

# Spatial Information Systems for Supporting Strategies of TransEuropean Management of Cross-Border Protected Regions in Central Europe

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## 1 INTRODUCTION

Protected cross-border regions are more and more affected by economically driven planning and management strategies. There is thus an urgent need to develop, integrate and maintain spatial information systems especially for protected regions which are both highly vulnerable as well as extremely important in terms of preservation of natural heritage. Similar problems arise from the fact that regions of cultural and natural heritage are divided by frontiers into two or more national parks, biosphere reserves, nature reserves or protected landscape areas in two or more countries with two or more administrative and management structures and - if existing - spatial information systems (SIS).

The project SISTEMaPARC (Spatial Information Systems for Transnational and Environmental Management of Protected Areas and Regions in CADSES [Central, Adriatic, Danubian and South-Eastern European Space]) within the EU INTERREG IIIB Programme aims to foster sustainable regional management and development of cross-border national park regions by improving or establishing geo-spatial information pools and TransEuropean exchange of communication concerning homogenised documentation, management and development of cross-border national park regions.

The project allows for initial activities bringing together research institutes, regional planning authorities and authorities of administration. Case studies are focussing on the cross-border nature protection regions Sächsisch-Böhmische Schweiz (DE/CZ), Neusiedler See-Seewinkel/Fertő-Hanság (AT/HU), Krkonose/Karkonosze (CZ/PL) and Triglav/Prealpi Giulie (SI/IT). The approach is open-ended in order to assure the successive integration of additional regions.

The homogenisation of geo-spatial and thematic references is a precondition for setting up and maintaining transnational networks of spatial information systems for management and long-term development of protected areas and regions. The project promotes the planning and establishment of ecologically sound spatial development strategies in the CADSES in general and – in close correspondence to the directives of international and European programmes such as IUCN-GreenBelt and EC-ESDP - of TransEuropean networks of ecological corridors particularly.

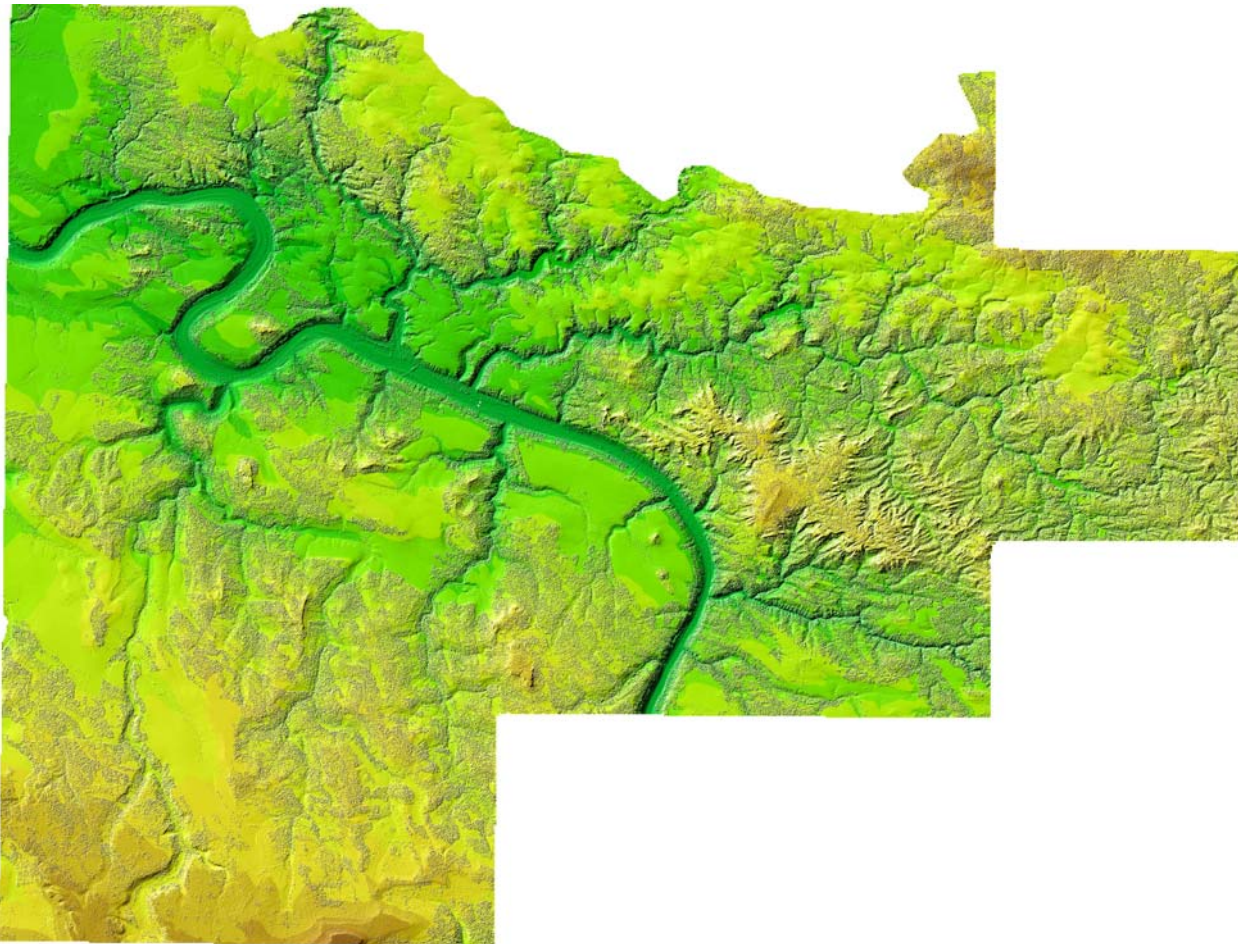
This paper exemplarily presents activities of continuous support of national park authorities and other regional actors with special regard to landscape management, tourism marketing and visitor guidance. A web-based platform for communication and exchange of geo-spatial information has been developed and implemented. It will support the establishment of structures for cooperation in and among specific regions in CADSES. Furthermore transnational exchange of experiences and know-how among cross-border national park regions in Central Europe is initiated. Monitoring and analysing the changes of land use patterns in time and space since the late 18th century supports the development of indicators which allow for comparative assessment of dynamics of impacts due to political and socio-economical changes during the last two centuries. Selected case studies interconnecting regional actors from Slovenia and Italy to Austria, Hungary, the Czech Republic, Germany and Poland in issues of spatial analysis and management by means of sophisticated geo-information networks are highlighted. A concluding remark refers to an outlook on the strategies for extension of geo-information networks and networking based on the project outcomes both in terms of integrating further regions in CADSES and Eastern Europe as well as in terms of enlarging the thematic scope of transnational spatial planning and management communication.

## 2 SPATIAL INFORMATION SYSTEMS IN NATIONAL PARK REGIONS

Spatial information systems are of striking importance for analysing and managing the dynamics of regional land cover and land use change (Walz et al., 2003). Protected regions have an important ecological value for preservation of biodiversity in environments dominated by different forms of human impact. Various national parks have been promoted during the last decades in the Central European Space (CES). On the one hand the official status of these national parks is very different and only few of them meet the IUCN criteria. On the other hand the specific national park regions differ in terms of geographical space and have to face different forms of impact caused by different parameters of pressure on the land. A lot of varieties of criteria, e.g. specific impact patterns, organisational constraints and methods of monitoring, managing and planning, have to be documented, analysed and harmonised.

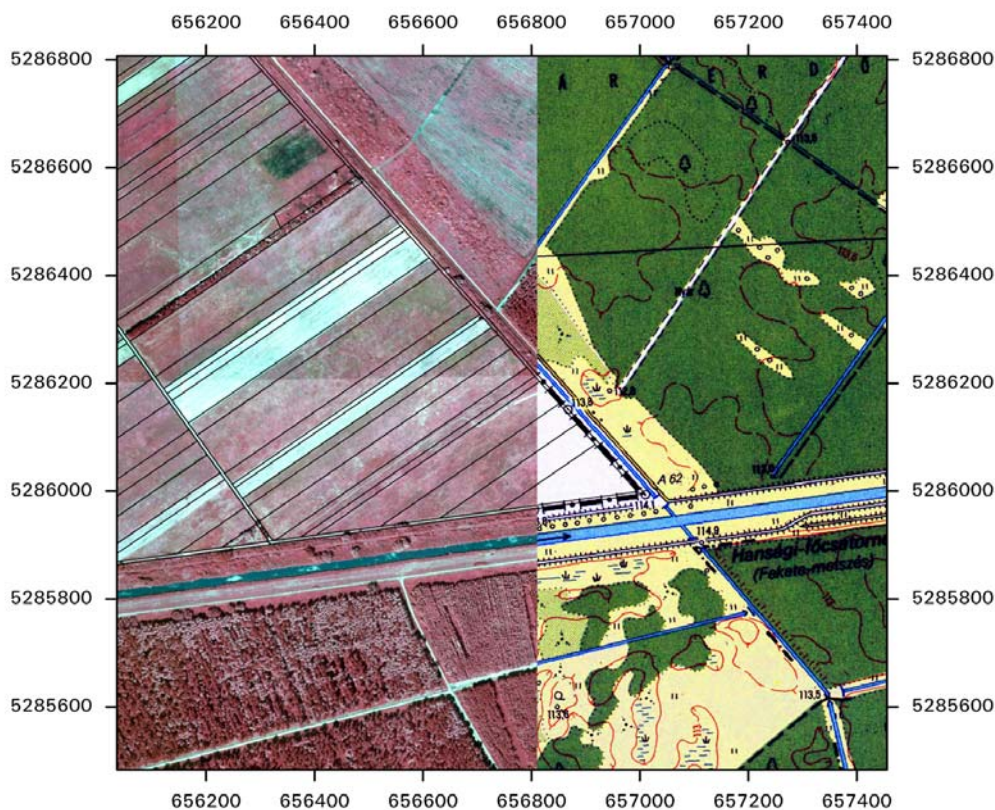
The project focuses on the development and implementation of spatial information systems for selected national park regions in order to analyse the socio-ecological and socio-economic status of the regions, to investigate on specific mosaics of impact patterns on a local and regional level, to improve national park management issues and finally to build networks of both cross-border and transnational cooperation.

The establishment of a representative data base both in terms of spatial as well as thematic qualities is supported by the interdisciplinary application of technologies such as remote sensing supporting land use and land cover change detection (LUCC) as well as landscape structural analysis, airborne laser altimetry for generating very high-resolution digital terrain and vegetation cover models and topographic information systems (see Graph 1), which allow for the calculation, maintenance, interpretation and presentation of digital terrain models (DTM), e.g. slope gradient models, slope aspect models and perspective views as well morphometric parameters (Csaplovics & Wagenknecht, 2000).



Graph 1: Color-Coded Digital Terrain Model of National Park Region Sächsisch-Böhmische Schweiz based on airborne laser scanner data (© IPF, TU Dresden)

The topo-chronological analysis of maps and plans for highlighting aspects of landscape transition in a retrospective time scale beginning with the late 18th century (regional maps) provides knowledge about the historical dimensions of landcover change (Walz et al., 2004). (Digital) cadastral maps support the large-scale level of investigations by allowing the synthesis of parameters of land use and protection status with information on ownership (see Graph 2). Advanced methods of terrain analysis like vegetation mapping, socio-economic and socio-ecological inventories have to establish a network of reference information.



Graph 2: Harmonisation of ortho-imagery and digital topographic cadastral map at the National Park Region Neusiedler See-Seewinkel/Fertő-Hanság (© I.P.F. TU Wien)

GISs are used for the integration of the whole bunch of heterogeneous hybrid data (remote sensing, maps, statistics, DTMs, sampling), for the homogenisation and maintenance, the analysis (multi-thematic analysis, e.g. for determining landscape structural parameters) and the presentation of data, as well as for multi-media data handling (virtual walks, integration of maps, videos and text).

Applying informatics helps to establish internet links between the national park information systems, to provide data transfer and exchange as well as networking, and to build facilities for storage of data and data products (e.g. CD-ROM).

In the frame of the presented EC-INTERREG IIIB project four specific regions have been selected for establishing a set of case studies. These regions are characterised by landscape units representative for the Central European Space. The cross-border National Park Region Sächsisch-Böhmische Schweiz (Czech Republic, Germany) is dominated by forests (93%) over hilltops and hillsides of basalt and granite and by the steep sandstone cliffs and gorges of the Cretaceous period. The National Park Neusiedler See - Seewinkel extends over a cultural landscape around the shallow steppe-lake Neusiedler See, its reed belt and around the areas east of the lake characterised by relic grasslands (puszta) and small shallow lakes with typical halophytic flora and fauna over quaternary sediments. In the Hungarian part of the lake the relics of the vast lowland moor of the Hanság enlarge the variety of landscapes of natural heritage. The National Park Karkonosze/Krkonosze extends over a large forest region along the Polish-Czech border containing highly valuable cultural landscapes in valleys and Alpine grasslands above tree limit. The National Park Triglav together with the Nature Park Prealpi Giulie along the Slovenian-Italian border represents one of the oldest protected national park regions in Europe. Together with its surroundings the region represents a variety of patterns of high mountain rocky landscapes, of Alpine forests and pastures, thus of cultural landscapes from valleys up to the mountain pastures.

By selecting these four regions we intended to collect a maximum of heterogeneous spatial data representative for national park regions within the Central European Space (CES), a subspace of CADSES. This gives us the opportunity to utilise the heterogeneity of spatial data to develop a highly efficient method of building a network of communication and interaction by means of national park spatial information systems.

### 3 SPATIAL INFORMATION SYSTEMS FOR TRANSEUROPEAN MANAGEMENT OF NATIONAL PARK REGIONS

Spatial planning in and around protected regions needs spatial information systems capable to handle large data bases both geometrically and thematically. Issues for managing interaction between primary and secondary zones as well as surrounding areas of protected or non-protected landscapes have to be supported by GISs.

Multi-scale approaches to regionalisation in landscape ecology have to take into account micro-scale, meso-scale and macro-scale investigations. Like biotope networks in agricultural landscapes and networks of more or less protected areas at a regional scale the importance of transnational networks of national parks is increasingly recognised by national authorities.

Though EU agriculture policies partly are orientated towards a new perspective of intensive/extensive land use strategies, the diversity of landscapes is still diminished by measures of land transformation which are driven by efforts to maximise productivity.

Especially the non-member and new-member countries in the EU have to face these impacts and have thus to be supported in protecting already protected and categorised regions or selecting regions which should be protected as soon as possible. Short-term acting and re-acting needs a high value of information support.

Actually national park authorities are building concepts for GIS-based spatial management in very different ways, with different motivations and with different progress. Monolithic approaches are common and thus only related to specific national parks. Bilateral concepts in the sense of connecting attempts to harmonise and standardise GISs on a cross-border level are rare. The cross-border links are thus of great importance and can serve as key initiatives for transnational cooperation in the CES. The chance to compare and harmonise two GIS concepts in a second degree level of transnational cooperation is set up by the North-South-transversal Polish-German-Czech-Austrian-Hungarian-Slovenian-Italian link.

We thus focus on the completion of inventories of national parks based on the different status of the four selected National Park GISs. By choosing the specific national park regions we meet several requirements of implementing GIS into spatial development strategies in and around protected regions by transnational cooperation in the Central European Space. On the one hand cross-border parks connect similar protected regions in old and new member countries, on the other hand the four cross-border regions cover an enormous variety of landscape units. Fortunately we can therefore handle a large heterogeneous spatial data base when building and harmonising GIS-based spatial development strategies for regional planning in and around national parks in Central Europe (Csaplovics et al., 2001).

National and transnational cross-border research on national park information systems is highly correlated to the tasks of the INTERREG programme. Interaction between activities at local and regional levels and the two fold transnational concept will highly increase the efficiency of building and linking spatial information systems.

Socio-economic and socio-ecological conditions are still different in member, new-member and non-member countries of CES. Protection of the environment in general and of national parks in particular is a common task with strong transnational components. The transnational cooperation opens a new dimension for operationalisation of cross-border spatial information systems of national parks. Existing transnational networks can thus be strengthened and established in terms of sustainable profit for both member and non-member partners. Category-1-classified border regions of member countries are additionally supported to protect and manage their regions of natural beauty and to increase the ecological but also economic (touristic) value of the regions when connecting cross-border national parks by homogenising management and planning strategies.

#### **4 SPATIAL INFORMATION SYSTEM AS DRIVING FORCES FOR INNOVATION IN SPATIAL MANAGEMENT OF PROTECTED REGIONS**

Innovation is achieved by linking cross-border national park management and planning issues by means of standardised spatial information systems. Recent communication technologies allow high-level data exchange of vector- and/or raster-based map and image data. Especially actual developments in facilitating GIS-data exchange, explicitly known under the terms OpenGIS and Interoperability, are integrated under web-based tools as the already invented GeoPortal. This gives way to a new quality of transnational on-line information support, which meets the requirements both driven by ecological aspects as well as by guidelines of regional and transnational planning (Csaplovics, 2005). On the one hand scientific and management demands can be supported efficiently, on the other hand data can be treated for presentation and thus for raising of people's awareness by supporting multi-media tools for thematic and topographic 4D-visualisation of national park landscapes. People, who are more or less concerned, can thus be motivated to familiarise with problems, constraints and ecological and economic advantages of living in and around national parks and national park regions respectively. People on both sides of the borderlines can be motivated to meet, discuss and get used to re-define the regional identity, which has been spilled by the political transitions in the CES during the 20th century.

As a key result spatial information systems, which are - in the presented case - particularly developed for national park issues, can also serve as key systems for building transnational environmental information systems in the CES, later in the CADSES and the European Space. The two fold approach additionally serves as a guideline for not only managing connected transnational regions but also for linking the mosaic of CES-National Parks. The status quo of and the needs for the development of protection strategies can for the first time be evaluated in an objective sense both in terms of multi-thematic as well as spatial topographic (geometric) accuracies. Policies of west-east transnational spatial development strategies can thus be supported in a long-term sense.

## 5 OUTLOOK

It is evident, that spatial planning in local, regional and continental scales has to integrate environmental protection of spatially and thematically well-defined regions. In addition the quality (IUCN-criteria) and quantity (number) of protected areas is not satisfying the minimum multi-scale standard of ecological demands. Thus homogenised networks of spatial information systems covering national park regions as well as regions of other protected areas will be of highest value for codifying protection of additional areas on an European level of decision finding. The networks of spatial information systems of national park regions are based on a trans-sectoral approach both in terms of the collection, integration, maintenance and analysis of multi-thematic data as well as in terms of supporting multipurpose planning for a well-balanced and sustainable ecological and economic spatial development of transnational cross-border regions of outstanding natural and cultural value.

Following the criteria of the IUCN, national park administrations are obliged to provide local and regional multilevel management plans. The project SISTEMaPARC fosters the establishment of standardised levels of management plans for the specific national parks and national park regions, for their cross-border relatives and will thus develop a new perspective of adjusting and homogenising management of national park regions in CADSES in perfect correspondence with the transnational guidelines of the INTERREG programme and in file with actions on interconnecting green spaces in Europe by preserving and linking the threatened nature conservation regions under networks of green corridors or – more specifically – under the Green Belt initiative.

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