/and main destinations for outings of the region	„Basic framework" of the tourism in the region	small tourism places and destinations for outings or single facilities or offers as supplement offers to the regional tourism
Touristic demand	mostly high to very high absolute and relative overnight stays and visitor numbers, proved by counting and questioning	partly overnight stays and visitor numbers proved by counting or questioning or at least observable	rather not proved by overnight stays, only individual visitor numbers, partly observable

Source: Ziener, 2003, p. 170 annex, modified

The concept of touristic nodes includes the definition and graduation of the touristic nodes in the region in a three-step hierarchy – big, middle and small nodes. The touristic hierarchy is defined for each region. Therefore, a big node in one region can function as middle node in another region. The big nodes are the main tourist centres or main destinations for outings in the region. Big and middle nodes create the basic structure of the tourism region. The small nodes – other touristic places, isolated tourist facilities or regular touristic performances – offer an additional touristic supply. Individual tourist facilities like a hotel, restaurant or wine tavern, a camping site, museum or riding stable can create a small touristic node. However, the existence of landscape attractions or historic-cultural sights, natural or cultural monuments is not enough for a definition of a small touristic node. If there is no infrastructure, tourist or recreational uses have to be proved through frequent visits (at least through experiences or observation). Very small nodes have only one tourist facility and are extremely instable (see Table 15).

A special case of touristic nodes are “divided nodes”. Meeting two conditions, big or middle nodes can be described as a divided node

1. The distance between the settlement areas is too great for one touristic node, but there are functional connections, which advise an integration to one node or

2. There is a only short distance between the settlement areas as a condition for only one node, but from the view point of landscape development the tourist flows between these settlements are interesting.

Divided nodes are defined and graduated like other touristic nodes. However, in contrast to the other nodes tourist flows between the parts of these divided nodes are described like the tourist flows between touristic nodes.

Characteristics of the concept of touristic nodes are abstraction and hierarchy (3 grades), location (spatial aspect) and dynamic (development). The hierarchy of only three levels of nodes provides an abstraction of the complex tourist supply and demand situation in a region. Functions and specialisation can be clarified through qualitative types of touristic nodes. The graduation of big and middle nodes is relative durable (only borderline cases should be permanently controlled). The small touristic nodes and in particular such nodes with only one or two tourist facilities can be changed stronger and faster. The tourism development can require a higher rank of a touristic node. Rarer recession processes lead to a lower graduation. Moreover, new touristic node (mostly small or middle) can emerge.

Advantages of the concept of touristic nodes can be summarised as follows:

- The tourism structure of a region is shown under aspects of supply and demand
- Big and middle nodes are relative robust in short-term changes
- Touristic nodes are usable in different questions
- The nodes can also be used in larger regions and at different spatial levels, whereas for example in the whole region only two levels of nodes are defined – big and middle nodes – and in selected areas all three levels,
- By means of a link of quantitative and qualitative valuations, ordinal scales and given intervals, the deficits of the touristic data basis can be equalised and
- Touristic nodes are unproblematic updatable (above all border cases and very small nodes).

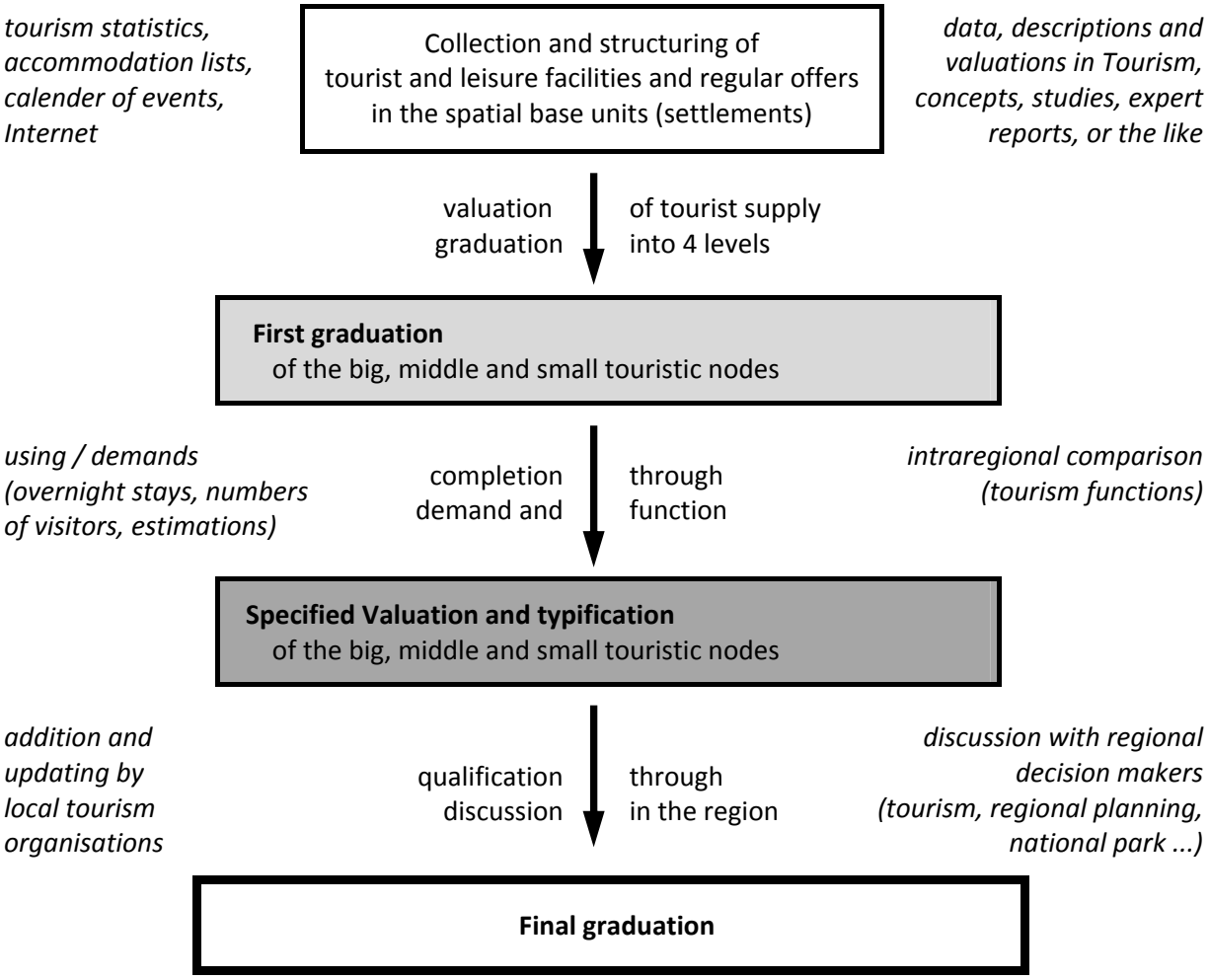


Figure 15: Definition and graduation process of the touristic nodes in the region

Source: Ziener, 2003, appendix S. 165, modified

Figure 15 shows the process of definition and graduation of the touristic nodes. At the beginning of the survey the spatial basic units have to be determined. Essential for this determination is the criterion of distance: settlement areas are combined if the distance is not more than about 2 km (road distance). The same criterion is practised for isolated tourist facilities. The graduation of the touristic nodes is made stepwise. At first the tourist supply in the settlements is analysed and the level of the node is defined. Additional data about tourist demand like overnight stays and numbers of visitors, mainly for big and middle nodes are integrated. In addition the specialisation of the touristic nodes can described via types of nodes. At any time, updates of the graduation are possible and necessary. These results of valuation should be controlled by local tourism organisations and discussed with regional organisations. But the valuations and perceptions of touristic places by tourist managers can differ from the empirical analysis.

The touristic data base in the Federal State of Burgenland and in Hungary

Statistical data bases of accommodation in Austria are declined in the last years. While the overnight stays are good documented on the community level (different kinds of accommodation, summer season and whole year), the numbers of bed in the communities were contained in tourism statistic of the Federal State of Burgenland only until 2005. Most of the information about tourist and

recreation facilities, restaurants or wine tavern is published on the websites of communities but some data are only available directly from communities or companies (Table 16).

Table 16: Availability of data in Austria and Hungary

Accommodation	beds	A	Statistics of Austria / Burgenland – only reporting communities, fee required, data protection, otherwise websites of communities and facilities, information from communities, associations, companies – *estimations, intervals*
		H	Hungarian Statistical Office – online publication, public and (partly) private accommodation of selected communities – *estimations, intervals*
	camping sites	A, H	website of or information from camping site operator
Gastronomy	number and kind of facility	A	websites of tourist communities, facilities ..., survey in communities
		H	Hungarian Statistical Office – online publication, websites of tourist communities, facilities ...
Tourist supply	number and kind of facility, regular events	A	websites of tourist communities, facilities ...,
		H	Hungarian Statistical Office: online publication, websites of tourist communities, facilities ...
Tourist demand	overnight stays	A	Statistics Austria / Burgenland – only reporting communities, all kinds of accommodation
		H	Hungarian Statistical Office – online publication, public and (partly) private accommodation of selected communities
	visitors, users	A, H	regional press, internet, information directly from communities, associations, companies
Functions	tourism, central place category	A, H	spatial planning documents – national, federal state level (Austria)

Source: own compilation A – Austria, H – Hungary

In Hungary, data about accommodation (beds and overnight stays in public and private facilities) as well as gastronomy, culture facilities and retail trade are available on the website of the Hungarian Statistical Office (databases, mostly in English). Other than in the Austrian part of the region the websites of communities or local tourist associations contain not all information about tourist facilities. Mainly small communities with a low-developed tourism (in particular in the eastern part of the Hungarian area) give only few or none information about touristic offers. Moreover, the language of these websites is mostly only Hungarian. Several statistical data of the Hungarian settlements (e.g. number of visitors, overnight stays) raise questions. Therefore additional telephone calls by the Hungarian project staff were necessary.

Assessment of touristic nodes in the Neusiedler See/FertőRegion

The following graduation of touristic nodes in the Neusiedler See/FertőRegion within the BIOSERV Project is based on a former graduation (Ziener, 2003) which was improved and updated. Especially in the Hungarian part of the region tourism development and an upgrading of touristic nodes were expected. But the necessary modifications are small. In comparison to 2002 the two Hungarian nodes Hegykő and Kapuvár are being upgraded as a middle node.

All tourist centres with lakeside resorts (except Podersdorf) are defined as divided nodes: big divided nodes as well as middle divided nodes. The distance between the settlement and the bathing and water sports area is very different (partly more than 2 kilometres) but the common criterion is the functional connection between settlement and lake resort (see above). Therefore, it is not possible to present these touristic places and the lake resort as two different nodes, for instance in a

discussion with regional or local tourism managers. From the viewpoint of landscape protection, visitor flows within the divided nodes, from the settlement through the reed belt to the lake resort, can be analysed. The situation of Fertőrákos is very special. The lake resort Fertő-tó is situated in the territory of Sopron it's and not a part of Fertőrákos. Therefore, this node is divided and in fact trans-communal.

The town of Sopron and Podersdorf (about 400,000 and 350,000 overnight stays per year) are the biggest nodes in the Neusiedler See/Fertőregion. Furthermore, the most important tourist centres in the region – Mörbisch, Rust, Neusiedl/See and Illmitz – belong to the big divided nodes. They registered about 100,000 or more overnight stays per year and a lot of daily visitors.

The touristic nodes in the cross-border Neusiedler See/FertőRegion show again the concentration of tourism and recreation activities to the lake and its surrounding (see Figure 16). Five big and three middle nodes in Austria (except Podersdorf all divided) and four middle nodes in Hungary (among them Fertőrákos as divided node) are situated here. Besides bathing and water sport this nodes provide a manifold touristic offer like cultural events (e.g. Mörbisch, Fertőrákos), wine taverns, museums and galleries, offers for families. The touristic nodes around the lake belong to the most frequent destinations for outing in the Neusiedler See/FertőRegion.

Middle nodes like St. Andrä/Zicksee (health facility – rehabilitation, bathing, camping), Weiden am See (holiday resort), Mönchhof (health facility, village museum), Vila Vita Pannonia Hotel and Holiday Resort or Hegykő (thermal bath) have all about 25,000 to 100,000 overnight stays and mostly a specific orientation. The new St. Martins Therme & Lodge which was opened in 2009 is currently classified as middle node due to 65,000 overnight stays and 265,000 visitors in the thermal bath ("Erfolgreiches erstes Jahr", der Standard, 4.11.2010).

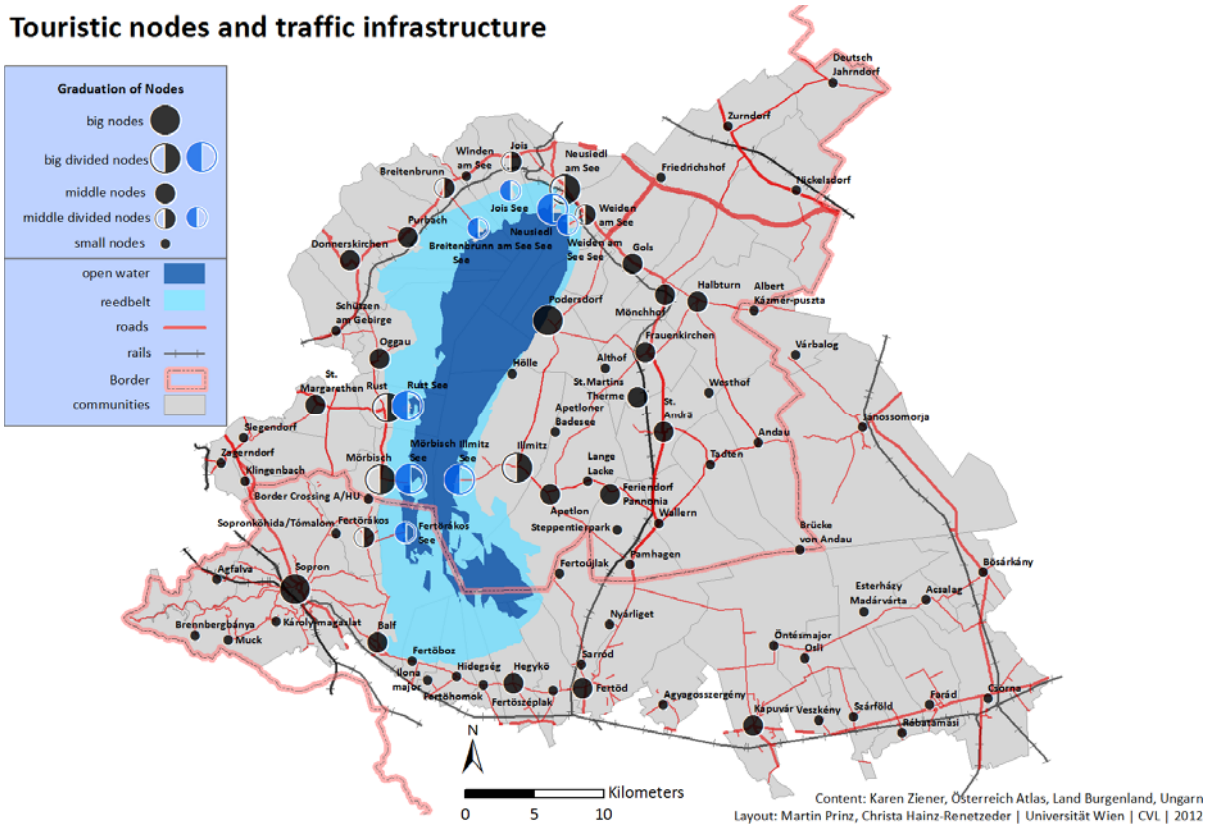


Figure 16: Touristic nodes in the Neusiedler See/FertőRegion

Source: Statistical Office of Burgenland, Hungarian Statistical Office, Websites of communities, information from communities, associations and companies

Besides, some tourist places with a low or very low number of overnight stays are defined as middle node because of a high number of daily visitors, for instance St. Margarethen (opera festival in the quarry, fairytale park), Frauenkirchen (church of pilgrimage), Halbturn (exhibitions and events in the castle), Gols (Golser Volksfest), Fertőd (Esterházy castle), Fertőrákos (lake resort, cave theatre) and Kapuvár.

Most of the big and middle nodes are connected by a couple of roads – the B 50 primary road between Eisenstadt and Neusiedl am See on the western lake shore and the main road through the Seewinkel area east of the lake from Neusiedl am See to Pamhagen and across the border to Fertőd and Fertőszentmiklós, the roads along the western and eastern lakeshore in Austria and along the southern lakeshore in the Hungarian part of the region which is running parallel to the primary road between Sopron and Győr. A great deal of these touristic nodes lies on the railway route around the Neusiedler See/Fertő. But the main problem of the railway traffic in the region is the location of stations at the periphery of the villages respectively between the settlement and the lake resort.

The big and middle nodes constitute the basic framework of the Neusiedler See/Fertőtourism region. The small nodes represent villages with a less developed tourism in particular in the periphery of the Neusiedler See region in Austria and the Hanság area in Hungary. Outside of the villages are (single) tourist facilities and outing destinations like wine tavern (Hölle between Illmitz and Podersdorf), horse riding centres (Althof, Westhof, Ilona major), bathing lake (Apetloner Badesee) or nature conservation area with different observation towers (Lange Lacke near Apetlon) defined as small nodes.

Qualitative characterisation of the touristic nodes in the Neusiedler See/Fertő Region

The function of touristic nodes depends not only on quantitative but also on qualitative attributes. The qualitative characterisation of the touristic nodes describes the major kinds of tourism and recreation in the settlements represented by a corresponding supply and demand (different facilities, visitor numbers). Furthermore this characterisation considered the relative importance of specific kinds of tourism in the settlement (main function) with a view to different target groups. Some characterisations are immediately clear, for instance, lake resort, culture or central place with a wider offer in retail trade and services. Other kinds of tourism like wine tourism, horse riding tourism or medical tourism (like dental tourism) are more difficult to estimate because there is a lack of quantitative data.

Health tourism is a special kind of tourism which gets more and more importance in the international tourism development. In the region some health resorts and thermal springs are located. The diverse other wellness offers in hotels and other wellness facilities are not included into this characterisation as well the dental tourism in Hungary and other forms of medical tourism.

The characterisation of culture tourism requires a variety of facilities or events and/or a greater number of visitors. In the combination of tourism and leisure time activities (Yacht club) the size of yacht harbours and marinas cannot be really estimated so that the combination of outdoor swimming pool and yacht harbour in any case is characterised as lake resort.

The category wine tourism is determined by wine growing, a couple of wine taverns (so-called Heurige in Austria) as well as special offers around the wine (e.g. information, excursions, events). Therefore not all wine-growing villages are characterised by wine tourism.

Nature or ecotourism as well as horse riding tourism and cycling tourism are generally (more) related to the landscape units or landscape character types and not to the settlements respectively the touristic nodes. The category Nature information refers to information centre of national parks or other protected areas which provide a deeper insight into nature, landscape or ecosystem.

Horse riding tourism and cycling tourism are not involved in the characterisation of the nodes as well as congress tourism which is more related to the professional life.

The characterisation of touristic nodes in the Neusiedler See/Fertő Region consists of the following categories:

Lake resort	bathing, water sports, partly camping
Health tourism	health resort, sanatorium, thermal bath, wellness
Cultural tourism	museums, galleries, exhibitions, theatres, events
Wine tourism	wine growing, wine tavern, offers around wine
Central place	central places in Austria and Hungary, retail trade and services
Holiday Park	single facility
Nature information	national park information centre
Others	theme park, Golser Volksfest

Table 17 shows the characterisation of big and middle nodes in the Neusiedler See/Fertő Region.

Small touristic nodes are determined through their single tourist facilities and often specialised, for instance, horse riding centre, museum, national park information, tavern or viewing tower.

Table 17: Qualitative characterisation of the big and middle touristic nodes in the Neusiedler See/Fertő Region

Settlement	Node	Accommodation (beds / nights)	Characteristics
Apetlon	middle	250-500 / 20,000	wine tourism
Breitenbrunn (with lake resort)	middle divided	500-1000 / 16,000	lake resort, wine tourism (old cellars)
Donnerskirchen	middle	250-500 / 16,000	wine tourism
Frauenkirchen	middle	500-1,000 / 2,000	cultural tourism (basilica)
St. Martins Therme & Lodge	middle	250-500 / 65,000	health tourism (thermal bath)
Gols	middle	250-500 / 17,000	wine tourism, others (Golser Volksfest)
Halbturn	middle	100-250 / k.A.	cultural tourism (castle)
Illmitz (with lake resort)	big divided	1,000-2500 / 150,000	lake resort, nature information
Jois (with harbour)	middle divided	250-500 / 25,000	lake resort, wine tourism
Mönchhof	middle	100-250 / 26,000	health tourism, cultural tourism (village museum), wine tourism (Kellerviertel)
Mörbisch (with lake resort and lake-stage)	big divided	1,000-2,500 / 100,000	lake resort , culture (Mörbisch festival)
Neusiedl (with lake resort)	big divided	500-1,000 / 85,000	lake resort , central place, wine tourism
Oggau	middle	500-1,000 / 22,000	lake resort, wine tourism
Hotel and holiday village Vila Vita Pannonia	middle	500-1,000 / 84,000	holiday park
Podersdorf am See	big	>5,000 / 380,000	lake resort, wine tourism
Purbach	middle	500-1,000 / 27,000	lake resort, wine tourism (old cellars)
Rust (with lake resort)	big divided	1,000-2,500 / 120,000	lake resort, wine tourism (wine academy)
St. Andrä / Zicksee	middle	1,000-2500 / 64,000	lake resort, health tourism
St. Margarethen (with Roman quarry and St.	middle	100-250 / 9,000	cultural tourism (roman quarry), others (fairy tale park)
Weiden (with lake resort)	middle divided	500-1,000 / 42,000	lake resort, wine tourism
Fertőd	middle	500-1,000 / 10,000	cultural tourism (castle)
Fertőrákos (with Virágosmajor and lake resort)	middle divided	250-500 / 12,000	lake resort, cultural tourism (cave theatre, museum)
Hegykö	middle	500-1,000 / 104,000	health tourism (thermal bath)
Kapuvár	middle	100-250 / 15,000	health tourism (thermal bath), central place
Sopron (with Löverek, Virágvölgy,	big	2,500-5,000 / 400,000	cultural tourism (variety), central place
Balf (with Balffürdö)	middle	250-500 / 8,000	health tourism

Austria: accommodation includes camping sites 2010, Hungary: public and private accommodation 2009

Source: Statistical Office of Burgenland, Statistical Office of Austria, Hungarian Statistical Office, websites of communities, information from communities, associations and companies

2.3.2.6. Detailed tourism and recreational analysis in selected areas

In order to get detailed insights into different kinds of tourism and recreation as well as functional relations and development aspects additional field surveys and expert interviews in selected area were carried out. In these study areas tourist facilities should be gathered as precisely as possible, the main activities described and development strategies explored. Moreover, in these areas the functional relations of tourism and recreation should be reflected. These additional studies focus on communes and areas with lower tourism development or specific situations in tourism and recreational activities. The tourist centres around lake and the lake resorts are not further analysed because the information basis is adequate. The requirements determine the size of selected areas and the delimitation based upon touristic nodes. Criteria for the sampling were:

- The different landforms in the trans-boundary region should be represented as well as the Austrian and the Hungarian part of the region.
- In the study areas for tourism not only typical landscapes but also typical tourist situations and recreational activities should be described.
- Study areas for tourism should be areas with information needs including border areas.

Accordingly, five areas for field studies were defined (Table 18 and Figure 17).

Table 18: Study areas for tourism and recreation

Study areas	Landforms	Touristic nodes	Main activities
Illmitz lake resort – Hölle – St. Andrä – Fertőújlak	Lake Basin with Lacken area (small shallow lakes), Low terrace	Illmitz (b), Apetlon (m), St. Andrä/Zicksee (m), VILA VITA Holiday Resort (m), Hölle (s), Lange Lacke (s), Apetloner Badesee (s), Fertőújlak (s)	nature oriented activities (bird watching, national park excursions), cycling (Lacken Cycle Path)
Halbturn – Albert-kázmérpuszta – Jánossomorja – Andau	Low lying terrace: Heideboden	Halbturn (m), Andau (s), Jánossomorja (s), Várbalog (s), Albertkázmérpuszta (s)	cultural tourism (exhibitions), camping / bathing (Pußtasee) in Hungary low tourist activities
Zurndorf – Deutsch Jahrndorf – Nickelsdorf – Friedrichshof	Elevated terrace: Parndorfer Platte, Leitha floodplains	Zurndorf (s), Nickelsdorf (s), Deutsch Jahrndorf (s), Friedrichshof (s)	low tourist activities, outdoor recreation (canoeing, cycling, horse riding)
Mörbisch – Balf – Muck – Brennbergbánya – Ágfalva	Lake basin, Hilly area and hill range, Low and middle range mountains	Sopron (b), Mörbisch (b), Fertőrákos (m), Balf (m), Sopronkőhida/Tómalom (s), Border-Crossing A-HU (s), Károly-magaslat (s), Muck (s), Brennbergbánya (s), Ágfalva (s)	tourism and local recreation, bathing / water sports (lake resorts, Tómalom), cultural tourism (festivals, museums), hiking and cycling, health tourism / wellness
Osli – Öntésmajor – Hansági-főcsatorna/ Einserkanal – Acsalag	Marshland and reclaimed marshland: Hanság	Öntésmajor (s), Acsalag (s), Osli (s), Andaui híd/Brücke von Andau (s), Esterházy Madárvárta (s),	very low tourist activities, national park excursions, cycling, historic-cultural interests (Andaui híd)

Source: own compilation b – big node, m – middle node, s – small node

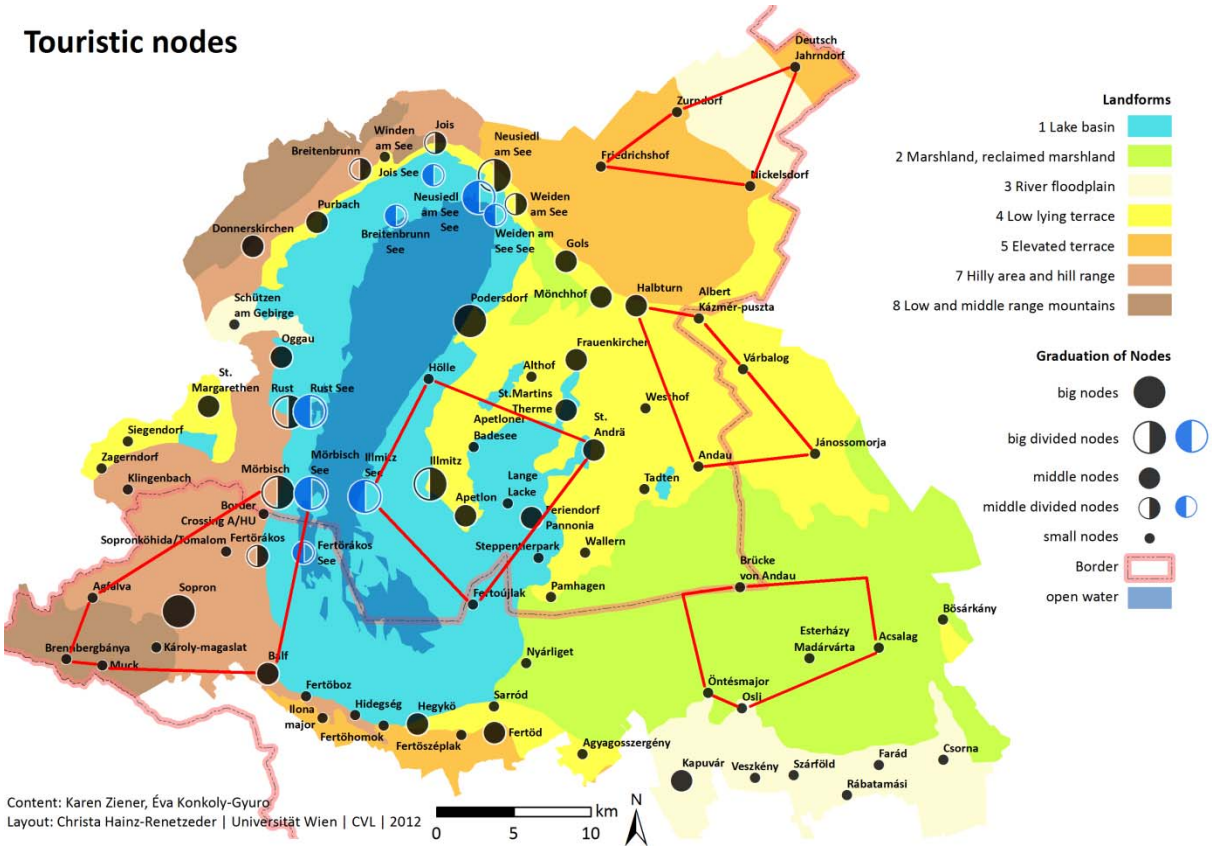


Figure 17: Study areas for tourism and recreation in the Neusiedler See See/Fertőregion

Source: own compilation

Nature-oriented activities and cycling in the area of small saline lakes of central Seewinkel (study area Illmitz lake resort – Hölle – St. Andrä – Fertőújlak)

The first study area is selected in order to analyse the nature-oriented activities around the shallow lakes east of Neusiedler See/Fertőin the Seewinkel area. These small shallow saline lakes which periodically dry out form a really unique landscape type. On the slightly higher elevation the grasslands are interspersed by patches of arable land and vineyards. The main leisure activities are cycling and nature experience in particular bird watching during the bird migration time in spring and autumn. Bird watching has a long tradition in this area especially at the Lange Lacke because Neusiedler See/Fertőregion is an important nesting and resting area for birds in Europe. Since foundation of the National Park Neusiedler See – Seewinkel the offers for bird watching and nature experience were constantly extended and improved. The National Park Management reduced the pathways close to the lakes. In the National Park area visitors are not allowed to leave the designated pathways. Conversely the National Park provides observation points and built high seats for bird watching. For the Conservation Zones maps with relevant infrastructure for tourists like designated pathways, high seats and parking spaces are provided (see Figure 18).

The visitor programme of the National Park Information Centre Illmitz includes many excursions (e.g. flora and fauna, ecology of different parts of national park, landscape preservation measures) in all seasons guided by trained and in most cases specialised excursion guides (website of the National Park Neusiedler See – Seewinkel). In 2010 the National Park realised 388 excursions with 7,449 paying participants and registered 35,584 visitors in the National Park Information Centre in Illmitz (Information of the National Park). Since 2010 the three-day Pannonian Bird Experience with exhibition, presentations, workshops and excursions around bird watching takes place annually in April (website of the Pannonian Bird Experience).

Beyond the border, near Fertőújlak, the facilities for visitors in the Hungarian Fertő-Hanság National Park are concentrated (see Figure 19). From the high seats visitors can see the habitat reconstruction areas and watch a rich variety of birds. Furthermore there are a multifunctional visitors' centre and nature school including permanent exhibition, conference room and accommodation close to Fertőújlak and an educational trail. The Sea Aster Nature Trail starts at the sluice of the Main Regulation Channel. It leads through the saline steppes grazed by typical Hungarian grey cattle, racka sheep and water buffalo as well as to the shallow saline lakes. Additional guided tours are provided (website of the National Park Neusiedler See – Seewinkel and of the National Park Fertő-Hanság).

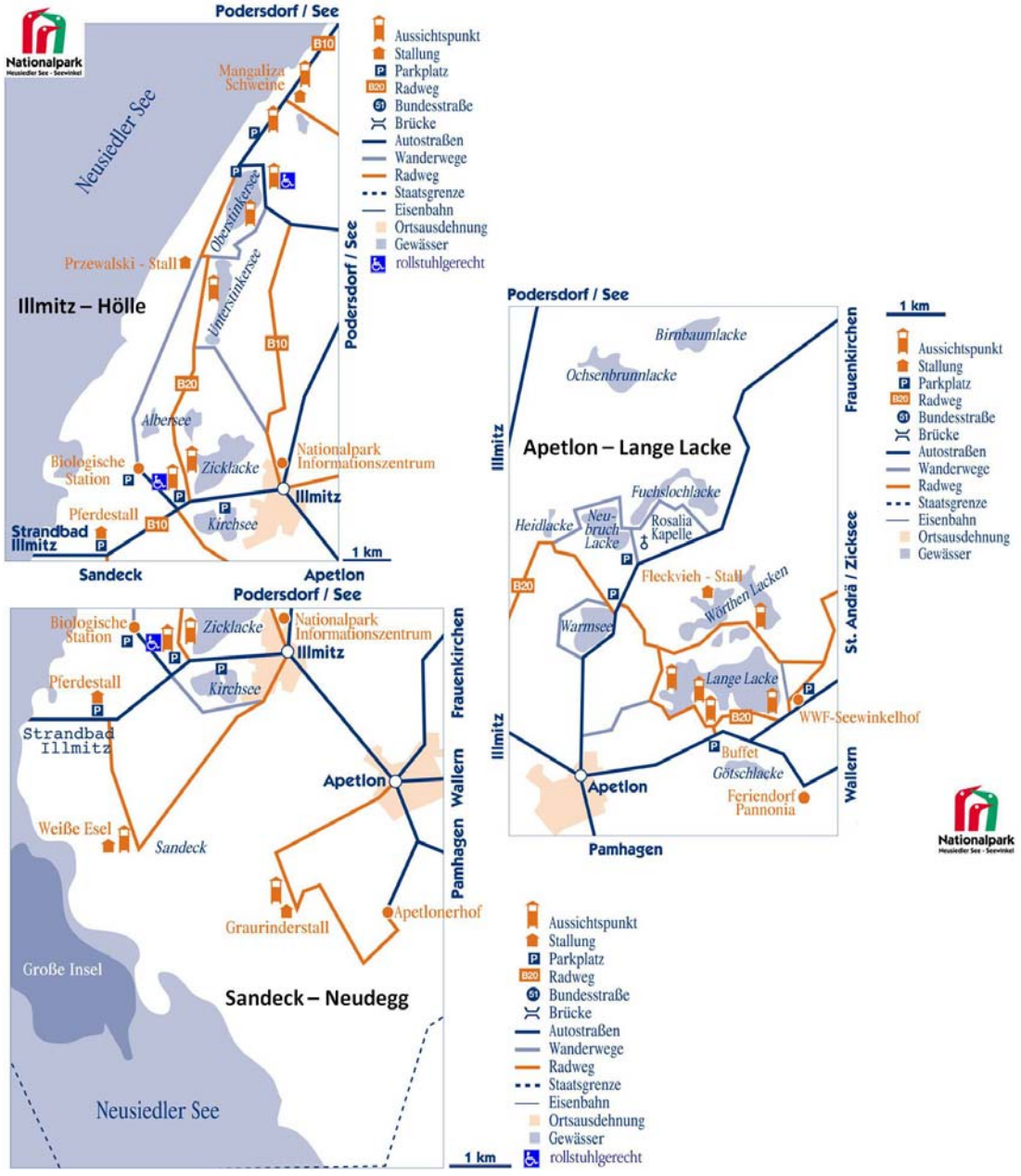


Figure 18: National Park Neusiedler See – Seewinkel: Infrastructure for Visitors in the Conservation Zones Illmitz – Hölle, Sandeck – Neudegg and Apetlon – Lange Lacke

Source: own compilation after the website of National Park Neusiedler See – Seewinkel

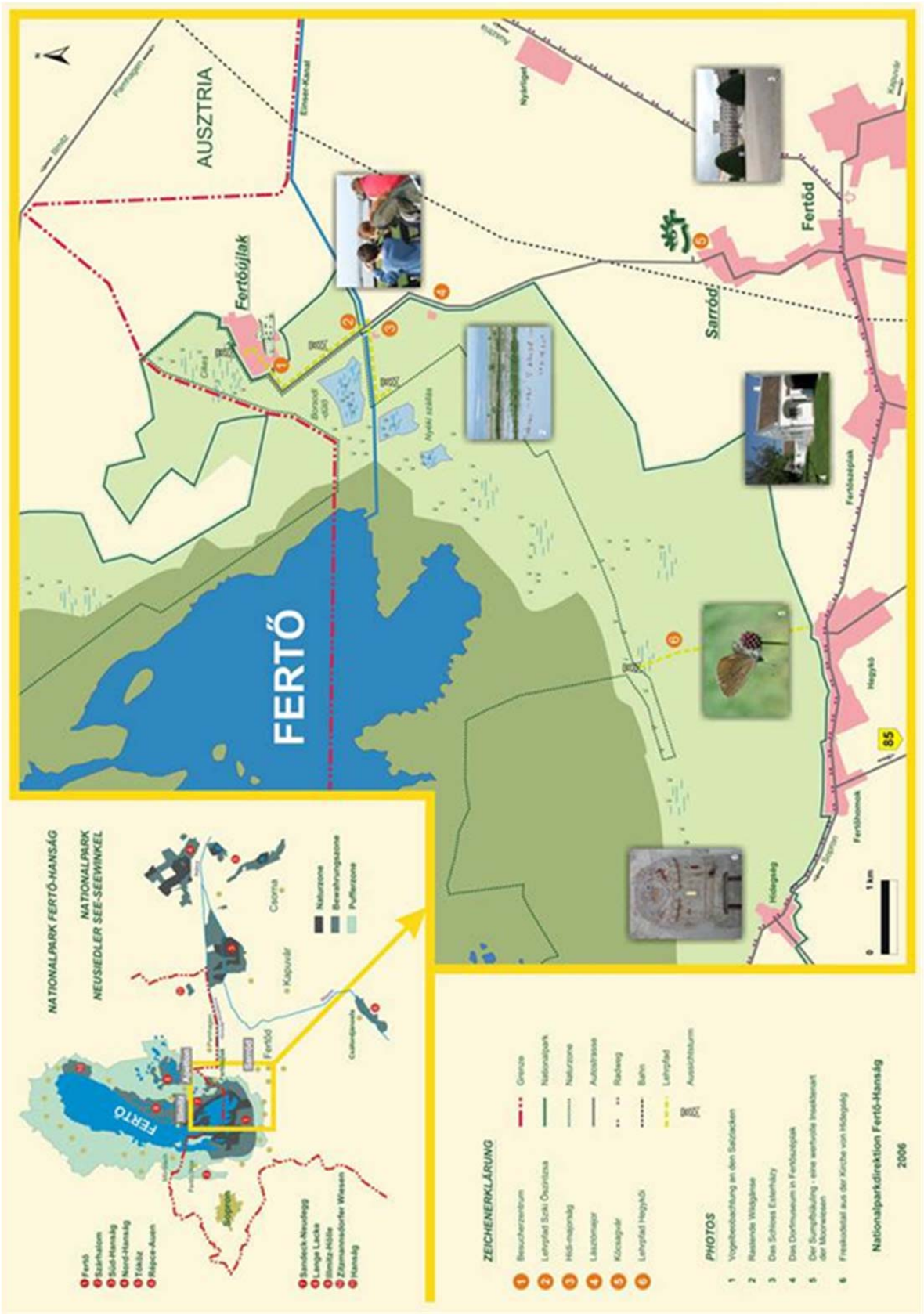


Figure 19: National Park Fertő-Hanság: Infrastructure for visitors in the area of Fertőújlak

Source: Homepage of the National Park Neusiedler See – Seewinkel

Nature oriented tourists, cyclist and National Park visitors, are holidaymakers as well as one-day visitors. Illmitz is categorized as big node because of more than 150,000 overnight stays (150,544 overnight stays), a lot of one-day visitors and different kinds of tourism like bathing and water sports, wine tourism, cycling and National Park tourism. Apetlon (19,627 overnight stays), St. Andrä am Zicksee (64,499 overnight stays) and VILA VITA Pannonia Hotel and Holiday Resort (Pamhagen 84,252 overnight stays, mainly VILA VITA) are middle touristic nodes in this area. From all these touristic nodes the small shallow lakes of the National Park are very good reachable via hiking or cycling paths. In the course of a cross-border project supported by EU a cycling path from Fertőújlak to the Austrian border will be constructed in order to close the gap in the cycling network (Geschnatter 4/2011).

Further touristic nodes are situated not very far from the area of small saline lakes: the big node Podersdorf (381,034 overnight stays), the new St. Martins Therme & Lodge (Frauenkirchen 66,179 overnight stays, mainly St. Martins Lodge, all data in Austria 2010, Amt der Burgenländischen Landesregierung, Landesstatistik 2011) and in Hungary the middle nodes Fertőd (castle, 10,647 overnight stays, main destination for outing) and Hegykő (thermal bath, 103,933 overnight stays, all data in Hungary 2009, Hungarian Central Statistical Office).

Besides the wine, the wine taverns (so-called Heurige) and the wine events (like Martiniloben early in November) the National Park contribute to the extension of the tourist season, in particular, in Seewinkel area because the main season for bird watching is in spring and autumn.

Single destinations for tourism and recreation in the agricultural landscape east of Neusiedler See/Fertő(study area Halbturn – Albertkázmérpuszta – Jánossomorja – Andau)

The northern part of Seewinkel area is part of landscape character type “flatland with medium or high intensity of human use and dominant homogenous arable land cover” (2b, see chapter 2.4.2). The study area is located on the lower sandy terraces of the Seewinkel and on both sides of the border, in Austria and Hungary. This landscape is characterised by the lack or insignificant presence of the surface water, the equally flat surface and the overwhelming intensive arable land parcels. Therefore the main perception is the monotony of the flat ploughed land only partly broken by tree rows and shelterbelts predominantly in Hungary. In Austria the large scale arable land is diversified through a significantly smaller parcel structure. The villages in Austria are more urbanised, surrounded with modern agricultural industry and with growing horticultural establishments. However the architectural heritage in the ancient core of the settlements is well preserved. In Hungary despite the lack of industrial activities the singes of the developing technical infrastructure is more and more visible inside and outside the growing settlements. In this study area the landscape function is dominated by agricultural and agro-industrial functions. The attractivity of this landscape and the landscape potential for tourism and recreation are less. There are only a couple of historical buildings and cultural monuments.

The study area of Halbturn, Andau and Jánossomorja represents the closer borderland between Austria and Hungary. Compared to the lake basin tourism is less developed, in particular the tourist accommodation sector (Andau 4,162 overnight stays in 2010, Amt der Burgenländischen Landesregierung, Landesstatistik 2011, Jánossomoria 1,354 overnight stays in 2009, Hungarian Central Statistical Office). In Halbturn and Várbalog overnight stays are not registered. The most important destination for outings is the castle in Halbturn with annual exhibitions (2010 about 27, 000 visitors, ORF Burgenland). Various cultural events like concerts, readings, wine tastings, Martiniloben events and Christmas market take place in the castle and the castle grounds as well as in the village. Due to the day visitors and different events Halbturn is classified as middle touristic node. The other settlements are only small nodes. In Andau the little bathing lake, Pußtasee, offers different possibilities for swimming, recreation and sport including camping site. Moreover, a horse riding centre is situated nearby the lake. In the small industrial town Jánossomorja visitors can find a number of historic-cultural sights, parks and green areas, some restaurants and hotels or guest

houses. The present Jánossomorja has an interesting culture and settlement history. In the three parts of the town various cultural, leisure time and sport events are held every year. The two Hungarian villages Várbalog and Albertkázmérpuszta are very small touristic nodes because of restaurant or tavern. But Albertkázmérpuszta is a destination for outings and cycling tours from the neighbouring villages in Austria. Between these nodes cycling trails are marked – from Andau to Halbturn and Nickelsdorf close to the border and partly along the border which also touches Albertkázmérpuszta, from Andau across the border to Jánossomorja and from there via Várbalog to Albertkázmérpuszta. Horse riding route runs from Andau to Halbturn west of the road. Only Halbturn is included in the Nordic walking routes of the Lauf- & Walking Arena Seewinkel – Heideboden.

The tourism potential of this study area is not so big. Halbturn castle is an important factor of cultural tourism in the Neusiedler See/FertőRegion. Positive effects of the St. Martins Therme & Lodge as an additional offer can be expected. Cross-border activities are also developed. Every year on the first weekend of August the International Bicycle Day "Ohne Grenze – Without Borders" is organised by Social Club Association in Jánossomorja and tourism association of Andau.

Leitha floodplains as less developed tourism area with new projects (study area Zurndorf – Deutsch Jahrndorf – Nickelsdorf – Friedrichshof)

The third study area is located northeast of Neusiedler See/Fertőon both sides of the Leitha River. It belongs to two landforms: the elevated terrace which is divided though the river floodplains. Therefore the transition from deep lowlands to higher terraces (Parndorfer Platte) is typical for this landscape. The land cover is partly divers, but monotonous surfaces are also present. Main landscape function is agriculture dominated by arable farming. The European Protected Areas Nickelsdorfer Haidel (12.25 ha, northwest of Nickelsdorf) and Zurndorfer Eichenwald und Hutweide (120 ha, south of Zurndorf) give an impression of the original landscape on the elevated terrace of Parndorfer Platte (website of Burgenland: Natura 2000 Gebiete). The Leitha/Lajta is a small shallow river with a slow flow rate. Between the villages Gattendorf and Nickelsdorf the river Leitha was renaturated in 2008. The dynamic landscape of Leitha floodplains are characterised by alternation of wetlands with changing water levels, grasslands, alluvial forests and arable land with a great variety of flora and fauna. In the settlements traditional structure and rural architecture is still visible, in particular in the village centres.

Tourism is less developed in these three villages (Zurndorf 3,390 overnight stays, Nickelsdorf 1,732 overnight stays, Deutsch Jahrndorf no reporting commune, all 2010, Amt der Burgenländischen Landesregierung, Landesstatistik 2011). The number of one-day visitors is not so great except the annual Nova-Rock-Festival in Nickelsdorf (about 150,000 visitors per year, Kleine Zeitung 10.06.2011). The settlements are classified as small nodes although the high number of festival visitors suggests beginnings of middle node.

Nevertheless, there are a couple of potentials for recreation and leisure time activities and the area is situated close to Bratislava and in the surroundings of Wien. On the Leitha and Kleine Leitha rivers guided canoe trips offer unique nature experiences. In Zurndorf and Friedrichshof riding centres provide various possibilities for equestrian sport including horse riding trails, training for horse and rider, riding and driving club and horse riding events. In Friedrichshof the Collection Friedrichshof which can be visited on a guided tour and a hotel specialising seminars and workshops are located. Friedrichshof is also a meeting place for artists and art lovers from around the world. In Nickelsdorf the Jazz Gallery Nickelsdorf take place every year since 1976. Beyond that the villages are connected by hiking, cycling and horse riding trails, for example, cycling trail between Donau-Auen National Park and Neusiedler See connecting Zurndorf and Nickelsdorf and borderland hiking trail from Deutsch Jahrndorf to Nickelsdorf (website of Regionalverband Leithaauen Neusiedler See).

The aim of tourism management in the Leithaauen region is to develop sustainable tourism and recreation. Therefore the Leithaauen Regional Tourism Association (Regionalverband Leithaauen Neusiedler See) comprising the local tourism associations of Kittsee, Edelstal, Pama, Deutsch

Jahrndorf, Gattendorf, Zurndorf, Nickelsdorf, Neudorf was founded. In particular, the regional tourism association organises the common marketing of communes in order to enhance the level of awareness (e.g. website), common events and the development of tourism infrastructure. In the on-going LEADER project "Riding, biking and hiking trails in the Leithaauen region" (2011/2012) the offers of hiking, cycling and horse riding tourism in the region will be expanded and strengthened including touristic trails with informative signs and resting places, a website with download possibility of new routes, and the revitalization of tourist attractions like the sculpture park in Deutsch Jahrndorf, the historic vine cellars in Edelstal and the Tractor Museum Gattendorf (Pannonische Rundschau Neusiedl/See, 24.2.2011). Cross-border projects with Hungarian or Slovak partners funded by INTERREG/ETC Programme are realised. The Project SERVUS PONTIS (2011/2012) with Rusovce, district of Bratislava, is dealing with upgrading and marketing of cultural attractions and events in the Leithaauen region and four districts of Bratislava as well as cross-border cycling connections supporting tourism and leisure time activities. Another project is focused on the development of sustainable cross-border canoeing tourism on the Leitha/Lajta River starting from Bruckneudorf to Mosonmagyaróvár (2010-2013). Project partner are the Leithaauen Regional Tourism Association, the communes of Bruckneudorf and Mosonmagyaróvár and Mosonmagyaróvár Aquatic Sports Association (website of mecca-consulting, List of Beneficiaries of the operational Programme Austria – Slovakia 2007-2013, website creating the future: Cross-border Cooperation Programme Austria – Hungary 2007-2013, information from Leithaauen Regional Tourism Association).

Tourism and local recreation in the area of Sopron and Lake Fertő/Neusiedl (study area Mörbisch – Balf – Muck – Brennbergbánya – Ágfalva)

The study area in the southwest part of wider investigation area is determined by the town of Sopron and its surroundings. Therefore, recreational activities of local population and tourism partly overlap. The landscape character changes from the lake basin over hilly areas to the low mountain range of Sopron Mountains. Accordingly the landscape potential for recreation and tourism is quite different reaching from bathing, swimming and water sports on the lake to hiking, Nordic walking and mountain biking in the hilly and mountain areas.

In the southern part of Lake Fertő/Neusiedl, in Hungary, a continuous reed cover with small patches of open water is dominant. The lake resorts of Mörbisch and Fertőrákos are situated at the border between the reed belt and the open water. The adjacent wet and dry grasslands are over woven by artificial channels serving the stabilisation of the water level of the lake. The reed and grassland areas have primarily conservation function (National Park Fertő-Hanság). While the open scenery of the immense reed belt is rather monotonous, on the pastures of the reclaimed lake shore, several woodlots and scattered woody vegetation provide some visual diversity.

The hill range between Fertőrákos and Balf is characterized by medium intensity of human use and heterogeneous land cover including villages and semi-urban settlements. This semi-open landscape has clear land-use zonation according the relief. On the lowest level, adjacent to the lake basin, encircled by grassland and arable land villages have been settled. Above them a mosaic of vineyards and gardens covers the gentle slopes, confined by closed deciduous forest on the hilltop. Valuable designated site is the thermophilous forest of Szárhalom on the top of the hill range between the lake Fertőand the Sopron basin. In the area of Mörbisch vineyards are dominating. The settlements with the traditional architecture play an important role in the pleasant scenery of the landscape. Due to the growing demand for residential and recreational areas in the vicinity of Sopron the traditional rural character of landscape has changed. As the Neusiedler See cycle path is running along the settlements of the foothill scenic views to the settlements and hills, the reed belt and partly the open water are possible from different points. The attractive white-beige 'Leitha limestone' occurring on the Rust Hills at Fertőrákos and St Margarethen has been exploited in quarries since the Roman times. The both ancient stone quarries are utilised as open air theatres. Other natural resources are the sulphurous springs. The most famous spring at Balf is feeding the popular spa (health tourism).

The historic town of Sopron and its periurban areas are situated in the Sopron basin and on the foothills of the Sopron Mountains. The intact medieval city centre is encircled by the remains of city wall originating from the Roman Scarbantia. In the space of town expansions several urban and periurban landscape mosaic units are visible, for example, the residential and institutional districts developed in the 19th century with green spaces and historic parks like the Elisabeth garden and the Arboretum of the University. Due to the historical sites, museums, exhibitions, restaurants as well as cultural events and festivals, Sopron has a high tourism potential.

The Sopron Mountains are the easternmost part of the Central East Alps, the continuation of the Rosalia Mountain range. The highest elevation is 557 m and it comes down in three large relief stairs to the town Sopron down to 214 m. The valley of Brennbergbánya was one of the first coal mining centres of Hungary in the 19th century. Today an exhibition presents this mining period. The closed forests of Sopron Mountains are not homogenous deciduous ones but widely spread spruce and pine plantation mix into the oak, oak-hornbeam and beech stands. Accordingly, the landscape potential for recreation and tourism is high. Residential areas and areas of secondary residences are gradually infiltrating into the forest of the mountain slopes and into the valleys of Sopron Mountains.

The main tourism destination in this area is clearly Sopron (2009: 3,675 beds and 410,244 overnight stays including Balf). The town functions as big touristic node. Besides cultural tourism and business tourism Sopron plays an important role as central place and destination for outings. Therefore, many one-day visitors come to Sopron. Guided city tours are integrated in the services of Neusiedler See Card. Some of the accommodations and the big hotels are located on the slope of Sopron Mountains in the district of Lőverek. They offer several opportunities for recreation, walking and hiking as well as wellness and sport programmes.

Located at the western shore of Neusiedler See Mörbisch and Fertőrákos are two other tourism centres. Despite of similar touristic structure the tourism development is different. Mörbisch is a big touristic node (2010: 1,615 beds and 99,754 overnight stays, Statistik Austria 2011, Amt der Burgenländischen Landesregierung, Landesstatistik 2011) which is divided into the village with a picturesque architecture and a variety of accommodation and gastronomy on the one hand and the lake resort (bathing, water sports) and the Mörbisch Festival on lake stage (2010 about 188,000 visitors, website Seefestspiele Mörbisch) on the other hand. From Mörbisch to Illmitz goes a regular ferry line. The neighbouring Hungarian village Fertőrákos is classified as middle touristic node which is also divided. The accommodations and the number overnight stays are noticeably lower (2009: 471 beds and 11,523 overnight stays, Hungarian Central Statistical Office). The tourism potential of Fertőrákos result from the historic sites in the original village centre, the only access point to the lake's open water in Hungary and last but not least the location on Neusiedler See cycle path. In particular, the open-air museum of former stone quarry and the famous Cave Theatre attract cultural tourists (currently closed because of modernisation). The lake resort[7] offers a possibility for bathing and good conditions for sailing and windsurfing. Shipping lines operate between Fertőrákos and Mörbisch, Rust or Illmitz.

Tourist interactions across the border have more and more developed. Mörbisch and Fertőrákos are connected via Neusiedler See cycle path (border crossing only for pedestrians and cyclists) and by water (shipping route, water sports). An upgrading of the road link for cars is in discussion for years. In the last years tourism in Mörbisch is declining (overnight stays as well as visitors of Mörbisch Festival) and the tourism development of Fertőrákos is only slow. Intensification of cross-border cooperation could promote the tourism development of both sides of the border.

The lake, the lake resort and the village of Fertőrákos are also included in the recreational area of local population. There is a regular bus service between Sopron and Fertőrákos, in summer even to the lake resort. The Lővér Fürdő (outdoor and indoor swimming pool) and the Tómalom Fürdő at the

[7] The lake and the lake resort belong to the territory of the municipality of Sopron.

Nagy-Tómalom pond offer further opportunities for bathing. The second pond, Kis-Tómalom, is mainly used for angling.

Both forest areas in the vicinity of Sopron, forest of Szárhalom as well as Sopron Mountains, are recreational areas with a high density of paths and hiking trails, with lookout towers (e.g. stone lookout tower on Károly elvation, Várhely lookout, Kecske-hegy lookout), educational trails (e.g. Cyclamen Nature Trail, Lily of the Valley Nature Trail, In the wake of Celts) and other leisure facilities. Because of local recreation in the residential environment the highest intensity of use is normally registered close to the settlements. The Soproni-hegység Nature Park aims at keeping a balance between nature conservation and touristic and urbanisation demand.

Scarcely developed tourism in the Hanság region (study area Osli – Öntesmajor – Hansági-főcsatorna / Einserkanal – Acsalag)

The main part of the Hanság study area can be characterised as marshland with low intensity of human use dominated by forest, grasslands and water. The continuity of the former interconnected wetland was broken after the water reclamation. Lakes and some patches of wetland have remained in the deepest areas within the mosaic of forest and grassland. The straight lines of the channels interlacing the area in a geometric web are result of the water reclamation. Forestry and nature conservation determine the landscape functions. A major part of this study area is included in the Fert*ő*-Hanság National Park.

The settlements Öntesmajor (municipality of Kapuvár), Osli, Földsziget (municipality of Csorna) and Acsalag are located in a flat landscape with medium or high intensity of human use and dominant homogenous arable land which is rather monotonous. This homogeneity of landscape is partly broken by tree rows and shelter belts. Landscape function is predominantly agricultural and agro-industrial. The potential for tourism and recreation is less.

Due to the very less developed tourism in the Hanság area there are no data about tourist beds and overnight stays. The three settlements Öntesmajor, Osli and Acsalag are only very small nodes. The only facilities for tourists or recreationists offers possibilities for outdoor recreation, in particular cycling, as well as experience of nature and information about nature and history. The little Öntésmajor Múzeum demonstrates the development of the Hanság, in particular, the flora and fauna, water-flow regulation and turf mining. The Hany Istók Nature Trail starting at the Birdwatchers' House of Esterházy between Osli and Acsalag leads to the strictly protected Csíkos Alder Wood, to the fairly old Király Alder Wood and to end at the Király Lake. The Birdwatchers' House of Esterházy one of the oldest birdwatchers' houses in Hungary, can only be visited by appointment (see Figure 20). Moreover, the National Park Visitor Centre offers a guided tour through this area (website of Fertő-Hanság Nemzeti Park). Infrastructure for cycling does not correspond in quality regarding either the routes or the path construction.

In the vicinity of this Hanság study area tourism is also less developed. The tourist potential of the two small towns along the road and railway line connecting Sopron and Győr is also relatively small. Kapuvár (14,968 overnight stays) is classified as middle node due to one-day visitors (cultural events) and health tourism (thermal bath) and Csorna (3,601 overnight stays) as small node with potential development to a middle node (thermal bath, culture).

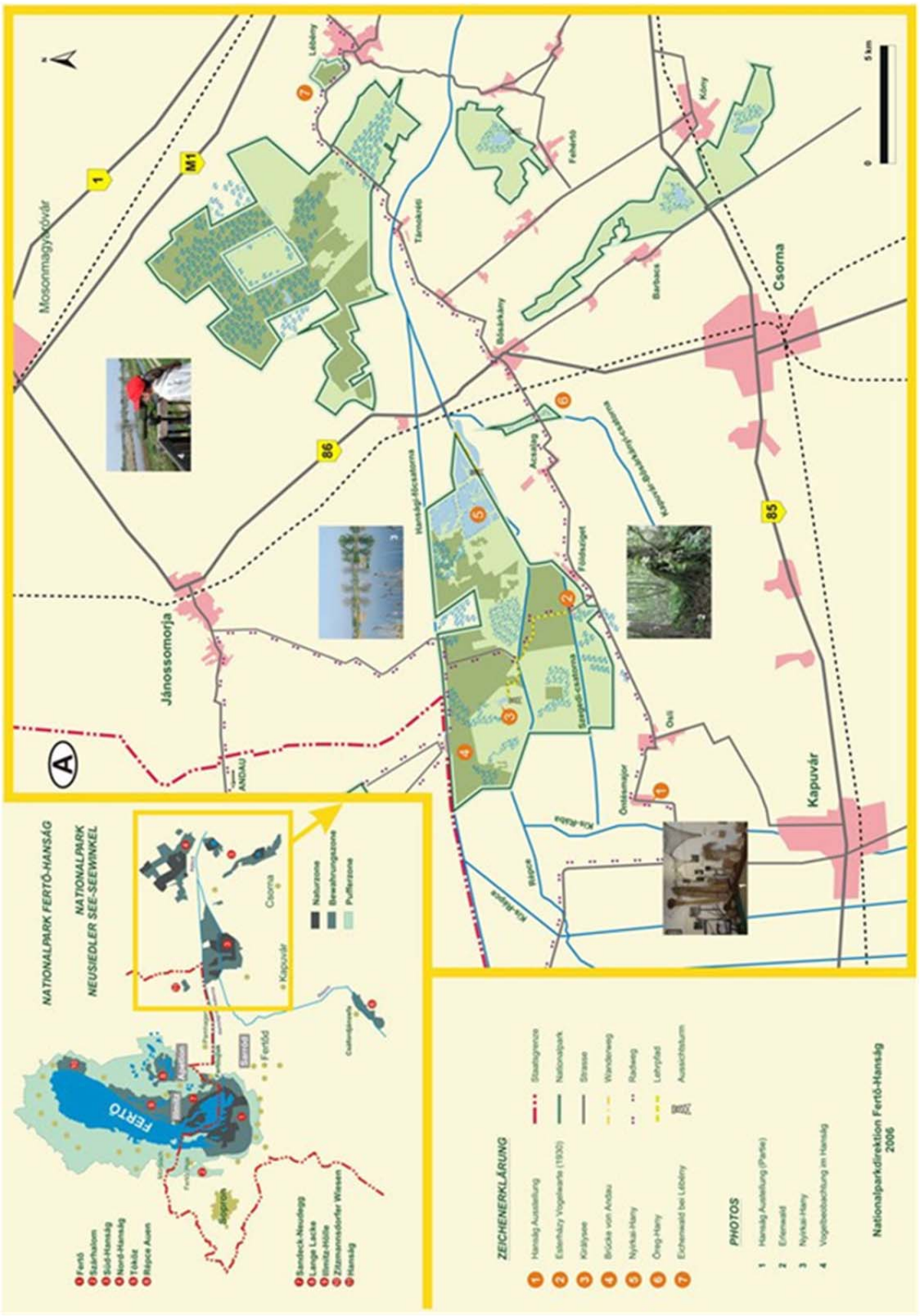


Figure 20: National Park Fertő-Hanság – Infrastructure for Visitors in the Hanság area

Source: Homepage of National Park Neusiedler See – Seewinkel

Currently the development of a cycle path network in the Hanság area and cross-border connection to the Seewinkel area (Austrian Waasen) takes place in the framework of INTERREG/ETC projects. On the basis of the cycling concept developed in the "GreMo Pannonia" project (2008-2012) the project “Environmentally friendly mobility Fertő-Hanság” (2010-2014) was implemented. Among other things it aims to the establishment of a closed cross-border cycle route network including marked cycle trails and resting places. This improvement of infrastructure should be the basis for the development of cycle tourism in the Hanság area (website creating the future: Cross-border Cooperation Programme Austria – Hungary 2007-2013, information from the Subregion of Kapuvár-Beled).

2.3.3. Nature Conservation

Another important utilisation claim in this region and the biosphere reserve is nature conservation and landscape management. At the lowest point of the Small Hungarian Plain lies the Neusiedler See in a basin without any outlets at around 113 m altitude. Originally, branches of the Primal ocean Tethys covered the Vienna basin and the Small Hungarian Plain. After the retreatment of the open ocean 13 million years ago, a small inland water was formed. The salt content decreased, large quantities of sediments were deposited. Tectonic depressions in that area about 13,000 years ago formed basins and pools, which were filled with postglacial feeders and precipitation. As such, an inland water was created which water water balance depends to a large extent of climate variations. In the years 1865 to 1870, the Neusiedler See evend completely dried out. Today’s water surface extends over an area of 320 km² with a depth of one to two meters. This historical development is largely responsible for its extraordinary nature values.

The Leitha mountains, which border at the western fringe of the lake basin is a low mountain range up to 500 m altitude. It presents remnants of the former bond between the Alps and the Carpathians. Its paleozoic underground (mica schist and gneiss) is covered by tertiary limestone. Oak-hornbeam-forests form together with beech the main proportiaon of the vegetation cover. The occurrence of Downy Oak (*Quercus pubescens*), manna ash (*Fraxinus ornus*) and smoketree (*Cotinus coggyria*) on the eastern and southern slopes suggest submediterranean character. Hackelsberg and Jungerberg, two isolated peaks (about 200 m altitude) between Leitha mountains and Neusiedler See exhibit similar geological attributes. Their eastern slopes, which fall steeply to the lake basin are covered by dense, low-growing downy oak-bushes. On the plateaus, a mosaic of primary and secondary dry grassland occurs being steppe remnants of former pastures with plant species like *Festuca valesiaca*, *Carex humilis* and *Festuca rupicola*, and which also support thermophilic perennial herb and dwarf shrub communities.

The lowlands around the lake offer optimal conditions for modern agriculture, especially viticulture, fruit-growing and cereal production (see chapter 2.3.1). The shallow steppic lake – the westernmost in Europe – with its broad reed belt (up to 5 km wide) and marsh vegetation is a unique area in Austria with many species under protection. In the Seewinkel area, about 30 small salt lakes surrounded by steppic grasslands are embedded in intensively managed farmland. These complexes of shallow lakes and dry grassland represent remnants of the Puszta, a former vast pasture landscape which contributes greatly to the high biodiversity of the region. Apart from the importance of these remnants for breeding as well as migratory birds including several species of geese, they also provide habitats for many rare or endangered species, including birds such as *Upupa epops* (hoopoe), small mammals such as *Spermophilus citellus* (European ground squirrel), and interesting vascular plants, for example *Pulsatilla grandis* (Pasque flower), *Iris pumila* (dwarf iris) and many orchid species. The high alkalinity of the soils results in habitats suitable for halophytic plants such as *Aster tripolium* (sea aster), *Salicornia prostrata* (glasswort) and *Lepidium crassifolium* (pepperwort), despite the distance from marine environments.

The Parndorfer Platte is featured as intensively agrarian used old-pleistocene gravel terrace. Nevertheless, a large population of the Great Bustard (*Otis tarda*) could be maintained until today due to the steppe character of that area.

The Leitha river floodplain constitutes some of the last remnats of pannonian lowland floodplain with surrounding meadows. Rare species such as *Acer tataricum* can be found here.

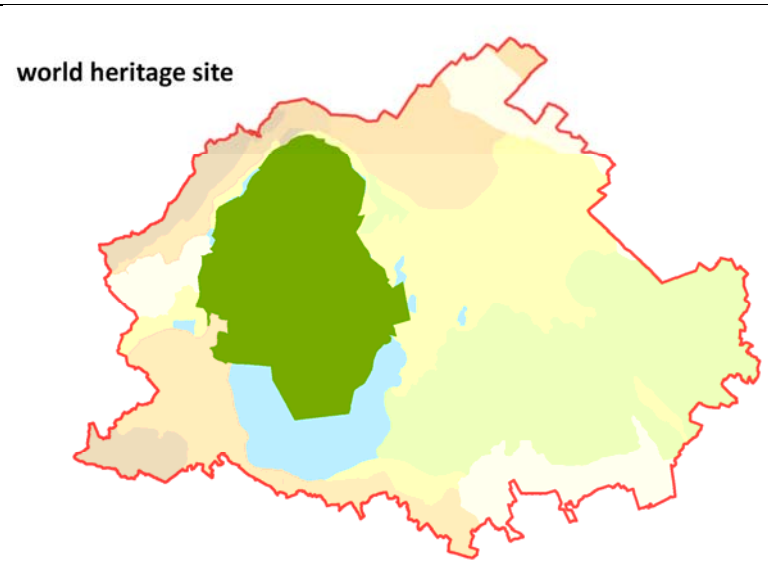
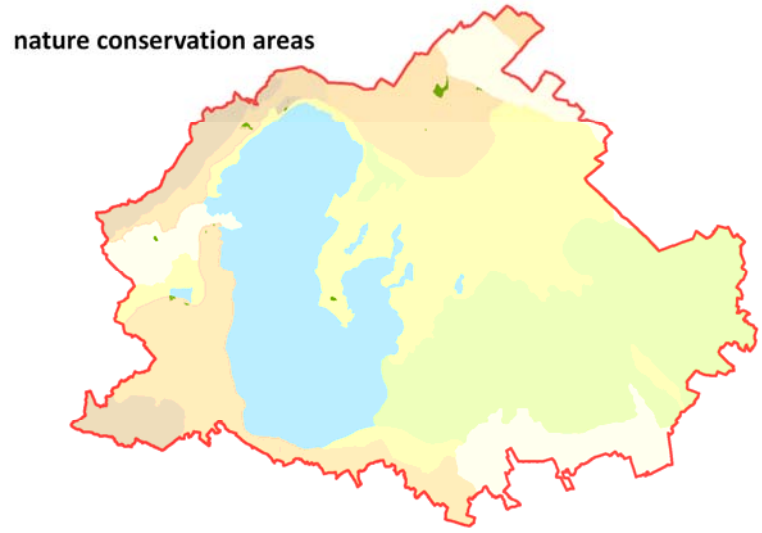
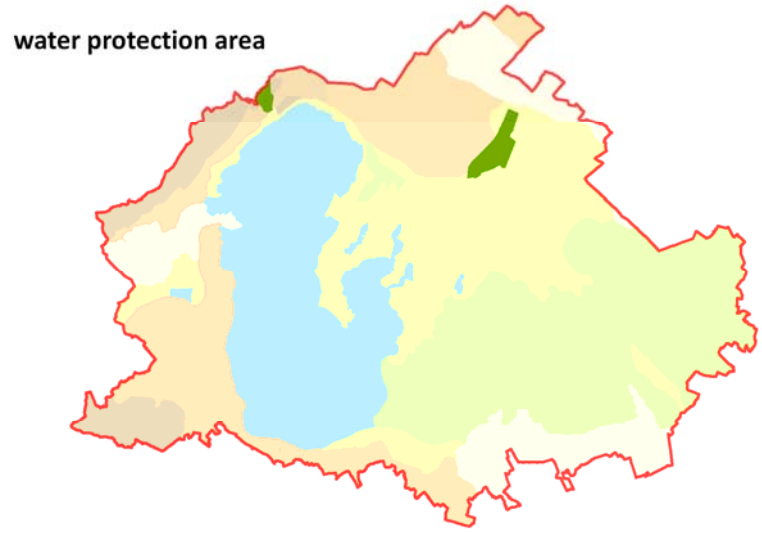
The whole area of the Seewinkel as well as the dry grasslands along the western shore of the lake has been heavily pastures during the last centuries. Large herds of cattle, horses, pigs and goats were driven by shepherds to the municipal pastures each day. The intensity of pasturing was driven by fodder availability and the location of the water posts. This traditional system of the so-called "Hutweide" was continuously given up in the 1960ies due to changes in demography and agricultural structures. Agriculture was mechanised and intensified, livestock husbandry lost importance. Large pastures were converted into agricultural land, not productive grassland was ploughed and timbered with grape-vines. Wetlands were largely abandoned and finally overgrown by reed. In the Seewinkel, the pasture area decreased from 5,366 ha in the year 1960 to below 1000 ha by the turn of the millennium. This dramatic decline of traditional land use systems lead to changes in the landscape character and inevitably to a reduction on habitat and species diversity.

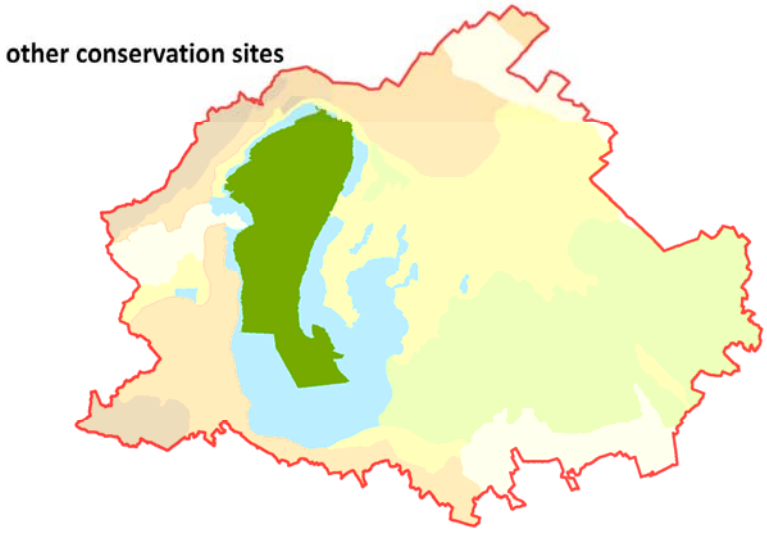
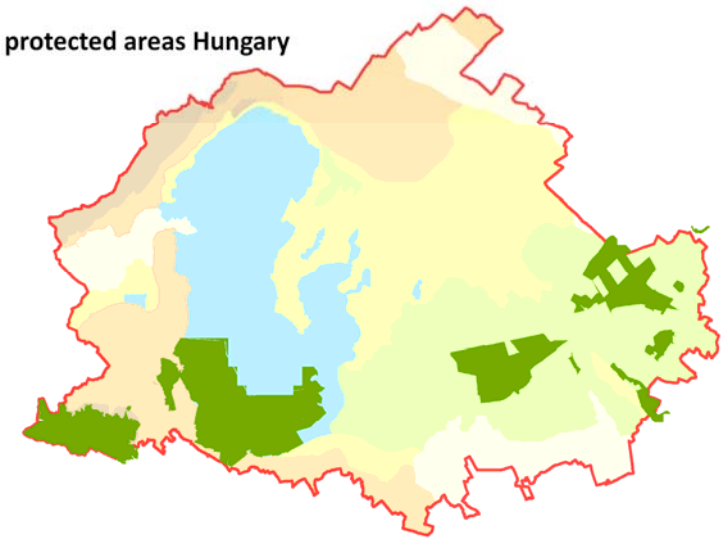
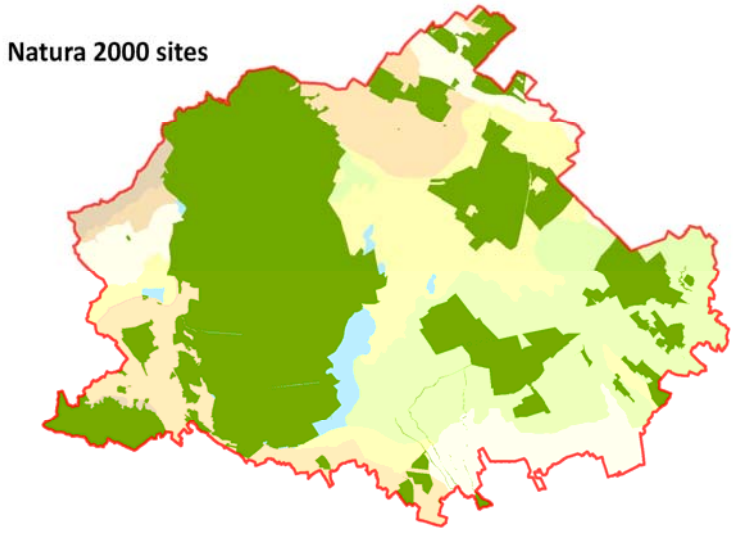
First nature conservation activities were given already in the 1930ies, when a few sites of the Seewinkels were protected. After the Second World War, these efforts were continued, but could not stop the decline in pasture areas which had been a general the trend in Eastern Austria. Especially the restricted development possibilities in the transboundary region to Hungary during the communist era (1948-1989) were the main reason that some remnants of this traditional land use system remained part of the current landscape. Persisting efforts of nature conservationists yielded in the re-establishment of pastures with cattle in 1987 leading eventually to the construction of the nationalpark in the year 1993. This has been the beginning of a sustainable regional development, both in the socio-economic and ecological perspective. Since then, livestock and the pasture area have continuously increased.

The special natural and historical situation of the project region resulted in a high number of different conservation areas and conservation strategies. Examples of the high amount of valuable areas and their conservation lable are presented in Table 19.

Table 19: Examples of conservation areas in the project region for both the Austrian and the Hungarian part

Protected areas in Austria	
Nationalpark Neusiedlersee – Seewinkel: Since 1993	

World heritage site by the UNESCO: Since 2001	
Nature conservation areas	
Water protection areas	

Biosphere reserve	
Protected areas in Hungary	
Nationalpark, landscape protection area	
Conservation areas in the whole investigation area	
European wide legislation:	

2.4. Harmonisation of Austrian and Hungarian landscape types - Landscape Types and landscape character (Konkoly-Gyuró et al., 2010)

Landscape character (LC) is the distinct and consistent pattern of elements that makes one landscape different from another, thus giving it an unique „sense of place" (Swanwick et al., 2002). Accordingly, landscape character assessment (LCA) has to take into account all relevant features of the investigated landscape that are capturing uniqueness at one hand and the typical pattern of its elements on the other hand. Typically, LCA results in two spatially explicit units – landscape character types and landscape character areas.

LC types are **generic** – they can occur in several areas, their description allows overregional comparison and their naming depicts the key features, which are common to all individual areas belonging to a type;

LC areas are **individual** – they occur only in one particular place on the Earth and should have a specific „regional" name;

Apparently, the wider investigation area Fertő/Neusiedlersee and Hanság consists of several types and many individual areas.

2.4.1. Defining landscape character types – methodological approach

Following the methodological approach outlined by Swanwick et al. (2002) and based on previous European (Stanners & Bordeaux 1995; Wascher et al., 2005; Groom, 2005), the national (CCA 1996-1999; Wrbka et al., 2000; Van Eetvelde & Antrop, 2005) and regional studies (Gälzer et al., 1994; Wutschitz 1995; Zech 2003), we developed a set of key landscape attributes for appropriate LCA-assessment in the Fertő-Hanság region.

Three main attributes in a hierarchical system have been chosen. The first two are complex and the third is a simple factual characteristic. First is the relief reflecting geomorphology, hydrology and geology. Relief complexes are derived from the digital elevation model (Jarvis et al., 2008), the hydrological system, soils (BFW, 2008) and the geological settings if relevant (Pascher et al., 1999; MTA-TAKI, 1982). Second is the human impact – expressing intensity and heterogeneity of the land use from the natural state towards the highly transformed urban areas. It is defined by satellite images, land cover maps (EEA, 2000; ESA, 1998) and field work. The third attribute is land cover dominance, a clear, measurable feature, nevertheless a very strong characteristic based on CORINE Land Cover information (EEA, 2000). It connects to the first two but also gives highly relevant additional information on the quality, helps in defining the real "face" of the landscape.

1. attribute: „Relief type" (Table 20): regional relief complexes are derived from the digital elevation model (Jarvis et al., 2008), the hydrological system, soils (BFW, 2008) and the geological settings (Pascher et al. 1999; MTA-TAKI, 1982; see Figure 21, Figure 22, Figure 23).

Table 20: Relief types of the investigation area as defined for the first attribute

I. Flatland types		
I.	01.	Lake basin
I.	02.	Marshland
I.	03.	River floodplain
I.	04.	Low lying terrace
I.	05.	Elevated terrace
II. Hilly types		
II.	06.	Large valley or basin within hills and low mountains
II.	07.	Hill range and hilly area with small basins and valleys
II.	08.	Foothill of the middle and high mountain
III. Mountain		**Types**
III.	09.	Intramontan valley
III.	10.	Low and middle range mountain
III.	11.	Upland, plateau
III.	12.	Island mountain

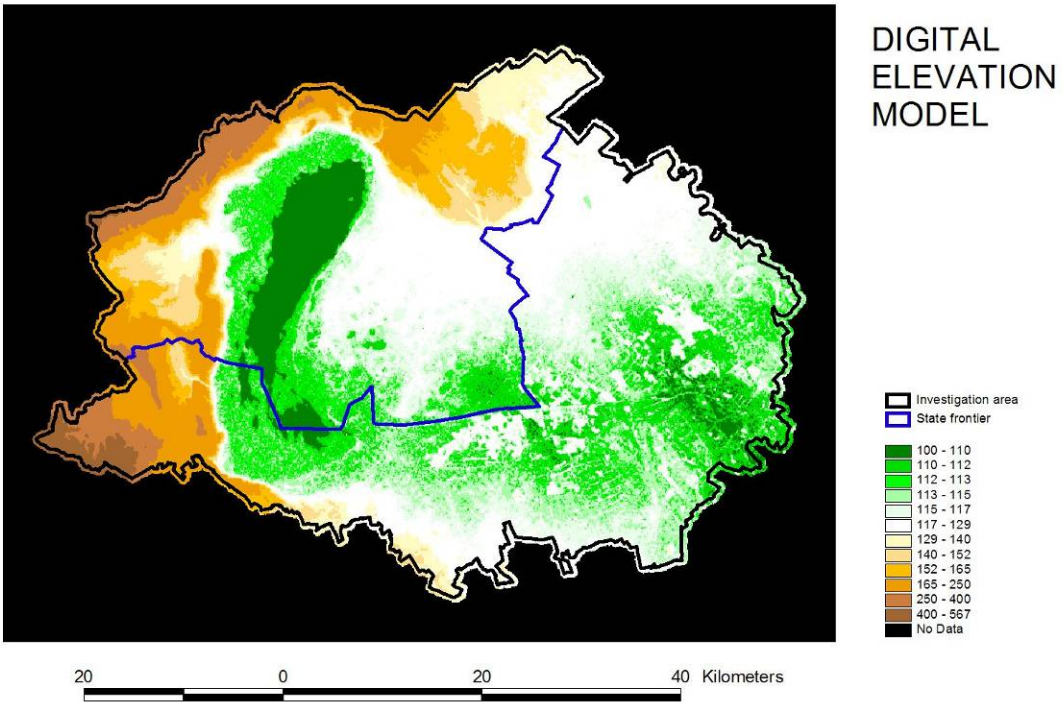


Figure 21: Digital elevation model. Based on Jarvis et al. 2008

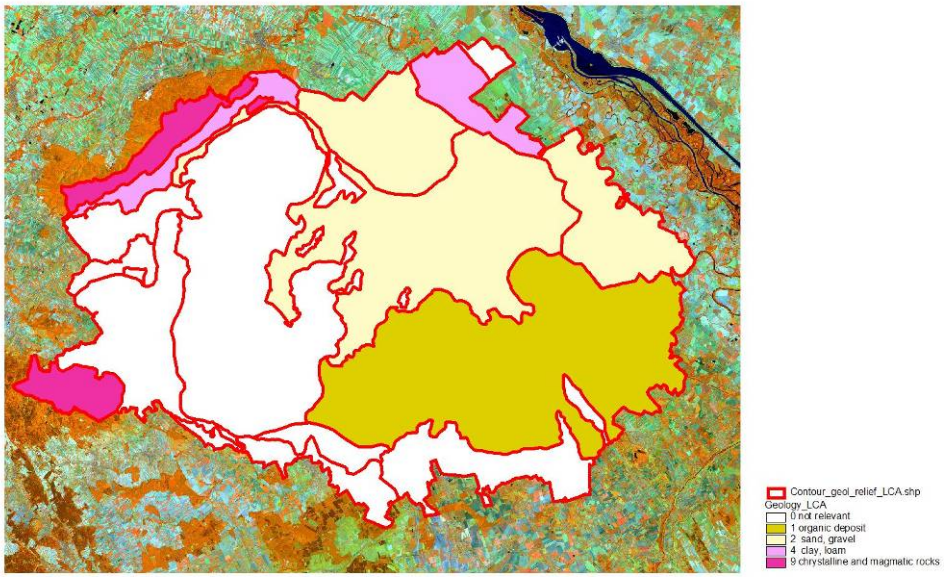


Figure 22: Geological settings

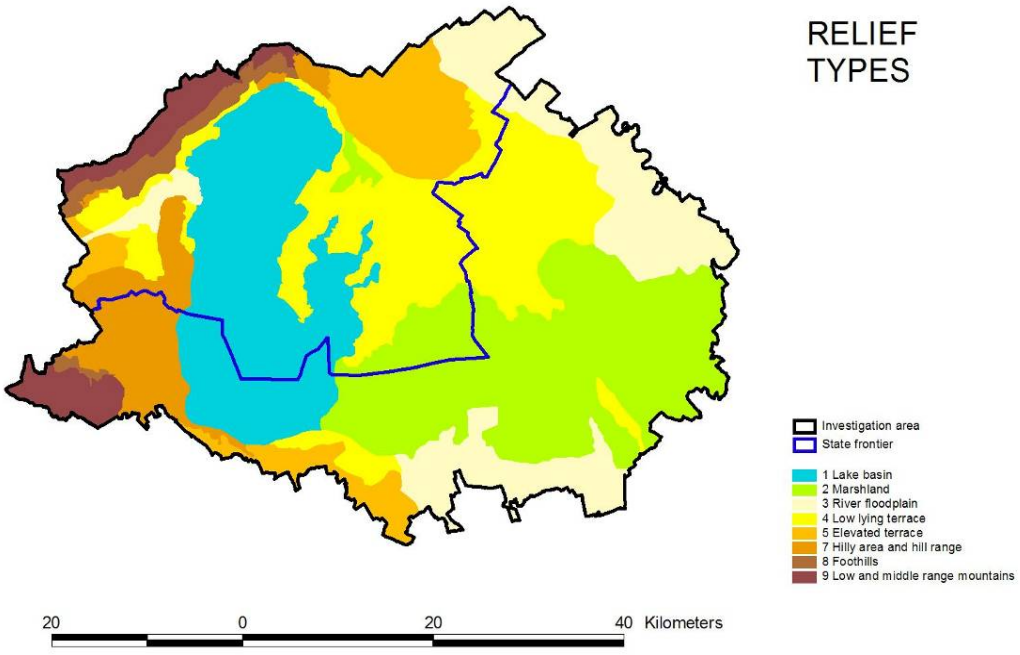


Figure 23: : Relief types

2. attribute: "Human impact" (Table 21): land use intensity and heterogeneity

This complex attribute takes into account the level of transformation of the original habitats and the mosaic patterns of the landscape based on satellite images (ESA, 2008), land cover maps (EEA, 2000) and perceptional information (Figure 24).

Table 21: categories of the second attribute "human impact"

I. **Low intensity human impact**
   1. natural, semi-natural, without settlements
   2. Heterogeneous extensive rural areas
   3. homogenous extensive rural areas

II. **Medium intensity human impact**
   4. Heterogeneous intensive rural areas
   5. homogenous intensive rural areas
   6. rural areas with significant technical infrastructure

III. **High intensity human impact**
   7. semi-urban/rural areas
   8. urban areas

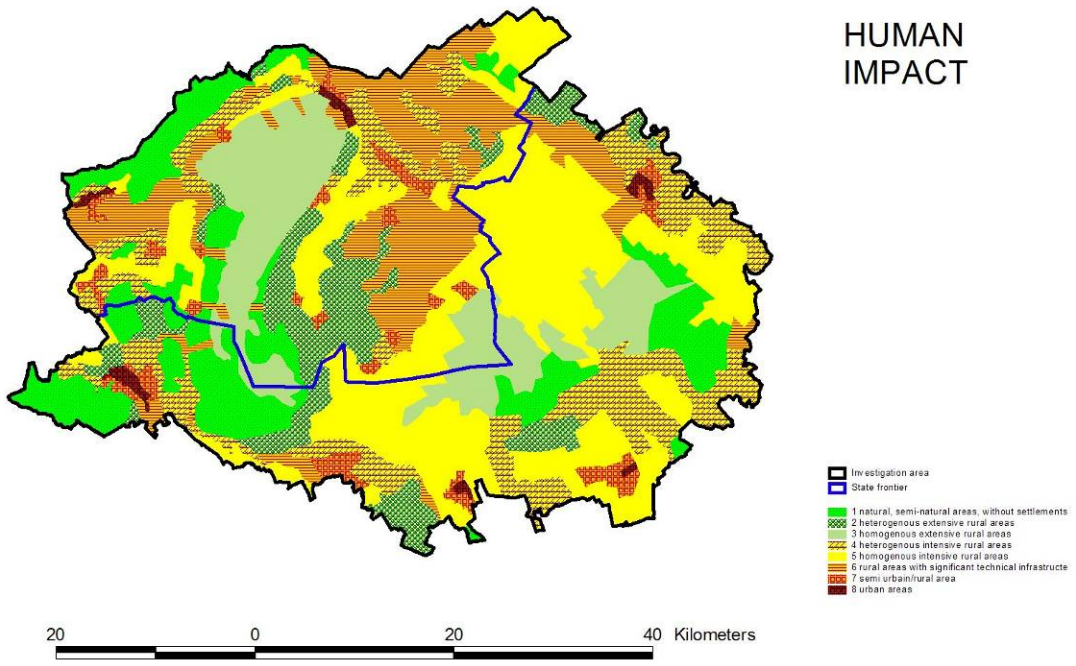


Figure 24: Human impact in the investigation area

3. attribute: "Land cover"

Table 22: dominance and underlying land-use system, derived from CORINE land cover maps (EEA, 2000), (Figure 25).

Table 22: Land cover categories used for the landscape character type assessment

0	Mosaic of different land cover types -
01.	Forest dominance
02.	Dominance of permanent waterbody
03.	Grassland and reed dominance
04.	Arable land dominance
05.	Vineyard-orchard dominance
06.	Low density built up areas
07.	Low density built up areas with significant recreational use
08.	High density built up areas
09.	Large industrial and mining areas
10.	Bare ground and sparsely vegetated land

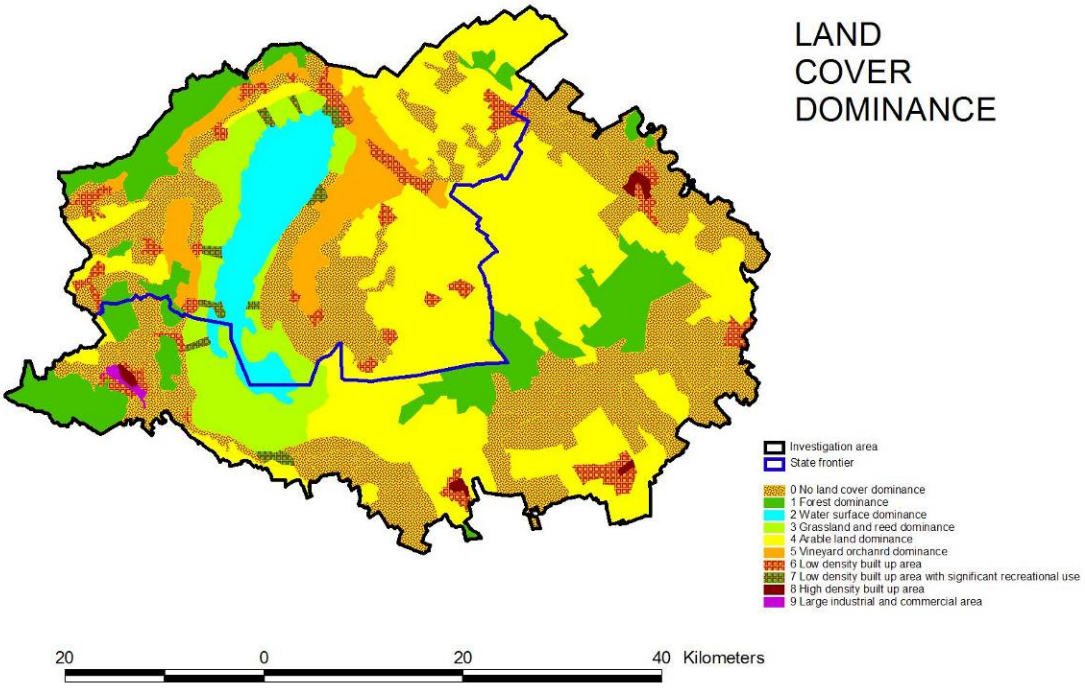


Figure 25: Land cover dominance

Relief and land cover dominance can be derived from cartographic datasets, but the human impact is both quantitative and qualitative attribute. The definition of human impact requires field work and perceptional information as well. This is a crucial part of the method when we include the qualitative information into a complex attribute and into the GIS system. This needs inevitably expert judgement and an accurate knowledge about the area concerned.

Also an important methodological question is the definition of the minimum mapping unit. It would be simple to state that we can shift between scales simply by increasing or decreasing the minimum extent of mapping units. In fact, this is a very technical view resulting in the loss of information about composition and patterns. Aggregate units by knowing the pattern and the real

differences between the constituting units, give different results than attach and attribute to a larger area according to the dominant unit. It is especially important in case of built elements and settlements, that contribute considerably to the character but often they are insignificant in extent. In order to be able to keep all important information of patterns and other significant characteristics a relative small unit of 1 km2 was chosen. The combination of the 3 attribute gave 45 types within an area of 1,000 km2 (Figure 26) which is an extreme high multitude of variations. Although these patches are relevant units of the landscape, thus their uniqueness should be taken into account while a further aggregation is necessary. So they are considered as basic mosaic units of the characterisation, and we call them landscape character mosaic units.

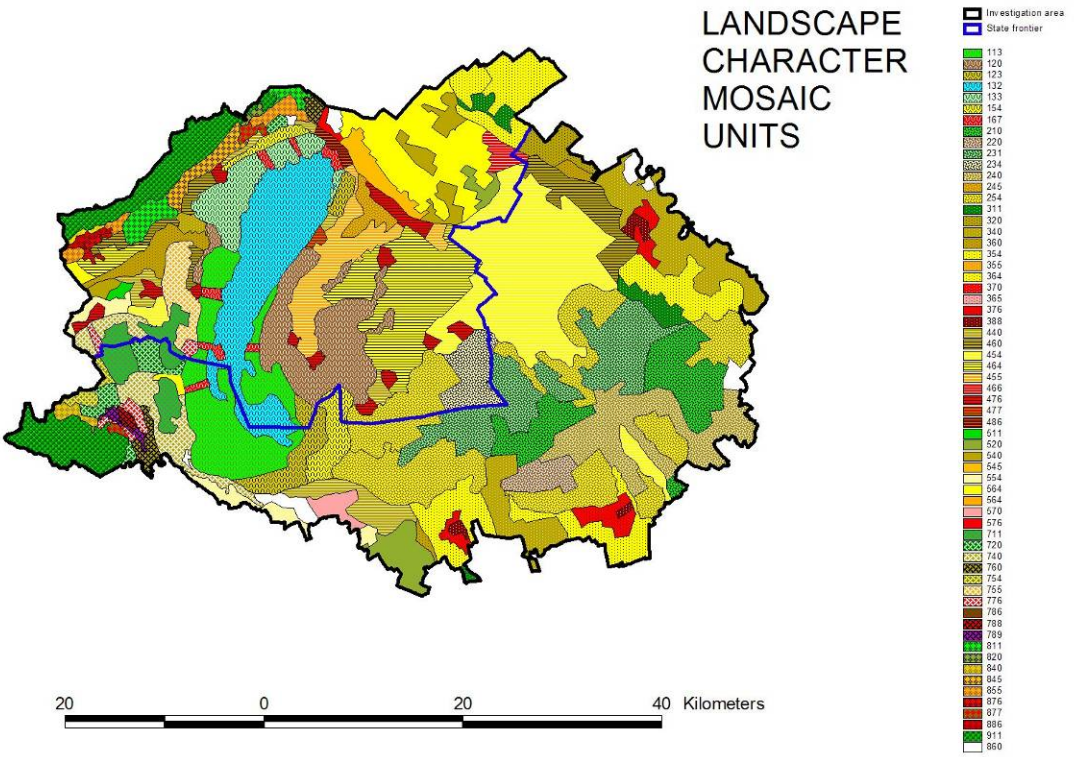


Figure 26: Mosaic units of the landscape character. Legend: nr.1 = relief type; nr.2 = human impact; nr.3 = land cover dominance

This stage was followed by an aggregation of the mosaic types through expert judgement. This is the second step that cannot be automated. It should be acknowledged that qualitative assessment cannot be processed exclusively by computer technique. At certain stages human decision making is necessary. We can increase the amount of impute data and refine the measurement and control the subjectivity, but finally the expert judgement and in case of landscape particularly the opinion of the locals should be part of the character assessment method. Finally the aggregation resulted in 14 landscape character types (Figure 27) that are described in the next chapter.

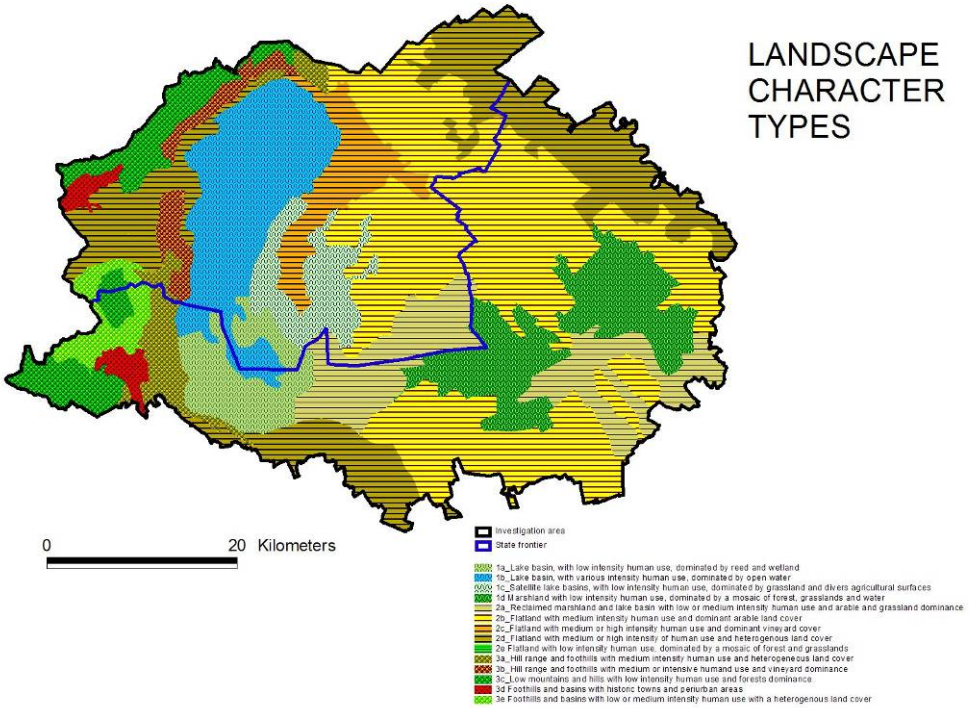


Figure 27: Landscape character types

2.4.2. Description of the landscape character types in the Fertő/Neusiedlersee landscape

1. Deep, water dominated lowlands

1a. Lake basin, with low intensity human use, dominated by reed and wetland (Figure 28, Figure 29)

This natural and semi-natural character type locates on the lakes southern, Hungarian zone and in few patches on the Austrian lake shore. In the shallow alkaline lake a continuous reed cover with small patches of open water is dominant. The adjacent wet and dry grasslands are over woven by artificial channels, serving the stabilisation of the water level of the lake. While the open scenery of the immense reed belt is rather monotonous, on the pastures of the reclaimed lake shore several woodlots and scattered woody vegetation provide some visual diversity. Only few built elements can be found around the lake, some farmsteads, pathways and bird watching towers.

Figure 28 a-d: Typical landscape elements and scenery of the natural and semi-natural lake basin. Photo: Éva Konkoly-Gyuró

These areas have primarily conservation function. The core zones of the national parks both in Hungary and in Austria belong to it mainly because of the nesting and feeding habitats for colonies of reed-nesting birds (eg egrets, spoonbills). It is also an important stepping stone and overwintering place for migrating birds along the Central-European flyway. In Hungary Grey cattle and Racka sheep grazing serve the conservation of this traditional Hungarian species and the grassland management. In Austria buffalos are kept on the wet grasslands. In this area there is no intensive recreational use, only ecotourism has significance outside the core zones of the national parks.

Figure 29 a-h: Typical landscape features and scenery of the natural and semi-natural lake basin Photo: a.b.c. Éva Konkoly-Gyuró. d-h. Ágnes Tirászi

1b. Lake basin, with various intensity of human use, dominated by open water (Figure 30, Figure 31)

The lakes northern and south-western zone, mainly the Austrian part and a smaller area in Hungary at Fertőrákos belongs to this character type. Characteristic is the significant open water surface surrounded by a reed belt of variable width. On the lake shore patches of open grasslands, arable land and some built up areas result in a heterogeneous land cover. In the vicinity of the neighbouring villages on the bottom of the western hill range recreational establishments (yachting and ship ports, exclusive closed marinas, beaches, and summer houses) are inserted into the reed belt. The new residential and summer houses, do not always respect the traditional building style.

Figure 30 a-d: Similarities of the character type "Lake basin with open water" at Mörbisch and Fertőrákos. Photo: a.b.c.d.f. Ágnes Tirászi, f. Lajos Puskás

A particular urbanized zone of the lake shore is located at the north-eastern part of the lake where the sand-terraces reach the lake basin at Podersdorf. That is the only place where the reed belt is lacking and visitors can have the experience of a large open water surface. The recently developed recreational district on the lake shore has a clear urban character, with many store hotels, large built up beach and camp site, big marina, wide multilane cycling road, parking lots and green spaces.

Figure 31 a-b: Podersdorf beach and harbor. Photo: a. Ágnes Tirászi, b. Éva Konkoly-Gyuró

The function of this landscape character type is mainly economic and recreational. Both traditional and regulated reed cutting and fishery are important activities. Well managed grasslands are grazed by horses and cattle. Beyond agriculture recreation has become more and more dominant in the last decencies. There is a growing demand for activities related to the open water and to the nature. Beyond regular ship traffic, bathing and sailing, cycling and ecotourism is also increasing. The rapid grows of the cycling tourism is due to the dense web of cycling roads and the diversity and attractiveness of the neighbouring landscapes.

1c. Satellite lake basins, with low intensity human use, dominated by grassland and divers agriculture (Figure 32)

The extensive rural area of several shallow salt lakes, called Seewinkel locates in Austria on the eastern part of the Fertőlandscape and form a really unique character type. The open landscape with dominant grassland cover and periodic water bodies has a slightly undulating relief. The water bodies, drying out in summer take the deeper relief level, within the sandy ridges. On the slightly higher elevation the grasslands are interspersed by patches of arable land and vineyards.

Figure 32 a-b: Small lakes drying out in Summer at Seewinkel, Illmitz Zicksee, Photo a. Ágnes Tirászi, b. Éva Konkoly-Gyuró

This character type has an important nature conservation function, similarly to southern lake basin (nesting and feeding habitat for breeding birds, stepping stones and overwintering place for migrating birds). But it is also a transition zones from the semi natural areas towards the more intensive homogenous land use.

1d. Marshland with low intensity human use, dominated by a mosaic of forest, grasslands and water (Figure 33, Figure 34, Figure 35, Figure 36)

Areas of this landscape character type occur on the deepest relief level of the former marshland Hanság and Tóköz. The areas that are separated today formed once an interconnected wetland. Their continuity was broken after the water reclamation. Lakes and some patches of wetland have remained in the deepest areas within the mosaic of forest and grassland. Forests are dominated by poplar plantation but also some remains of the original *Alnus glutinosa* "marsh forest" occur. Grasslands and arable land inserts into the forests. Wet grasslands are diversified by furzy and willows. The strait lines of the channels interlacing the area in a geometric web are results of the water reclamation however landscape patterns preserved the former irregularity around the lakes. Hamlets, farms, forestry and hunting residences locate on the edges of these areas.

Particularly valuable are the remains of the original "waterworld" the Barbacs lake and the King lake and the marsh forests. A special parcel called "Tízrendes" north from Rábatamási, where the tree rows and forest belts dividing the hay meadows create a coffer (or cassette) structure. The "Birdwatching house" of the Eszterházy family is a unique natural and cultural historical monument a nice example of the conservation of traditional eco-cultural features.

Visual landscape characteristics are closeness in the forests with long linear axes along the channels and organic mosaic structure with nice coulisses in the surroundings of the lakes and hay meadows. The diverse patterns of the natural areas bear an inspirational sense of timeliness. On the contrary the regular poplar plantation provides a strict counterpoint suggesting a provisionality and modern emptiness.

Figure 33 a-e: Northern Hanság, forest plantations and strait lines of channels. Photo: a,b. Éva Konkoly-Gyuró, c-e. Ágnes Tirászi

Figure 34 a-c: Alnus glutinosa natural forest in the northern Hanság near Osli Photo: Ágnes Tirászi

Figure 35 a-b: Artificial lakes in the northern Hanság near Osli Photo: Ágnes Tirászi

Figure 36: Grassland with woodlots and shrubs in the southern Hanság, near Kóny. Photo: a,b. Éva Konkoly-Gyuró

Forestry and nature conservation determine the land use and landscape functions. Grassland and reed management have significant role mainly in the designated sites but somewhat in the non protected areas too. Hunting fishing and recreation around the lake has also an importance. Hamlets and farmsteads are partly restored, but some are abandoned or not properly maintained. There is a risk of vanishing of these valuable buildings although they have a great potential for touristic use.

2. reclaimed marshland, reclaimed Lake basin and Terrace flatlands

2a. Reclaimed marshland and lake basin with low or medium intensity human use, arable- and grassland dominance (Figure 37)

The former wetlands, covered by peaty soils, adjacent to the lake on the south-east are today over woven by artificial channel network and some wet patches in the deepest relief levels. The large parcels of ploughed land and grasslands are divided by tree rows of various frequency. Recent processes of intensification and extensification create differences in the landscape. Once the growing significance of the bio fuel crops increases homogeneity, the large set aside areas and planned restoration of the reclaimed marshland, but also the expanding “plastic villages” of vegetable production can lead to a different character.

While in Austria built up surfaces are insignificant in this character type, in Hungary a series of small rural settlements can be found here. Characteristic are both compact villages, and few dispersed ancient farmstead buildings, remains of the large nobiliary properties.

Figure 37 a-e: Typical landscape features and scenery of the natural and semi-natural lake basin Photo: a.b.c. Ágnes Tirászi, c.d.e. Éva Konkoly-Gyuró.

Main landscape function today is still agricultural production with hunting, although a transformation process is going on. The abandonment of arable land subsidized from the agri-environmental schemes in Austria and the restoration initiatives in Hungary lead to a renaturalisation process and to more significant conservation function and ecotouristic use.

2b. Flatland with medium or high intensity human use and dominant homogenous arable land cover (Figure 38)

This character type locates both in Austria and Hungary in the transition zone of the lake basin to the Hanság but also on the lower sandy terraces of the Seewinkel as well as on the elevated terraces of Parndorf. It embraces several flatland relief types like river floodplains, low and elevated terraces. Despite the differences of the geomorphology there are several strong common characteristics. Important is the lack or insignificant presence of the surface water due to the flood protection and the higher elevation of the terraces. Furthermore the similar visual appearance is due to the equally flat surface and to the overwhelming intensive arable land parcels.

Main perceptional characteristic is the monotony of the flat ploughed land. The homogeneity is partly broken by tree rows and shelterbelts predominantly in Hungary, while the large scale arable land is diversified through a significantly smaller parcel structure in Austria. Settlements and the protection of the architectural heritage are not the same either. In Austria the villages are more urbanised, surrounded with modern agricultural industry in the periurban zones and with growing horticultural establishments. However the architectural heritage in the ancient core of the settlements is well preserved. In Hungary despite the lack of industrial activities the singes of the developing technical infrastructure is more and more visible inside and outside the growing settlements.

Figure 38 a-d: Typical landscape scenery, infrastructural and agro-industrial establishments at the flatland dominated by arable land. Photo: a.b.c. d. Lajos Puskás

Landscape function is predominantly agricultural and agro-industrial but recently energy production by wind turbines has increasing significance on the Plateau of Parndorf and in smaller scale also in Hungary. These areas are less attractive, have neither recreational nor nature conservation potential. In the neighbourhood and between designated nature reserves there is a need for habitat restoration in order to enhance connectivity between natural areas.

2c. Slightly undulating flatland with medium or high intensity human use and dominant vineyard cover (Figure 39)

This flat vineyard landscape occurs mainly in Austria in the north-eastern area, on the Pltateau of Parndorf and on the lower gravel terraces around Neusiedler am See and Frauenkirchen. In the open landscape the intensive agriculture, large vineyards are dominant with patches of arable land and some semi-natural surfaces. Settlements are modern, semi urban, and urban small towns with agrarian industry and expanding commercial areas.

The new “forest” of wind turbines confines the horizons from north giving the singe that the traditional cultural landscape of the Neusiedlersee ends here. Modern recreational establishments, commercial and industrial objects are against the pleasant scenery of the world heritage cultural landscape.

Figure 39 a-e: Typical landscape scenery and spots of the cultural heritage at the slightly undulating flatland dominated by vineyard. Photo: a.c.e. Ágnes Tirászi, b.d. Lajos Puskás

Agriculture, industrial and commercial activities are prevailing in this area. Some hotspots like the Castel of Halbturn and the Village Museum in Mönchof, the cycling roads between the vineyards and the local vine provide some recreational significance. Natural, semi-natural habitats are almost entirely lacking here, similarly to the previous character type with intensive arable land dominance. Thus the area act as a barrier in transport and migration processes between natural habitats, have a negative isolation impact in a nature conservation perspective.

2d. Slightly undulating flatland with medium or high intensity of human use and heterogeneous land cover (Figure 40, Figure 41, Figure 42)

The areas of diverse flatlands are intermediate between the hill range and the lake basin in Austria at the Wulka floodplain as well as between the lake and the higher terraces of the Raab watershed around Fertőd. These heterogeneous landscapes show a dynamics both spatially and temporally. Typical are the transitions from deep lowlands to higher terraces and from rural to urban. Rapidly changing land cover is is divers in some places, but monotonous surfaces are also present.

The Wulka floodplain and adjacent terraces in Austria have rural character with medium intensity of human use and well kept villages. The semi-open plain is covered mainly by arable land diversified by tree rows, forested patches and grassland. The almost invisible small Wulka river is accompanied by discontinuous wooded vegetation. The semi-urban settlements of the surrounding hills infiltrate

into the plain with their developing industrial and commercial areas, resulting in a slight change of the rural character.

Figure 40 a-c: Wulka floodplain from Siegendorf and typical constructions at the flatland near St. Margarethen Photo: Éva Konkoly-Gyuró

In Hungary these are urbanisation axes along the main roads in the surrounding of the small towns creating continuous settlement tissue and thus linear barriers in the ecological network. While city centres are rich in cultural heritage and have preserved the historic character, new residential areas without respect to the traditional building style, industrial areas, expanding constructions of commercial areas and infrastructures provide significant visual degradation.

Figure 41 a-b: Eszterházy Castle and garden. Fertőd Photo: Éva Konkoly-Gyuró

Figure 42 a-d: Industrial commercial and new residential constructions in Kapuvár, Kóny and Fertőd; Photo: Éva Konkoly-Gyuró

Main landscape function is agricultural production with some important hotspots of the cultural heritage. On the border of the protected and non protected areas, at the fringe of the former marshland, lies the small town Fertőd (formerly called Eszterháza), the eastern gate and the actual capital of the Fertőlandscape where in the 18th century Count Miklós 'the Magnificent' Eszterházy commissioned the building of Hungary's most famous Baroque palace ad garden, relocating to here his main residence from the ancient family seat of Eisenstadt.

3. Hill range and Low mountains

3a. Hill range and foothills with medium intensity human use and heterogeneous land cover (Figure 43)

This diverse character type encompasses patches of both extensive and intensive rural areas and some semi-urban settlements on the western sandstone hill range sweeping on the lake shore from north towards south, mainly on the Hungarian side. The semi open landscape has clear land-use zonation according the relief. On the lowest level, adjacent to the lake basin, encircled by grassland and arable land a chain of villages and small towns, has been settled. Above them a mosaic of vineyards and gardens covers the gentle slopes, confined by closed deciduous forest on the hilltop. Valuable designated site is the thermophilous forest of Szárhalom on the top of the Rust Hill range between the lake Fertőand the Sopron basin.

These areas serve predominantly human uses, mainly the traditional wine production, horticulture and settlements with significant tourism. Being rich in cultural heritage and scenic views it has although an important cultural and aesthetic function. The 'Leitha limestone' abundant in fossils, occurs in several parts of the Carpathian basin, also on the Rust Hills at Fertőrákos and St

Margarethen. This rare limestone, supplying a good and an attractive white-beige building material has been exploited in quarries since the Roman times. The open cast mining is still significant today; although the ancient stone quarries are utilised as open air theatres both in Hungary at Fertőrákos and in Austria at Rust. Other particular natural resources are the sulphurous springs. The most famous spring at Balf in Hungary is feeding the popular spa since the Roman times. The recently developing cycling tourism has its main western axe along the settlements of the foothill. The culinary specialities having strong connection to the landscape potentials – vine, fruit and local food from fish and grey cattle meet – attracts visitors also predominantly to the villages of this character type.

Main aesthetic characteristic is diversity on the gentle undulating relief of the hills and the far sweeping view on the reed covered lake. The settlements with the traditional architecture play also an important role in the pleasant scenery of the landscape. This is a core zone of the world heritage cultural landscape although the ongoing urbanisation provides some pressure. Due to the increasing touristic development and the new demand for residential areas, mainly in the vicinity of the neighbouring towns - Sopron, Eisenstadt - the traditional rural character of some intensively growing settlements is changing.

Figure 43 a-g: Hill range with a diverse mosaic of land cover and some nice spots of cultural heritage; Photo: Éva Konkoly-Gyuró

3b. Hill range and foothill with medium or intensive human use and vineyard dominance (Figure 44)

The patches of this character type are situated in Austria on the northern part of the Rust Hill range, on the foothills of the Leitha Mountain and on the small island hill ”Hackelsberg”. The sunny south and west slopes have a certain Mediterranean character. Despite the homogenous land cover, the landscape is visually far not monotonous. The undulating surface of the hills, the gentle curves of the vineyard rows and roads, following the relief, the diverse extent of the parcels and even some solitary trees and clumps provides an agreeable variety in the landscape scenery. The small semi-urban settlements with traditional village centres are harmoniously inserted into the lower part of the slopes. The roads with the range of vine cellars climb uphill from the villages. More and more “Heuriger” invite visitors. These are typical Austrian small, cellar taverns, where once the new vine of the year was offered with snacks. Today they are the centres on wine tourism and also important characteristics of the landscapes with vineyard dominance. Their charming architecture, the terraces shaded by vine-arbours provides special attractiveness.

These landscapes are intensively used agrarian areas with developing settlements. Tourism is based on the wine culture and the dense cycling road network and on the complex potentials of the neighbouring areas. The “Güterwegs” of the hillsides, where no transit traffic is allowed are designated cycling roads, link the water related recreational facilities of the lakeshore with the scenic view points and vine cellars of the higher areas thus contributing to the more and more intense cycling tourisms. Due to the recreational and residential demand the growth of the built up areas results in an expansion of the villages parallel to the lake shore, along the main roads. Developing technical infrastructure is equally important visual feature giving the impression of modernisation.

Figure 44 a-d: Landscape scenery near Rust and Herurigers of Purbach and Mörbisch; Photo: Éva Konkoly-Gyuró

3c. Low mountains and foothills with low intensity human use, covered by closed forests (Figure 45, Figure 46)

Representatives of this character type are parts of the pre-alpine low mountains and hills. The middle range of the crystalline Leitha Mountain with a maximum high of 483 m above sea level confines the Neusiedlersee landscape from north and west and can be seen as geological bridge between the Alpine arch and the Carpathians. The central parts are built up by siliceous bedrocks, the margins are characterised by calcareous sediments from the marine phases of the adjacent basins. Attractive representative of the limestone caves is the Bear cave (Bärenhölle) near Jois. The Sopron Mountain the easternmost tongue of the Central East-Alps, the continuation of the Rosalia Mountain range is divided from the Leitha Mountain by the 12 km wide gap of the Sopron gate or basin. It has similar geological pattern but the limestone fringe is missing thus the narrow valleys as well. The highest elevation is 557 m in Hungary and it comes down in three large relief stairs to the town Sopron until 214 m. The most important water course the water rich stream Rák arriving into the town Sopron fed once several mills. The valley of Brennberg was one of the first coal mining centres of Hungary in the 19th century.

Land cover in the Leitha Mountains is almost homogeneous oak-hornbeam forest with fringes of thermophilous downy oak associations and some infiltration of Robinia pseudo-acacia and small grassland patches on the hillsides of the deep valleys chopping into the mountain from south toward north. The closed forests of the Sopron Mountains are not homogenous deciduous ones. Widely spread spruce and pine plantation mix into the oak, oak-hornbeam and beech stands.

Figure 45 a-c: Closed deciduous forest with some cultivated patches in the narrow valleys in the Leitha mountains; Bear cave near Winden, chapel. Photo: Éva Konkoly-Gyuró

Predominant land use is forestry with a significant share of traditionally maintained coppiced hornbeam stands. Recreation and tourism have important role as well especially in the vicinity of the towns. The Hiking trails both in the Leitha and Sopron Mountains lead to scenic spots with the view of the mountains and the lake. The stone lookout tower of the Károly elvation (398 m) replaced the former wooden constructions in 1936 is a nice example of the buildings from the early hiking movement. The Sopron Mountain became an important climatic sanative centre for heart diseases due to the pre-alpine fresh air, thus several sanatoriums and hotels were built into the forests near to the city. The Nature Park in the Leitha Mountain and Landscape Protection Area of Sopron in Hungary aims at keeping a balance between nature conservation and touristic and urbanisation demand.

Figure 46 a-b: Sopron Mountains Lőverek in the vicinity of the city with recreational and residential buildings. Photo: Éva Konkoly-Gyuró

3d. Foothills and basins with historic towns and periurban areas (Figure 47)

This particular landscape character type is represented by the towns Sopron and Eisenstadt with their similar natural geographical settings, architectural heritage and modern periurban zone. Both have a city core with medieval and baroque spatial structure and buildings. The intact medieval downtown of Sopron in a form of a horseshoe arch originates from the roman times. It is encircled by the remains of the city wall.

The city centres are surrounded by several urban and periurban landscape mosaic units. First are the residential and institutional districts developed in the 19th century, dissected by green spaces and green bands in the flat basin. Some buildings and historic gardens has a significant heritage

value: the castle with the English garden in Eisenstadt, the Elisabeth garden and the Arboretum of the University in Sopron.

Further residential areas are gradually infiltrating into the forest of the mountain slopes dissolving into the recreational areas of the forests. In Sopron a particular type of secondary residences have been created between the two World War in the forests of the mountains foothills, the so called "lőver"-s. This special forest gardens with small, usually wooden houses served for recreation. Amongst other fruit and forest trees, the emblematic chestnuts of the Sopron mountains have been preserved in these gardens. They were such well-graced that many citizens spent most of the summertime here. It was part of the life form that is unfortunately disappearing along with the valuable constructions and the diversity of fruit tree species and the chestnuts.

The growths of the cities residential areas in the 1970-ies proceeded also toward the bottom of the basins and resulted in the monotonous many store housing estates. The most recent development is furthermore that the gentle south slopes of the Leitha Mountains and the Fertőhills become a periurban transformation zone where the former vineyards and utility gardens turns into new residential areas. Finally a general feature is the expansion of the new commercial and industrial „parks" along the main road around the cities.

Most important transformation take place the periurban areas where both the function and the structure of the areas changes. The traditional character of the historic town is disappearing in these new landscape mosaic units and it has both ecological and aesthetical consequences. The density of the built up surfaces significantly increase, orchards, vegetable and vine gardens disappear gradually and give place to modern ornamental gardens around the new family houses. Flat periurban areas dynamically transform from agricultural to industrial and commercial use. The expanding infrastructure results in a growing density of road and other communication networks. The high proportion of built up areas and the growing intensity of land use creates a strong barrier effect for the living species around the cities.

The small basins with gentle slopes, between the higher forested hills, north from Sopron have similar relief and land use dominance. However a variety of different mosaic units can be found in this character type. Both the Hungarian and Austrian parts have a definite land use zonation according to the relief and the exposition of the slopes. On the bottom along the Rákos stream there are wet grasslands with patches of arboreous vegetation in Hungary and arable land in the higher elevation. In Austria the wet grasslands are missing due to the drainage of the deepest, wet relief levels. West slopes are covered by a mixture of cultivated vineyards and smaller arable parcels in Austria and by set aside fields in Hungary. The top of the hills and the east slopes are forested.

Generally true, that the Hungarian part is less intensively used and despite the larger grain size landscape pattern is less regular. In the proximity of the border in the area of the former iron curtain there is a sleeping landscape without settlements where large agricultural surfaces e.g. vineyards are abandoned since several decades. On the contrary in Austria and near to Sopron the land use intensity and the heterogeneity is higher along with a smaller grain size of the parcels. Drainage canals provide regular patterns.

Part of the cultural heritage is the archeological sites from iron age. A historical particularity of the area is the memorial place on the border at "Piusz puszta" where the iron curtain was opened in 1999.

While the eastern valleys have a clear rural character on both side of the border, the main infrastructural axe between Sopron-Wien and Sopron Eisenstadt intersect the western part of the area attracting more new commercial and industrial establishments. Thus landscape function is rather diverse. It is also an important hunting area and beyond agricultural and horticultural production some industrial and commercial function is occurring. Nature conservation has less significance, but some recent tendencies can bring it more into front in Austria by the extensification due to the agri-environmental schemes. On the contrary the future development can lead toward

intensification in Hungary in the former Iron curtain zone and close to the town Sopron where a speed up of land use change is most probable.

Figure 47 a-e: Typical views of the mosaic units of the historic town and periurban areas. Photo: Éva Konkoly-Gyuró

3e Foothills and basins with low or medium intensity human use, mainly arable and grassland dominance (Figure 48, Figure 49)

The small basins with gentle slopes, between the higher forested hills, north from Sopron have similar relief and land use dominance. However a variety of different mosaic units can be found in this character type. Both the Hungarian and Austrian parts have a definite land use zonation according to the relief and the exposition of the slopes. On the bottom along the Rákos stream there are wet grasslands with patches of arboreous vegetation in Hungary **and arable land in the higher elevation. In Austria the wet grasslands are missing due to** the drainage of the deepest, wet relief levels. West slopes are covered by a mixture of cultivated vineyards and smaller arable parcels in Austria and by set aside fields in Hungary. The top of the hills and the east slopes are forested.

Generally true, that the Hungarian part is less intensively used and despite the larger grain size landscape pattern is less regular. In the proximity of the border in the area of the former iron curtain

there is a sleeping landscape without settlements where large agricultural surfaces e.g. vineyards are abandoned since several decades. On the contrary in Austria and near to Sopron the land use intensity and the heterogeneity is higher along with a smaller grain size of the parcels. Drainage canals provide regular patterns.

Figure 48 a-e: Typical views of the Sopron basin. Photo: Éva Konkoly-Gyuró

Part of the cultural heritage is the archeological sites from Iron Age. A historical particularity of the area is the memorial place on the border at “Piusz puszta” where the iron curtain was opened in 1999.

While the eastern valleys have a clear rural character on both side of the border, the main infrastructural axe between Sopron-Wien and Sopron Eisenstadt intersect the western part of the area attracting more new commercial and industrial establishments. Thus landscape function is rather diverse. It is also an important hunting area and beyond agricultural and horticultural production some industrial and commercial function is occurring. Nature conservation has less significance, but some recent tendencies can bring it more into front in Austria by the extensification due to the agri-environmental schemes. On the contrary the future development can lead toward intensification in Hungary in the former Iron curtain zone and close to the town Sopron where a speed up of land use change is most probable.

Figure 49 a-d: Sleeping landscape in the Iron curtain zone in the Rákos stream valley and the memorial place at the state frontier where the Iron curtain was opened in 1989. Photo: Éva Konkoly-Gyuró

2.5. Potential landscape functions

2.5.1. Constructed vegetation types

Vegetation types

In principle, we took existing vegetation maps of the region for gathering information on potential vegetation communities of the area in question. Niklfeld (1970/1989) described eight types of Natural Vegetation, where he explicitly stresses the point not to provide PNV (Figure 50). Bohn et al. (2000/2003) aimed at ”presenting natural site potential in the form of the current natural vegetation, which corresponds to the actual climatic conditions, soil properties (nutrient and water budget as well as soil depth) and the native flora in the various landscapes” (Figure 51). Both maps work on a rather large scale: 1:2.000,000 and 1: 2.500,000 respectively. Thus, the spatial resolution is rather poor and not applicable for our objectives, we want to provide a better resolution on a smaller scale. Still, both maps gave us valuable information of the vegetation communities which are most likely to occur in the project region.

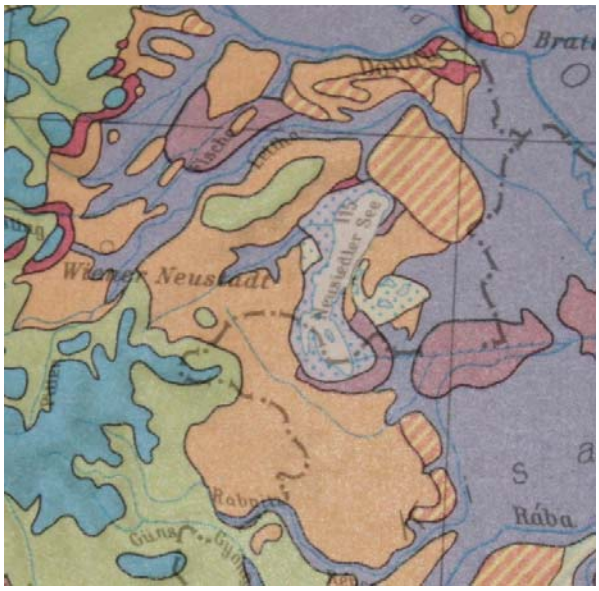


Figure 50: Part of the map of Natural Vegetation of Niklfeld (1970/1989) showing eight different vegetation types listed in Table 23.

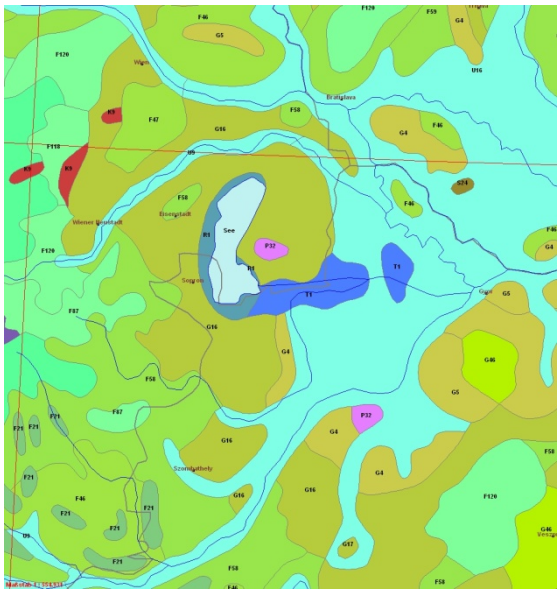


Figure 51: Screenshot of the PNV-map developed by Bohn et al. (2000/2003) visualising seven different vegetation communities listed in Table 23.

Table 23: vegetation types according to Bohn et al. (2000/2003) and Niklfeld (1970/1989) with respective site conditions used for defining the distribution pattern of the types, slightly modified by amending vegetation type beech forest.

	Bohn et al. (2000/2003)	Niklfeld (1970/1989)	site conditions
	water body	water body	
azonal	inland halophytic vegetation	halophytic vegetation	salty and alkaline soils, annual precipitation <450 mm; Solonchak- or Solonetz-soils
azonal	freshwater tall reed swamps	reed bed	(nearly) permanent water cover, water saturated soils, meso- to eutrophic standing water bodies on diverse subhydric to semiterrestric soils
azonal	Alder carrs and swamp forests	fens and alder swamp forests	high standing ground water in silted up water bodies, valleys, depressions; soils: different kinds of peat and gley
azonal	Hardwood alluvial forests in combination with softwood alluvial forests and wet lowland forests	Alluvial forests	coarse grained sediments with sandy-silty cover layer, periodically to episodic flooded
zonal			submontane forests preferring carbonate but also existing on more humid, only slightly carbonate influenced sites
zonal	colline-submontane sessile oak-hornbeam forest	oak-hornbeam forest of central European hills	flat to slightly inclined warm sites mostly on loess, but also on brown chernozem and cambisols, rather distant groundwater

zonal	Italian-Pannonian-central Balkan colline-submontane (to montane) sessile oak-(pedunculate oak-) bitter oak forests	Pannonian bitter oak-sessile oak forests	flat to slightly inclined, preferably S-,W-aspect on lime-free sediments, shallow loamy-sandy cambisols to deep stagnosols
zonal	Pannonian lowland mixed pedunculate oak forests	Submediterranean and Pannonian forests and copsewood with downy oak	dry, shallow soils (often Rendzina), substrate carbonate or lime on strongly inclined S- and W- slopes
		submediterranean influenced loess forest steppe with mixed oak forests	slightly to strongly inclined S- and W- slopes; loess, limestone, marl

Based on Bohn et al. (2000/2003) and Willner & Grabherr (2007), specific site conditions for each vegetation type were extracted (Table 23). In principle, the region is characterised by a strong control of standing and ground water leading to the development of azonal communities. Only where the influence of water is only of minor importance, zonal communities can grow. We modified the list of vegetation types by introducing also the vegetation type of beech forest, as submontane conditions exist in the Sopron Mountains.

Geodata

We translated the site conditions into selection criteria of geodata. We used data on soil (polygon data), geology (polygon data) and a digital elevation model (raster data with a pixel size of 70m) presented in Figure 52 and Figure 53. Climate variation is strongly correlated to topography and thus not directly implemented into the niche descriptions. In GIS, we processed all geodata-layer with "identity" and cleaned the resulting shape. Thus, we were able to provide a consistent attribute list separated for the Austrian and the Hungarian part, since geodata where partly different. Additionally, we included the information on streams and rivers into the map by buffering running waterbodies by 10 meters and included into the "identity" process. Minimum mapping unit was 400m². The different attributes of the geodata were assigned in a hierarchical way (first azonal, then zonal communities) to the individual vegetation types via attribute selection (Table 24) eventually ending up with a map of "Constructed Vegetation Types". Only the vegetation type "alluvial forest" was treated also by a spatial selection of all alluvial soil polygons within the search radius of 250 m of running waterbodies and assigned.

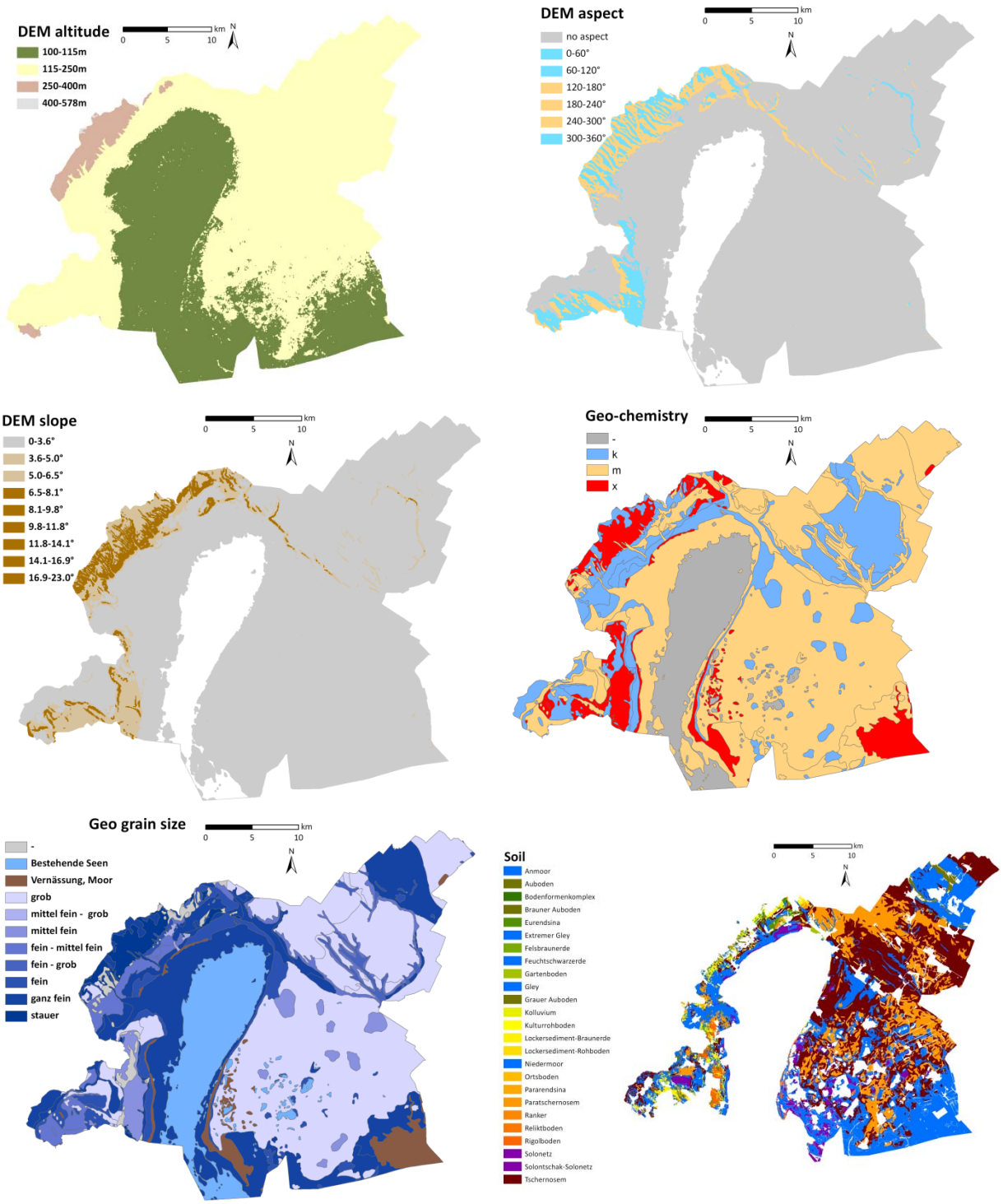


Figure 52: Geodata on DEM (source: SRTM), geology (source: Geologische Bundesanstalt) and soil (source: Bodenkarte von Österreich, Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft) for the Austrian part of the Investigation area.

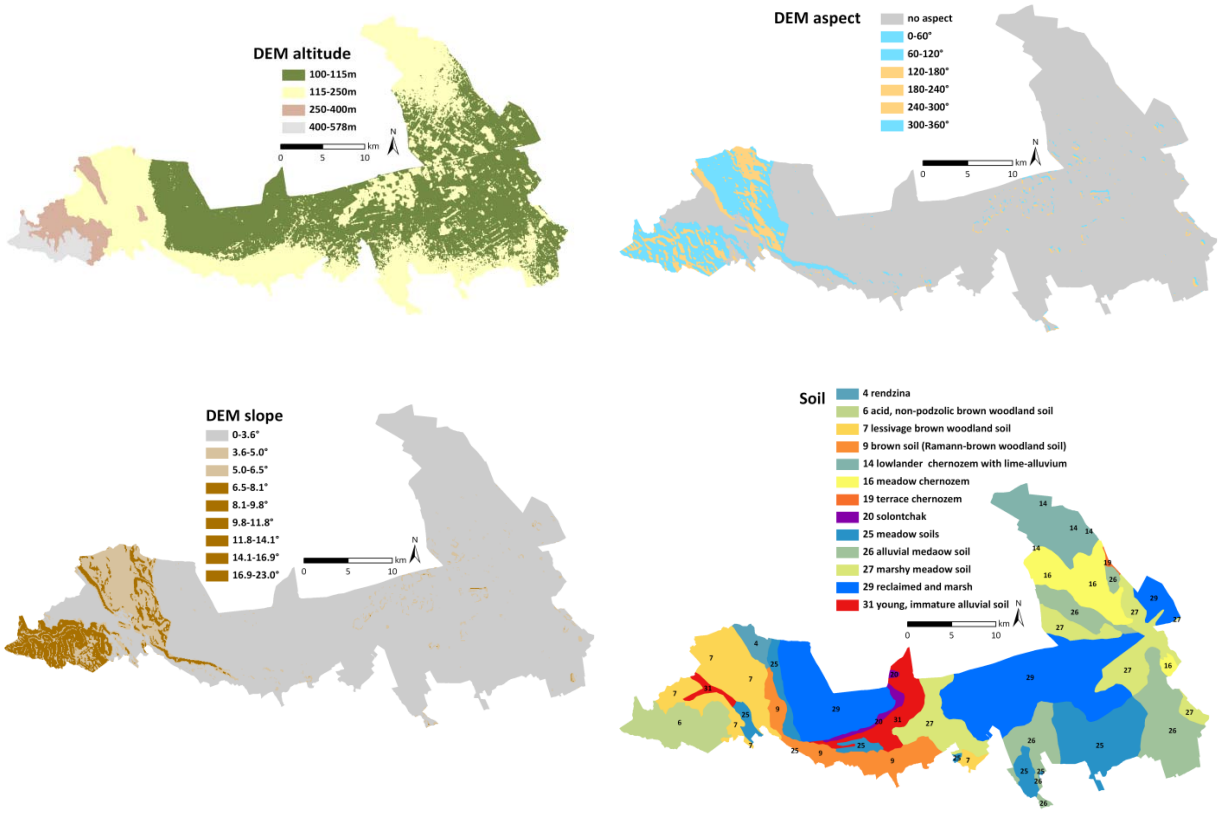


Figure 53: Geodata on DEM (source: SRTM) and soil (source: Agrotopographic Map of Hungary) for the Hungarian part of the Investigation area (source for the Geological map: Geological Institute of Hungary (MÁFI)).

Table 24: Constructed vegetation types and their selection criteria separated for the Austrian and the Hungarian part of the wider investigation area. Sel.hier = selection hierarchy, indicating the sequence of the selection process.

veg.types	select by attributes [AT]	Sel.hier	select by attributes [HU]	Sel.hier
water body / rivers	"Formation" = 'Bestehende Seen' / "vegtype" = 'rivers'	1	"stream250m" > 21 / "stream10m" = 21	1
halophytic vegetation	"vegtype" = ' ' AND ("soil" = 'Solonetz' OR "soil" = 'Solontschak-Solonetz')	2	"soil" = '20'	2
reed bed	"vegtype" = ' ' AND ("height_ran" = 1 AND "Korngroess" = 'ganz fein')	4	"height_ran" = 1 AND "A" = 'Tavi' OR "height_ran" = 1 AND "A" = 'Tavi-mocsári' AND "vegtype" = ' '	3
fens and alder swamp forests	"vegtype" = ' ' AND ("Formation" = 'Vernässung, Moor' OR "soil" = 'Anmoor' OR "soil" = 'Extremer Gley' OR "soil" = 'Feuchtschwarzerde' OR "soil" = 'Gley' OR "soil" = 'Niedermoor')	3	"soil" = '29' OR "A" = 'Mocsári' AND "vegtype" = ' '	5

Alluvial forests	1. select by location: target layer "union_all" source layer: "aut_widia_buffer_gew" apply search distance 250m; 2. select from current selection: "vegtype" = ' ' AND ("soil" = 'Auboden' OR "soil" = 'Brauner Auboden' OR "soil" = 'Grauer Auboden')	5	1. select watercourses = 21 2. buffer with 250 m 3. union with vegetation shape 4. select by attributes: "stream250m" = 21 AND "soil" = '26'	4
Beech forests (not in Niklfeld)	vegtype = ' ' AND "height_ran" = 4	6	vegtype = ' ' AND "height_ran" = 4	6
oak-hornbeam forest of central European hills	vegtype = ' ' AND ("height_ran" = 3 OR "height_ran" < 3 AND ("code_aspec" = 1 OR "code_aspec" = 2 OR "code_aspec" = 6))	7	vegtype = ' ' AND ("height_ran" = 3 OR "height_ran" < 3 AND ("code_aspec" = 1 OR "code_aspec" = 2 OR "code_aspec" = 6))	7
Submediterranean and Pannonian forests and copsewood with downy oak	"vegtype" = ' ' AND (height_ran < 3 AND "code_slope" > 2 AND ("code_aspec" = 3 OR "code_aspec" = 4 OR "code_aspec" = 5) AND "chemistry" = 'k')	8	"vegtype" = ' ' AND (height_ran < 3 AND "code_slope" > 2 AND ("code_aspec" = 3 OR "code_aspec" = 4 OR "code_aspec" = 5) AND "chemistry" = 'k')	8
Pannonian bitter oak-sessile oak forests	"vegtype" = ' ' AND (height_ran < 3 AND "code_slope" > 0 AND ("code_aspec" = 3 OR "code_aspec" = 4 OR "code_aspec" = 5) AND ("chemistry" = 'm' OR "chemistry" = 'x'))	9	"vegtype" = ' ' AND (height_ran < 3 AND "code_slope" > 0 AND ("code_aspec" = 3 OR "code_aspec" = 4 OR "code_aspec" = 5) AND ("chemistry" = 'm' OR "chemistry" = 'x'))	9
submediterranean influenced loess forest steppe with mixed oak forests	area left over: DEM < 250 m; Aspect S-W (gridcode: 0, 3, 4, 5), slope < 3	10	area left over: DEM < 250 m; Aspect S-W (gridcode: 0, 3, 4, 5), slope < 3	10

2.5.2. Capacity matrix

The vegetation types were linked by expert knowledge about the different types´ capacities to provide various landscape functions. Therefore, a capacity matrix was created (Table 25). Whereas on the x-axis selected landscape functions are placed, on the y-axis the 12 land cover and vegetation types are placed marking the capacity for providing the function at the intersections. The so-called vegetation type value (VET) ranges from 0 to 5. The higher the value, the higher the general relationship between biotope type and function:

Table 25: Capacity matrix of different vegetation types for providing individual landscape functions. 0 = no relevant link between vegetation type and specific function, 1 = low relevant link, 2 = relevant link, 3 = medium relevant link, 4 = high relevant link, 5 = very high relevant link (adapted from Burkhard et al., 2009).

vegtype	*Climate_regulation*	*Disturbance_prevention*	*Water_regulation*	*Water_supply*	*Soil_retention*	*Soil_formation*	*Nutrient_regulation*	*Pollination*	*Refugium_function*	*Nursery_Function*	*Food*	*Raw_materials*	*Genetic_resources*	*Medicinal_resources*
alluvial	5	5	5	4	5	5	5	3	5	4	2	4	2	3
anthropogen	2	2	1	0	1	0	1	1	1	0	0	0	0	0
beech	5	5	5	3	5	5	5	2	5	5	3	5	2	3
bitter+sessile oak	5	5	5	3	5	5	5	2	5	5	3	4	2	3
downy oak	3	3	4	2	4	4	5	2	4	3	3	3	2	3
fens	3	4	5	4	3	5	5	2	5	3	1	3	0	2
forest steppe	1	2	3	1	3	3	4	2	4	2	3	2	2	3
halophytic	0	2	3	0	3	3	3	2	5	2	1	0	0	0
oak-hornbeam	5	4	5	3	5	5	5	2	5	5	3	5	2	3
reedbed	5	5	5	1	2	2	5	1	5	5	5	4	1	1
rivers	4	4	4	5	0	0	4	1	4	4	3	0	0	0
waterbodies	5	4	5	1	0	0	4	1	4	3	4	0	1	0

2.5.3. Area-weighting

For receiving the final potential landscape functions values, we calculated the area-weighted mean of the VET-values within each landform. Finally, we took the mean value of the sub-functions within each main function in order to plot the main potential functions “Provision”, “Regulation” and “Habitat” onto a 3-axes spider web diagram.

2.6. Concept of actual services assessment

The methodological framework is based on the availability of data for the location of the selected landscape functions. Driven by the link between landscape functions and mappable landscape features two different levels of functional assessment considering location and spatial scale are distinguished (Figure 54):

1. **Habitat and regional approach**

Landscape functions are directly assessed at the landscape element scale. Each function can be related to a specific habitat (biotope type) within the landscape.

2. **Landscape character approach**

For those functions (services) that occur at a broader scale than the landscape element level, additional indicators have to be defined.

These two levels of landscape functions assessment form the basis of our different function mapping approaches. Within this framework, only the actual landscape functions are assessed.

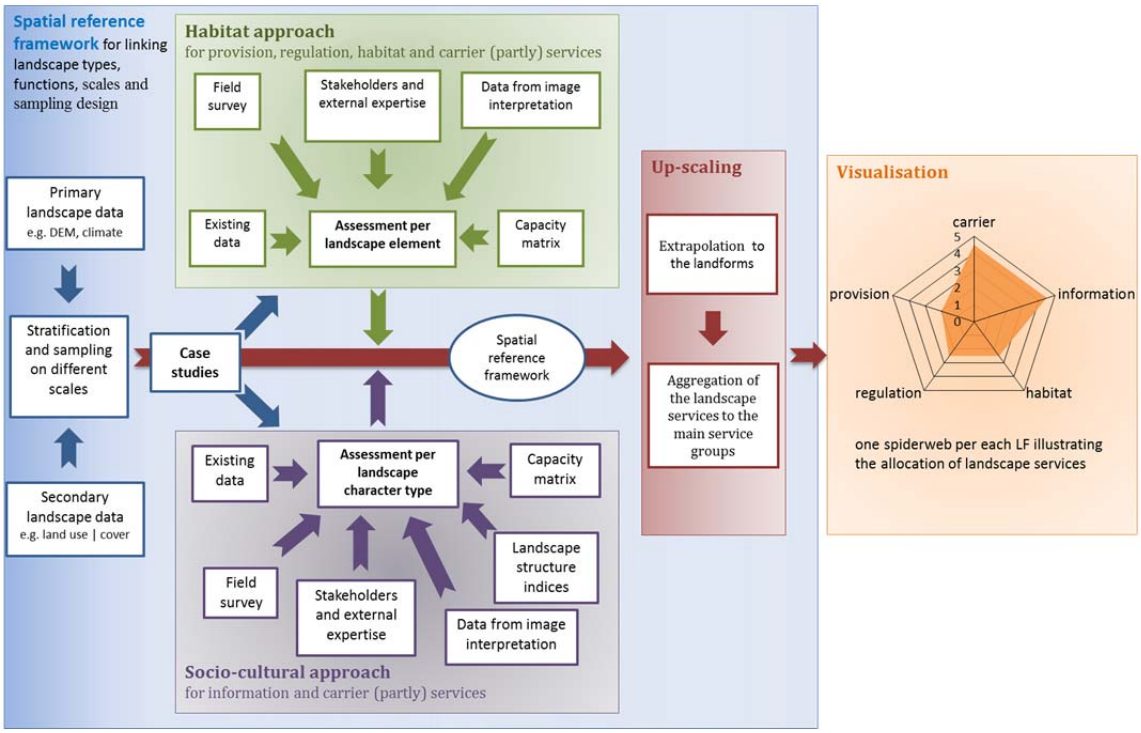


Figure 54: methodological approach for the assessment of landscape services

2.6.1. Habitat and regional approach: provision, habitat, regulation, carrier (partly)

The habitat approach (Haines-Young & Potschin, 2008; Burkhard et al., 2009) is based on the use of a matrix of habitats and their related functions. As data availability for specific function indicators (e.g. yield kg per hectare and year for production function or biodiversity index value for an ecological function) is limited or often not comparable or transferable to various areas and scales, the habitat approach provides a good opportunity to map landscape services. A clear advantage of using habitats as a framework to represent the output of landscape services is that distinct ecological units could be considered as “bundles” of services that they deliver. It is generally known that most ecosystems are multifunctional, as structures and processes within them are capable of generating a wide range of different services (de Groot, 2006). In our project we provide a new advanced assessment strategy for landscape service provision at the landscape scale. It offers great potential to combine expert judgements with semi-quantitative data derived from field data. As spatial reference unit we applied biotope types (land use/cover classes LUC).

2.6.1.1. Sampling and identification of representative validation areas

For a statistical correct analysis of data (calculation and comparison), a minimum amount of samples is necessary. Sampling can be either done by a pure random selection or by defining strata which give the basic set of elements which are equally likely to be chosen. At least three samples per category (i.e. stratum) should be selected for minimizing variations within a single dataset. So, the first step is the definition of the basic set and the strata which are defining them.

At first, the whole investigation area is overlaid by a regular raster dividing the surface into squares. We used the official European Grid system (Inspire, 2009), based upon the ETRS89 Lambert Azimuthal Equal Area coordinate reference system and has its centre of the projection at the point 52º N, 10º E and false northing: Y0 = 3.210,000 m, false easting: X0 = 4.321,000 m. In the present study, we used a basic grid-size of 1x1 km with a refinement to 500x500 m (Figure 55).

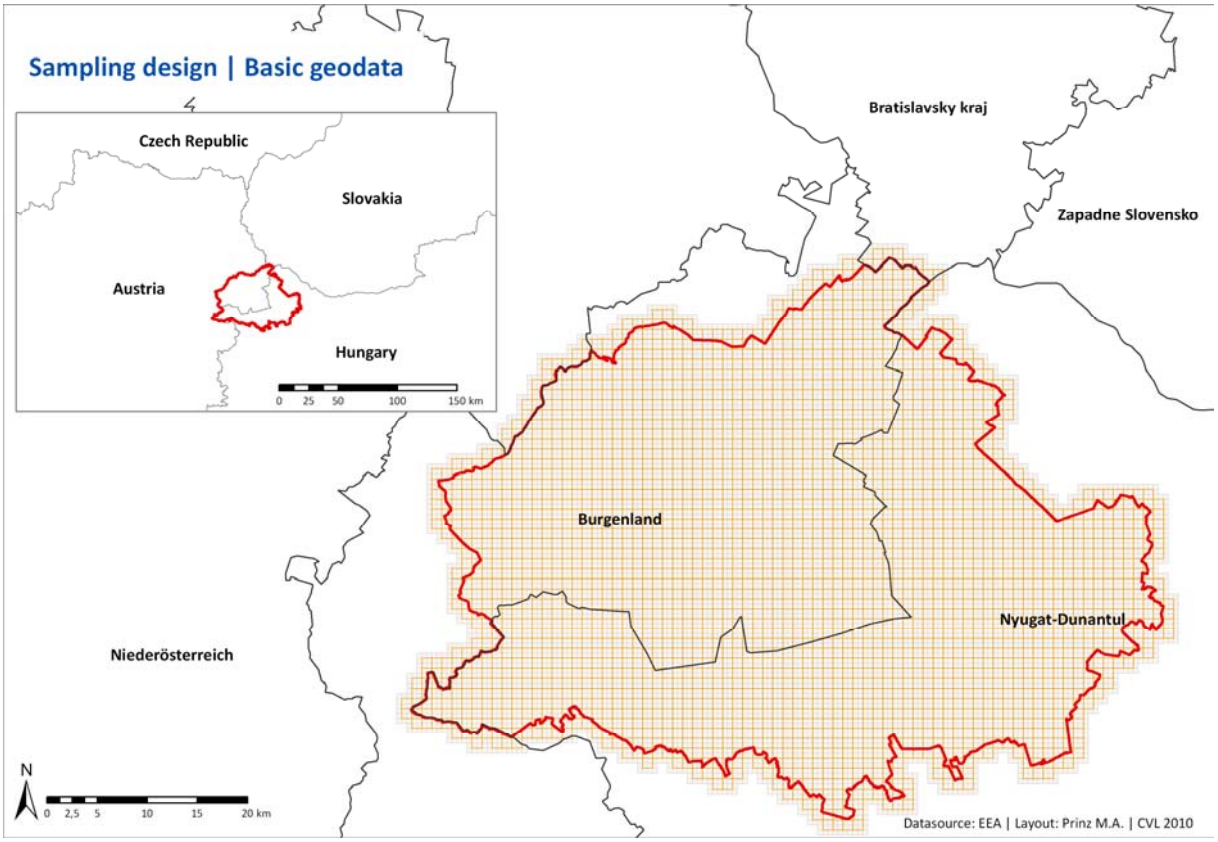


Figure 55: Basic set of raster cells (1x1 km) in the BIOSERV project region which serves as basis for the selection of sample sites.

In the next step, we overlaid the raster with the geodata information in order to refine the strata:

Highest level of the Landscape character types (Konkoly-Gyuró et al., 2010)

Location of Neusiedler See and not accessible areas such as the reed belt

Extent and location of shallow lakes

Location of artificial surfaces

Location of protected areas

In the subsequent stage, a rule-set for the selection of grid-cells was built defining how the attributes of these geodata contribute to the designation of the individual grid-cells to the basic set of the stratification categories:

→ Selection because of attributes

Selection of grid-cells overlapping more than 99 % within the core area

Selection of grid-cells overlapping not more than 1 % with not accessible areas (Neusiedler See, large reed belts, steep areas)

Selection of grid-cells dedicated to one single landscape character type with more than 99 % of the cell-area

Selection of grid-cells with less than 30 % covered with shallow lakes

Selection of grid-cells with less than 10 % artificial surface (Basedata: Corine Landcover 2006)

Selection of grid-cells dedicated to a protected/not protected area with more than 75 % of the cell-area

→ Selection because of spatial position (taking the surrounding 500x500 m squares into account):

Selection of grid-cells distant more than 500 m within the core-area-border

Selection of grid-cells distant more than 400 m within a landscape character-type-border

→ Random selection of remaining grid-cells

Selection of four grid-cells for each combination of LCT and protected/not protected area

Final selection of three grid-cells depending on optimal land cover/use, available secondary data (e.g concerning agriculture) and/or accessibility

With each selection rule, the number of potentially selectable gridcells decreased, in the beginning with >2000 potential sample sites and leaving only 857 remaining grid cells as basic set for the random sampling per stratum.

The selection of four grid-cells for each combination of LCT and protected/not protected area including the surrounding eight 500 x 500 m grid cells resulted in 54 sample sites (of 56 possible - for LCT "8" and protection status "unprotected" only 2 grid cells are possible; LCT "6" is not in the wider investigation area – therefore 6*4*2+1*4+1*2 = 54) 1km² cells (Table 26). 34 sample sites are located in Austria, 20 in Hungary (Figure 56).

Three out of the four sample sites per category were finally chosen for further analysis and field work. The remaining sample sites act as a reserve if any circumstances may hinder the investigation of the selected sites. Therefore, 13 grid cells will not be used for further analysis.

Table 26: Randomly selected grid cells which resulted from the application of the rule set on all possible 1km² sites of the wider investigation area.

ID	cellNr	P/U	LCT	ID	cellNr	P/U	LCT
1	725	1	1	28	258	1	8
2	972	1	1	29	1009	2	1
3	806	1	1	30	927	2	1
4	895	1	1	31	1008	2	1
5	2151	1	2	32	970	2	1
6	1070	1	2	33	1354	2	2
7	1465	1	2	34	1165	2	2
8	1416	1	2	35	2280	2	2
9	1644	1	3	36	1457	2	2
10	1496	1	3	37	1735	2	3
11	1685	1	3	38	2104	2	3
12	1686	1	3	39	1543	2	3
13	1884	1	4	40	1551	2	3
14	1992	1	4	41	1888	2	4
15	770	1	4	42	1425	2	4
16	1670	1	4	43	980	2	4

17	1388	1	5	44	1682	2	4
18	1199	1	5	45	1437	2	5
19	1200	1	5	46	1384	2	5
20	1246	1	5	47	1485	2	5
21	295	1	7	48	1034	2	5
22	270	1	7	49	124	2	7
23	119	1	7	50	206	2	7
24	263	1	7	51	171	2	7
25	16	1	8	52	201	2	7
26	86	1	8	53	194	2	8
27	29	1	8	54	26	2	8

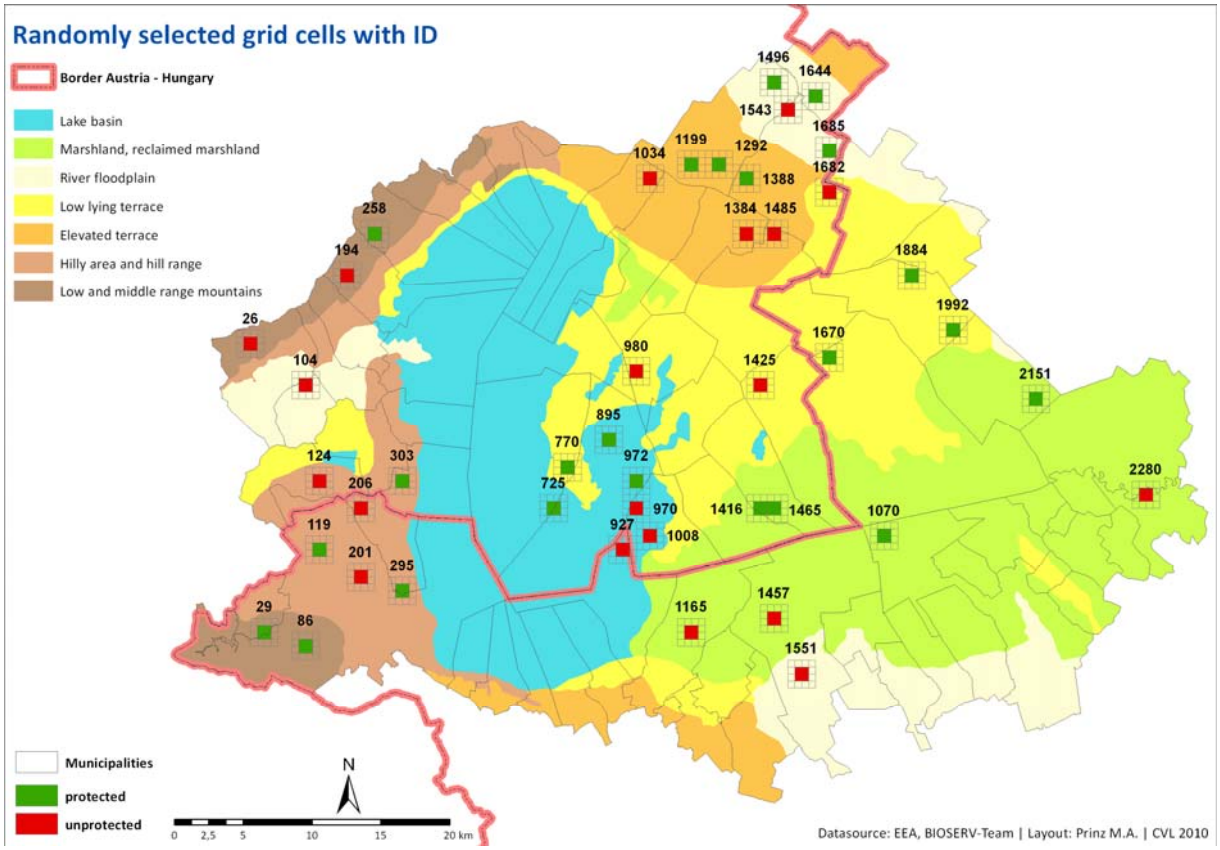


Figure 56: Selected grid cells for further investigation

2.6.1.2. Service assessment

During field survey each landscape element was assigned with a biotope type. Then the biotope types were linked by expert knowledge about the different biotope types´ capacities to provide various landscape functions. Therefore, a capacity matrix was created. The so called "biotope type function value" was extended in a second step by "qualifier" that came from field work. The resulting "landscape element function values" were extrapolated to the different landforms, where the individual landscape function values were aggregated to the "main service groups", the so called

"service group values" (Figure 57). Below, the individual steps are described in detail (Table 27-Table 31).

In a first step, biotope types were linked by expert knowledge about the different biotope types´ capacities to provide various landscape functions. Therefore, a capacity matrix was created (see Table 27 as an excerpt). Whereas on the x-axis selected landscape sub-functions as described in Table 1 (excluding the information functions) are placed, on the y-axis the 181 LUCs are placed. At the intersections, different biotope types´ capacities to provide landscape sub functions were assigned. The so-called biotope(type)function value (BIF) ranges from 0 to 5. The higher the value, the higher the general relationship between biotope type and function:

0 = no relevant link between LUC and specific function, 1 = low relevant link, 2 = relevant link, 3 = medium relevant link, 4 = high relevant link, 5 = very high relevant link (adapted from Burkhard et al., 2009).

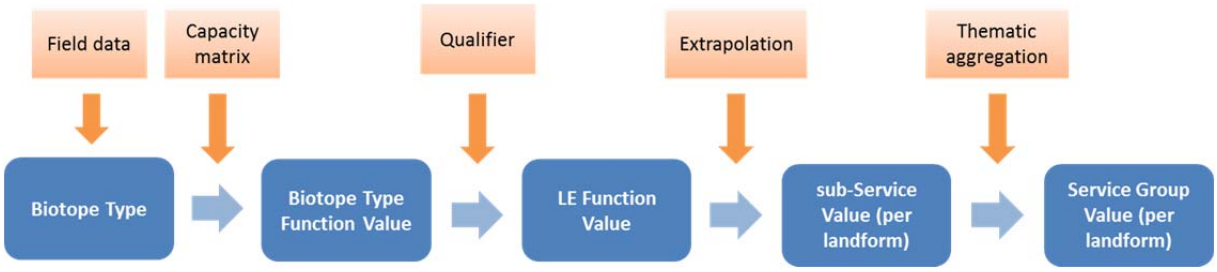


Figure 57: Assessment of the Regulation, Habitat, Provision and Carrier (partly) services applying the habitat approach; LE: Landscape element

Table 27: Excerpt of the capacity matrix for the assessment of the different links between the biotope types and the related functions. The individual functions were assessed on a scale consisting of: 0 = no relevant link between LUC and specific function, 1 = low relevant link, 2 = relevant link, 3 = medium relevant link, 4 = high relevant link, 5 = very high relevant link.

	Climate regulation	Disturbance prevention	Pollination	Refugium function	Soil formation
Grain fields extensive	0	1	2	2	3
Forage crops	0	2	3	1	3
Root crop extensive	0	1	2	1	3
Root crop intensive	0	0	1	1	2
Mixed green forests	5	5	2	5	5
Wet woodlands	5	5	2	5	5
Old fallow land with tall herbs	0	3	2	2	4
Village paved	4	1	0	0	0

The BIF values derive from first expert evaluations and are extended in a second step by semi-quantitative data gained from field work. Including habitat heterogeneities into the assessment methodology allows us to draw local as well as regional specific conclusions.

During field mapping specific qualifiers concerning biotope structure, management, pressure and valuable attributes were assigned to each landscape element (biotope) within the investigation area.

Each of these qualifiers has either a positive (1) or a negative (-1) or no influence (0) on the provision of a function (Table 28).

Table 28: example of the qualifier matrix; the relationship between qualifiers and sub-functions; (-)1 = negative influence, 0 =no influence, 1 = positive influence.

Qualifier	Climate regulation	Disturbance prevention	Pollination	Refugium function	Soil formation
Destruction of LE (all types)	-1	-1	-1	-1	-1
Construction work (all types)	-1	-1	0	-1	0
Path- and road construction	-1	-1	0	-1	0
Fragmentation	-1	-1	0	-1	0
Debris and dump deposition	0	0	0	-1	0
Sand / gravel banks	0	1	0	1	0
Organic deposits (hay, brushwood)	0	0	0	0	1
Dwarf shrubs	0	0	1	0	0
Submerse vegetation	0	0	0	1	0
Floating leaf vegetation	0	0	0	1	0
Structural diversity	0	0	0	1	0
Old growth stand worth preserving	0	0	0	1	0
Traditional land use type worth preserving	0	0	0	1	0
Natural relief form worth preserving	0	1	0	0	0

Table 29: Schematic BIF table; relationship between LEL (Landscape element, biotope) within the investigation area and sub-functions.

BIF

	sub function 1	sub function 2	sub function 3
LEL 1	4	1	2
LEL 2	0	1	2
LEL 3	1	2	1
LEL 4	1	3	1
LEL 5	3	5	3
LEL x	4	2	3

Table 30: Schematic QUAL table; the qualifiers for one LEL are summed up for each sub-function. Therefore each LEL gets one QUAL value for each sub-function.

QUAL

	sub function 1	sub function 2	sub function 3
LEL 1	-1	0	0
LEL 2	1	0	0
LEL 3	0	1	0
LEL 4	-1	1	1
LEL 5	-1	0	1
LEL x	1	1	-1

Table 31: Calculation table for one sub-function within the investigation area; for each LEL, the BIF and QUAL values are summed up, weighted by area and finally categorised within the range 0-5 resulting in the landscape element function value (LEFV).

(BIF+QUAL)

	BIF	QUAL	BIF+QUAL	(BIF+QUAL) * area	(BIF+QUAL) * area	LEFV -categorized (0-5)
LEL 1	4	-1	3	3*0.01	0.03	3
LEL 2	4	1	5	5* 0.15	0.75	5
LEL 3	1	0	1	1*0.02	0.02	2
LEL 4	1	-1	0	0*0.35	0	0
LEL 5	3	-1	2	2*0.004	0.008	1
LEL x	4	1	5	5*0.01	0.05	4

The BIF value can now be either increased or decreased or remain constant by integrating the mapped qualifiers into the assessment calculations and results in a qualifier-value (QUAL). As the area of a landscape element has also an impact on the provision of a function (e.g. a large forested area has more impact on climate regulation than a small one), additional area-weighting is integrated into the assessment (Table 31), except for Transportation, Habitation, Energy Conversion and Waste disposal functions. Regarding Waste disposal, area-weighting was not appropriate because direct relationships between areal share and functional capacity could not be outlined. In terms of Transportation, Habitation and Energy Conversion functions the nested sampling design in the frame of BIOSERV did not seem to be representative to outline the actual state of these functions in a comprehensive way. To overcome these inconsistencies a regional approach to measure these functions has been carried out.

Regional GIS-based assessment of landscape services
Ad Carrier Service: <u>Transportation</u>

To measure the actual state of Transportation within the project region, absolute run lengths of transportation networks were separately calculated for all 7 Land Form Types (LFTs). Main and side roads, as well as railroad tracks were integrated into the assessment. Due to traffic densities, the lengths of the main roads were double-weighted. Resulting track lengths were divided by total areas, again separately for each LFT, resulting in areal density values of the transportation network. It was assumed that at present state the potential of transportation facilities is not fully exploited in any of the seven LFTs. In order to fit the outcomes of the transportation service assessment to the generally applied categorization system for ecosystem service evaluation, equally distributed percentile-values were deduced for this designated function using SPSS 16. Following the aforementioned considerations re-categorized values finally ranged from [0;4].

Ad Carrier Service: <u>Habitation</u>

To comprehensively include settlement areas and other man-made facilities such as Industrial and Commercial sites, Sport and leisure facilities into the assessment CLC 2006 was taken as source layer.

Areal proportions of the predefined classes were again separately calculated for all LFTs by multiplying class areal shares with class specific BIF-values, which served as weighting factors. The outcoming interim results were consequently divided by the total areal values of each LFT to finally reach comparable results for the integration into the overall ecosystem service evaluation.

Ad Carrier Service: <u>Energy Conversion</u>

As previously described in section xy the Energy Conversion function considers facilities for the conversion of wind energy into electricity. Again, to obtain a most meaningful result for the entire

investigation area in the frame of BIOSERV, a regional assessment to measure the actual state of wind energy conversion was conducted. On the basis of a map sheet (Regionales Rahmenkonzept für Windenergieanlagen), provided by the "GIS Koordinationsstelle, Raumordnung Burgenland" all actual locations of wind power stations within the BIOSERV investigation area were detected. Unfortunately this base layer was only available for Austria. On the Hungarian side of the study region wind power stations were mapped after visual interpretation of the latest aerial imagery available. All wind power stations on the Austrian as well as on the Hungarian side were concentrated in LFT 5 only. In analogy to previously outlined steps for the assessment of Habitation and Transportation functions the areal proportion of wind park stations was calculated for LFT 5. In order to deduce landscape´s potential for the establishment of wind parks and to measure its relationship to the present situation all suitable zones for designated wind parks were identified as well, again relating to the map sheet above mentioned above. The proportion of already built wind parks and suitable sites outlined in the spatial planning concept was also calculated afterwards and resulting values were re-categorized under the assumption that all recent and suitable sites together are representing landscape´s potential regarding the Energy conversion function.

2.6.2. Socio-cultural approach: information services and touristic services (Report IV)

2.6.2.1. Socio-cultural approach: information services

Functions and services: aesthetical information, cultural and artistic information, spiritual and historic information, science and education, recreation.

The landscape perspective is important for those functions and services, where single biotope types and/or landscape elements do not have an indicator value as such, but their extent, magnitude or sum within the whole landscape provides the indicator value. This is generally the case for the information service, where only the picture as a whole is of a certain value to society and allows for differentiation among the individual landscapes. An example for this is touristic infrastructure: the bicycle paths have a touristic value but the indicator for the service can be expressed only as the length of bicycle path in kilometres per landscape type.

The information services are analysed by landscape character types defined in the first year of the BIOSERV project (chapter 2.4.2). Finally, results were transformed into landform types for comparison and common analysis.

A special focus is given also to the two functions "Recreation" and "Tourism facilities" in order to account for the high touristic relevance in the region Fertő-Neusiedler See. The use of the detailed knowledge on tourism derived from former projects and within BIOSERV enables us to analyse these two functions in depth with a good fundamental knowledge.

Because of the fact that the assessment works on a different spatial unit and scale, the general workflow needs an independent adaptation and works in a different way than the habitat perspective. In principle, the workflow consists of six consecutive steps:

i. Indicator development

Indicators have been developed for each component of the information service (aesthetical information, cultural and artistic information, spiritual and historic information, science and education, recreation). Selection has been made according to available data in Austria and Hungary.

There are three main types of indicators: indicators of the spatial landscape elements (polygons) e.g. land cover types and indicators of the linear (lines) e.g. edge density, and punctual (points) landscape elements, e.g. density of cultural elements.

The most important data for indicator development were the following: topographic and tourist maps, data base on landscape values, satellite images from the study area. Available data have been digitalized in ArcGIS 9.3.

ii. Service Weight (SW)

SW values for landscape elements show the significance of the indicators -related to spatial (SWs), linear (SWl) or punctual elements (SWp) - in each subservice. SW values were defined by expert judgement for each land cover class and linear or punctual landscape element occurring in the sample area. Values range from 0 to 5. The value 0 means no relevance, the value 5 means high significance.

iii. Indicator values (IV)

Indicator values were calculated per each landscape character type and for each subservice. IV for spatial elements were calculated as the area and proportion of certain land cover classes in the landscape character type (%). Indicator values for linear and point elements show the presence and the density of landscape elements (km/km^2, piece/km^2). The density of visually relevant edges has been calculated for forests (any forest edge), waters (any water edge) and vineyards (any vineyard edge) in each landscape character type (km/km^2).

iv. Indicator service values (ISV)

ISVLCT1,2…=SVsubservice1,2… *IV1,2…

e.g. In case of two indicators (IV1 and 2) in one landscape character type the calculation is the following:

ISVLCT1_sub1=SVsubservice1*IV1

ISVLCT1_sub1=SVsubservice1*IV2

ISVLCT1_sub2=SVsubservice2*IV1

ISVLCT1_sub2=SVsubservice2*IV2

…..continue until subservice x

ISV-s were calculated in case of all indicators for all subservices in each landscape character type.

v. Normalized Indicator Service Value (NISV)

ISV values are highly diverse in measures and units. In order to get comparable data a normalisation is needed. Normalised values range from 0-5.

Normalized Indicator Service Values show the relevance of the indicators for the given landscape services per landscape character types. After having defined the classes for each series from 0-5 thus creating the normalised values, the sum and the mean of the NISV per landscape character types were calculated.

Sum and the mean of the NISV-s have been calculated separately for the three kinds of indicators, thus the result will not depend on the number of indicators associated to spatial, linear or point type landscape elements:

NISVS_subservice 1-x = ΣNISVS

NISVL_ subservice 1-x = ΣNISVL

NISVP_ subservice 1_x = ΣNISVP

vi. Landscape service value (LSV)

Landscape service values have been defined for each landscape character types. LSV are derived from the addition of the mean NISV of the three indicator types (spatial, linear, points) for each subservices (Figure 58).

LSV LCT1,2... = ΣmeanNISVs_subservices1-x + ΣmeanNISVl subservices1-x + ΣmeanNISVP subservices1-x

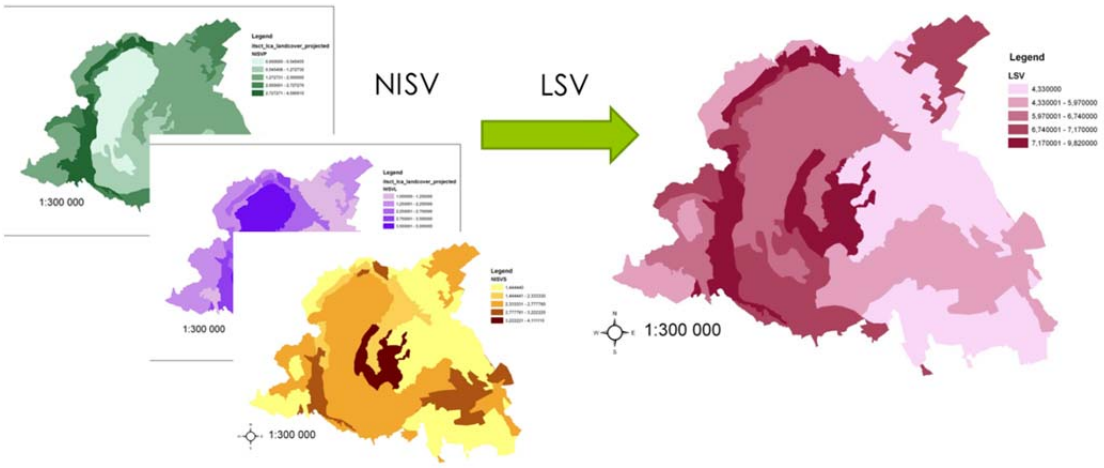


Figure 58: Relation of NISV and LSV

vii. Normalisation and transforming results into landform types

Landscape service values have been normalised (values [0;5]) in order to show the importance of information services and its relation to other services. After, we integrated all different LCT related values for information function into one series of spiderweb. The idea behind is not to lose any relevant information of the single LCTs but to integrate all values into LFT assessment. To achieve this, we took the area-weighted means of the values for carrier and information functions.

Differences between landscape character types and landforms

Due to the fact that the socio-cultural approach works with different indicators with a different spatial scale, these results could be integrated within the spatial reference framework with clear links between the scales (Figure 59).

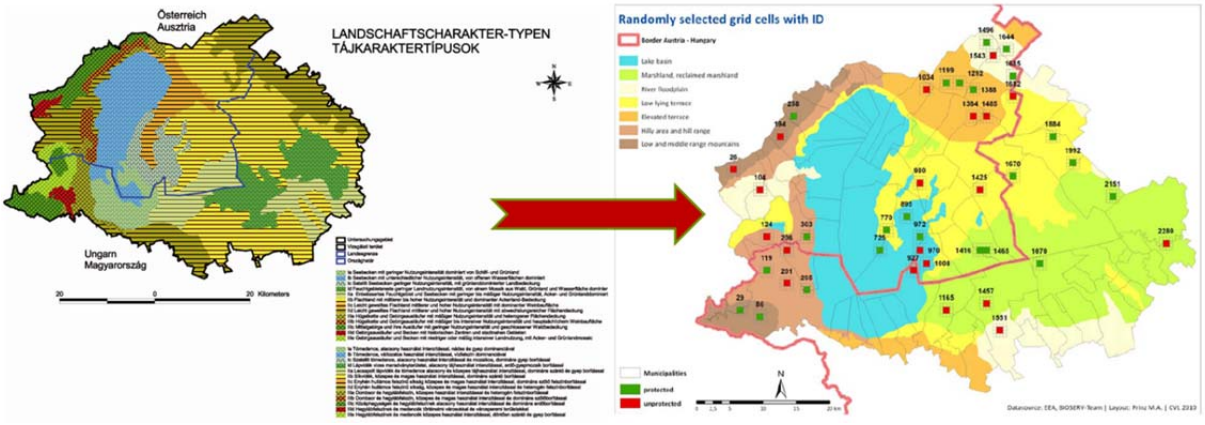


Figure 59: Relation of Landscape character types and landform types

1. Indicators and their significance

Three main types of indicators have been developed for each component of the information service (S1: aesthetical information, S2: cultural and artistic information, S3: spiritual and historic information, S4: science and education, S5: recreation). Table 32 shows the list of developed indicators and the significance of the indicators defined by Service Weight values ([0;5]).

Table 32: Selected indicators, service weights and data sources related to spatial (SWs), linear (SWl) or punctual elements (SWp) - in each subservice.

Indicator groups		Indicators	S1	S2	S3	S4	S5	Data source
Point eements	Density of sacral buildings	churches	5	5	5	3	4	topographic (1) and tourist maps (2), landscape values data base (3)
		chapels	4	4	4	2	3	
		crucifixes	3	4	4	1	1	
		statues (sacral+non-sacral)	3	4	4	2	1	
		cemeteries	4	4	5	1	1	topographic map
	Density of non-sacral buildings	castles	5	5	5	4	5	tourist map
		vinehouse, cave, Heuriger	4	4	3	3	5	tourist map, expert knowledge
		look-out towers	5	2	2	4	5	tourist map
		archaelogical sites	3	5	5	5	3	landscape values data base
		museums	3	5	5	5	4	tourist map
		study trails	4	2	2	5	4	tourist map
		research (visitor) centers	3	2	2	5	4	expert knowledge
Linear elements	Visually relevant edges	any forest edge	5	4	1	2	5	satellite image (4)
		any water edge	5	4	1	2	5	
		any vineyard (permanent crops) e	5	4	2	1	5	
Spatial elements	Land cover							
		Water bodies	5	3	4	5	5	
		Wetlands	4	3	5	5	2	
		Forests	5	4	3	5	4	
		Natural grasslands	4	3	5	5	4	
		Arable land	2	2	2	2	1	satellite image
		Permanent crops	3	2	2	2	3	
		Pastures	4	3	3	3	3	
		Heterogenous agricultural..	4	4	3	3	3	
		Scrubs	2	2	2	2	1	

References:

(1) Fertő, Lajta-hegység, Hanság. Turista-, kerékpáros és szabadidőtérkép. Wanderkarte mit Rad un Freizeitthematik. 1:80 000, Szarvas Kiadó.

(2) Collection of Landscape values TEKA http://tajertektar.hu/hu/kereso. Institute of Geodesy, Cartography and Remote Sensing

(3) Topographic maps 1:100 000 EOV (Uniform National Projection).

Legend

S1	Aesthetic information
S2	Cultural and artistic information
S3	Spiritual and historic information
S4	Science and education
S5	Recreation

Visually relevant edges

The edges were derived by the classification of a RapidEye-satellite image by the process of Object-based Image Analysis (OBIA). This procedure provides a new bridge between theoretical concepts (Wu & Louck,s 1995; Poole, 2002) applied in multi-scaled landscape analysis, remote sensing methods and GIS (Burnett & Blaschke, 2003; Blaschke, 2010). It consists of the following steps (Burnett & Blaschke, 2003; Benz et al., 2004):

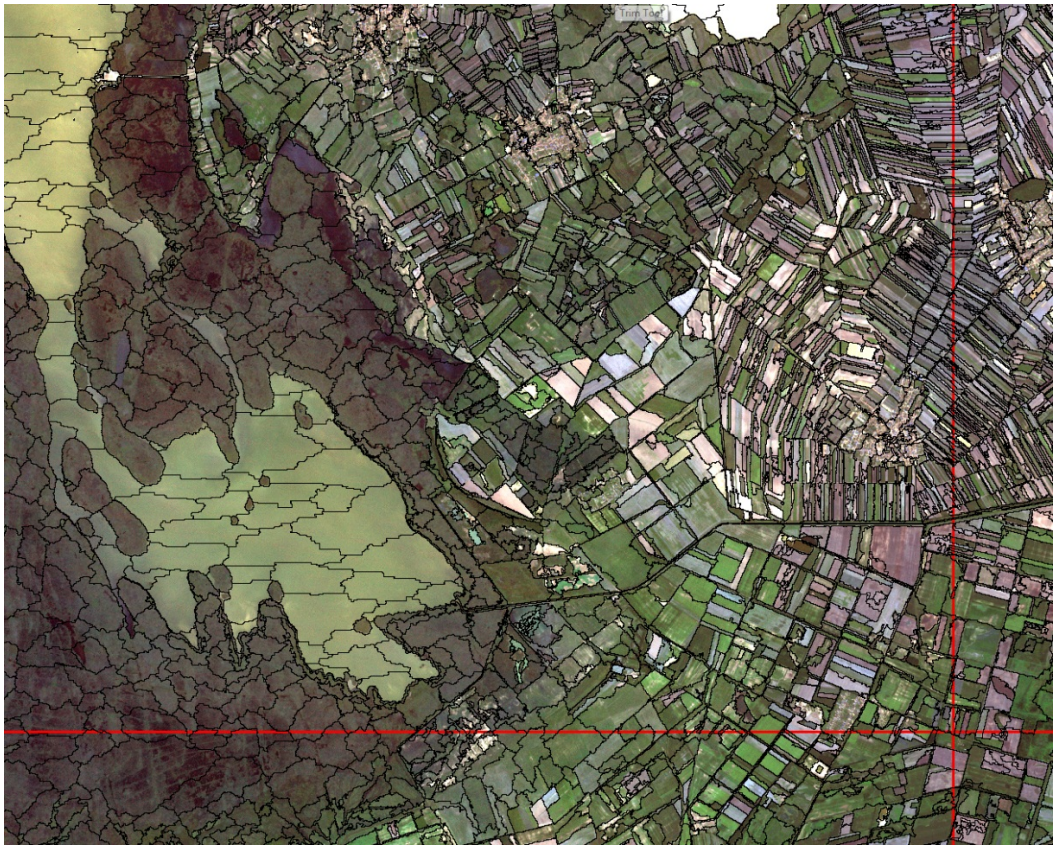
- Multi-resolution segmentation of remote sensing imagery, which enables the delineation of image objects simultaneously on different scales;

- Image objects, linked through a hierarchical object network, where each image object is described by its object features (spectral values, shape and texture), by neighbour and hierarchy-related features;

- Classification of the image objects based upon their feature space. Different supervised classification strategies can be combined within rule-based procedures to create a semantic classification system to represent real world objects.

We applied OBIA using the commercial software eCognition Developer 8 (Definiens AG, 2009a, b) where a two level hierarchy was defined: The lowest level was used to define a fuzzy classification system, which then was used to create a semantic classification at the highest level.

For the segmentation, we used Maximum Likelihood method with 20 classes in order to derive feasible segments of the satellite image (Figure 60). Afterwards, we used the CORINE dataset to rescale the 10 CORINE classes of the first hierarchical level with a fuzzy majority filter to fit the segments of the satellite image (Figure 61). Finally, this could be exported as a shape file and further processed in ArcGIS for the calculation of the Edge density for the visually relevant edges.



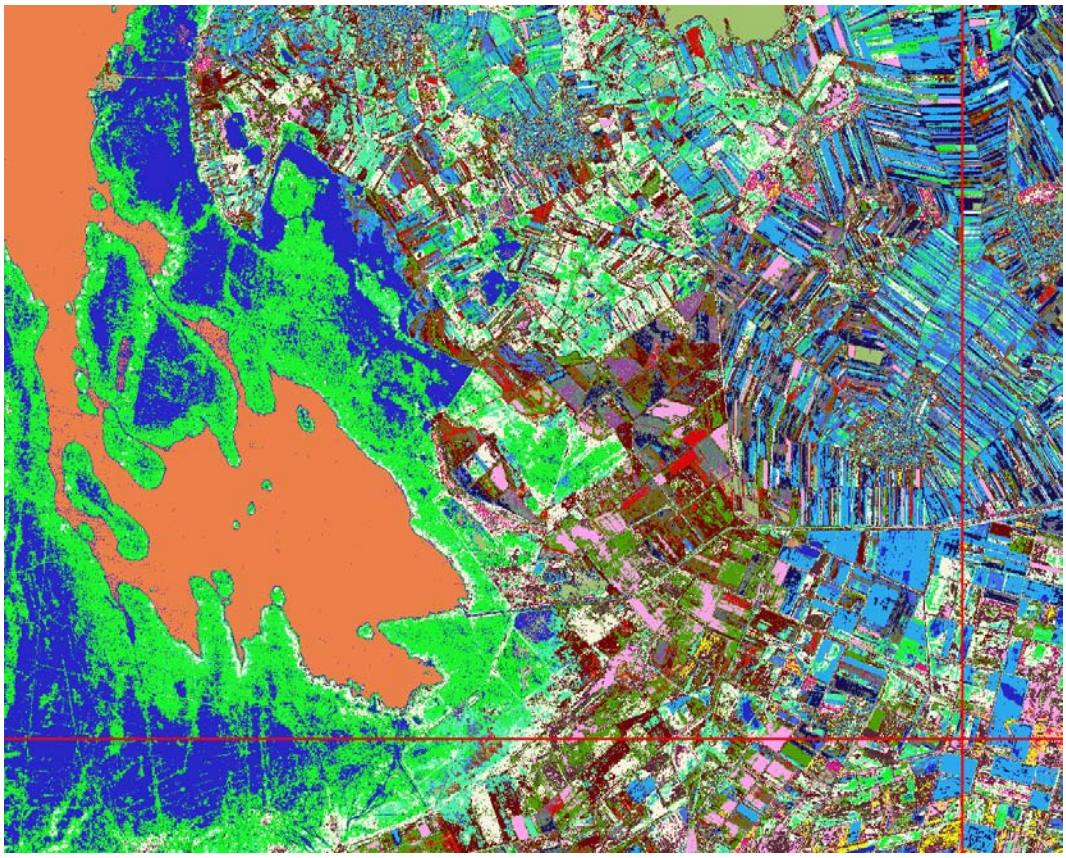


Figure 60: Maximum likelihood classification resulted in segments of the satellite image which were classified into 20 preliminary classes.

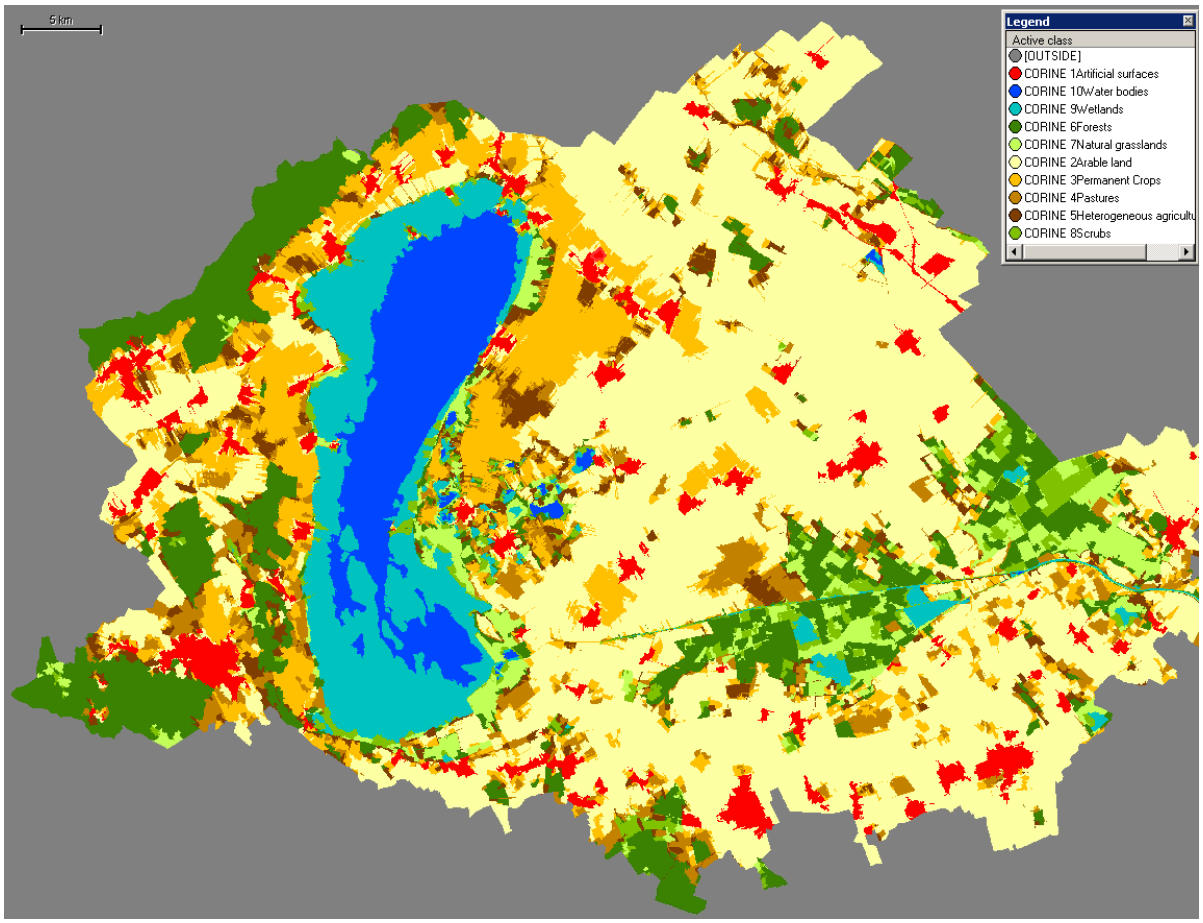


Figure 61: final classified satellite image for the 10 CORINE categories of the first hierarchical level.

2. Normalized Indicator Service Values (NISV)

Normalized Indicator Service Values show the relevance of the three kinds of indicators (NISV (P), NISV (L), NISV (S)) for the given landscape services per landscape character types.

Normalized Indicator Service Values of point elements are the highest in 3a, 3b, 3d landscape character types. In 3a character type the high values due to the high density of – look-out towels, castles, and also the high density of sacral buildings. In the landscape character type 3b, archeological sites and museums also have higher importance. In 3d there is a very high density of sacral elements, in addition the presence of landscape values related to viticulture results in the highest NISV values.

There is a relative low density of point elements in 1a-1d landscape character types, due to the naturalness and the designation of these areas (see Table 33, Figure 62, Figure 63).

Table 33: NISV (P) values in each landscape character types

$NISV_{(P)}$														
		1a	1b	1c	1d	2a	2b	2c	2d	3a	3b	3c	3d	3e
NISV1	churches	1	1	1	0	2	3	4	4	4	4	2	5	3
NISV2	chapels	1	1	2	0	1	2	3	3	4	5	2	5	4
NISV3	crucifixes	1	1	1	0	2	3	4	4	3	5	2	4	2
NISV4	statues (sacral+non-sacral)	0	0	0	0	1	2	0	2	4	2	2	5	2
NISV5	cemeteries	1	1	1	0	1	2	4	4	4	5	1	5	3
NISV6	castles	0	0	0	0	0	3	0	4	5	0	0	0	0
NISV7	vinehouse, cave, Heuriger	0	0	0	0	0	1	3	2	4	4	3	5	0
NISV8	look-out towers	2	1	5	0	2	0	2	2	5	4	3	4	0
NISV9	archaelogical sites	0	0	0	0	0	1	0	2	3	4	4	5	3
NISV10	museums	0	0	0	0	0	1	2	3	2	4	3	5	4
NISV12	research (visitor) centers	3	1	4	0	1	0	0	0	0	0	0	2	0
	sum	9	6	14	0	10	18	22	30	38	37	22	45	21
	mean	**0,818**	**0,545**	**1,273**	**0**	**0,909**	**1,636**	**2**	**2,727**	**3,455**	**3,364**	**2**	**4,091**	**1,909**

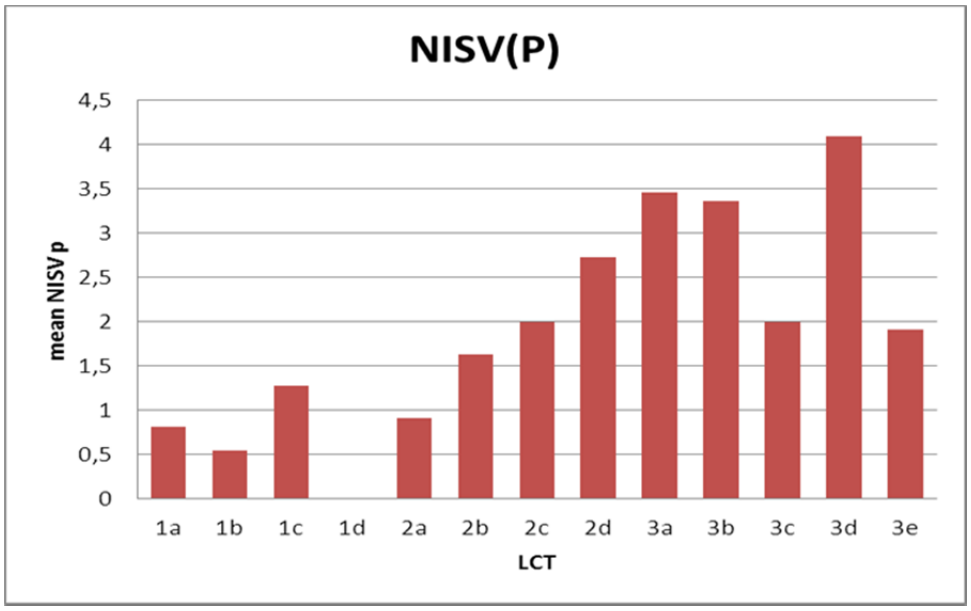


Figure 62: NISV (P) values in each landscape character type

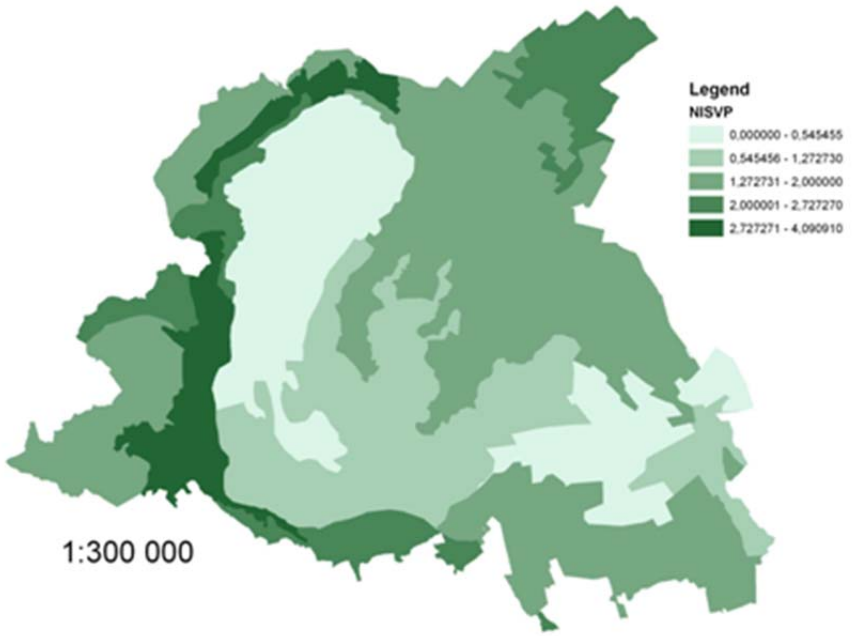


Figure 63: Normalized Indicator Service Values of point elements in the region Fertő-Neusiedler See

Normalized Indicator Service Values of linear elements are derived from visually relevant edges in landscape (aesthetical function) and study trails (science and education function). The highest normalized indicator values are in found in the lake basin (1a, 1b, 1c LCT-s) and in the hill range and foothills of low mountains (3a, 3b LCT-s) (see Table 34, Figure 64, Figure 65)

Table 34: NISV (L) values in each landscape character types

$NISV_{(L)}$		1a	1b	1c	1d	2a	2b	2c	2d	3a	3b	3c	3d	3e
NISV11	study trails	5	0	0	0	0	0	0	0	3	0	4	0	0
NISV22	Any water edge	5	5	5	4	3	2	3	1	2	3	0	0	1
NISV23	Any permanent crop	1	5	4	2	3	2	5	4	4	5	1	3	4
NISV24	Any forest edge	3	5	4	5	2	1	2	3	4	3	4	1	3
	sum	14	15	13	11	8	5	10	8	13	11	9	4	8
	mean	**3,500**	**3,750**	**3,250**	**2,750**	**2,000**	**1,250**	**2,500**	**2,000**	**3,250**	**2,750**	**2,250**	**1,000**	**2,000**

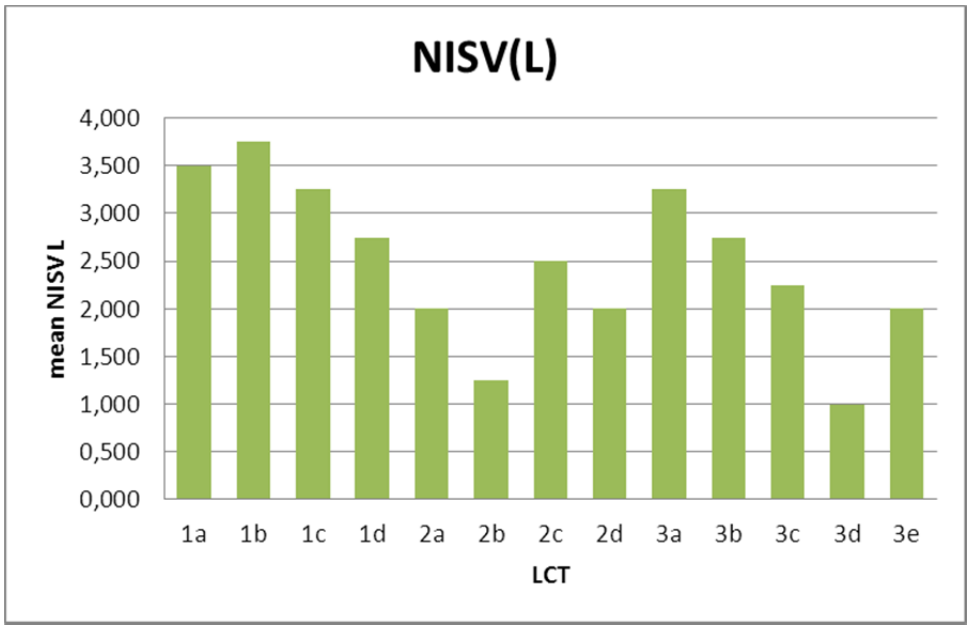


Figure 64: NISV (L) values in each landscape character type

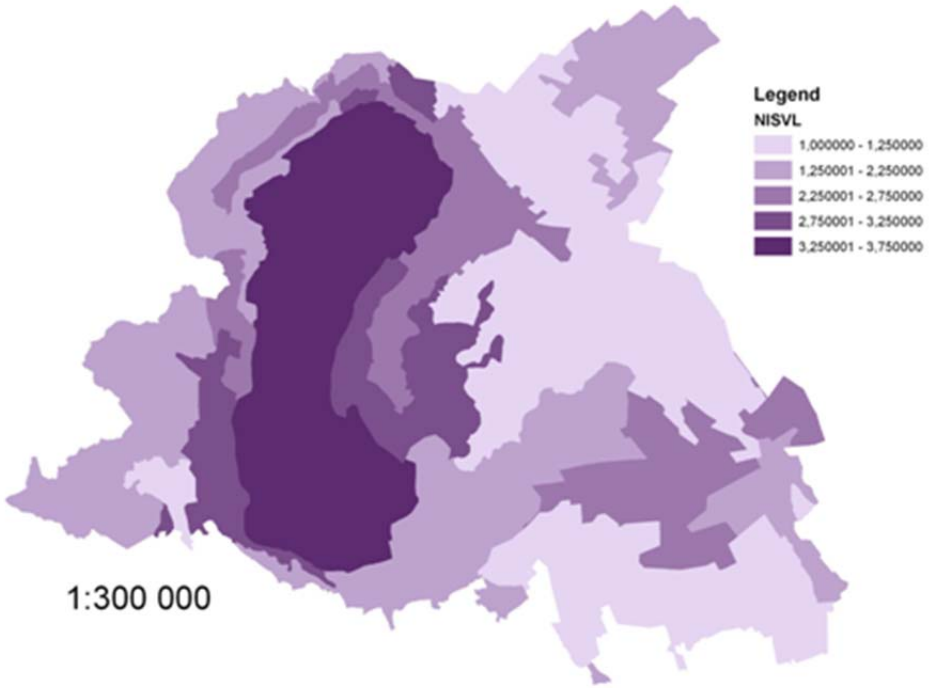


Figure 65: Normalized Indicator Service Values of linear elements in the region Fertő-Neusiedler See

Normalized Indicator Service Values of spatial elements are derived from the area of each landcover classes in the landscape character types. Table 35, Figure 66 and Figure 67 below show the results of the NISV (S) values in each landscape character type.

Table 35: NISV (S) values in each landscape character type

$NISV_{(S)}$		1a	1b	1c	1d	2a	2b	2c	2d	3a	3b	3c	3d	3e
NISV13	Water bodies	3	5	4	2	0	0	0	0	0	0	0	0	0
NISV14	Wetlands	5	5	4	4	2	1	3	1	2	2	0	0	1
NISV15	Forests	3	1	4	5	3	1	1	4	5	2	1	1	3
NISV16	Natural grasslands	5	4	5	5	2	1	2	1	3	1	4	0	1
NISV17	Arable land	1	1	3	2	5	5	2	4	3	3	1	3	4
NISV18	Permanent crops	1	1	4	2	3	2	5	4	4	5	1	3	4
NISV19	Pastures	1	1	4	2	4	1	2	3	4	3	1	3	5
NISV20	Heterogenous agricu	2	1	5	2	2	1	4	4	5	4	3	3	5
NISV21	Scrubs	3	3	4	5	2	1	1	1	2	1	2	0	2
	sum	24	22	37	29	23	13	20	22	28	21	13	13	25
	mean	**2,667**	**2,444**	**4,111**	**3,222**	**2,556**	**1,444**	**2,222**	**2,444**	**3,111**	**2,333**	**1,444**	**1,444**	**2,778**

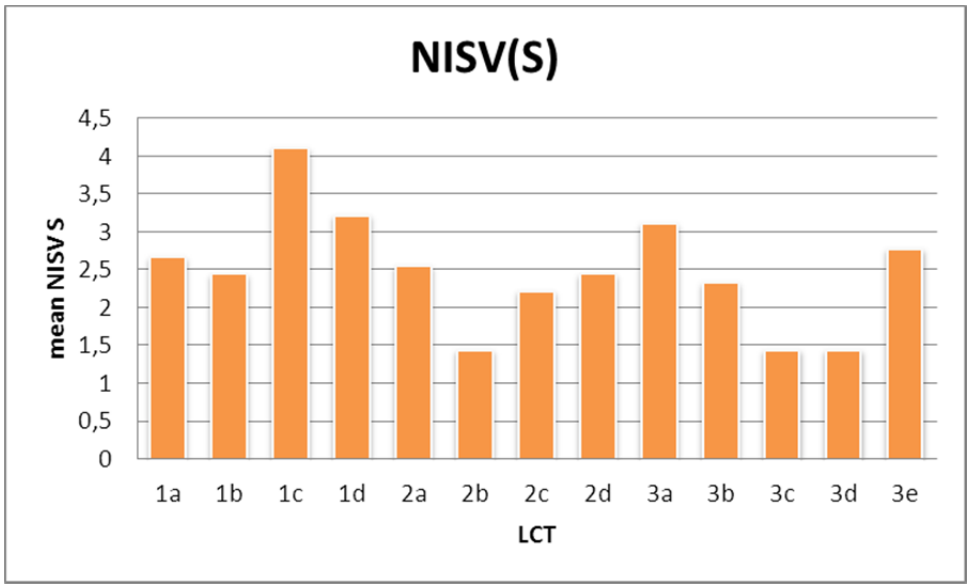


Figure 66: NISV (S) values in each landscape character type.

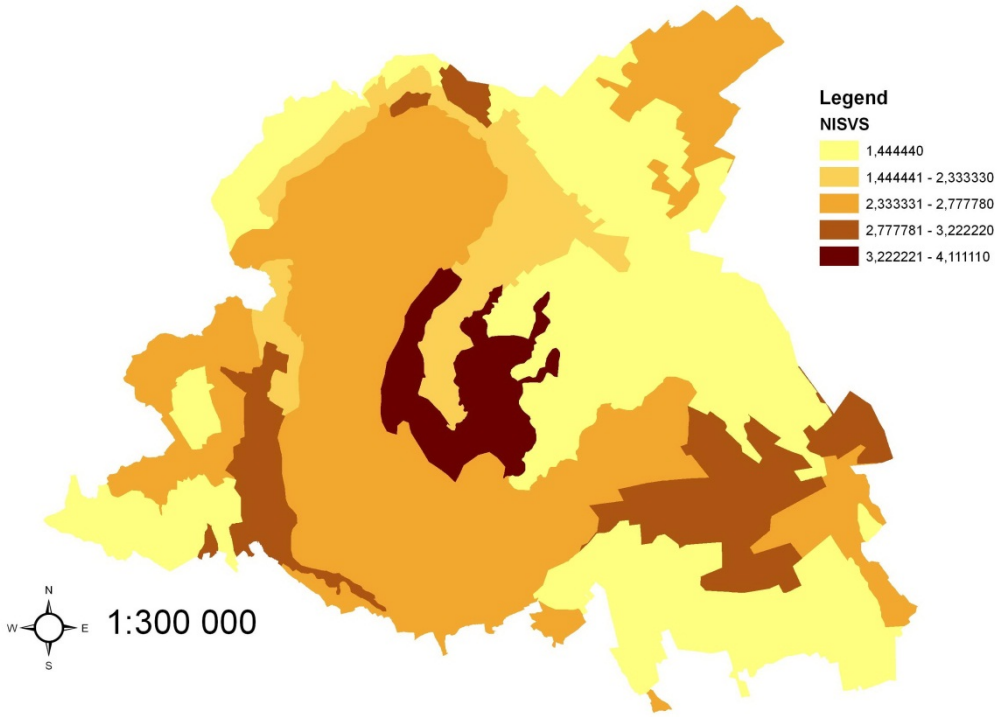


Figure 67: Normalized Indicator Service Values of spatial elements in the region Fertő-Neusiedler See.

3. Landscape Service Value LSV

LSV-s are derived from the addition of the mean NISV of the three indicator types (spatial, linear, points) for each subservices. The highest values are found in 3a, 3b, and 1c Landscape character types (see Figure 68). It means that hill ranges and foothills of low mountains with medium or intensive human use dominated by a mosaic of forest, grasslands and water surfaces or vineyard dominance have higher information services. Relatively high information service values occurred also in low intensity human use areas, as remnants of marshlands dominated by a mosaic of forest, grasslands and water surfaces (Figure 69, Table 36).

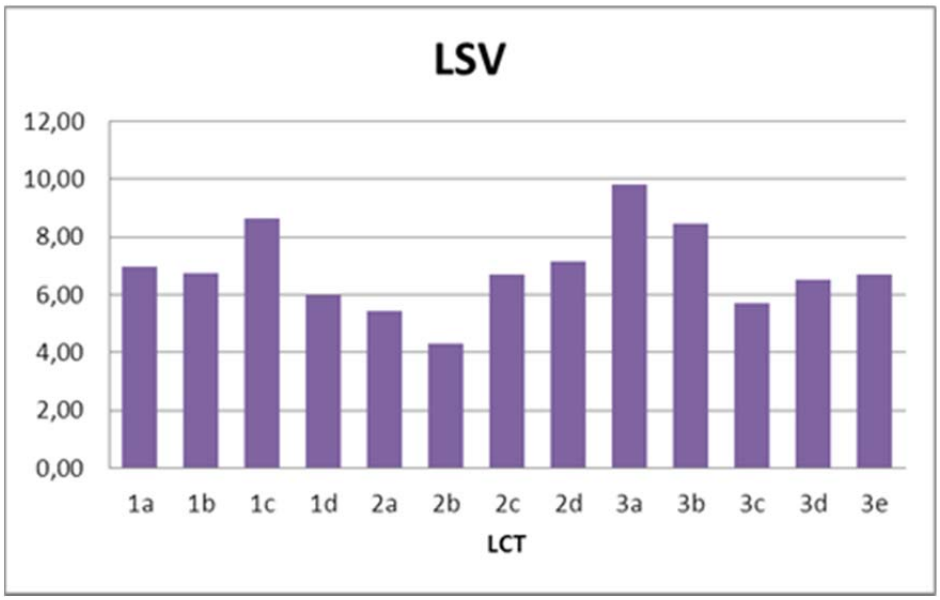


Figure 68: Distribution of Landscape service values in the landscape character types

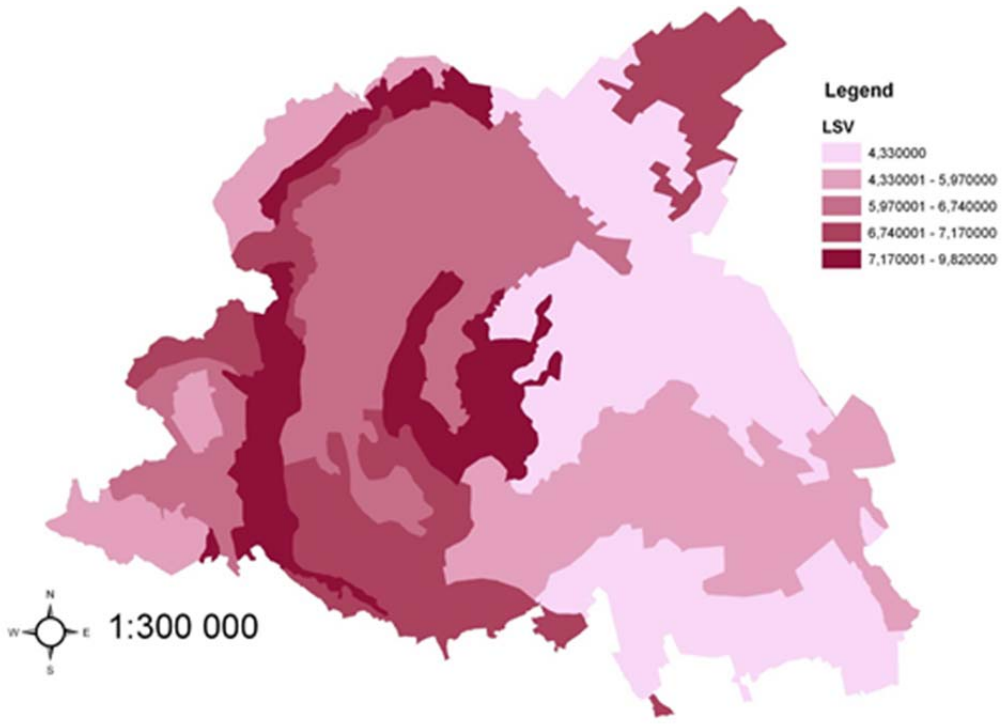


Figure 69: Distribution of Landscape service values in the landscape character types

Table 36: Distribution of Landscape service values in the landscape character types

	Landscape characer types												
	1a	1b	1c	1d	2a	2b	2c	2d	3a	3b	3c	3d	3e
LSV	6,98	6,74	8,63	5,97	5,46	4,33	6,72	7,17	9,82	8,45	5,69	6,54	6,69

2.6.2.2. Socio-cultural approach: touristic services

The requirements of tourism and recreational use to the landscape can be very different. Tourists, day trippers and local recreationists have different interests and activities, and so do their requirements concerning landscape, climate and infrastructure as well as expectations. Besides these demand-related requirements of cultural landscape, touristic infrastructure and accessibility also the strategies and economic objectives of tourist companies influence the touristic requirements on the landscape functions in the region.

Terms and valuation approaches of recreational potential, suitability and value

The valuation of the landscape for tourism and recreational use is connected with very different terms and concepts, among others "recreational potential", "recreational suitability" and "recreational value" of landscape. Various criteria and appraisal procedures on different spatial levels were developed especially from the 1970ies to the early 1990ies (e.g. Kiemstedt et al., 1975; Pötke, 1979; Harfst, 1980; Barsch & Saupe, 1994). They can be divided into general methods and activity-specific methods which based upon the different interests and needs of recreational user groups or types. Current works about recreational potential or suitability are mostly related to GIS-based planning of tourism or recreational use such as within regional plans, landscape plans or management plans of protected areas (e.g. Bundesamt für Bauwesen und Raumordnung 2005; Engels, 2008; Walz & Berger, 2004, Landeshauptstadt Dresden (Umweltatlas) 2007, Zweckverband Großraum Braunschweig, 2008a, b).

Apart from undefined or synonymous use, "recreational potential" is more focused to natural and landscape attributes while "recreational suitability" includes other aspects like tourist facilities, accessibility and disturbing factors. Sometimes criteria of recreational potential are regarded as natural factors of recreational suitability. Recreational potential represents a nature science or user perspective based upon the classical criteria of Kiemstedt und Marks: landform configuration, vegetation and land use, edge of woods and waters. The main indicators are naturalness, unique character and diversity, whereas most attention is given to the assessment of landscape diversity. Recreational suitability is mainly a planning category which is used on all levels of spatial and landscape planning. On the basis of recreational suitability, recreational areas were identified and recommendations for the development were given. Moreover, it is assumed that the existing areas of tourism are suitable for recreation. The recreational value results from more complex methods of valuation. From the different valuation approaches and methods for the recreational potential of landscape, a couple of main indicators can be obtained (see Table 37).

Table 37: Main criteria and indicators of the recreational potential of landscape (depending on spatial planning level)

Main criteria	Criteria / Indicators
Landscape Diversity	Diversity of landform configuration: e.g. slope gradient, altitude difference, narrow valleys, Diversity of land use: classification of land use, proximity to water, small landscape units, glades, Linear landscape elements: edge of woods and water bodies (length), line of trees, hedge, flowing waters, riparian woodland, Point-shaped landscape elements: single tree, groves, small biotopes (waters, hedge)
Naturalness	Land use: percentage of unbuilt areas, hemerobic levels, edge of woods and water bodies, inhomogeneity, character and intensity of anthropogenic impact, Landscape Fragmentation: fragmentation stage as measurement of naturalness / non-naturalness

Woods	percentage of woods, percentage of deciduous wood, percentage of coniferous forest
Waters	presence of waters, lake / artificial lakes (percentage of area), river / canal, brooks / ditches (number), water quality assessment, depth of a body of water, quality of the edge of a body of water
Panorama	panorama views, clear views
Climate	climatic altitude, mean temperature of the year, yearly rainfall, bioclimate
Unique character	unique selling proposition (tourism)
Scenery (visual)	quality of scenery, preferred landscape elements,

Source: own compilation after Grabaum et al., 2005; Walz & Berger, 2004; Kiemstedt et al., 1975, Barsch & Saupe, 1994, Greif et al., 2002; Mönecke & Wasem, 2005, Bundesamt für Bauwesen und Raumordnung, 2005; Landeshauptstadt Dresden (Umweltatlas) 2007

Kiemstedt et al., (1975) developed already in the 1970ies an extensive catalogue of indicators for the recreational suitability of different complexes of recreational activities: recreation in summer at the water (bathing/swimming, playing, camping, fishing), recreation in summer on the water (boating, sailing, boat trips), recreation in summer bonded to area (walking/hiking, playing, cycling, nature observation, sightseeing, climbing) and recreation in winter (skiing, sledding, hiking, skating). The relevance of indicators was valuated into different categories: necessary landscape or infrastructural requirements for this recreational activity (minimum entitlement), improving criteria (quality grade), indifferent criteria without any impact on the recreational activity, restrictive criteria (disturbing factors). Apart from the landscape, towns and village were evaluated (accommodation, touristic facilities, sights, climatic altitude and infrastructure). Similarly Fingerhut (1972) evaluated the recreational suitability of the landscape for different user types like hiker type, landscape type, sports type or educational type (see Pötke, 1979).

In the landscape planning of the Frankfurt Rhein-Main Conurbation Planning Association another approach for the assessment of recreational suitability is used (Landschaftsplan des Umlandverbands Frankfurt, 2000). The valuation of selected scenery types (e.g. field long-range, field small-scale structured, valley small-scale structured, vineyard, river/pond/artificial lake, urban park, constructed area) based upon the local expertise of landscape and land use planer. The landscape suitability is valuated for three kinds of recreation: (1) hiking, walking, cycling, landscape experience, (2) water oriented recreation like playing at the water, swimming, boating, fishing as well as perceptions and experiences of water during walking, hiking and cycling, (3) nature observation – flora and fauna. Finally different landscapes units of the region were evaluated (e.g. Hoher Taunus, Vortaunus, core of urban agglomeration Frankfurt-Offenbach) and recommendations from the view point of recreational suitability are given. In contrast the landscape valuation of the city of Dresden is related to three main motives for recreation: (1) experiences of semi-natural landscapes (little disturbance and few stress factors), (2) experience of rural cultural landscape, sustainable economic activities and more healthy environment and (3) experience of the city and the urban landscape. On the map, the recreational suitability of these different areas is valuated in six grades: suitability for tourism, suitability for regional recreation with touristic potential, suitability for local and city-wide recreation, limited suitability for local recreation, low value for outdoor recreation and no suitability for outdoor recreation (Landeshauptstadt Dresden (Umweltatlas) 2007).

Barsch & Saupe (1994) connected type-related and individual valuations to combined recreational values on local level as well as regional level. These complex valuations of functional units include landscape qualities, e.g. lakes or landscape diversity, recreational facilities, preferences of different user groups, relevance for regional planning as well as possibilities for recreation at and on the waters.

A number of valuations focus only on one landuse type like forests (e.g. Ruppert, 1971) or agricultural land (e.g. Greif et al., 2002). Following this, the criteria are more differentiated. For

example, the valuation of the suitability of agriculturally used areas for nature related recreation with in the INTERREG II C project Natural Resources of the Federal Institute of Agricultural Economics (AWI) in Vienna consists of accessibility as indicator of the demand for recreation and thr supply of suitable areas (scenic attractions, usability).

With all diversity of methods for recreational potential or suitability assessment, some basic aspects are visible. On the one hand most of the valuation methods focus to selected landscapes, land use or functional area types. On the other hand recreational suitability is usually valuated for different recreational activities, selected user groups or specific motives. Therefore, the landscape character of the Neusiedler See/FertőRegion as well as the main recreational and sport activities, motives and interests of tourists and local recreationists have to be considered. The preferences of tourists and recreationists are due to their interests and activities together with their landscape expectations. Based upon the principles of landscape valuation, the interests of tourists and recreationists and the view of tourism sector (see chapter 2.3.2) a couple of conclusions for the valuation of landscape services can be drawn:

- The evaluation criteria relate to the characteristics of Neusiedler See/Fertőlandscape, in particular the specific land use, landform configuration, different kinds of waters. In addition, the valuation will take into consideration the main image factors of the region: the combination of nature and culture, landscape and regional diversity, the lake and the wide reed belt, wine and wine-growing, tourism and tourist activities, birds, nature protection and management including national park. Spatial differences of these landscape attributes are covered by the landscape character types.
- The valuation of landscape functions will be carried out in respect to recreation as a whole but with regards to the main recreational activities in the region or in the landscape character type. Besides quietness and relaxation, which are not related to a specific landscape, the main nature-oriented activities in the Neusiedler See/Fertőregion are cycling and bird watching. Bathing is mainly connected with the lake and the lake resorts. Museums and cultural events are located in the settlements excepting the performances in the quarries of St. Margarethen and Fertőrákos as well as the lake stage of the Mörbisch Festival within the reed belt.
- The valuation of tourism facilities is connected to the development of tourism as an economic sector. In Austria the marketing strategy of the regional tourism association is based upon the five core areas nature, culture, sports, wine & cuisine and health. In these fields tourist facilities, events and products have been advanced in the last years. This applies to the Hungarian part of the region, too, even though no regional marketing strategy for tourism development exists.
- Whereas the landscape can be estimated on the basis of types or classifications (e.g. land use, landscape elements, altitude differences) the valuation of tourist facilities requires an individual analysis (e.g. touristic nodes, touristic trails).

Tourism and Recreation within the actual services assessment

The assessment of the Recreation function and Tourism-facilities function is based on the principles of the valuation of landscape functions from the view of tourism and recreation research. The Recreation is integrated into information functions and services as one of five sub functions (see chapter 1.3).

Tourism-facilities belong to the carrier functions and services because it is related to the results of human activities in the sector of tourism and recreation. The different touristic facilities provide the basis for various kinds of tourism and recreational activities like cultural tourism, water sports,

cycling, nature-oriented activities or wellness. Tourist facilities in settlements are integrated in the valuation and graduation of touristic nodes. These nodes are source and destination of the activities of tourists and recreationists. Landscape-oriented activities like hiking or cycling take place between these nodes. The usability of waters for bathing and water sports is a product of different aspects: suitability of water (e.g. water quality, access to the open water), size of the water body as precondition for the different kinds of water sports as well as a basic infrastructure (e.g. landing stage). While bathing is concentrated to the lake resorts which are integrated into the touristic nodes water sports take place on a larger part of the water surface.

Tourism-facilities assessment

The assessment of Tourism-facilities function and services is based on three indicators: (1) touristic nodes, (2) touristic routes and (3) water sports. Tourism-facilities are valuated from the landscape perspective. The spatial basic unit for the valuation of the indicators is the Landscape character type (LCT). In order to show the partly existent differences of tourism-facilities within one LCT for those types which consist of more than one area the valuation is carried out also for each area separately (LCTA).

(1) Indicator: Touristic nodes

The touristic nodes are the result of a complex valuation of tourist supply and demand as well as the intraregional tourist functions (see chapter 2.3.2.5). Through the inclusion of all tourist and leisure facilities and a partial completion through visitor or user information, also day-visitors as well as recreationists are integrated. The touristic nodes are graduated into a three-step hierarchy: big, middle and small nodes. Big nodes represent the main touristic centres and/or main destinations for outings in the region. Middle nodes cover an average and expected supply in the region. Some of them are specialised in different kinds of tourism or leisure time activities like culture tourism or health spa. Big and middle nodes create the basic structure of the tourism region. The small nodes offer an additional touristic supply. A special case of touristic nodes in the Neusiedler See/FertőRegion are “divided nodes”. Big or middle nodes are described as a divided node if the distance between the village and the lake resort is too big, but the functional connections advise the integration to one node.

On the level of touristic nodes the first step of assessment contains the transformation of the touristic node rank into a five scale valuation. The value of the divided nodes is also divided (see Table 38).

Table 38: Touristic node value (TNV)

Big node	5
Big divided node	2.5 / 2.5
Middle node	2
Middle divided node	1 / 1
Small node	1

Source: Own calculations

After that, the number of touristic node is weighted with the Touristic node value (TNV). Nodes which are situated on the border of LCT areas are numbered as a half node in both LCT areas. The result is a weighted number of each Touristic node (see examples in Table 39).

Table 39: Valuation on the Touristic node level, first results

Nodes	TNV	Number of nodes	Weighted number of nodes
Podersdorf	5	1	5
Neusiedl Ort	2.5	1	2.5
Neusiedl See	2.5	1	2.5
Möchhof	2	1	2
Hegykő	2	1	2
Jois Ort	1	1	1
Jois See	1	1	1
Hölle	1	1	1
Csorna	1	1	1
Balf	2	1	2
St. Andrä	2	0.5	1
Bösárkány	1	0.5	0.5

Source: Own calculations

In the next step, the indicator was further developed to the Density of touristic nodes weighted with Touristic node value (DWTN). The tourist facilities in the LCT or LCTA are valuated via the density of big, middle and small touristic nodes. At first, the Density of touristic nodes is calculated as weighted number of touristic nodes related to the area of LCT respectively LCTA. The measuring unit of DWTN is 100 km² (St. Martins Therme and Lodge is not included in this assessment because the valuation was not clear at the assessment period). After that the Density of touristic nodes was normalised into the values 0-5, 0 means no touristic nodes (see examples in Table 40). Visualisation as maps shows the distribution of the indicators in the project region (Figure 70, Figure 75, Figure 76).

Table 40: Valuation of touristic nodes on the LCT level and LCTA level – Examples

LCT	LCTA	Weighted number of nodes per LCT/LCTA	Area LCT/LCTA (km^2)	DWTN LCT/LCTA (per 100 km^2)	DWTN LCT/LCTA normalised
1a		1.0	111.96	0.89	1
1b		19.0	264.80	7.18	2
1d		1.5	135.39	1.11	1
	1d-1	*0*	*21.55*	*0*	*0*
	1d-2	*1.5*	*113.84*	*1.32*	*1*
2a		3.0	186.35	1.61	1
	2a-1	*1.5*	*48.98*	*3.06*	*1*
	2a-2	*1.5*	*137.37*	*1.09*	*1*
2b		22.5	592.27	3.80	1
	2b-1	*0.5*	*3.03*	*16.52*	*3*
	2b-2	*9.0*	*191.64*	*4.70*	*1*
	2b-3	*13.0*	*397.60*	*3.27*	*1*
2c		14.0	106.36	13.16	3
3c		3.0	117.79	2.55	1
	3c-1	*0*	*15,93*	*0*	*0*
	3c-2	*3,0*	*47,31*	*6,34*	*2*
	3c-3	*0*	*54,55*	*0*	*0*
3d		5.0	18.73	26.70	5

Source: Own calculations

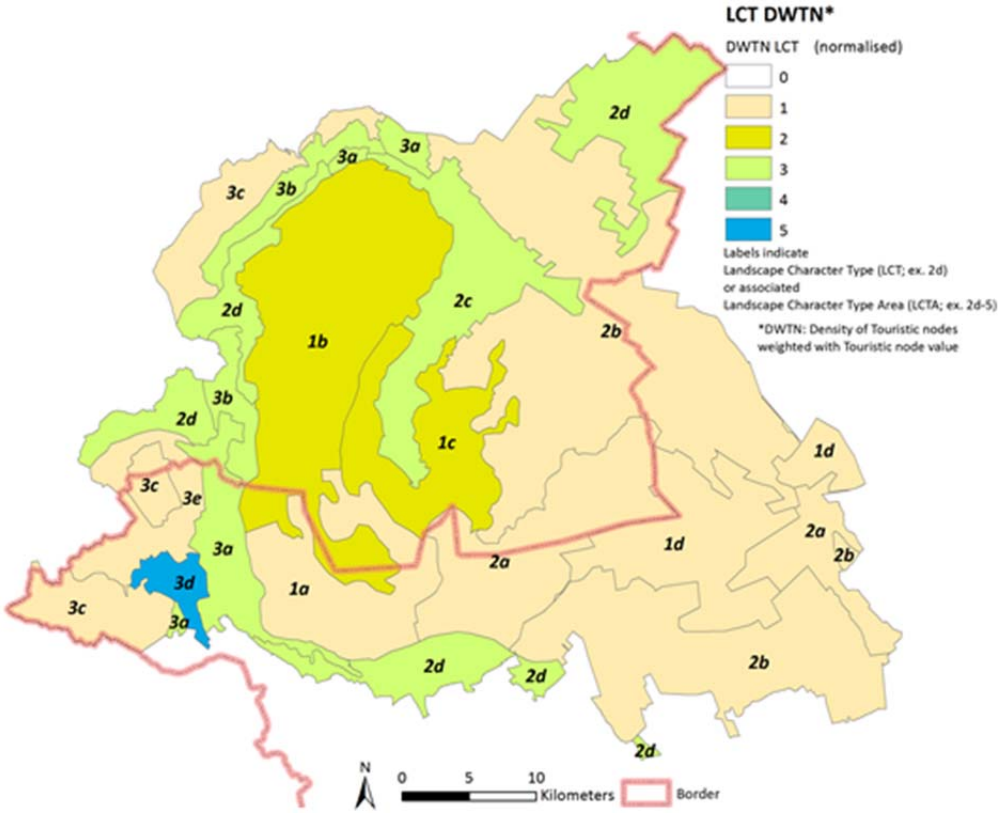


Figure 70: Density of Touristic nodes weighted with Touristic node value – valuation on the LCT level (St. Martins Therme and Lodge not integrated into the assessment)

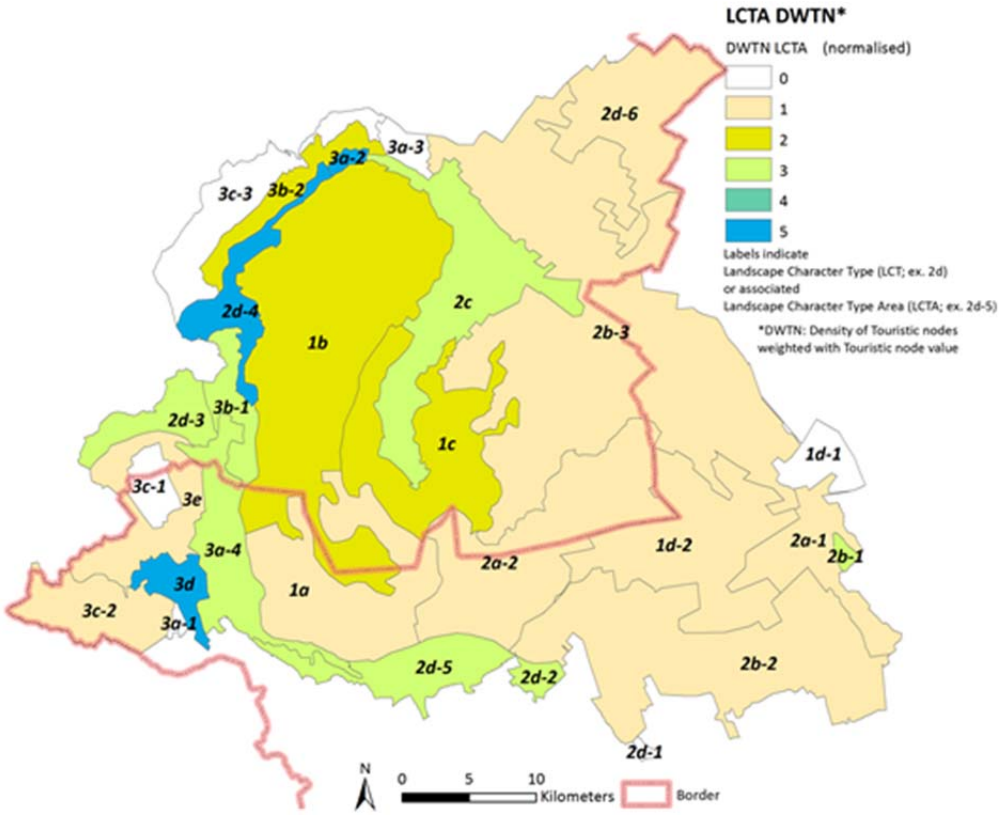


Figure 71: Density of touristic nodes weighted with touristic node value – valuation on the LCTA level (St. Martins Therme and Lodge not integrated into the assessment)

(2) Indicator: Touristic trails

The second indicator shows the density of touristic trails. This indicator includes all hiking, cycling, horse riding and Nordic walking trails which are marked in the landscape and/or in maps. Marked and described trails and routes lead to landscape and cultural attractions. The different trails accommodate the different needs of user groups. For example, cycling trails are mostly longer than hiking trails. Touristic trails play an important role for tourists and one-day visitors who do not know the area. In practice a way can be marked as hiking trail and as cycling trail. Moreover, defined trails can be used by different user groups like hiking trails by Nordic walkers or cycling trails by hikers. Furthermore thematic trails, educational trails and experience trails belong to touristic trails. Classical educational trails include information boards which provide descriptions and explanations of natural topics.

Various maps and some information on the website of Neusiedler See Tourism Association (NTG) are the source of information about the different kinds of touristic trails, for example NTG maps of cycle paths and horse riding paths (Neusiedler See Tourismus GmbH, 2008a and 2008b). Nordic walking trails are only documented in the two Nordic Walking Areas: Nordic Walking Trails R.O.M. on the Western shore of the lake and Running and Walking Arena Seewinkel-Heideboden. Marked horse riding trails are localised in the Seewinkel area. All these touristic trails were digitised and attributed in the GIS-environment. Finally, for all trails the length could be calculated.

Educational trails are multifunctional facilities which aim to environmental education as well as an upgrading of the tourist facilities. Nowadays the term educational trail is often replaced by thematic trail. Modern forms of touristic trails combine education with nature experiences by means of interactive gathering of information and integration of all senses: sight, listening, touch, smell and taste. All types of Educational trails (Study trails) are integrated in the information function. Therefore they are not considered in the indicator Touristic trails.

The indicator touristic trails comprises all hiking trails, cycling trails, horse riding trails and Nordic walking trails. There is no valuation on the touristic trail level necessary because all types of touristic trails get the same value. The basis for valuation is the total length of all touristic trails related to the area of LCT or LCTA - Density of touristic trails (DTT, see Table 41 and Figure 76, Figure 73).

Table 41: Valuation of Touristic trails on the LCT level and LCTA level – Examples

LCT	LCTA	Σ Length of all Touristic trails per LCT/LCTA (km)	Area LCT/LCTA (km^2)	DTT LCT/LCTA (per 100 km^2)	DTT LCT/LCTA normalised
1a		15.0	111.96	13.43	1
1b		89.6	264.80	33.83	1
1d		18.0	135.39	13.26	1
	1d-1	*0*	*21.55*	*0*	*0*
	1d-2	*18.0*	*113.84*	*15.77*	*1*
2a		48.8	186.35	26.15	1
	2a-1	*10.4*	*48.98*	*21.17*	*1*
	2a-2	*38.4*	*137.37*	*27.92*	*1*
2b		372.6	592.27	62.92	2
	2b-1	*0.4*	*3.03*	*13,82*	*1*
	2b-2	*14,8*	*191.64*	*7,75*	*1*
	2b-3	*357,4*	*397.60*	*89,89*	*2*
2c		195.1	106.36	183.40	4
3c		61.5	117.79	52.21	2
	3c-1	*2,9*	*15,93*	*18,04*	*1*
	3c-2	*52,8*	*47.31*	*111,59*	*2*
	3c-3	*5,8*	*54.55*	*10,68*	*1*
3d		13.1	18.73	70.13	2

Source: Own calculations

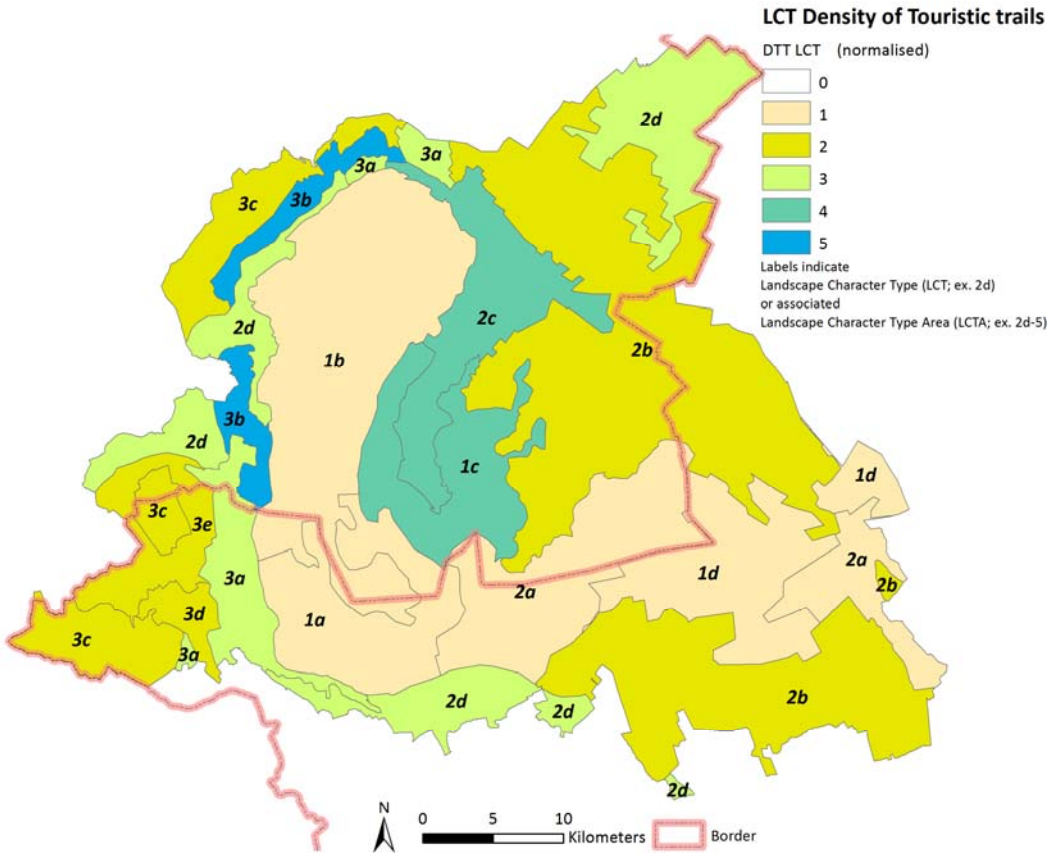


Figure 72: Density of touristic trails – valuation on the LCT level

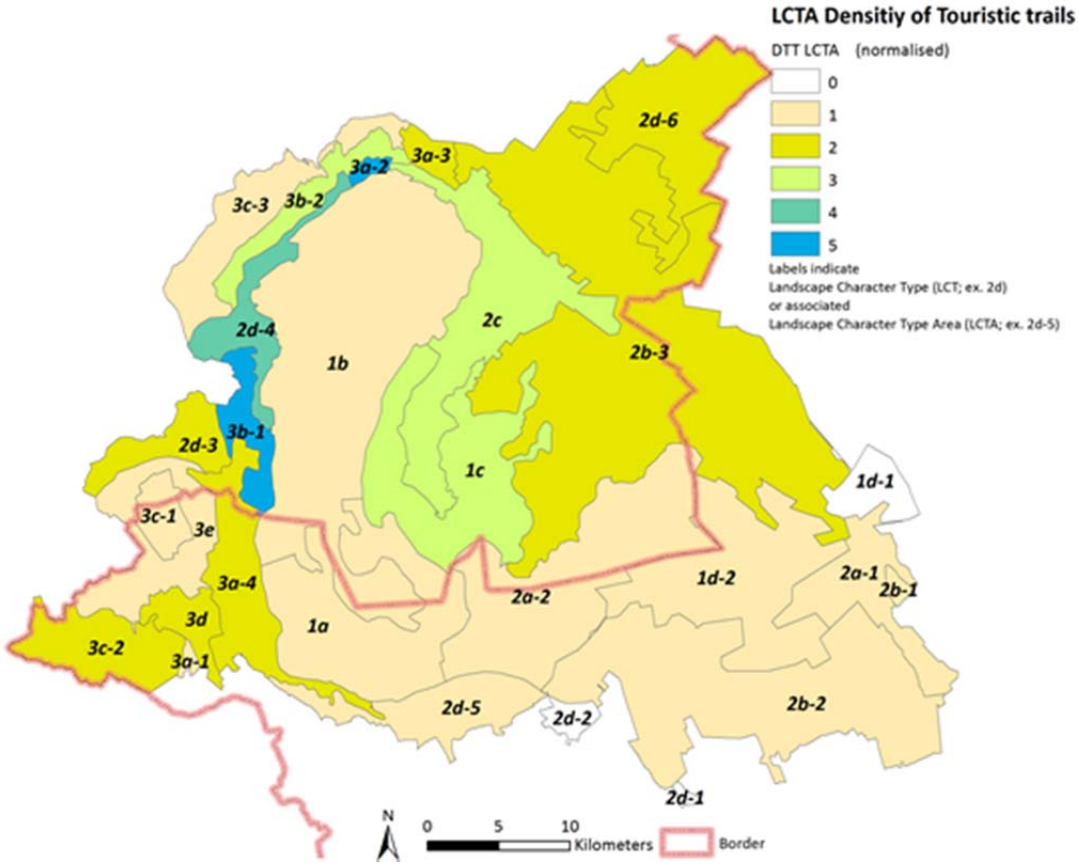


Figure 73: Density of touristic trails – valuation on the LCTA level

(3) Indicator: Water sports

In addition to touristic trails the water sports possibilities are considered. This includes the access of lake or pond and the existence of basic infrastructure like boat bridges. However, the quantity and quality of water sports facilities is not object of this indicator because they are integrated in the touristic nodes.

On the level of open water areas the first step of assessment contains the valuation of possible uses for water sport activities. Angling is not assessed separately because complete and consistent data about all little fishing areas in the region are not available (information from Burgenländischer Fischereiverband).

The Neusiedler See/Fertőis the biggest lake in the region with various water sports opportunities. There are ideal conditions for sailing, windsurfing and kite-surfing. Fishing with fishing permits is also possible. Beyond that the Neusiedler See/Fertőis large enough for regular ferry traffic and boat tours. Only one or two kinds of water sports are possible in the Zicksee near St. Andrä (windsurfing, boating) as well as in the small pond Nagy-Tómalom (boating). The whole sector of the Leitha/Lajta River is used for canoeing and paddling tours. Therefore the Neusiedler See/Fertőgets the highest Water sports value (WSPV) and the other waters with water sports opportunities the lowest value (see Table 42).

Table 42: Water sports Value (WSPV)

Various possibilities for bathing and water sports	5	(Neusiedler See/Fertő)
Usability for 1/2 kinds of water sports	1	(Zicksee, Nagy-Tómalom, Leitha)

Source: Own calculations

Due to the big difference between the area of the Neusiedler See/Fertőand the other waters in the region the water surface is not included in the valuation of water. The LCT and LCTA get the same value like the waters itself. The WSPV is already normalized (see Table 43).

Table 43: Valuation of Water sports on the LCT level and LCTA level

LCT	LCTA	WSPV LCT/LCTA normalised	Waters
1b		5	Neusiedler See/Fertő
1c		1	Zicksee
2b		1	Leitha
	2b-3	*1*	*Leitha*
2d		1	Leitha
	2d-6	*1*	*Leitha*
3a		1	Nagy-Tómalom
	3a-4	*1*	*Nagy-Tómalom*

Source: Own calculations

(4) Integrated Tourism-facilities value

These three touristic values are aggregated to the whole tourism-facilities value. For this purpose all normalised values are summarized. The result is normalised again (see Table 44 and chapter 3.2.1).

Table 44: Valuation of Tourism-facilities Value on the LCT level and LCTA level – Examples

LCT	LCTA	DWTN LCT/LCTA normalised	DTT LCT/LCTA normalised	WSPV LCT/LCTA normalised	Sum of normalised values	TFV normalised
1a		1	1	0	2	1
1b		2	1	5	8	5
1d		1	1	0	2	1
	1d-1	*0*	*0*	*0*	*0*	*0*
	1d-2	*1*	*1*	*0*	*2*	*1*
2a		1	1	0	2	1
	2a-1	*1*	*1*	*0*	*2*	*1*
	2a-2	*1*	*1*	*0*	*2*	*1*
2b		1	2	1	4	3
	2b-1	*3*	*1*	*0*	*4*	*2*
	2b-2	*1*	*1*	*0*	*2*	*1*
	2b-3	*1*	*2*	*1*	*4*	*2*
2c		3	4	0	7	4
3c		1	2	0	3	2
	3c-1	*0*	*1*	*0*	*1*	*1*
	3c-2	*2*	*2*	*0*	*4*	*2*
	3c-3	*0*	*1*	*0*	*1*	*1*
3d		5	2	0	7	4

Source: Own calculations

2.6.3. Upscaling of Landscape function values from single landscape elements to LFTs

Except from Habitation, Transportation, Energy conversion, Aesthetic information, Recreation, Cultural and Artistic information, Science and Education and Tourism-facilities functions, where a regional/landscape character assessment was applied from the start, all other sub-functions, which have been measured on the basis of single landscape element characteristics, had to be scaled-up to regional levels.

Starting with already pre-categorised values between [0;5] derived from the ArcGIS-model, which were called landscape element function values (LEFVs) upscaling was carried out in a stepwise approach (Table 45-Table 47)

Table 45: Schematic calculation of one single sub-function value (sFV) per one sample site (1x1 km); area-weighted mean values of all LEFVs were calculated.

	LEFV (0-5)
LEL 1	3
LEL 2	5
LEL 3	2
LEL 4	0
LEL 5	1
LEL x	4
sFV per sample site (area weighted mean)	**3**

Table 46: : Schematic calculation of one sub-service value (sSV) per one landform type; mean of all sFVs were calculated

	sFV (0-5)
Sample site 1	3
Sample site 2	5
Sample site 3	2
Sample site 4	0
Sample site 5	1
Sample site 6	4
sSV per landform (mean)	**2.5**

Table 47: Schematic aggregation of the sub-service values sSV (demonstrated by the example of Habitat service group) to the Service group value (SGV) per landform; calculated by the mean of all sSVs.

Sub-services for Habitat service	sSV per landform
Refugium	3.3
Nursery	2.5
SGV (mean)	**2.9**

To receive one single value for each sub-function per sample site (1x1 km) area-weighted mean values of all LEFVs were separately calculated for all designated sub-functions that have previously been included in the GIS-model. The outcomes, again ranging from [0;5] could be seen as the actual state of each investigated sampling site in the fulfilment of certain sub-functions (Table 45). Each LFT is represented by 6 random stratified sample sites (please refer to chapter 5). The in-Situ results of sub-function-provision were consequently extrapolated to LFT-level by calculating mean values out of each set of representative sample site based results (Table 46).

In the next step three out of five main service values in the frame of the Ecosystem Service assessment, such as Regulation service, Habitat service and Provision service could be obtained by combination and calculation of mean values for related sub-functions on LFT level (Table 47), apart from LFT 1.

LFT 1, describing the lake basin acted as a special case, because representativeness of the sample sites for up-scaling possibilities on the entire LFT were limited due to inclusion of Neusiedler See itself plus its adjacent reed belt and satellite lakes in the LFT. However, these inaccessible areas comprise more than 60% of LFT1 and therefore must be taken into account for Ecosystem Service provision.

To overcome these difficulties LFT 1 was split up into 4 parts such as the terrestrial region, characterized by sample site outcomes, the lake itself, the reed belt and the satellite lakes. For latter three, provision of certain Ecosystem services was derived by calculating area-based values from the BIF table and afterwards combining them with sample site based results for the terrestrial area

according to their areal-weights. This approach can be vindicated by the uniformity of land units that have separately been treated here which didn´t require for an additional qualifier assessment.

Interrelating Functions/services of different spatial levels for the Carrier and Information Service assessment

The Carrier service group is comprised of 6 sub-functions/services, particularly Waste disposal, Transportation, Habitation, Energy conversion, Cultivation and Tourism facilities. Tourism facility service (Chapter2.6.2.2) was calculated on LCT basis. Taking the single LCTs as reference units was possible because LFT-based results could be spatially referred to the LCT based assessment of tourism facilities. Again, mean values of the designated sub-functions/services were calculated to reach Carrier main service values on the LCT-level.

In terms of assessment of the Information service, which is comprised by Aesthetic information, Recreation, Cultural and Artistic information and Science and Education sub-services please refer to section xy. Again for this main service spatial reference units were set on LCT-level.

Creation of final charts, representing the actual state of Landscape service provision on LFT level

In order to unite and visualize separately calculated main services together in spiderweb diagrams, some prerequisites must be met. As previously outlined two main services (Carrier and Information service) were calculated on LCT-basis, these services had to be harmonized and integrated into the spatial level of LFTs first. In the first step the spatially least abundant LCTs which did not cover more than 5% of a designated LFT were neglected in the upcoming steps. Then area-weighted partial values of the LCT-based main services were calculated for each LFT-reference unit.

E.g.: LFT 2 (Marshlands) is dominantly comprised of LCTs 1d (covering 35.1%), 2a (35.3%) and 2b (27.6%). Summming up 98% of LFT 2 are covered by these 3 LCTs. Now, Carrier and Information service partial values were area-weighted and summed up to reach one final value for LFT 2.

After the aggregation process seven final spiderweb charts could be delineated, each consisting of five final axes which are representing the actual state of Ecosystem service provision expressed by the five landscape main services that were chosen for the assessment.

2.7. Seville criteria (WP 4)

2.7.1. general description of Seville strategy

The Seville Strategy for biosphere reserves has transformed the original focus of biosphere reserves as areas for research on ecosystems, monitoring and environmental conservation (Man and Biosphere Programm). During the 1970ies and 1980ies several national park were recognized as biosphere reserve. The second World Congress of Biosphere Reserves held in Seville 1995 defined a set of (new) objectives and procedures governing the recognition of potential biosphere reserves: Seville Strategy and the International Guidelines. According to the Seville Strategy biosphere reserves are terrestrial or coastal/marine ecosystems which are internationally recognized and integrated into the framework of UNESCO's Man and the Biosphere Programme and the Network of biosphere reserves. Each biosphere reserve is intended to fulfil three complementary functions: a conservation function, a development function and a logistic support function. It consists of three different zones with different aims of protection and impact of uses: core areas, a buffer zone and a flexible transition area. Based on the past experience in implementing the innovative concept of biosphere reserve and the emphases to the three functions a couple of key directions were identified. Among others is emphasized, that all zones of biosphere reserve contribute to conservation, sustainable

development and scientific understanding. The human dimensions get more importance. The management should be open, evolving and adaptive and bring together all interested groups and sectors in a partnership approach. Biosphere reserves should be used to further our understanding of humanity's relationship with the natural world. “In sum, biosphere reserves should preserve and generate natural and cultural values, through management that is scientifically correct, culturally creative and operationally sustainable.” (UNESCO, 1996, p. 3-4). The following strategy includes four goals consisting of objective as well as recommendations and implementation indicators for the different levels: international level, national level and individual reserve level.

2.7.2. Seville conform Leitbild creation

A set of 19 single landscape services has been developed, worked out, pooled into 5 main groups and extrapolated on the seven Landform types within the wider investigation area of the BIOSERV project to illustrate the actual state of service provision of the landscapes around Neusiedler See. Additional potential service fulfilment along a required zoning for a redesigned biosphere reserve within the region had to be estimated by consulting local experts on landscape planning, nature conservation and tourism.

According to predict optimal provision, regulation and habitat service potential within the biosphere reserve´s core zone the previously derived potential landscape functions (see chapter 2.5) have been taken as a proxy. The remaining carrier and information service values could be estimated by referring to the respects of the Seville-criteria. They were set to “0” concerning the carrier function and “2.5” concerning the information function, after consulting the Seville-criteria handbook and internal discussions.

In terms of potential service provision for the buffer and transition zones values for habitat, regulation and provision services were again determined following the guidelines of the Seville-criteria and the actual state of service provision within the single LFT´s. As specific values could be hardly defined, the values span a domain and therefore are visualized as blurred bands within the final spiderwebs (see chapter 3.2.2) rather than concrete lines. However, potential values of carrier and information functions for the buffer and transition zones couldn´t be assessed without consultation of regional planning authorities and stakeholders as these functions are strongly influenced by regional and local activities.

For this reason potential objectives and goals differ between the single LFT´s and in this sense no general guidelines could be defined due to cultural and socioeconomic disparities within the LFT´s. To resolve this issue a regional expert meeting was organized at the 3rd of November 2011, involving regional stakeholders to jointly develop and discuss on potential target values, especially focussing on the carrier and information functions for designated buffer and transition zones. Due to lack of time the evaluation was only carried out for three out of seven LFT´s of the wider investigation area such as for LFT 2 (Marshland and reclaimed marshland), LFT 4 (Low lying terrace) and LFT 7 (Hilly area and hill range).

Procedure

First of all, the participating experts were briefed up on the general concept of ecosystem service evaluation and the particular method applied in the framework of BIOSERV. Then a series of hand-outs, encompassing 5-axis spiderweb diagrams illustrating the actual state of ecosystem service provision and the potential Seville conform services of the environmental services throughout each Landform of interest to be discussed during the meeting were distributed to the experts (see Figure 5 and Figure 6). Within the spiderweb diagrams also predefined potential value ranges of habitat, regulation and provision services were illustrated. Additionally, a table including target sub-services,

framing the carrier and the information main service (please refer to section xy) and associating rating schemes were supplied to the committee. The rating scheme contains five categories such as “substantial increase (+50%)”; “moderate increase (+25%)”; “stagnation (+/- 0%)”; “moderate decrease (-25%)” and “substantial decrease (-50%)”. With the help of this categorization the expert committee could estimate potential adaptation possibilities for designated sub-function provision within the LFT´s of interest.

In case of the carrier main service, the actual service assessment was carried out on LCT-level first and then subtotals were extrapolated on LFT-level. The same was true for the expert driven assessment of potential service provision: First the experts discussed about which of the proposed categories would either be desirable, appropriate and feasible for each function in each LCT targeting the two strata of transition and buffer zone. E.g. in ”LCT 1d” which has a 35% share of “LFT 2” experts plead for a moderate increase in “cultivation” within the transition zone and a stagnation of “cultivation” in the buffer zone. In some cases the experts could not agree on one category, therefore intermediate values were assumed, for example 37.5% increase. This procedure was carried out for all carrier sub-services and all LCTs within the LFTs of interest. Finally, potential values were calculated by summing up the proposed increased or decreased area weighted sub service values. Consequently the ratios between the potential and actual service values were calculated. E.g., in LFT 2 the experts opted for an up to 30%-increase of the carrier service if a transition zone would be established therein and for a 10% increase in a buffer zone. In comparison when focussing on LFT 7 the experts rated for an increase of only 22.5% resp. 8.5%.

Estimation of potential information main function could only be roughly assessed on the spatial level of the whole LFT´s, though the evaluation of the actual information function has also been derived on LCT-level first and then extrapolated for the single LFT´s (see chapter 2.6.3). This is due to the fact that the information function consists of several sub services that either affects the target landscape on local up to regional level in different proportions. In detail, the procedure applied for the estimation of potential information function values was the same as for the potential carrier service assessment, but the resulting increase of the potential services obtained for buffer and transition zones did not differ from each other that much, compared to the potential carrier services.

Finally, the spiderwebs diagrams expressing the landscape´s potential of possible transition and buffer zones were complemented by former missing values for information and carrier function (see Figure 78 and Figure 83).

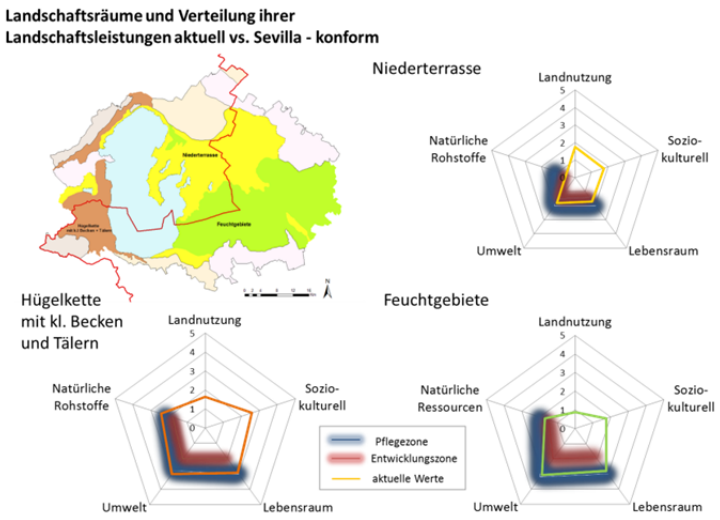


Figure 74: Handout for the stakeholders illustrating the actual landscape service provision as well as the Seville conform services within the landforms low lying terrace, hilly area and hill range and marshlands.

Sevilla-konforme Einstufung der Landschaftsleistungen im Landschaftsraum **„Feuchtgebiete“**

Sozio-kulturelle Funktion

Teilfunktionen	Pflegezone	Entwicklungszone
Bebauungsgebiete		
Landwirtschaft		
Wind- und Kleinwasserkraftwerke		
Müllablagerungsplätze		
Verkehr (Straßen und Wegenetze)		
Tourismusinfrastruktur		

Bewertungsschema

+ +	• starke Zunahme
+	• mäßig Zunahme
~	• Gleichstand
-	• mäßig Abnahme
- -	• starke Abnahme

Figure 75: Form to be filled in during the stakeholder workshop in Rust focusing on the information services.

3. Results

3.1. Potential landscape functions

3.1.1. Constructed Vegetation types

In general, the different vegetation communities did separate very well. The quick look on the map of Constructed Vegetation (Figure 76) seems rather plausible, also in comparison with the small maps of Bohn et al., (2000/2003) and Niklfeld, (1970/1989). We want to stress the point, that the construction is reproducible and transparent, only based on geodata having in mind the shortcomings of the geodata, mainly (i) differences in resolution and scale and (ii) incomplete coverage. When necessary the definition of the selection criteria and the hierarchical sequence can be adapted and refined.

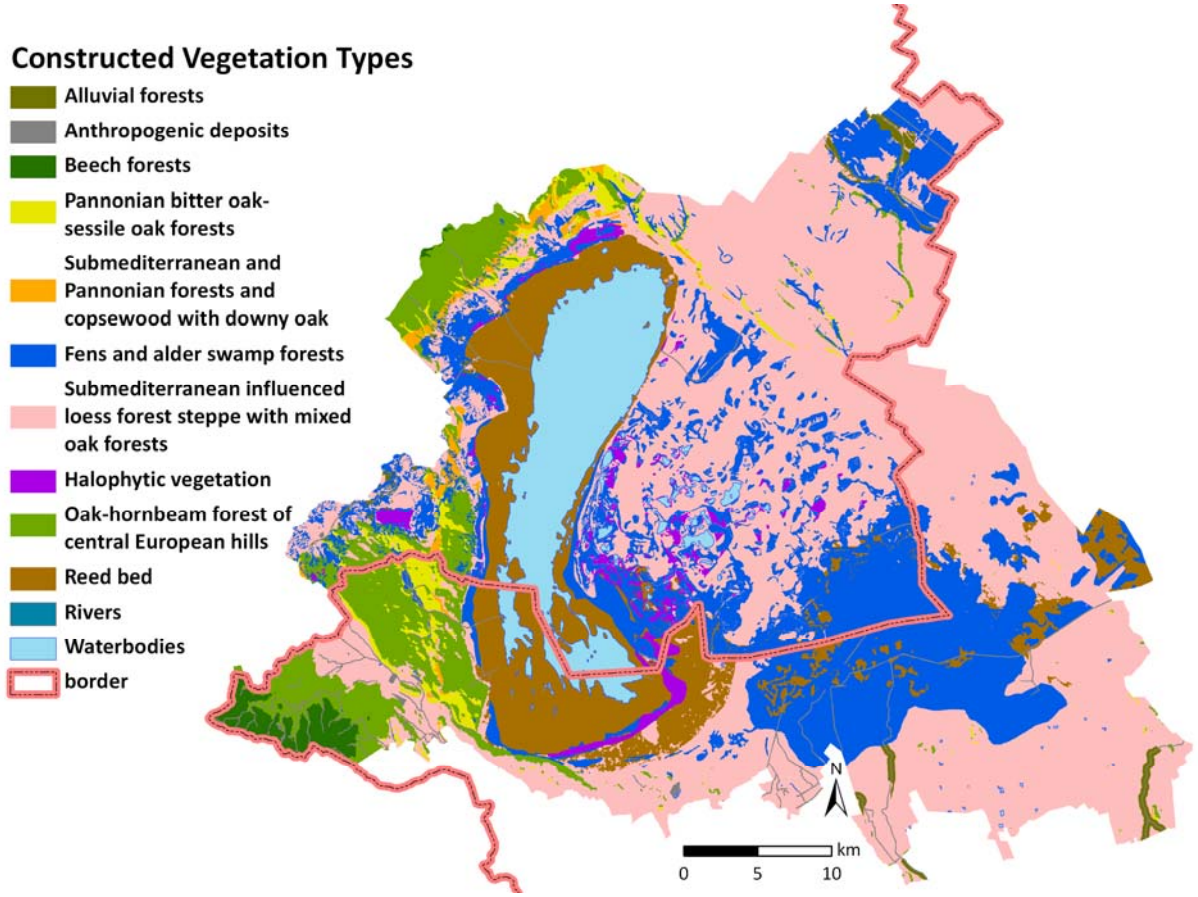


Figure 76: Constructed Vegetation Types of the wider investigation area.

Going more into detail, alluvial forests seem rather underrepresented along the rivers Leitha and Kleine Leitha. Also along the Wulka, different forest types occur but rather the little alluvial one – only in small patches. Patches of halophytic vegetation also might be missing, e.g. in Oggau along the lake shore. In general, these problems are associated to the fact, that the soil data do not cover the whole area, as the soil map in general excludes information on soils of artificial areas and forests. Therefore, vegetation types which are mainly described by their soil properties are likely to be underrepresented in this map.

3.1.2. Potential landscape functions

The distribution of the different Constructed Vegetation Types varied enormously among the landforms as also the landforms as such already are of different size (Table 48).

Table 48: area [ha] of Constructed Vegetation Types per landform

LANDFORM	1	2	3	4	5	7	8
alluvial	28	31	1,093	125	15	64	7
anthropogen	0	0	0	11	48	108	41
beech	0	0	0	0	0	0	2,516
bitter+sessile oak	0	41	22	79	370	3,069	286
downy oak	16	0	8	54	51	940	465
fens	8,183	22,799	3,632	5,785	619	1,808	28
forest steppe	5,579	14,989	11,533	33,736	18,555	5,554	60
halophytic	2,827	0	6	305	0	31	0
oak-hornbeam	36	51	92	52	364	8,463	5,577
reedbed	18,961	3,658	0	227	0	32	0
rivers	41	129	106	50	6	125	96
waterbodies	15,588	18	37	42	6	11	1
Total area of landform	51,260	41,716	16,528	40,465	20,035	20,205	9,077

Based on the capacity matrix and the location of the vegetation types, a picture of the distribution of the individual subfunctions can also be drawn. Examples are shown in Figure 77, where the differences among sub-functions become clear.

a. b.

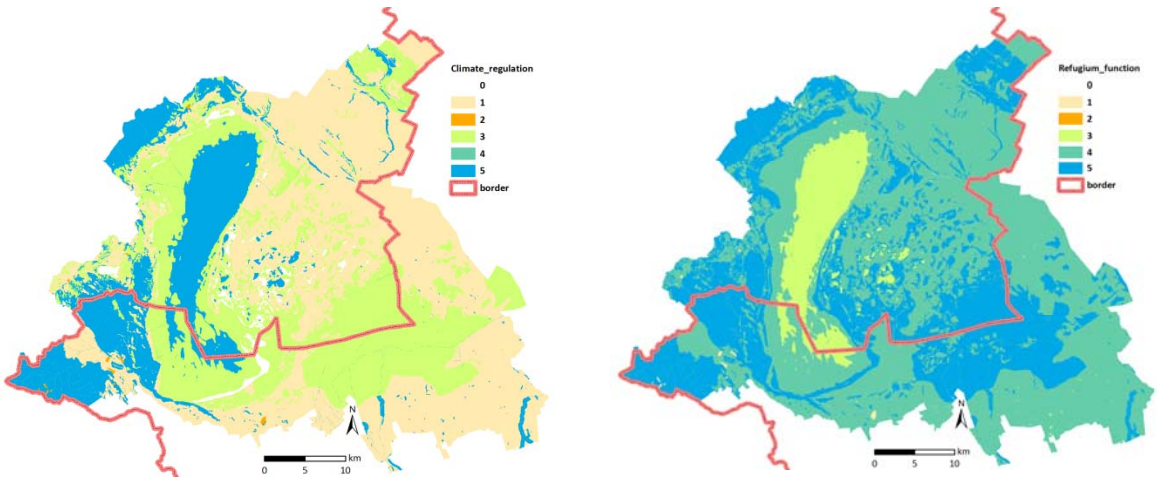


Figure 77: a. The sub-function climate regulation shows higher values in the western part of the investigation area; b. the potential of the refugium function is very high throughout the whole investigation area. 0 = no provision, 1 = low provision, 2 = modest provision, 3 = medium provision, 4 = high provision, 5 = very high provision.

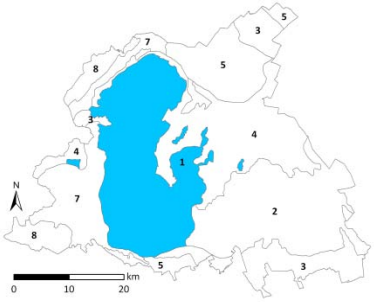
The aggregation of the sub-functions to the main three potential functions blurred to some extent the picture of the functions' provision due to the averaging. Therefore, the general picture of the three potential functions looks rather similar in all landforms, giving the highest values always to

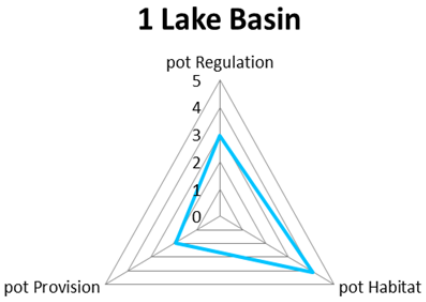
"Habitat", followed by "Regulation" and then "Provision". Depending on the area-weighting of the VEG-values, the mean potential landscape function looked more differentiated among the landforms when looking at the detailed values (Table 49, Figure 78).

Table 49: Main potential landscape functions in each landform

LANDFORM	pot Regulation	pot Habitat	pot Provision
Landform 1	2.959	4.082	1.928
Landform 2	3.279	3.731	1.971
Landform 3	2.870	3.341	2.287
Landform 4	2.606	3.171	2.340
Landform 5	2.493	3.101	2.486
Landform 7	3.648	4.256	2.785
Landform 8	4.200	4.875	3.164

a.





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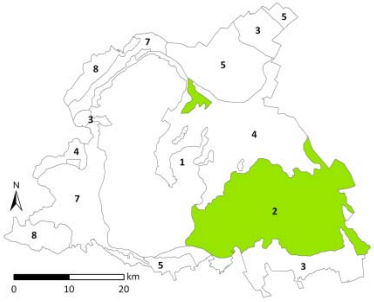

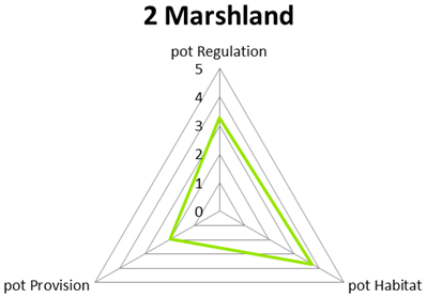

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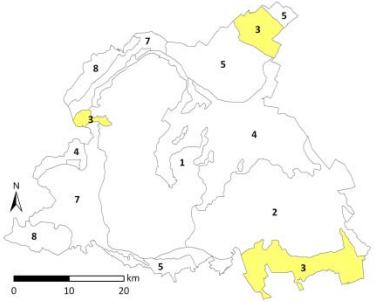

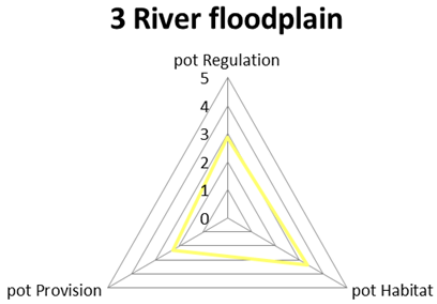

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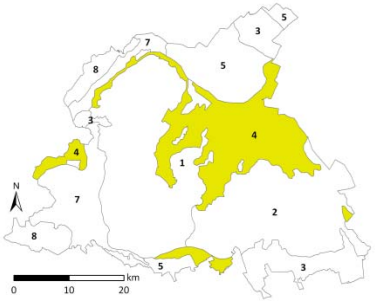

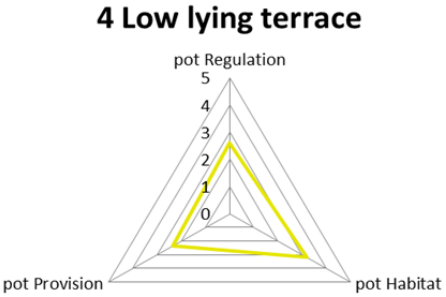

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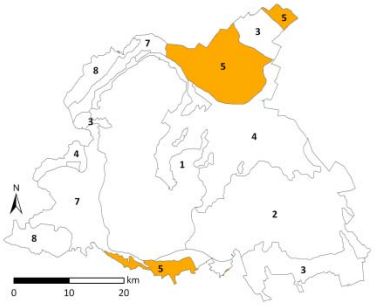

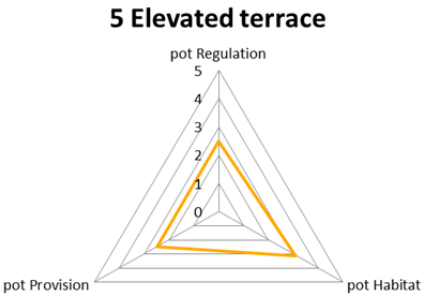

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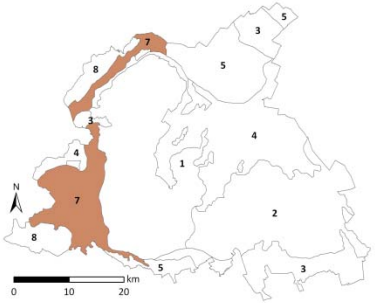

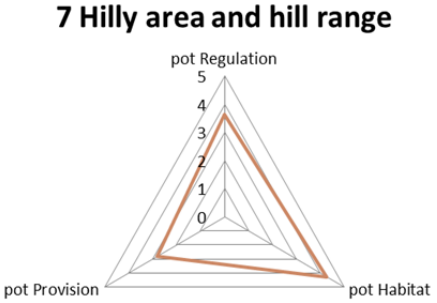

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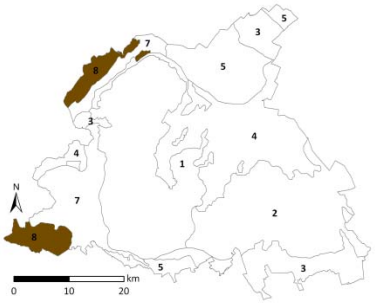


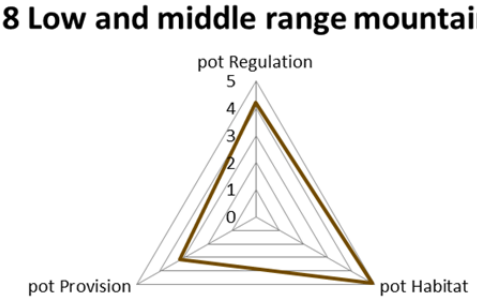


Figure 78: Location and potential landscape functions for each landform (a.-g.)

Conclusion

In general, the direct link between the constructed vegetation types and the main potential landscape functions showed a high value for all functions. Only in the details, some sub-functions would be better supported and provided by other vegetation types than the ones potentially occurring in the region of Neusiedler See.

Still, not for all sub-functions, this method can be applied. The way forward to explicitly address each sub-function is to develop indicator sets targeted to each of these. But this would encompass the need of very detailed data and statistical relationships which are not available yet.

Nevertheless, our study showed the possibilities of an overview assessment appropriate to grasp the main differences between different landscapes and different vegetation and land cover types.

3.2. Actual landscape services (D4.2)

3.2.1. Examples of validation areas (D3.2) and indicators: ALL

On the LCT level the Tourism-facilities value (TFV) reflects the concentration of tourism to the lake and the immediate surroundings (see Figure 79). The high value of the northern part of the lake basin which is dominated by open water (LCT 1b) results from water sports. The big and middle divided touristic nodes on the lakeshore lie only partly in the lake basin.

The hill areas on the western shore of the lake (LCT 3b) are higher valuated than the flat areas on the eastern shore (LCT 1c and 2c). The reasons for this situation are manifold, in particular the different landscape structure and consequently a different structure of settlements and touristic nodes.

The marshland areas (LCT 1d and 2a) as well as the southern part of the lake basin which is dominated by the reed belt and wetlands (LCT 1a) have the least Tourism-facilities value. In former times the Hanság area was covered by extended wetlands with the result that the settlements are very small. The land use is dominated by agriculture and tourism is underdeveloped.

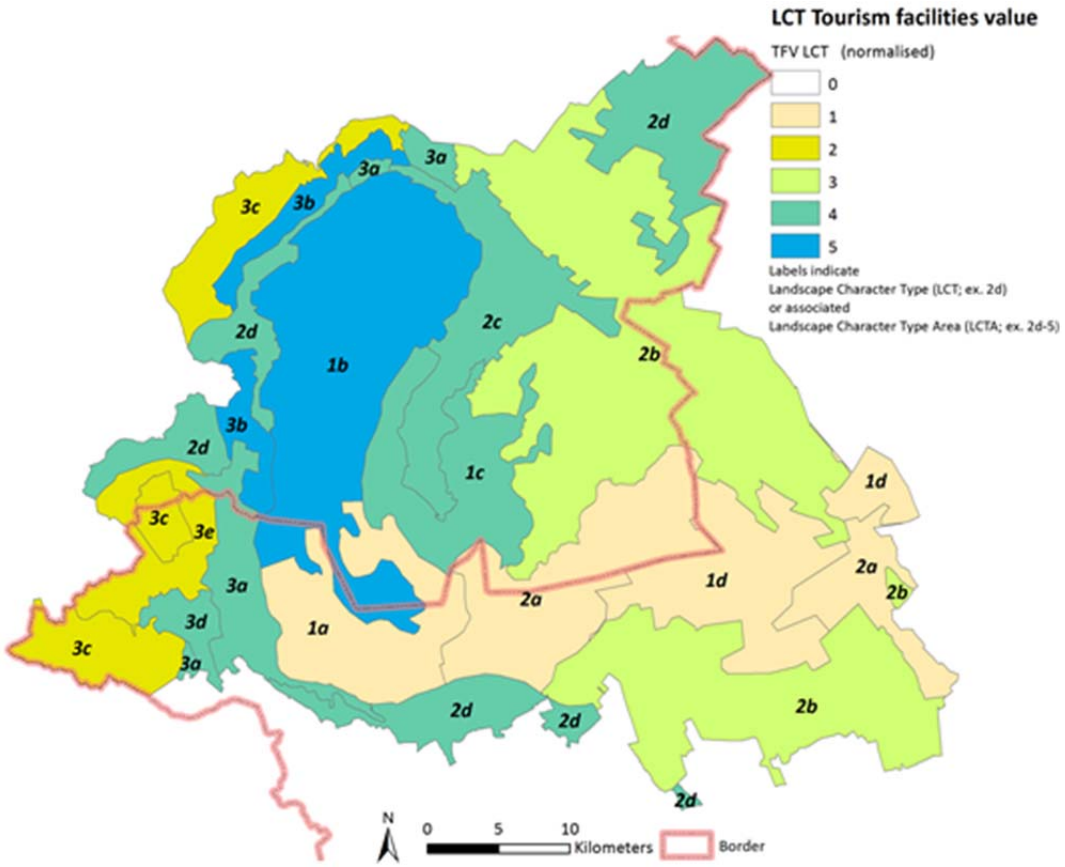


Figure 79: Tourism-facilities value – valuation on the LCT level

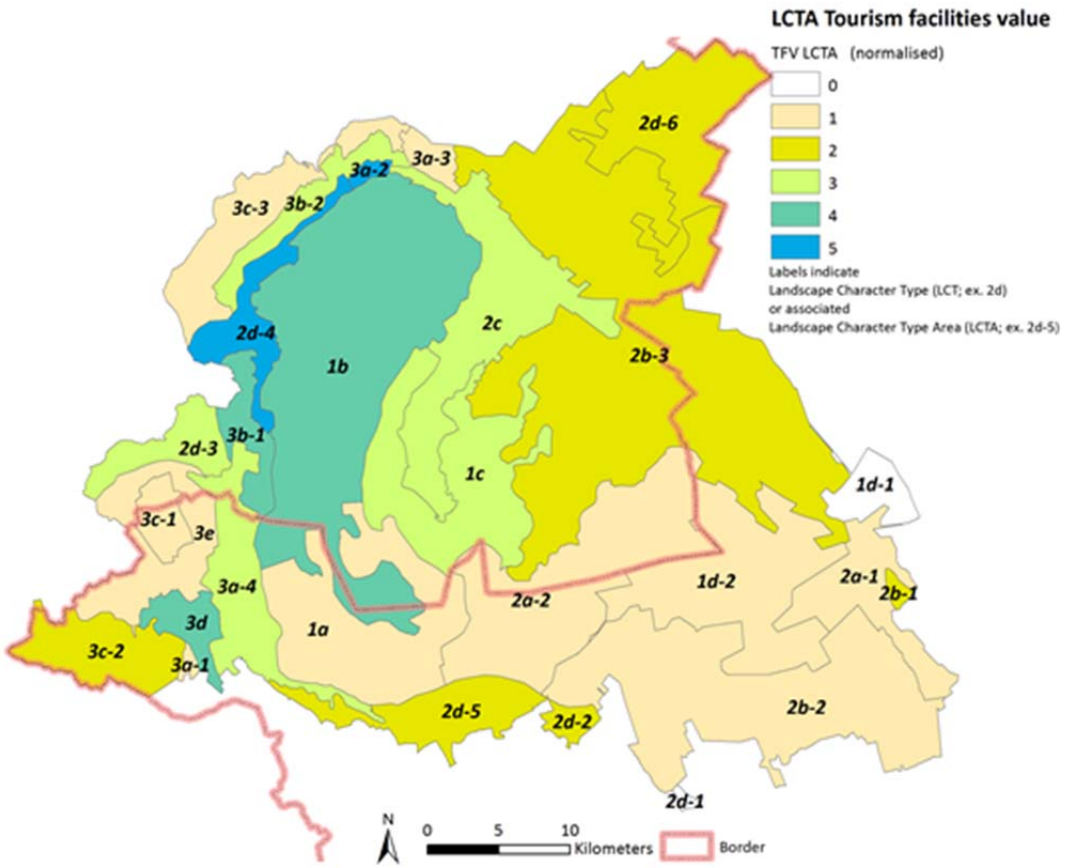


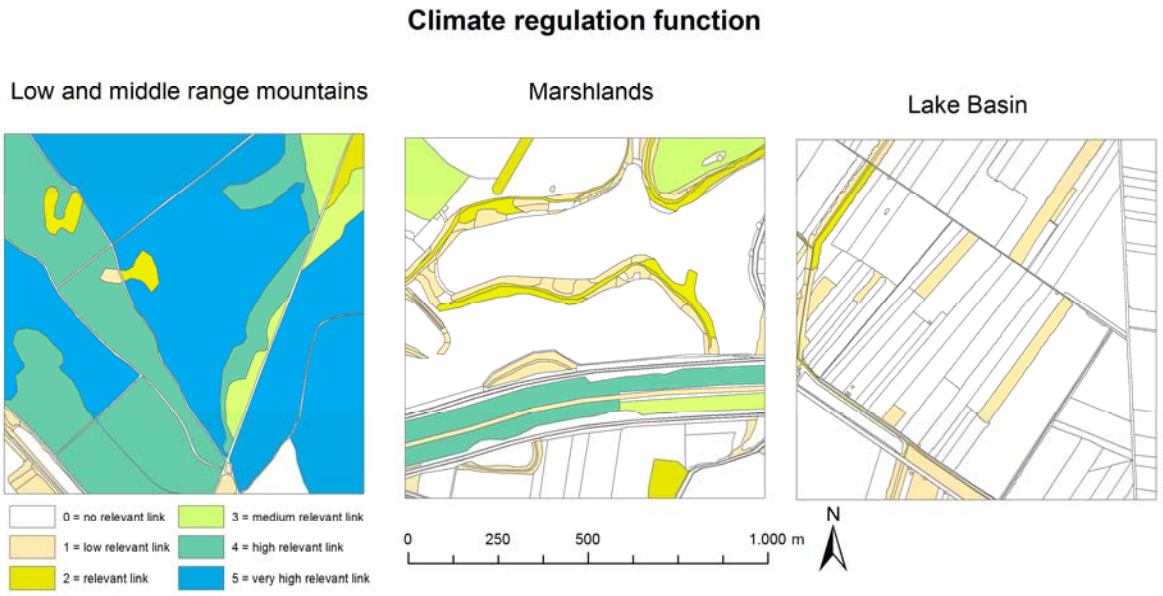
Figure 80: Tourism-facilities value – valuation on the LCTA level

Several valuations of LCT are the result of statistical effects. Like the valuation on LCTA level shows, tourism development is only partly connected with the Landscape Character Type (LCT) (see Figure 80). The location and distance to the lake, historical and cultural aspects as well as local and regional development and planning have influenced the tourism development. Especially the different parts of the LCT 2d (Flatland with medium or high intensity of human use and heterogenous land cover) are very different valuated. In the relative small area on the north-west shore of the lake (LCTA 2d-4) some touristic nodes and a lot of touristic routes are concentrated. In contrast to this the southern flatlands around Fertőd (LCTA 2d-5 and 2d-2) and the north-east part (2d-6, Parndorfer Platte) have a lower Tourism-facilities value (Figure 79Figure 80).

Preliminary results of the habitat approach

Within the habitat approach landscape functions were assessed at the landscape element (biotope type) scale. The maps below show the biotope types´ capacity to provide specific services within different landforms. The selected landscape sample within the landform “low and middle range mountain” has a very high capacity to provide “climate and water regulation as well as nursery function” mainly due to the large forestry areas. The example of the lake basin reflecting mainly arable land shows the lowest values for all three functions (Figure 81).

When aggregating the single sub-functions to the main function groups hot and cold spots of the environmental (provision, habitat and regulation) function can be identified (Figure 82).



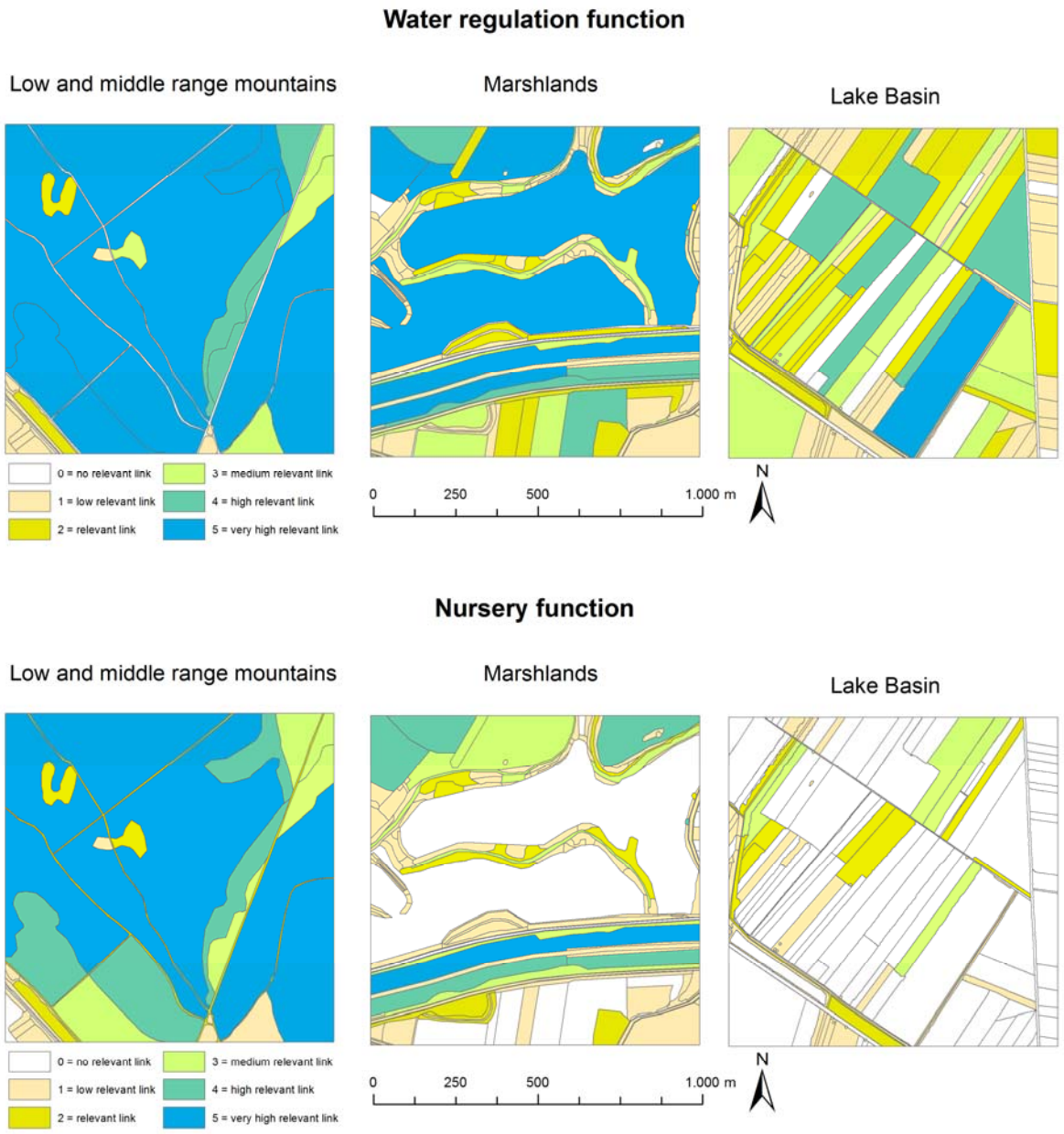


Figure 81: The landscape samples within the LFs: low and middle range mountain, marshland and lake basin show the biotope types´capacties to provide the climate and water regulation as well as the nursery function.

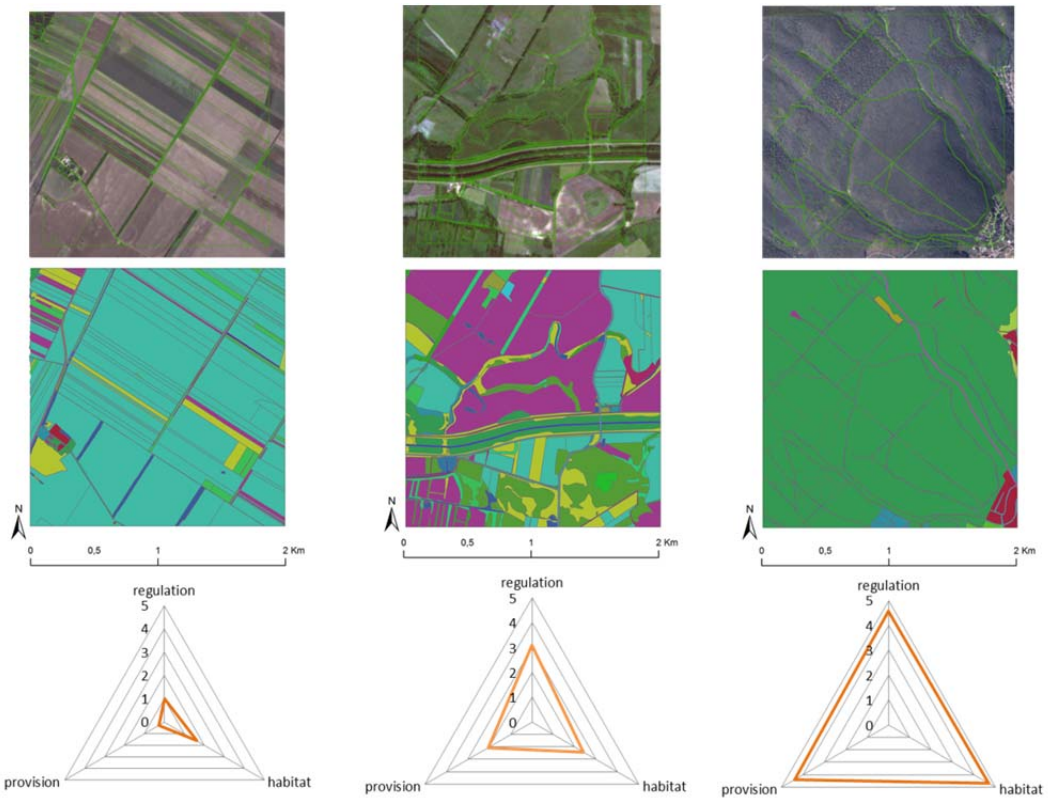


Figure 82: Hot and cold spots of the regulation, provision and habitat services.

3.2.2. Spiderwebs of each Landform / LCA

The results are visualised by seven spiderwebs describing the allocation and trade-offs in landscape service provision. Each landform is characterised by one spiderweb. The figures represent the high diversity within the investigation area ranging from the natural and semi natural areas such as the shallow lake and its immense reed belt, the remaining marshland and flood plains over the extensive used hilly area to the intensive agricultural regions in the low lying terraces.

Lake Basin

Figure 83: Surrounding area of Mörbisch. Photo: Éva Konkoly-Gyuró

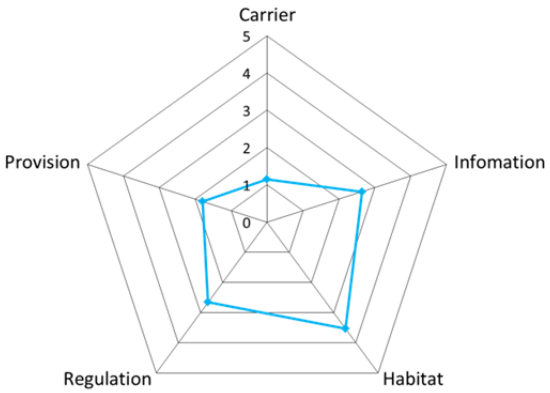


Figure 84: Allocation of landscape services for LF lake basin

Figure 84 presents the allocation of the landscape services within the landform “lake basin”. The Habitat (refugium and nursery), Regulation (e.g. local climate, water and nutrient regulation) and Information (e.g. aestethic, recreation , science and education) services have reached the highest values, which is mainly based on the dominating shallow lake surrounded by the reed belt as well as on the natural and semi-natural area in the southern and eastern part of the landform. These areas have primarily conservation function. The core zones of the national parks both in Hungary and in Austria belong to it mainly because of the nesting and feeding habitats for colonies of reed-nesting birds (eg egrets, spoonbills). The open scenery of the immense reed belt in the south and the grassland area in the east intermingeld with few pathways and bird watching towers provide visual diversity. However, the high values of the information services is not only based on the asthetic information but mainly on the recreational service provided by that area. In contrast to the idyllic southern part with low human impact (only ecotourism), the recently developed recreational district on the lake shore in the north-east at Podersdorf has a clear urban character with many store hotels, large built up beach and camp site, big marina, wide multilane cycling road, parking lots and green spaces. The carrier (e.g. habitation, transportation and tourism facilities) services have the lowest values due to some villages embedded in the lake basin with agicultural use, mainly pastures and vineyards.

Marshland

Figure 85 : Grassland with woodlots and shrubs in the southern Hanság, near Kóny. Photo: Éva Konkoly-Gyuró

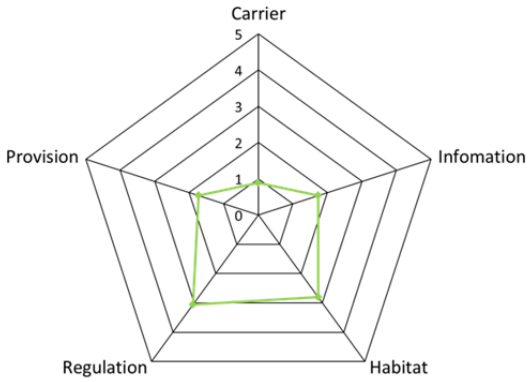


Figure 86: Allocation of landscape services for LF marshland

River floodplain

Figure 87: Leithaauen, Photo: www.Leithaauen-neusiedlersee.at

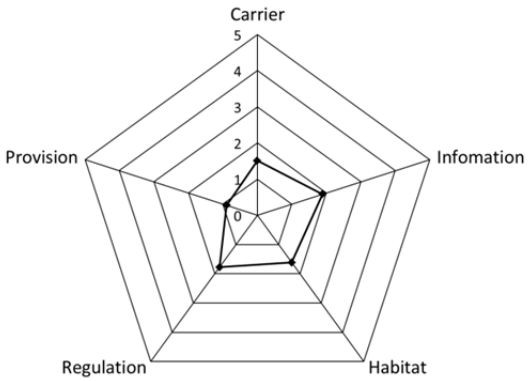


Figure 88: Allocation of landscape services for LF river floodplain

The Marshlands have a high capacity to provide Habitat and Regulation services (Figure 86). Lakes and some patches of wetland have remained in the deepest areas within the mosaic of forest and grassland supplying a range of Regulation services. Forests are dominated by poplar plantation but also some remains of the original Alnus glutinosa “marsh forest” with high nature value providing refugium and nursery habitat for wild animals. Wet grasslands and arable land insert into the forests. In comparison to the former services the Information and Provisioning services have reached lower values. This might be based on the fact that the former wetlands, covered by peaty soils, adjacent to the lake on the south-east are today over woven by artificial channel network and only some wet patches in the deepest relief levels. Recent processes of intensification and extensification create differences in the landscape. On the one hand the increasing biofuel crops and the expanding “plastic villages” of vegetable production and on the other hand the large set aside areas lead to a different character. The very low value of Carrier services may be also explained by this contradictory phenomenon (intensification versus extensification). While in Austria built up surfaces are insignificant in Hungary a series of small rural settlements can be found.

Figure 88 presents the landscape services provided by the region influenced by the river Leitha in the north east, the Wulka river in the west and the Raab flood plain in the south east of Hungary. The Leitha, the Raab as well as the Wulka are typical alpine rivers that are important corridors within an intensive used agricultural land. There remain still some flood plain forests and wet grasslands of high nature value providing Habitat, Regulation and Provision services. However, in relation to the whole region within this landform the river corridors and their flood plain forests represent only a marginal percentage of area which explains the relative low values of the environmental (Provison, Regulation and Habitat) services. The high Carrrier service values, including agriculture and transportation might be based on the intensive used area surrounding the river floodplains.

Low lying terrace

Figure 89: Flatland dominated by arable land in the north of Andau. Photo: Éva Konkoly-Gyuró

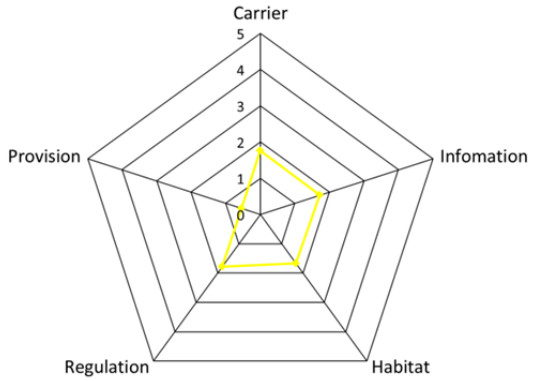


Figure 90: Allocation of landscape services for LF low lying terrace

Elevated terrace

Figure 91: Wind turbines at Plateau of Parndorf. Photo:Tamara Zhuber

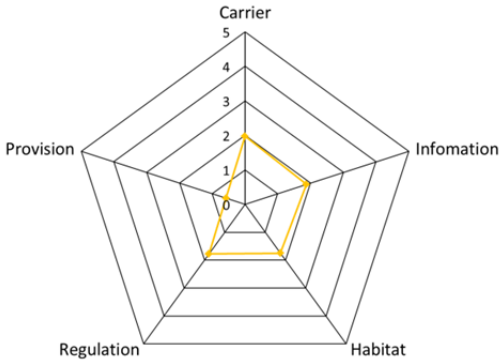


Figure 92: Allocation of landscape services for LF elevated terrace

Figure 90 and Figure 92 show more or less the same allocation of LS. Both landforms are characterised by the lack or insignificant presence of the surface water due to the flood protection and/or the higher elevation of the terraces. Predominat is the equally flat surface covered by intensive arable land parcels and periurban zones and with growing horticultural establishments. Recently also energy production by wind turbines has increasing significance on the Plateau of Parndorf and in smaller scale also in Hungary. These areas are less attractive, have neither recreational nor nature conservation potential. That is why both landforms present at the same time the lowest values in the Provisioning (e.g. wild food, raw materials) and the highest values in Carrier services. The relative high values in Regulation and Habitat services may be due to the well preserved nature conservation areas (wet grassland with high biodiversity) within these monotonous landforms.

Hilly area and hill range

Figure 93: Panorama image of the hilly area nearby Rust and Oggau. Photo: Éva Konkoly-Gyuró

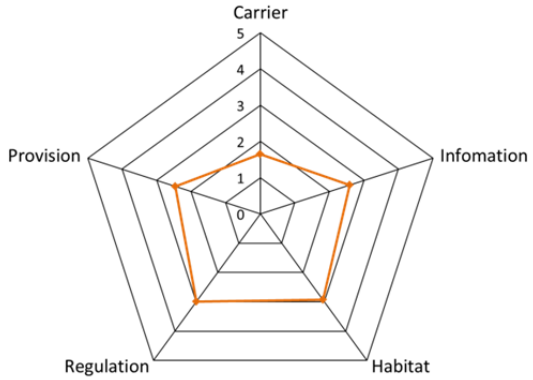


Figure 94: Allocation of landscape services for the LF hilly area and hill range

Low and middle range mountains

Figure 95: Panorama image of Löverek. Photo: Pal Balázs

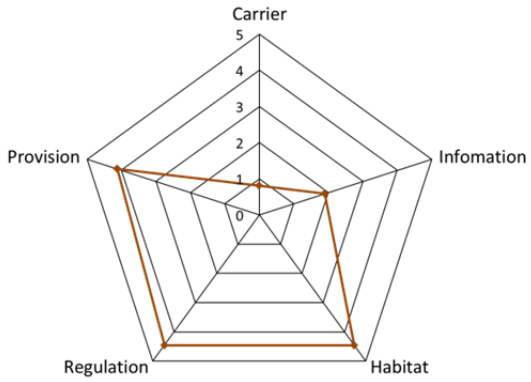


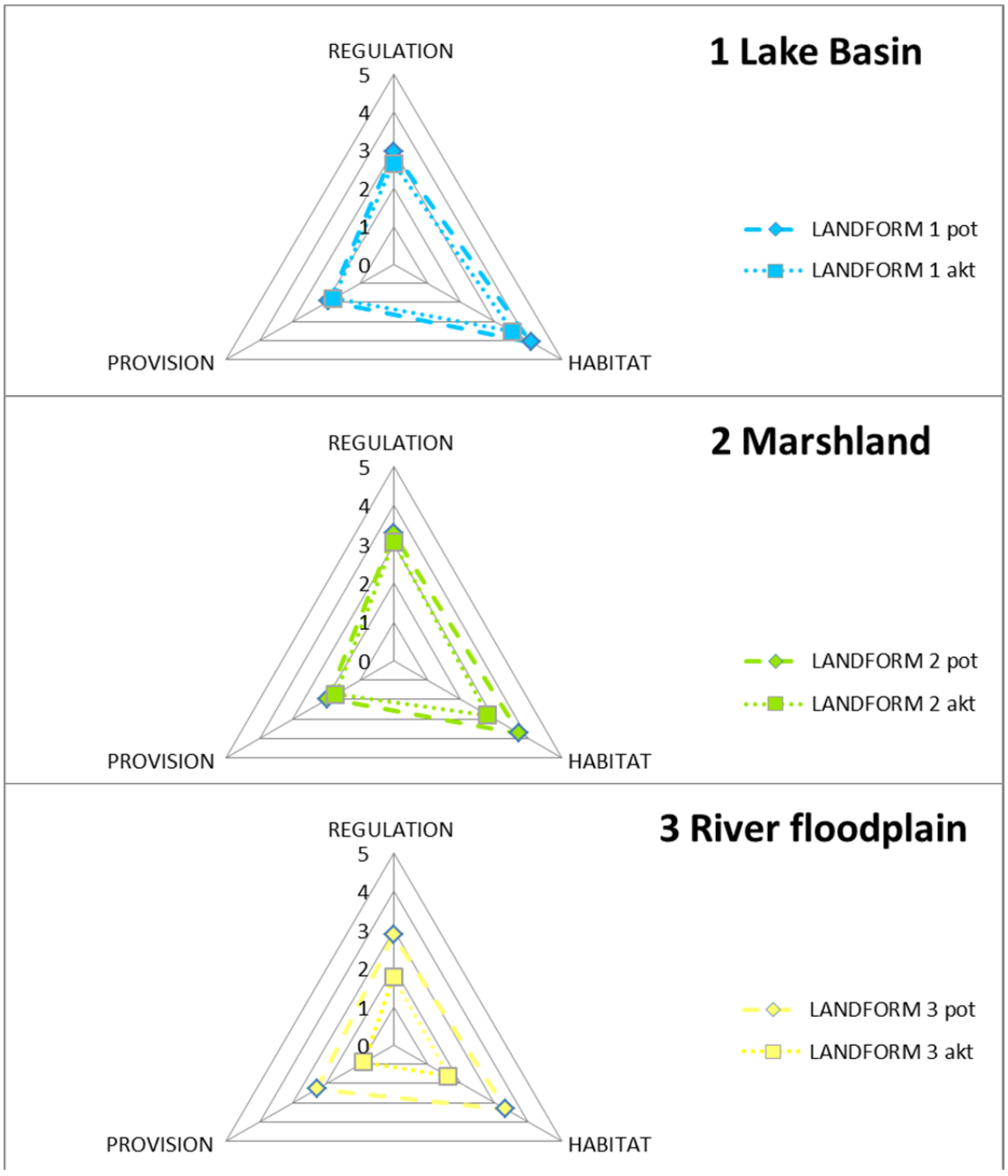
Figure 96: Allocation of landscape services for the LF low and middle range mountains

The spiderweb values of the landform “Hilly area and hill range” are well balanced (Figure 94) reflecting a diversified landscape including both extensive and intensive rural areas accompanied by some semi-urban settlements. The relative high values of Regulating and Habitat services are based on the semi open landscape on the western sandstone hill, mainly in Hungary with its clear land-use zonation according the relief. On the lowest level villages and small towns are embedded in grassland and arable land adjacent to a mosaic of vineyards and gardens that cover the gentle slopes and are confined by closed deciduous forest on the hilltop. The gentle undulating relief of the hills and the view on the reed covered lake as well as the settlements with the traditional architecture attract visitors at any season. In Austria on the northern part of the Rust Hill range, on the foothills of the Leitha Mountain and on the small island hill ”Hackelsberg” the sunny south and west slopes have a certain Mediterranean character. With exception of the hill ”Hackelsberg”, where valuable dry grassland still remain, the landscapes are intensively used mainly covered by vineyards. Tourism is based on the wine culture and the dense cycling road network inserted to the landscape.

The landform “low and middle range mountain” is characterised by low mountains and foothills with low intensity human use, mainly covered by closed forests. The remarkable high values of Provisioning, Regulation and Habitat services (see Figure 96) are based on the almost homogeneous oak-hornbeam forest with fringes of thermophilous downy oak associations with some infiltration of Robinia pseudo-acacia and small grassland patches on the hillsides of the deep valleys in the Leitha Mountain. The closed forests of the Sopron Mountain consist of widely spread spruce and pine plantation mix into the oak, oak-hornbeam and beech stands. Although recreation and tourism play an important role especially in the vicinity of the towns, Carrier (e.g. tourism facilities, transportation, habitation) and Information (e.g. recreation, aesthetic, science and education) services have only reached low values within this landform.

3.3. Comparison of Potential landscape functions and actual services spiderwebs (3 axes)

For the three axes “regulation”, “provision” and “habitat”, a comparison between the landscapes’ potential and the actual service delivery can be made. In principle, in nearly all landforms, the potential was higher than the actual service (see Figure 97). In “Lake Basin”, “Marshland” and “Hilly area and hill range”, the potential was nearly exploited, except for the habitat axis which showed in all LFTs the least consumption and the highest development possibilities. One big exception is the landform “Low and middle range mountain” which exhibited overexploitation of regulation and provision. This was mainly due to the current big forested areas whereas in the map of constructed vegetation types, also forest steppe was delineated in this area (with lower capacities in these two axes).



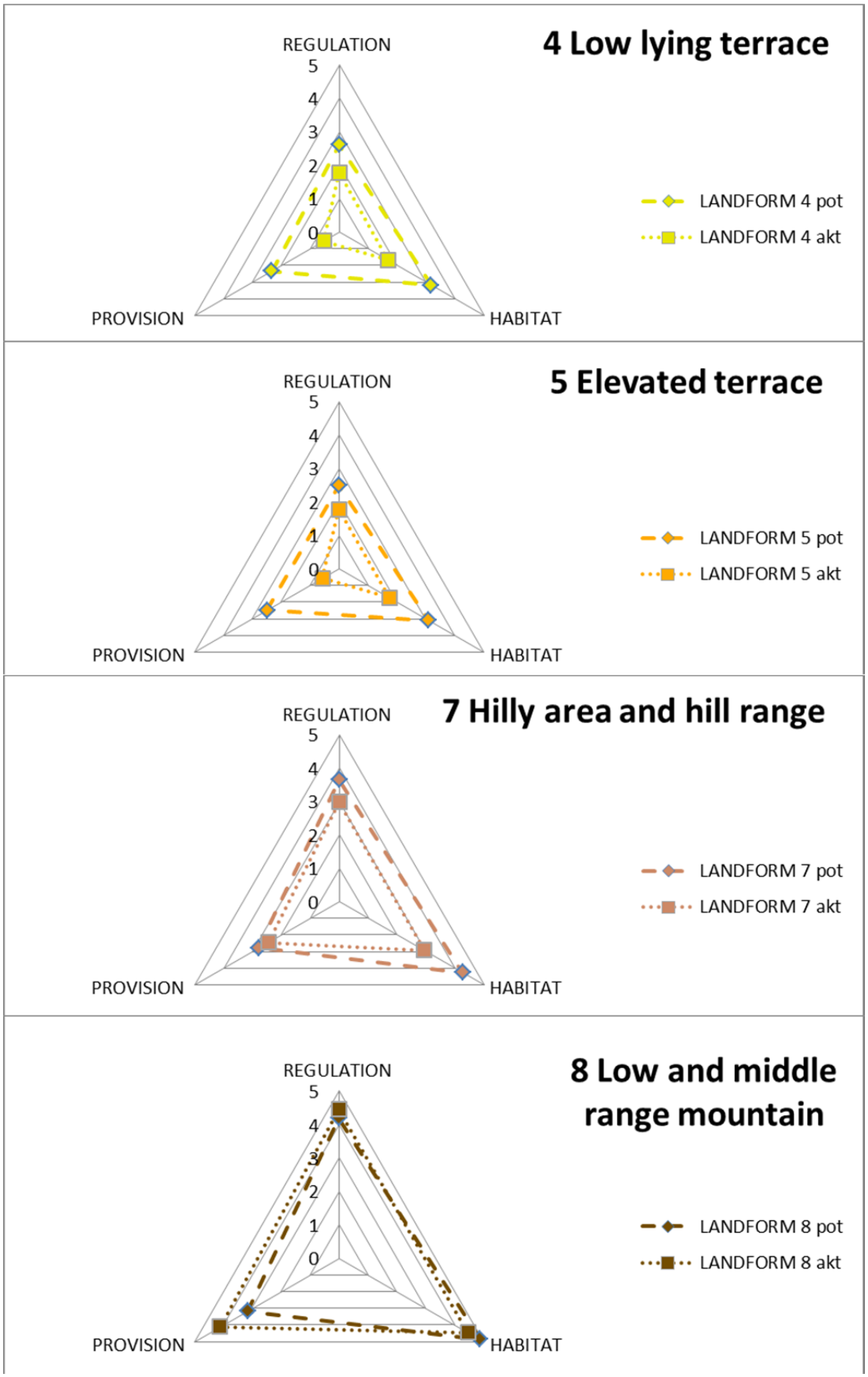


Figure 97: Triangles with the comparison of potential landscape functions with actual service delivery for the seven landforms in the project region

3.4. Results from stakeholder participation process

The following chapter gives an overview on the results of the participation process. During an expert workshop in Rust stakeholders from different sections concerned (politics, tourism, nature protection…) were asked to take part in the implementation of an overall concept for a new biosphere reserve Neusiedler See. In addition, a summary of the conference on "'Landscape Services' and Ecological Networks as Basis for a possible Redesign of a transboundary Biosphere Reserve", which took place in Illmitz, is given.

3.4.1. Communication with decision maker

As the dissemination of scientific concepts and results was one of the major goals of BIOSERV, communication with key-stakeholders and decision makers was decisive. In Austria, nature conservation and territorial planning is in the responsibility of the regional governments. This holds also true for the administration of Biosphere Reserves. Therefore the relevant authorities of the federal province Burgenland have been informed regularly about aims, methods and preliminary results. As a peculiarity, three politicians served in responsible positions during the working period of BIOSERV, thus alls three had to be informed individually. This was done in the format of separate briefings with 1-2 Hours duration, including a presentation by the project team and a short discussion afterwards. These briefings were conducted in the following sequence:

- LR N.Berlakovich (Sept.2007 – mainly presentation of results of "redesigning" project)
- LR W.Falb-Meixner (Sept.2009)
- LR A.Liegenfeld (Nov.2011, Feb.2012)

As a result, the federal province of Burgenland recognised the importance of a redesigning of the existing pre-Seville BR. Although the scientific considerations for a large-scale approach were acknowledged in the polticial arena, a final decision was not taken so far. Alternatively a small-scale approach has been brought up by local decision makers, focussing on the inclusion of the existing world heritage site. Such a solution is not optimal from conservation and landscape ecological point of view, but has some advantages with respect to administrative and financial issues.

In addition, a consultation process has been launched with Dr.R.Schattovich the representative of the spatial planning authorities in the federal province of Burgenland. This was initiated at an early stage of the project on 18 march 2010, when a longer discussion was conducted, followed by regular consultations and exchange of results and planning documents. This active communication resulted in a very active participation of relevant key-stakeholders and regional experts during the ecosystem services-assessment workshop in Rust in 2001.

3.4.2. Expert Workshop for evaluation of landscape functions in Rust

The expert workshop on the subject of "Ecosystem Services of the Biosphere Reserve Neusiedler See" took place on November 3rd 2011 in Rust, Austria. Eleven experts from different disciplines and both countries participated in the workshop, which was held in German. Representatives from Hungary were able to speak German.

After an **official welcome** by the project team the experts were asked to introduce themselve (name and institution) and to name one word they associate with the term Biosphere Reserve. Most of the participants associated the term with nature protection, a unique natural and cultural landscape, birds or development, but also terms like UNESCO, cooperation or integrative were mentioned.

In the **presentation part** of the workshop, basic knowledge of the endangerment of the natural and cultural landscape as well as the current situation of the Biosphere Reserve Neusiedler See was introduced by the project team. Moreover, the chances for the region in consequence of a new Biosphere Reserve Neusiedler See were presented. In the second part of the presentation the current results of the BIOSERV project were outlined.

In the "***World Café***" the experts were asked to evaluate the related services of the landscape functions carrier function and information function with regard to the three different landforms: marshland, low lying terraces, elevated terrace. The evaluation was based on a given evaluation scheme (Figure 98). These three landforms were chosen because they are representative of the whole region and can be found in Austria as well as Hungary. Because of the fact that protection has priority in the core area, those areas were not valued. The experts were asked to evaluate the current situation of the region as well as the desired future development.

Concerning this matter, a main point of criticism was the definition of the ideal development for the region. In this respect, experts see differences between Austria and Hungary. In their opinion the current situation of the related services varies from one country to the other. While, for example, traffic infrastructure in the landform marshland in Austria is relatively well developed, Hungary shows evidence of clear deficits. Another point of criticism was the partially unclear definition of terms, which caused problems in valuation. For example, speaking of agriculture it has to be clarified if one means intensive or extensive agriculture because extensive agriculture should increase whereas intensive agriculture should decrease. Also the key points of the umbrella function of the label "Biosphere Reserve" should become more evident.

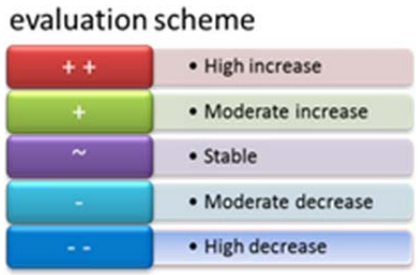


Figure 98: Evaluation Scheme, Stakeholder Workshop Rust

Discussion of the related services of the carrier function for 3 landforms

Table 50: Evaluation results of the carrier function

Results – Carrier function						
	marshland		low lying terraces		elevated terrace	
related services	buffer zone	transition area	buffer zone	transition area	buffer zone	transition area
Habitation	~	+	~ / +	+ / ++	+ (1 for ~)	+ / ++
Cultivation	~ / -	+ (1 for ++)	~	+	+ (H ~)	+ (H ~)
Energy conversion	~ (H -)	~	~ (1 for -)	+ / ~	~	~
Waste disposal	~	+	~	~ / +[1] (H +)	~	+
Transportation	~ (H +)	+ (H ++)	~	+	~	+
Tourism facilities	+	++	+	++	+	++

notes

H = Hungary

[1] lop / garden waste

The table above (Table 50) shows the results of the discussion on carrier functions for the marshland, low lying terraces and elevated terrace. According to the experts the intensity of habitation in the landform marshland deserves the evaluation "- /moderate decrease". The fact that a deconstruction of buildings is impossible prompted them to vote with "~/stable". Concerning cultivation (agriculture) in the landform marshland, experts argued that it makes a big difference whether, for example, one speaks of intensive or extensive agriculture. Intensive use would mean a moderate decrease whereas an extensive use would cause abandonment or grazing. Even the economy needs to develop. Relating to waste disposal, experts see a moderate increase for example for lop or garden waste, which could cause a win-win situation for all. Discussing the subject transportation, the panellists agreed that it is necessary to differentiate between the situation in Austria and Hungary. In their opinion Hungarian infrastructure in the affected region is badly established. All experts agreed that the subfunction tourism facilities has to be developed and cannot stand still.

It was also said that energy conversion stays "stable" because the number of wind generators could not be increased (UNESCO label "World Heritage") and, as things stand at present, there seems to be no possibility for a decrease.

Discussion of the related services of the information function for 3 landforms

Table 51: Evaluation results of the information function

Results – Information function						
	marshland		low lying terraces		elevated terrace	
related services	buffer zone	transition area	buffer zone	transition area	buffer zone	transition area
Aesthetic information	++ (H +)	~ (1 for - / 1 for +)	++ (H ~)	+ (H ~)	+	+
Recreation	+	+	+	++	++	++
Cultural & artistic information	+ (1 for ++ / H ~)	+ (H ++)	+	+	+	+
Science & education	++	++	++	++	++	++

notes

H = Hungary

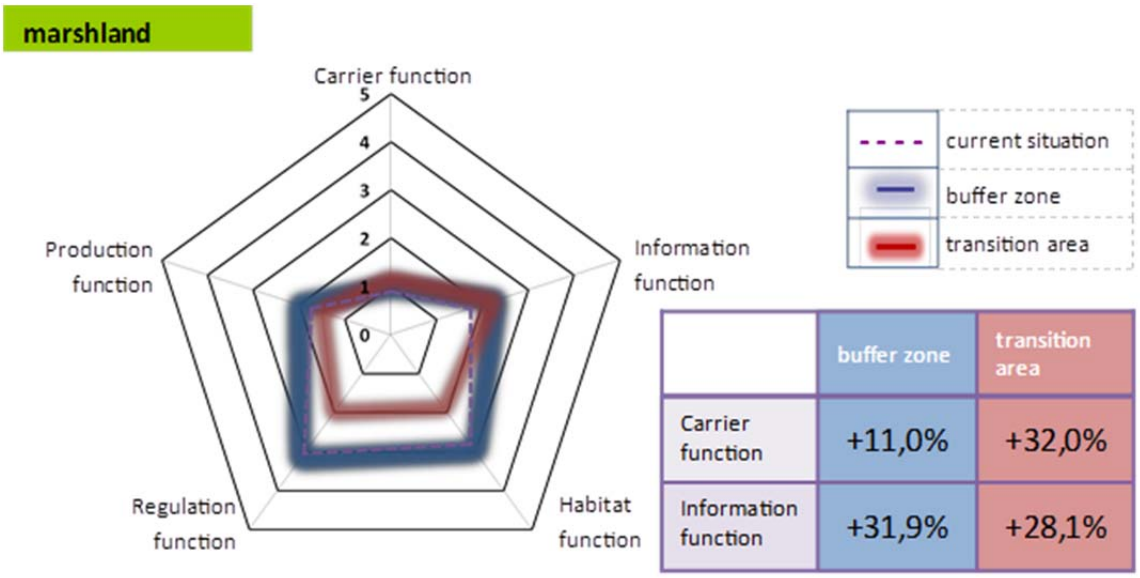
In the opinion of the panellists, disused or constantly uncultivated land could be a problematic factor for landscape aesthetics especially in low lying terraces (see Table 51). For recreation experts see a high increase in the buffer zone of the elevated terrace and the transition area of low lying terraces. For the marshland they evaluated recreation with "moderate increase" in the buffer zone as well as the transition area. A "moderate increase" was also seen for cultural & artistic information. Concerning science & education all experts agreed that there is need of transmitting knowledge about the importance of the habitat "Neusiedler See" which led them to evaluate it with "high increase".

Figure 99: Expert Workshop Rust

Figure 100: Expert Workshop Rust

The spider webs below (Figure 101Figure 102Figure 103) show the results of the world café for the discussed landforms. In summary, it can be said that the results of the BIOSERV project basically accord with the idea of the experts described in chapter 3.4. The axes of the graphs represent the functions and services of the cultural landscape. The purple broken line shows the actual

specification of the different functions represented in the Neusiedler See region. The blue and red lines show the potential landscape functions based on the experts' evaluation discussed during the workshop. The ratings reflect the desired or imaginable development of the region in a fictitious buffer zone and transition area.

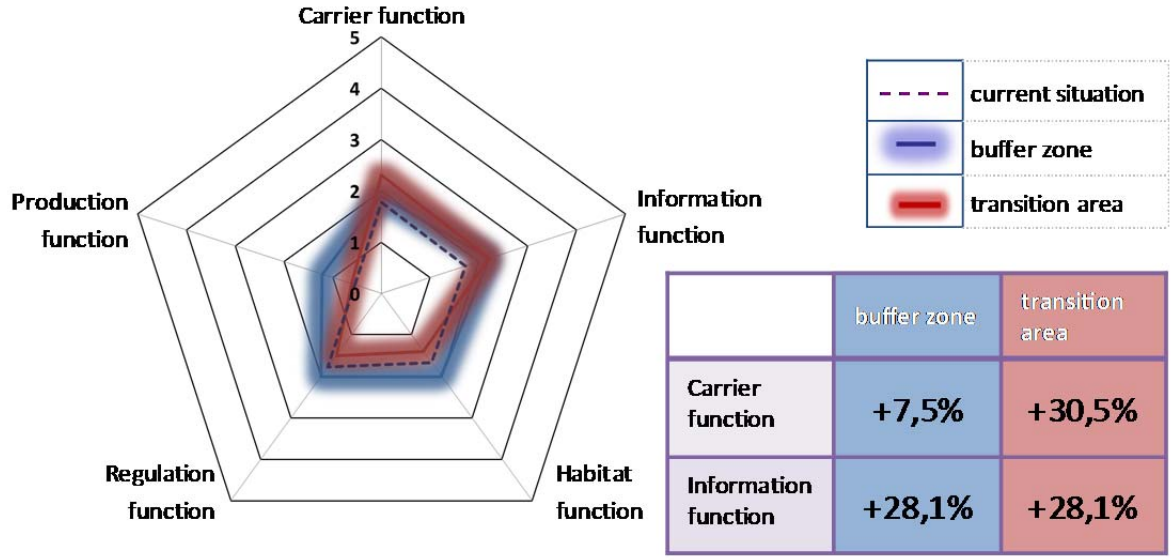


	buffer zone	transition area
Carrier function	+11,0%	+32,0%
Information function	+31,9%	+28,1%

Figure 101: Results of the World Café for the landform marshland

As shown in Figure 101, the experts see a huge potential in the development of the information function in marshlands. This applies to the development of the buffer zone (31.9%) as well as the transition area (28.1%). In the opinion of the experts, also an increase up to 32% for the carrier function in the transition area is possible and preferable, which can especially be reached by transport, tourism and agriculture.

low lying terraces

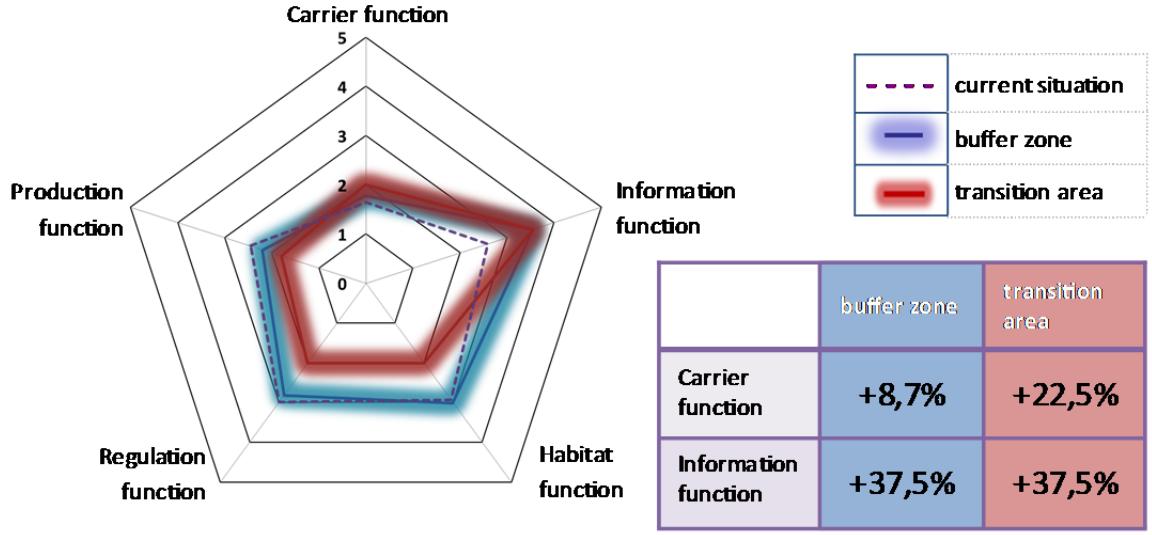


	buffer zone	transition area
Carrier function	+7,5%	+30,5%
Information function	+28,1%	+28,1%

Figure 102: Results of the World Café for the landform low lying terraces

The results for the low lying terraces (Figure 102) look similar to those for marshlands. Again, experts see a huge potential in the development of the information function in the buffer zone and transition area (28.1%) as well as the carrier function in the transition area (30.5%). On the contrary, the buffer zone offers less development potential for the carrier function (7.5%).

elevated terrace



	buffer zone	transition area
Carrier function	+8,7%	+22,5%
Information function	+37,5%	+37,5%

Figure 103: Results of the World Café for the landform elevated terrace

Even for the landform “elevated terrace” (Figure 103) the evaluation of the experts shows a similar distribution of potential. Compared to the landforms shown before, the development of the information function for the landform “elevated terrace” represents the highest potential of all

discussed landforms. Experts see a potential of development for the information function in the buffer zone and transition area of up to 37.5%.

To sum up, it can be said that the experts see the highest potential of development in the information function (aesthetic information, recreation, cultural and artistic information as well as science and education), regardless of whether they talk about marshland, low lying terraces or elevated terrace of the region Neusiedler See.

3.4.3. Information workshops in Illmitz 2009 and 2011

In the framework of BIOSERV project two information events were held in the information centre of national park in Illmitz.

Information event in the beginning of the project in Illmitz 2009

The informative meeting on the subject of "Ecosystem Services as scientific foundation for the sustainable implementation of the redesigned biosphere reserve Neusiedler See" took place on Oct. 9th 2009 in the information centre of the Neusiedler See National Park in Illmitz, Austria.

Approximately 40 participants from different departments (see graph below, Figure 105 and Figure 106) took part in the meeting. Among others the mayors of several municipalities of the region Neusiedler See, members of the Provincial Government of Burgenland, representatives of the tourist board and the association "World Heritage Neusiedler See" as well as the head of the urbarial municipality and Burgenland's environmental ombudsman attended the meeting (Figure 104). Representatives of the University of Western Hungary and of the Fertő-Hansag National Park took part as well. The meeting was held in German and lasted for about three hours.

Figure 104: Audience of the meeting on October 9th 2009, Source: Allex

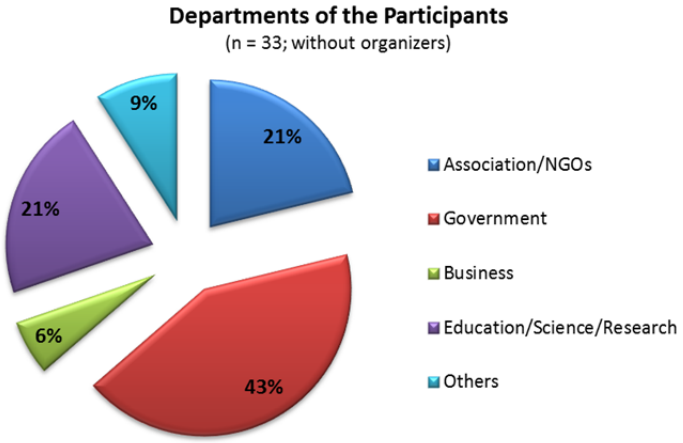


Figure 105: Departments of the participants of the informative meeting in Illmitz

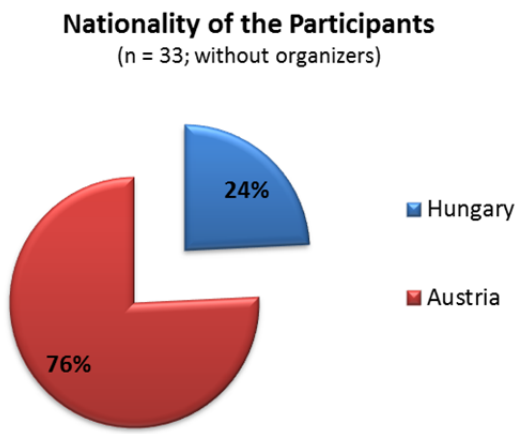


Figure 106: Nationality of the participants of the informative meeting in Ilmitz

After an official welcome, Univ. Prof. Dr. Alois Herzig (Biological Station Neusiedler See) talked about *"The biosphere reserve Neusiedler See from the manager's point of view*". In this talk he presented the history of the development of the Biosphere Reserve Neusiedler See (Figure 107).

Figure 107: Presentation of Prof. Herzig on 9th October 2009, Source: Allex

In the second presentation *"Biosphere reserves in Austria: an overview*" Ass. Prof. Mag. Dr. Karl Reiter (University of Vienna) gave an overview of the current situation of Biosphere Reserves in Austria and the intent of the label Biosphere Reserve itself.

The cross-border types of landscapes of the region Neusiedler See were clearly illustrated by Dr. Éva Konkoly-Gyuró (University of Western Hungary in Sopron) in her speach on *"Different types of landscapes in the region of Fertő – Neusiedler See – Hansag*" .

In the next part of the presentation block Dr. habil. Karen Ziener (University of Klagenfurt) presented the results of the completed MaB pre-project "Redesigning the biosphere reserve

Neusiedler See“, which aimed on the development of options for a realignment of the Biosphere Reserve Neusiedler See by an integrated landscape- and regional development and the initiation of a concept for the continuation of systematic ecological and socio-economic research.

In the last presentation Dr. Thomas Wrbka (University of Vienna), head of the project team BIOSERV, introduced ”The research project BIOSERV: an outlook“ in its main features, work packages and expected results.

After the presentation block, there was a panel discussion, in which Dr. Herzig, Dr. Reiter, Dr. Konkoly-Gyuró, Dr. Ziener and Dr. Wrbka answered and discussed questions of the audience.

International Post Conference Report in Illmitz 2011

The conference on *“‘Landscape Services’ and Ecological Networks as Basis for a possible Redesign of a transboundary Biosphere Reserve”* took place on Nov. 25th 2011 at the Information Centre in the Austrian part of the National Park Neusiedler See – Seewinkel.

During the conference, options for a sustainable redesign and transboundary enlargement of the Biosphere Reserve Neusiedler See, which were elaborated in the course of the international projects.

TransEcoNet (Central Europe) and BIOSERV (MAB), were presented and discussed.

The language of the conference was German (English in parts) with simultaneous translation into Hungarian.

Figure 108: Conference at the Information Centre of the National Park Neusiedler See – Seewinkel in Illmitz, Source: Czachs

Overall, 62 experts from different departments (see graph below, Figure 109 andFigure 110) took part in the conference. As a representative from politics, Andreas Liegenfeld, Member of the Provincial Government of Burgenland, attended the conference.

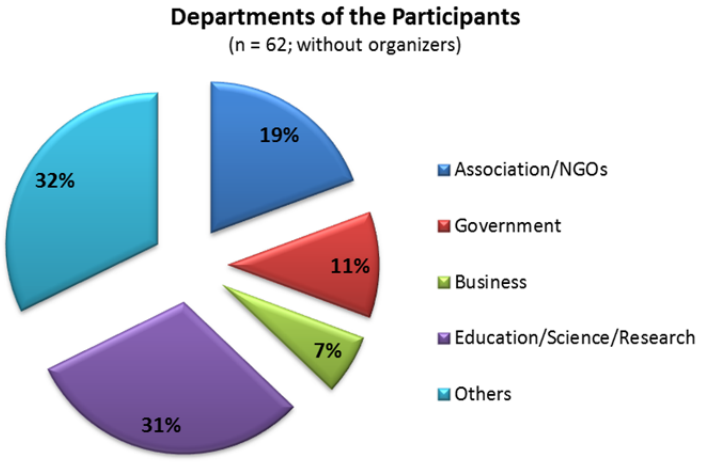


Figure 109: Departments of the participants of the conference in Illmitz

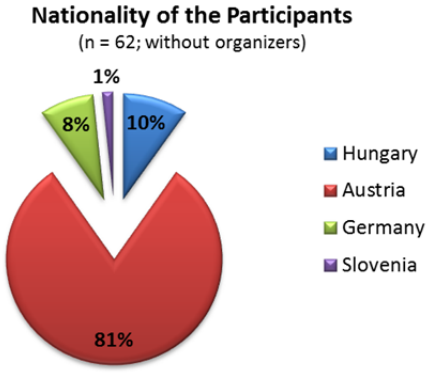


Figure 110: Nationality of the participants of the conference in Illmitz

The Opening Plenary speaker Univ. Prof. Dr. Elmar Csaplovics (Dresden University of Technology, project manager of the Central Europe Project TransEcoNet) gave a review of the project "TransEcoNet" in Central Europe and current projects with Austrian attendance.

In the first presentation ***"Ecosystem services – current research in Europe"*** an overview of ecosystem functions and services in a multifunctional landscape was given by Dr. Benjamin Burkhard, (Christian-Albrechts-Universität Kiel), and an integrative valuation concept was presented that allows a comparison of different types of landscapes based on the services they offer. The results of these evaluations could be used to make trade-offs between different land using interests and to facilitate suitable and sustainable land-using decisions. In addition, an overview of the numerous landscape-ecological activities currently taking place in Europe was given.

In the second presentation ***"Biosphere reserves as a motor for regional development"*** Univ. Prof. Mag. Dr. Georg Grabherr, Austrian Academy of Sciences, gave an overview of the history of biosphere reserves. Given arguments indicated that biosphere reserves are a good motor for regional development provided that the parties involved are motivated to take action because the concept of biosphere reserves depends on initiative.

Ass. Prof. Dr. Thomas Wrbka (University of Vienna), head of the project team BIOSERV, spoke about ***"Landscape as basis of life and living space– What do we get out of our landscape?"*** This presentation provided an overview of the current situation of the Neusiedler See region, focusing on the existing natural and cultural landscape as well as the various categories of protected areas. In addition, the results of the Man & Biosphere project "Biodiversity and Ecosystem Services as scientific foundation for the sustainable implementation of the Redesigned Biosphere Reserve 'Neusiedler See'" (BIOSERV) were presented. With its umbrella function the label "Biosphere Reserve" provides a new chance to coordinate the different forms of land use and the various categories of protected areas to allow a sustainable development of the region. Moreover, a redesigned Biosphere Reserve Neusiedler See was drafted, which was defined by using an evaluation system, established during previous projects, considering the results of the expert workshop in Rust (November 3rd 2011). These results could form the basis of future policy in regional development.

After the first presentation block there was a **panel discussion** on: *"Biosphere Reserve Neusiedler See – a label with future?"*. The panel, moderated by Alois Lang (National Park Neusiedler See – Seewinkel) and comprising Univ. Prof. Dr. Alois Herzig (Biological Station Neusiedler See), Andrea Szucsich (ARGE Naturparke Burgenland), DI Dorothea Jagschitz (chairwoman of farm holidays), Klaus Hofmann (Manager of the St. Martins Therme) and Alois Lang himself, discussed the future prospective of the Biosphere Reserve Neusiedler See and the importance of the label for the several sections.

The last presentation was titled ***"Place and Identity in Borderlands"***. In this poetic talk on her work Univ. Prof. Dr. Julia Ellis Burnet (University of Nova Gorica) gave an insight into the relationship between humans and their personal place, which is affected by the story of someone´s life, local environment and geographical location as well as ethic tradition, religion and family.

At the end of the official part of the conference the **film *"Borders and Humans around the Neusiedler See"*** was presented. The film was produced during several years of filming in the course of the CENTRAL EUROPE Project TransEcoNet and shows how the residents perceive their own landscape.

4. Discussion

4.1. Identification of possible congruencies and discrepancies for Biosphere reserve

In the course of the project workshops and conferences were held to involve responsible persons and representatives of affected areas in the planning process. The aim was to find the optimal solution for the region. Both praise and criticism have been voiced. The main conclusions of the project are summarized below.

4.1.1. Project team´s opinion (based on our results)

According to the results of this study a redesign of the Biosphere Reserve "Neusiedler See" is possible. The existing BR provides a good basis on which the redesign could build upon.

In our analysis we could identify some differences in the investigation areas of Austria and Hungary. Based on the larger sizes of conservation areas (especially of national park) conservation issues are more important in Hungary, whereas the sustainable development function of the BR is not acknowledged by Hungarian stakeholders. By comparison the participation of the Hungarian stakeholders is much lower in workshops and the interest is marginal. The umbrella function of the BR pooling various areas of different protection categories is neither acknowledged.

Our results showed different potential and actual landscape services in the individual LCT's . Therefore we recommend that landscape character types should play a role in the future identification of the BR and that in the Austrian part of the BR umbrella function and regional development function should be stressed more. Furthermore the future BR should integrate parts of the region which are not in any protection category yet.

4.1.2. Outsiders view (reflection on the newspapers)

The press also has published reports on the imminent withdrawal of the UNESCO label "Biosphere Reserve" and the possible consequences on the region (Kronen Zeitung, December 13th 2011; Standard, January 18th 2012). Criticism was passed especially on politics, which has so far delayed a decision. At the moment responsible politicians believe that the label "National Park" is the highest award, so they disbelieve that there is need for a Biosphere Reserve.

Also the reader feedback on (Krutzler, 2012) indicates that considering that the Neusiedler See region is currently protected by several categories of protection, outsiders do not see any disadvantages for the region by the loss of the label "Biosphere Reserve".

This reveals that further investigation is required concerning the added value of the label "Biosphere Reserve" and its benefits for the region Neusiedler See.

4.2. Critical view on our methods

The main points of criticism of the experts raised during the workshops, were the definition of the "ideal development" for the region as well as the partially unclear definition of terms (see chapter 3.5.2).

Referring to the presented evaluation system, the question has been raised if it is possible to take current or planned projects like the rewetting of the Hanság into account and to draw comparisons. According to Thomas Wrbka it is possible to display the functions potentially, which allows to compare how interventions in the landscape affect the landscape services.

Data availability and indicator development for the socio-cultural approach

Indicator development for each component of the information service (S1: aesthetical information, S2: cultural and artistic information, S3: spiritual and historic information, S4: science and education, S5: recreation) was highly depend on data availability. Three kinds of indicators have been developed: indicators related to punctual, linear, spatial elements. We set up a common data base for punctual elements. We collect this source of data from different data sources. We collect and select information from maps, with the legend of important touristic nodes and data from other researches e.g. inventory of landscape values (called TEKA in Hungary). In some cases we also used expert knowledge e.g. wine cellars.

Especially, there was lack of data related to linear elements, where we calculated only the visually relevant edges in the landscape, but there are also other relevant issues e.g. panoramic roads/roads with panoramic view, tree rows, that need to be considered.

Indicators related to spatial element are derived from Corine Land Cover data. Other relating issues can be mentioned, for example accessibility, visibility, diversity of land cover and also the diversity of morphology.

Data availability and spatial scales concerning the habitat approach within our approach landscapes are considered as a human ecological system that provides a wide range of services. Therefore, we build on a multifunctional view of landscape including both natural and cultural aspects. As different landscapes have different functions based on their structure and processes the individual landscape capacities to provide services are strongly linked to natural conditions: e.g. land cover, hydrology, soil conditions, fauna and flora, elevation, slope and climate as well as human impacts: mainly land use but also pollution and emissons, etc. All this information should be as detailed as possible, however finding appropriate indicators related to the specific service providing unit and exploring how functions and services are correlated with different landscape scenarios are still unresolved questions (Seppelt et al., 2011, Wallace, 2007). Current landscape service indicators are still limited by insufficient data and an overall low ability to convey information (Layke, 2009). In our study we aimed at assessing a wide range of services to provide a good overview of the benefits people derive from landscapes. Therefore, we decided to use an expert driven approach expanded by the qualifiers gathered during field work to see first trends for landscape service assessments. In following up projects the expert evaluation values of the capacity matrix can be revised by data from monitoring, measurements, computer based modelling, targeted interviews or statistics.

Some services are even relevant at more than one scale. For instance regulation services can occur both at global scale (climate regulation) and plot-scale (biological nitrogen fixation) (de Groot, 1992). Also pressures on ecosystem services can have effects at different scales. In general physical processes on small scales are often driven by the impact on long period phenomena at large scales (climate patterns, hurricanes, fires) (Limburg et al., 2002). However, large scale processes are also strongly influenced by smaller scale occurrences, for example, microbes respire enough CO2 to keep many lakes and rivers supersaturated (Levin, 1992; del Giorgio et al., 1997). Hence, for the analyses of the dynamics of service supply it is very important to consider the drivers and processes at scales relevant for service generation. However, within the habitat approach we have only focused on the service providing unit scale. To integrate effects at broader scales e.g the landscape scale both spatial configuration of the landscape elements and effects of neighbouring features (e.g. power plant) have to be integrated.

Spatial reference

Landscape services values are calculated in landscape character types, however finally the overall results for each group of functions are presented in landform types. One of the weaknesses of the

project result is that not all (only information) landscape functions were analysed in landscape character types. However, the results of function assessments could provide a baseline information for landscape character types and the ongoing processes in each type.

Aggregation to main landscape services

Our approach is based on the assessment of the sub-functions and services at the service providing unit. In a second step they are extrapolated and aggregated to the main service groups which may result in a loss of information. A sort of weightening of the single sub-functions and services within one main service group could partly solve the problem. Thus, important services such as “cultivation” or “transportation” could be more emphazised.

Another problem may arise when extrapolating the landscape functions to the landscape scale. As the functions and services were assessed at landscape element scale or at landscape character types, the effect on a broader scale could be different. Investigations on the extent of service delivery as well as trade offs in service delivery have to be undertaken.

General feedback on the label “Biosphere Reserve”

During the expert workshop in Rust, one of the main questions concerned the added value of the label “Biosphere Reserve” considering that the Neusiedler See region is currently protected by several categories of protection. Some experts see one of the most important added values of the label in the umbrella function, which could be a new chance to coordinate the different forms of land use and the various categories of protected areas to allow a sustainable development of the region. In contrast to other categories of protection the label “Biosphere Reserve” leaves room for recreation and tourism as well as regional development in addition to protection and conservation, research and education. This for example could play an important role in the tourist sector. This reasoning is based on the grounds (i) that nature value /conservation plays also an important role in the tourism sector and (ii) that the various categories of protected areas are very hard to communicate to residents and tourists. They also agreed that the Biosphere Reserve could help to communicate the concept of the Neusiedler See as one region. The enlargement of the Biosphere Reserve would also mean an enlargement of the whole (tourist) region Neusiedler See, including for example the west bank.

A biosphere reserve could (more or less) help to expand the borders and include some more areas (or municipalities). In addition, some experts cast doubt on the compatibility of the biosphere reserve with the aims of a national park, which is arbitrary because since biosphere reserves are based on a very flexible concept no conflicts of interest are to be expected. Another important aspect was that tourism needs space to develop and that there has to be enough room for building activities (e.g. housing development) in the region.

During the panel discussion at Illmitz all attendant parties considered in substance that the National Park as well as the Biosphere Reserve are important institutions for the region. Especially the tourist sector implements marketing concepts to promote regional tourism using the label “Biosphere Reserve”. A loss of this label could have fatal consequences for both economy and nature and therefore needs to be avoided. Furthermore, they agreed that only a sustainable all-over concept could secure the future of the region.

5. Conclusion / Outlook

5.1. Opportunities and possibilities for a renewed biosphere reserve Neusiedler See/ Arguments for BR

The existing Biosphere Reserve Neusiedler See simply consists of the lake and its surrounding reed belt. In its current status it does not comply with the Seville Strategy. Without an adjustment to this, the withdrawal of the UNESCO label "Biosphere Reserve" and, in consequence, the loss of the chances involved is imminent (Lange, 2004). But which chances are we talking about and why is the label Biosphere Reserve that important for the Neusiedler See region, which is already protected by a large number of categories of protection?

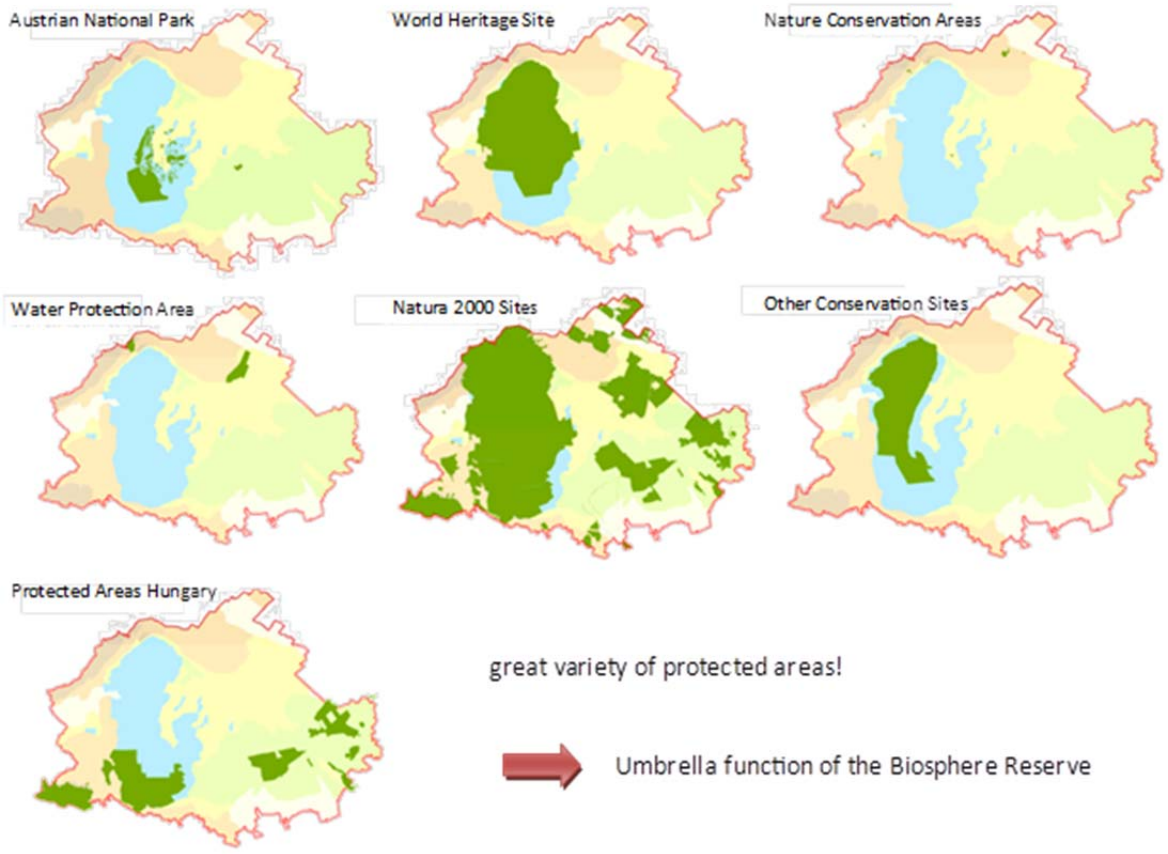


Figure 111: Current categories of protection of the Neusiedler See region

The region, reaching from Leithagebirge via Seewinkel to Hungary, is protected by a large number of protection categories (Figure 111), which partly have different interests underlying. As shown by Table 52, besides protection of nature in the stringently protected core zones recreation and environmental education are in the foreground of the category National Park. Regional development in this category plays a subordinate role. Also at Ramsar Sites, protection and balanced use of habitats of rare birds and water birds take priority. Tourism and regional development are not provided in these protected categories. The category Landscape Conservation Area is mainly aimed at the protection of landscapes with unique character, beauty and recreational value. A coordinating office and appropriate management structures to encourage cooperation are entirely missing here (Lange, 2004). On the contrary, the label "Biosphere Reserve" combines all the aims of the consisting categories of protection and could form a reasonable umbrella over the existing protection categories. The objectives of Seville include both the preservation of biological and cultural diversity,

and in addition the sustainable development of the entire region as well as research and education (Lange, 2004).

Table 52: Aims of the different categories of protection, currently existing in the Neusiedler See region

categories of protection	aims of protection	protection/ conservation	research	education	recreation/ tourism	regional development
Biosphere Reserve	protection of characteristic natural and cultural landscapes	■	■	■	■	■
National Park	protection of natural ecosystems and recreation facilities	■	■	■	■	▪
World Heritage Site	protection of natural areas of outstanding universal value	■	▪	■	■	■
Ramsar Sites	promotion and conservation of the wetlands	■	■	■	▪	
Natura 2000 Sites/ European Nature Reserves	maintenance or restoration, at a favourable conservation status, of natural habitat types or species to be protected	■	■			
Nature Reserve Neusiedler See - Leithagebirge	protection of landscapes with particular suitability for recreation, tourism and environmental education	■		■	■	■
Nature Conservation Areas	main purpose is the protection of cultural properties	■	▪	▪	▪	
Landscape Conservation Areas	conservation of traditional landscapes	■	▪	▪	▪	

Adapted from Lange (2004)

Sectors such as agriculture and nature conservation, nature protection and tourism, nature conservation and hunting, could be coordinated and harmonized. The Biosphere Reserve Management in this connection can act as an information centre and contact. Due to the potential size of the transition area alone the Biosphere Reserve offers favourable conditions for cooperation; besides the development of new project ideas also existing projects and initiatives of the region could be linked and even become generally known and efficient (Biosphärenreservat Niedersächsisches Wattenmeer, Ed., 2007). It is important to say that these projects are not limited to existing protected areas such as projects of the National Park but that rather projects outside of these already existing areas should be initiated. In addition, access to funding for the entire Biosphere Park region will be facilitated through the label.

A cross-border cooperation provides further advantages and is facilitated by the common coordination centre “Biosphere Reserve Management”. Cross-border projects such as infrastructure for sustainable mobility in this way can be easily coordinated and implemented.

Due to the fact that live and economic activity of the people in the region is an integral part of the Biosphere Reserve concept, new development opportunities are also found for tourism. Biosphere Reserves act as a positive image medium and provide the opportunity to develop as a unique tourist destination in competition with other regions. More and more tourists appreciate a gentle and nature-friendly tourism and make their holiday decisions on the basis of criteria such as "sustainability" or "natural". In the future, intact landscapes are going to gain in importance for the economic development of rural areas as a location factor. Preservation and development of these kinds of intact landscapes is what the label “Biosphere Reserve” stands for (Biosphärenreservat

Niedersächsisches Wattenmeer, Ed., 2007). The awareness of the label also provides an additional avenue for the international marketing of the region which will be a benefit for the areas included in the expanded Biosphere Reserve (reaching from Leithagebirge to Hungary) as well. Due to the large-scale zoning, tourist activities could be concentrated and the enormous pressure of different actors on the lake could be channelled. The project results have shown that the development of tourism is capable of being well integrated in the new concept.

Even other sectors, for example agriculture, can have greater access to funding in order to finance projects to improve sustainable agriculture and regional value added (e.g. marketing of regional products and strengthening of existing marketing initiatives) (Lange, 2004).

The implementation of sustainable projects in the whole region, even outside the core zone, turns nature protection into a positive side effect. The fragmentation of the currently existing protected areas with different categories of protection and the associated lack of networking between these areas, for example, could provide stepping stones to create a connection between existing protected areas by the strengthening of contractual conservation management agreements in the buffer zone. Through its coordination function mentioned before the label "Biosphere Reserve" forms an umbrella over the existing categories of protection, coordinates different interests and commitments and also allows cross-border cooperation in the field of nature protection. The balance of restoration measures, for example the restoration of the connection between Hansag, Fertő and the Danube, would thus be relieved. However, a coordination centre for the promotion of communication between those responsible is still missing. The Biosphere Reserve would be the appropriate means to promote cooperation and create a synergistic effect between the different interests in the area around Neusiedler See (Lange, 2004).

To achieve this, the requirements of a Seville-compliant zoning and size of the Biosphere Reserve area have to be created. The results of this project have shown that the potential for a Seville-compliant Biosphere Reserve Neusiedler See exists. Now politics has a duty to create the structures and the instruments necessary for pointing the way forward to a further development of the Neusiedler See region.

5.2. Further steps

5.2.1. Recommendations for UNESCO and Academy

The BIOSERV approach included some elements of participatory planning and transdisciplinarity. This can be documented by the results of the stakeholder and expert consultation process, and the feed-back from participants at the public presentations.

Nevertheless the implementation of scientific results into the political decision making seems to be unsatisfactory. Mainly the adoption of appropriate enlargement options of the existing pre-Seville BR failed to some extent. This is due to a lack of knowledge about the Seville strategy and its potential benefit for regional development. Furthermore some key-stakeholders, namely from nature conservation authorities and the National Park Neusiedler See –Seewinkel, appeared to be reluctant to accept a more integrated approach to nature conservation. In addition the concept of Biosphere reserves was not seen as a desirable option for transboundary cooperation by Hungarian representatives.

Based on these experiences, the BIOSERV-team concludes with the following recommendations:

→ a regular consultation process about existing pre-Seville Biosphere Reserves between the responsible authorities and the Austrian MaB-committee should be established

→ knowledge about the Seville strategy and its potential benefit for regional development should be promoted by an information campaign, jointly organized by the federal province and the Austrian MaB-committee

→ a label for regional marketing of sustainably produced goods from the proposed BR should be developed under the umbrella of UNESCO and the Austrian MaB-committee respectively

→ promoting the BR-concept by organizing excursions and other Twinning-activities to best practice examples in Austria (Gross-Walsertal, Wienerwald) and neighbouring countries (eg. Spreewald, Rhön, Schorfheide, Schaalsee in Germany)
→ strengthen the role of existing nature reserves as core areas for the future BR by ensuring sufficient financial resources and optimal management
→ promote the concept and underlying philosophy of BRs in Hungary and foster transboundary cooperation in this respect
→ further develop inter- and transdisciplinary research on the integration of conservation into economic activities as a stimulus for sustainable regional development

5.2.2. Recommendations for regional authorities (transboundary)

The following recommendations are addressed to regional authorities and should facilitate the coordination of the demanding objectives of Biosphere Reserves as model landscapes for sustainable development, maintaining biological diversity and climate protection as well as steering developments.

National Parks, Biosphere Reserves as well as other categories of protection with their various functions, duties and responsibilities have to be seen as equal categories of protection. The awareness level of the different categories must not lead to a higher or lower acceptance in politics. Because of its special valuation as category of protection with simultaneous development needs, the label “Biosphere Reserve” requires more attention and corresponding facilities which requires money and material expenses.

Besides environmental criteria the selection of sites of the Biosphere Reserve must take different economic and social conditions of the region and the states Austria and Hungary into consideration, to represent as many representative areas within the region of the Biosphere Reserve as possible. Additionally the multi-functionality of the core area, the buffer zone and the transition area with their specific focal points and categories of protection should be taken into account. The protected areas currently existing like the National Park Neusiedler See – Seewinkel or Nature Reserves could be designated as core areas and cross-linked.

The implementation of the label “Biosphere Reserve” demands the development of a very good planning culture. On the part of regional planning concepts have to be established which contain aims and general principles. These have to be grounded in regional planning at all levels. Socio-economic and socio-cultural issues should be taken equally into account along with environmental protection and nature conservation issues in Biosphere Reserve planning. To take into consideration the economic and personal concerns of people of the region, framework concepts should be drawn up involving all important groups. In general, citizens as well as associations and interest groups (nature conservation, land use, industry, tourism…) should continually be involved as eminently important partners and stakeholders in the broad field of management and development (Deutscher Rat für Landespflege, Ed., 2010).

To handle the variegated duties and responsibilities of the Biosphere Reserve like nature protection, regional development, monitoring, education or communication an administration must be set up, which is endowed with adequate staff and tangible means.

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