

VITAL LANDSCAPES

Innovative visualisation

Description and materials for new tools



EUROPEAN UNION
EUROPEAN REGIONAL
DEVELOPMENT FUND



**VITAL
LANDSCAPES**
CENTRAL EUROPE Project

VITAL LANDSCAPES

Valorisation and Sustainable Development of Cultural Landscapes
using innovative Participation and Visualisation Techniques

Work package 3

3.3.6: Summary: description of innovative tools

Project partners:

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Further information on the project is available on www.vital-landscapes.eu.



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CENTRAL EUROPE Project

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CONTENT

- 1 Visualisation of landscape development: starting points, challenges**
- 2 Description of tools and approaches**
 - 2.1 Innovative aspects of 3D visualisation software VITAL LANDCAPES TOOLS**
 - 2.2 Innovative aspects of Community based knowledge management**
 - 2.3 Innovative aspects of the manual on community based landscape management**
 - 2.4 Innovative aspects of GIS based decision support system**
 - 2.5 Innovative aspects of new visualisation channels**
 - 2.6 Innovative aspects of Geo referenced database**
 - 2.7 Innovative aspects of digitised historic maps**
- 3 Summary and outlook**

1 Introduction

Cultural landscapes in Central Europe are of great value as evidence of our natural and cultural heritage and part of our common history. They are an important precondition for human well-being, quality of life and regional identity for residents and visitors alike. The economic and tourism potential of landscapes forms a source of sustainable regional development. However, landscapes are endangered due to a lack of awareness, insensitive development and rapid change. Given the need to upgrade the technical infrastructure and to foster the economy, the sensitive development of the landscape is often neglected in practice. In addition, many rural areas suffer from population decline due to negative demographic trends and the outward migration of young people.

The main goal of the VITAL LANDSCAPES Project was contributing to preserve the quality, diversity and beauty of cultural landscapes as required by the European Landscape Convention and the Territorial Agenda of the EU. To enhance the potential for their future sustainable development, the Project developed and adapted, amongst others, new (digital) technologies for visualizing and moderating landscape changes.

What is the benefit of such digital tools? Since landscapes are very complex systems with many actors, who have generally different levels of knowledge and various attitudes towards landscape development processes, visualisation of landscapes, landscape changes, landscape history, present and future scenarios are very relevant options to increase public understanding of landscape development and planning. Furthermore, these platforms help to find common language and to increase the knowledge about landscape and to encourage public participation in landscape management and planning.

The following summary describes in detail the strong and weak points of five advanced visualisation tools as developed and applied by the Project. With this handbook we hope to provide useful information for all people engaged in landscape planning and regional development in Central Europe. For more information please see our Website www.vital-landscapes.eu.

2 Description of tools and approaches

2.1 Innovative aspects of 3D visualisation software

The University of Agriculture in Krakow has developed interesting research results in the course of the VITAL LANDSCAPES project. These results include the creation of innovative 3D visualisations of cultural landscape changes. The work was carried out for the park and manor complex *von Nostitz* in the village of Mściwojów (object of study for the project).

However, the visualisations were not an end in itself but a part of comprehensive methodology for building public participation, within the pilot project, through active involvement of local inhabitants and decision-makers. Important elements here were regional seminars organized in Mściwojów and Krakow as well as extensive studies carried out for the needs of 3D visualizations.

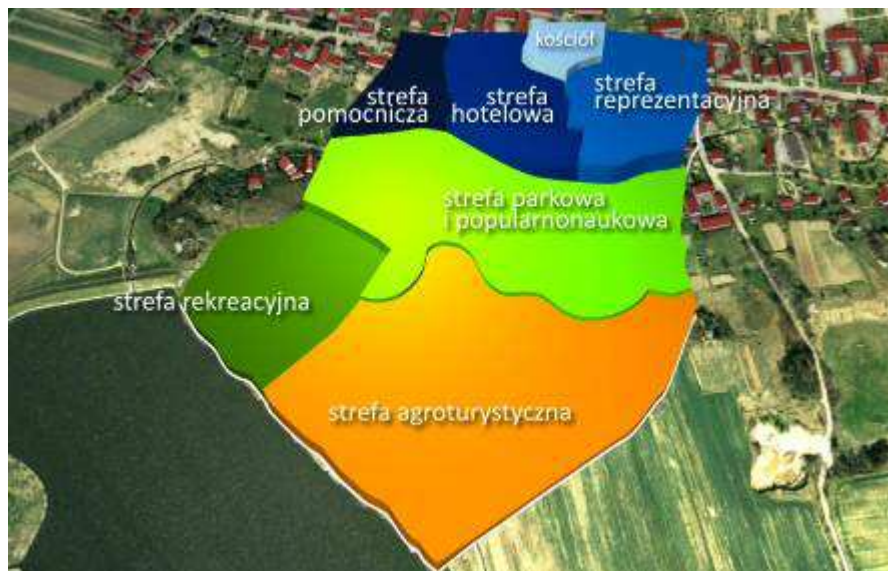


Fig. 1: Area of study divided into zones

The aim of the working group established at the beginning of the project was to implement the above methodical assumptions. The team consisted of local community leaders, representatives of community authorities from Mściwojów and experts from the Agricultural University in Krakow. The progress of the project was discussed during a series of regional seminars, devoted to the following issues:

- analysis of the Mściwojów area;
- based on the above, definition of its assets and potential for non-agricultural economic development;
- suggestions of potential development objectives;
- conclusions that the renovated park and manor complex with adjacent objects (the farm, the vineyard, and the water reservoir) will be the main development axis for Mściwojów.

Changes occurring in the area were illustrated by the experts with the help of advanced 3D visualisations. The use of 3D techniques turned out to be a very attractive aspect for local members of the working group and it increased their interest in project activities. On the other hand, thanks to the visualisations it was possible to improve the concept all the way through and add new elements.

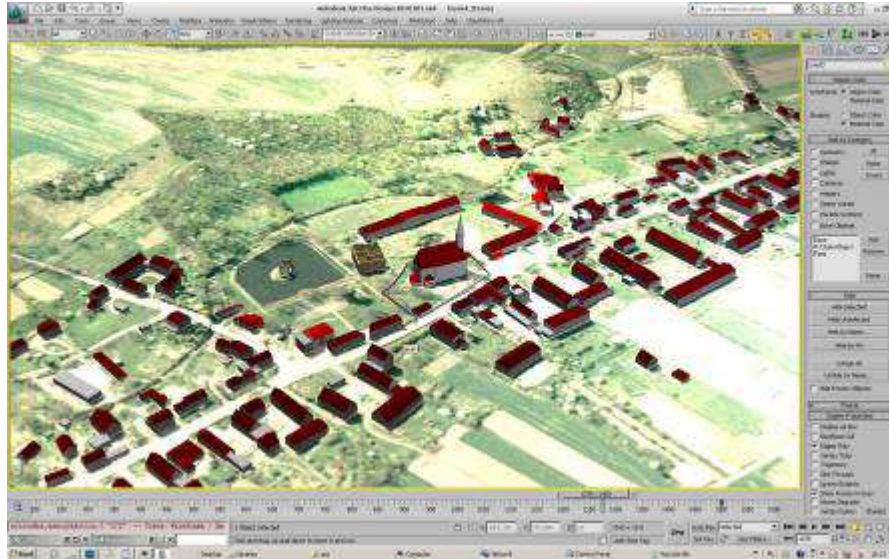


Fig. 2: Current state: Digital Terrain Model + ortophotomap + 3D buildings

Three-dimensional techniques have been used in architectural design and urban planning for over 20 years now. Also in the case of creating design projects for non-urban areas, the use of 3D techniques has many advantages; mainly for the following reasons:

- It simplifies the decision-making process in landscape development by facilitating the assessment of landscape dominants, open views, etc.
- It facilitates the search for architectural forms for new objects, as in the process of generating a three-dimensional model for the existing state it is natural to create a study of architectural forms and define existing means of expression, previously applied materials, historical structural solutions, etc.
- 3D visualisations make communication with project customers more effective. Local inhabitants find it easier to understand and interpret the final result of the study in the form of visualisations and 3D animations than traditional project documentation.

The presented visualisations were created in 2011. The design work was performed with *Microstation* software. Then, *3DStudioMax* with an attached *Forest Pack Pro* procedure was used to prepare the visualisation.

The result is more than 80 images of crucial project proposal elements and flyover animations of the studied area with surrounding grounds. Input material to the conducted work consisted of the following:

- spatial development concept for the village of Mściwojów;
- data obtained from Centralny Ośrodek Dokumentacji Geodezyjnej i Kartograficznej [Geodesic and Cartographic Documentation Centre];

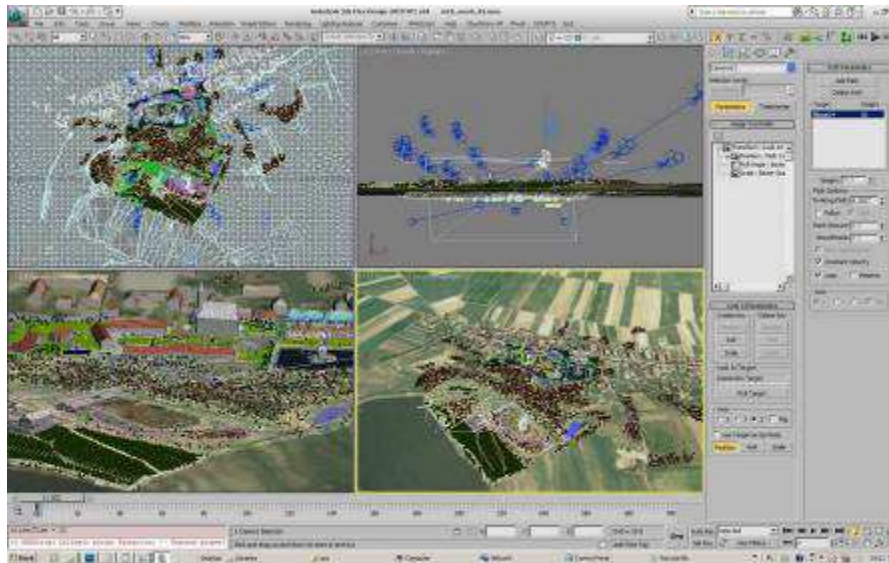


Fig. 4: Distribution of camera views

An important asset of the software is the mental ray rendering engine, which allows making precise visualisations, using the energy balance of lighting distribution in a three-dimensional scene while maintaining the physical properties (energy conserving) of the used materials, whilst the whole process occurs along a linear 32 bit light model.

3DStudioMax software makes it possible to conduct the full spectrum of these tasks: from accurate modelling of any object, to creating animations, special effects, and simulations.

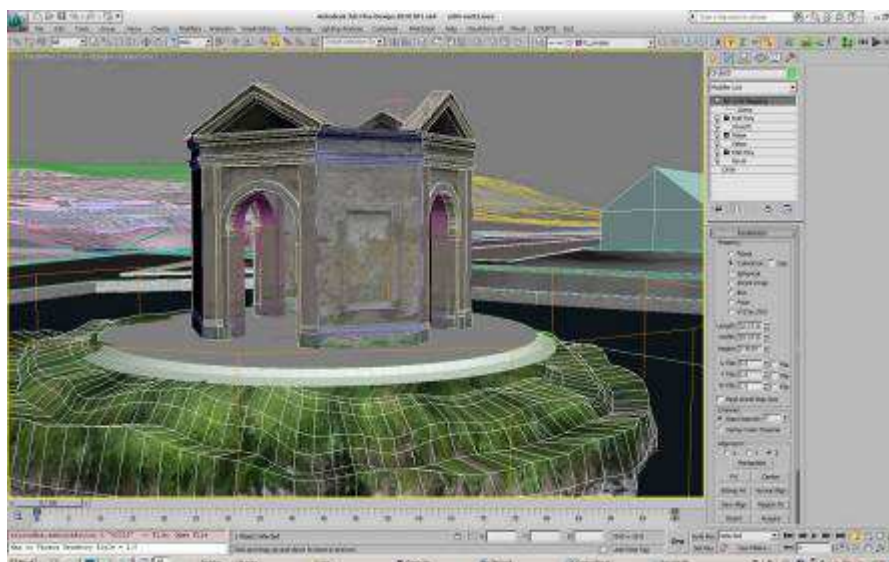


Fig. 5: Model of Romantic ruins on the island

The software can be also used to manage 3D scenes and provides a system of external links which facilitates work on complex scenes especially in the case of multiple users. The user (of the working group) taking advantage of XRef refer-

ences is able to work on smaller fragments of the scene edited as separate files. Afterwards, the links can be connected as components of a larger whole.

The basic geometry type used by *3D Studio Max* is a grid of triangles (mesh). Triangle meshes are collections of objects called faces. Face is the smallest 3D object consisting of at least three vertices forming a surface whose visibility is defined by a normal perpendicular to the surface. *3D Studio Max* software also makes it possible to work on non-uniform rational basis spline functions (NURBS) and solid geometry boundary representations (BREP). For 3D objects within three-dimensional geometry *EditablePoly* and *EditableMesh*, it is possible to import 3D models from external applications (CAD) and prepare geometry for the final visualisation.

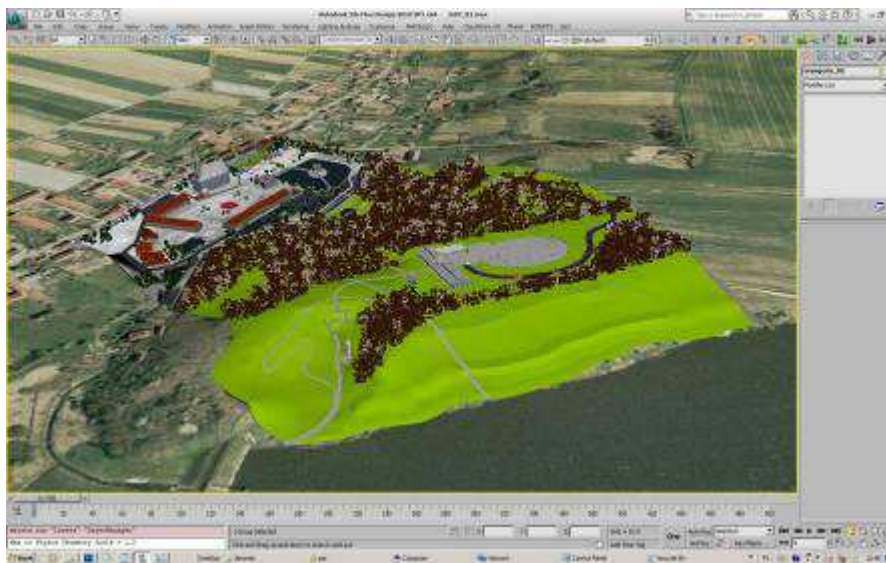


Fig. 6: First use of Forest Pack Pro on the developed model

If work is conducted in a larger design team, the most spectacular results will be obtained when the three-dimensional scenes are built from scratch in *3D Studio Max* (or another complex 3D graphic editor), based on suitably filtered information from source applications, parallel to CAD drafts. Such an approach will also enable most comprehensive use of all tools, techniques and 3D modelling methods offered by the *3D Studio Max* software. The most important of these make it possible to create models and then transform them.

The next step is called mapping, which is the process of assigning textures to 3D models. In order to implement the process each vertex coordinate $[X, Y, Z]$ needs to be transferred from three-dimensional space to coordinates $[U, V, W]$ in two-dimensional texture (bitmaps).

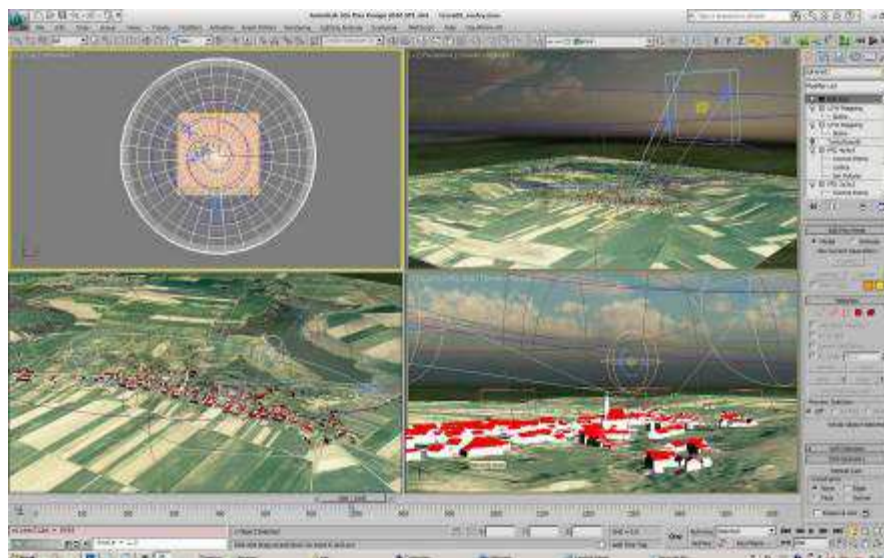


Fig. 7: Adding the sky dome to the existing model of Mściwojów area

The final image is generated with the help of rendering engines. They combine advanced simulations of physical phenomena with the characteristics and structure of various material types, reflection and light tracking algorithms, including dispersion, caustics and refraction, as well as the effects related to camera optics and antialiasing (the process of smoothing pixels of the final image).

The entire work process has equipped the project team with a number of important experiences and conclusions. First of all, it should be noted that there are currently no software packages to carry out the whole process from start to end. This is caused by the multiplicity of sources for particular data used in the project proposal, publication and presentation to all interested parties. Another reason is divergent expectations and needs of various participants of the design process.

As a result, it turns necessary to use multiple computer tools: CAD software in the case of designers and dedicated 3D graphic editing programs in order to generate final images and animations. At the same time, there is a perceptible difference between CAD programs and programs for editing 3D graphics.

That is the reason why an important element of the project was to create special software VITAL LANDCAPES TOOLS, the output of the design team, which filled the gap between the existing programs used for building Digital Terrain Models (DTM) and high-end software for texturing and visual exposure in High Definition (HD). With the help of the developed scripting language, it was possible to exchange data at the level that enabled their full utilization in *3D Studio Max*. This opened new opportunities for convergence between the two systems: it was possible to make full use of all the opportunities offered by modern CAD software, while ensuring full integration of data and their subsequent use in a typically graphic program.



Fig. 8: 3D visualisation of the whole concept

2.2 Innovative aspects of Community based knowledge management

The communities have knowledge and experience about the area they live in. It can be called local knowledge or everyday experience, but anyway these are some case different from those, which are hold as knowledge by scientists or developers. They know and use landscape values and intangible heritage of their environment. This is the reason why in Vital Landscapes Project PP6 emphasizes the importance of local communities and believes that they can have a big role in the knowledge management of the landscape as well. The only question was how to provide a platform to local stakeholders to express and summarise their knowledge in a system where all members of the society can see and can be used for landscape management. The answer: **“a website with editable community knowledge”** is already an innovative tool, and the solutions on the website are also innovative as:

- these concentrate on landscape as an area changing thanks to stakeholder activities and environmental processes
- these differentiate between landscape values of exact location and elements of intangible heritage in local scale
- these provide platform for community members to individually upload their values to the website and give a reason why they consider as value or heritage
- these ensure that documented values are selectable, can be filtered and commented and it is controlled by the developer of the website.

“Knowledge management” means continuous collection and maintenance of information, practical knowledge, and know-how transfer among distinct groups of society. “Community based” means that this management is based on the knowledge of the society about landscape. It considers the landscape values as elements, buildings, objects, sites in the landscape, but the spiritual, intangible heritage as well, as values related to history, tradition and other human activities are also part of the landscape.

PP6 developed a knowledge management system, which is based on the communities and considers the landscape values as elements, buildings, objects, sites in the landscape, but the spiritual, intangible heritage as well, as landscape includes the natural and cultural values too. It is an online available system, so everyone can use it and expand this database easily from home computers.

PP6 developed an online knowledge management platform for the Vital Landscapes Pilot area Nagyberek serving local stakeholders (from landscape planners to inhabitants). The website describes the landscape values and heritage of the area. Two modules that verify the community based landscape management are running in Nagyberek pilot area application: Landscape Value and Intangible Value modules (Tájérték Berek és Eszmeiérték Berek). The website applications offer a platform available for any users to upload landscape relevant comments, photos, surveyed landscape elements, intangible heritage elements. Community has a special role to enhance the usefulness of this application.



Kérdőlap
Élő Tájak Projekt
Info Berek
Fotó Berek
Tér-Idő Berek
Látvány Berek
Tájképi Berek
Ezzenel Ártók Berek
Alakított Berek
Döntés Berek

Bélapás

E-mail:
Jelszó:

Regisztráció

Címkék

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[Fotó] [Képek]
[Látvány] [Képek]
[Vízvilág] [Vízvilág]
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[Alakított] [Alakított]

Időjárás Berek



Bélapás
Szavazás
Képek



Bélapás
Szavazás
Képek

Élő Berek > Tájépítészeti Berek

[< Vissza a találatokhoz] [< Széchenyi család kastélyparkja] [Római katolikus templom >]

A tájkép neve: **Kápolna - Széchenyi mauzóleum** (46.970773769773854, 17.642793859340050)

Lekész, Indoklás (miért tájkép?): A parkban található a Széchenyi-család klasszicista jellegű síkapuja, amely a XIX. sz. második felében épült.

Típus: Kultúrtörténeti

Az értékek jelentősége: Országos

Település: Somogyvár

Felmerítés / Felismerés: Nagy György

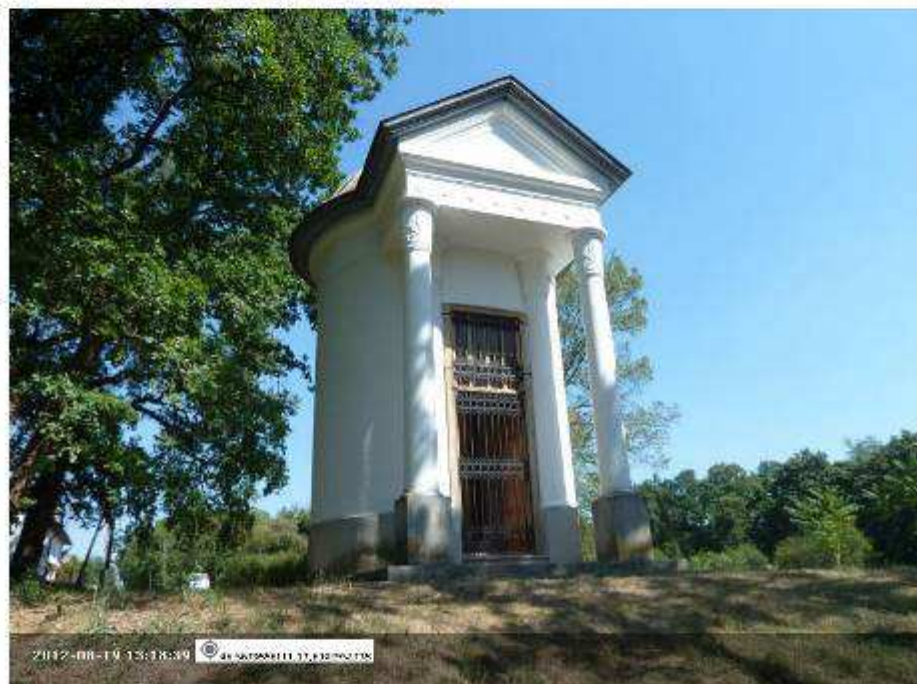


Fig.9: Print screen of the website: Presentation of a landscape value

The user can upload to this platform landscape relevant comments, photos, surveyed landscape elements, intangible heritage elements, information, descriptions about the landscape values and heritage. Only the registered users can add elements to this database, but any visitors can see them on the website. The visitors can see these uploaded values on maps and can read and see photos about them. The application presumes an extremely active local community, open-minded decision-makers, helpful local activists, a conceptual and talented developer team of landscape planners, IT specialists and website developers. The starting of modules' operation consists of more steps, some requirements must be fulfilled:

1. Collection or survey of landscape values
2. Digitalization of values (text digitalization by scanning or typing, using digital photographs, GPS coordinates for geo-locating landscape elements)
3. Data upload to the website by filling out data sheet
4. Presentation of landscape values on website
5. Evaluation, maintenance, communication of values.

The “Landscape value” and “Intangible heritage” modules have **two different** main elements:

- **Input information about values and heritage**

The surveyed, collected landscape values and intangible heritage elements: name of the values, description, category, coordinates, photos and their location on maps.

- **An innovative online platform that presents:**

- important landscape and settlement information;
- maps, and GIS system for documentation of values;
- surveyed or collected landscape values (geometrically referenced) in three categories: Natural, Cultural, Scenic values;
- intangible heritage related to NGOs, land use, gastronomy, tradition, information service, literature, scenery, crafts, heritage protection, local heroes, peoples, education, press and media, sport, free time and tourism, historical sites, music;
- a platform for stakeholders to add input to the existing knowledge base, and to name, map, describe, evaluate the elements of the knowledge base.



Fig. 10: Print screen of the website: The structure of "Intangible heritage" module

Community has a special role to enhance the usefulness of this application. This kind of management has a practical pilot area application already where the members of the local community and other relevant stakeholders can interactively participate in the knowledge management of the landscape. Local community itself is the base that can individually survey, map, describe and evaluate landscape elements online via the Vital Berek website and thus manage values in two modules of the online platform.

The community based knowledge management webpage provides an overview of landscape value relevant knowledge, offered by a common platform. It raises the number of well-informed inhabitants, stakeholders, and has the potential to emerge an up-to-date summary of landscape management know-how. Its community developing background helps to enhance local awareness and active local stakeholder participation that is very low in Hungary and especially low in the Nagyberék region.



Fig. 11: Visualized location of landscape values in Visual Berek module

Thanks to this platform the knowledge of the community and the individuals can be highlighted, preserved and can be presented to all interested members of the community. This information can be useful for landscape development and local community awareness-raising too. The database can be extended and the values can be evaluated or validated by the community. This management method is a renewable, visual, simple, and continuously developing vital system.

As a result of innovative solutions PP6 experienced that

- local people became interested in their landscape values and intangible heritage.
- landscape values and intangible heritage as the products of the project became interesting to media.
- the project managers are thinking to organise a value hunting during summer 2013.

2.3 Innovative aspects of the manual on community based landscape management

It is very difficult to explore the „key-moments” of variant procedures, with which the stakeholders’ participation can be achieved. The communities have great role in landscape planning, because they have comprehensive knowledge about the area and their interests and values determine the success of landscape planning processes. Without involving local communities into landscape development processes and without getting know their values the sustainability is impossible. Many excellent publications revealed to urge community based planning and public participation, in spite of these works and the methods did not come into general use or become widespread.

This is the reason why PP6 created a handbook with title: Guide of Community-based Landscape Management. It discusses public participation and social learning in landscape management. This is an electronic guide, available online with simple and transparent structure and several figures and illustrations. It serves the purpose to give a hand – using the potential of web – to the local and regional authorities, local governments, civil associations and other possible stakeholders in:

- Assisting to configure and manage clear and retraceable processes;
- Supporting the cooperation of regional organisations, which have an effect on the landscape and are stakeholders in landscape maintenance;
- Urging the public participation of stakeholders (residents, communities, organisations).

The guide can be useful in procedures – mainly in several typical processes – which influence the natural and environmental merits of landscapes and the whole landscape in a determinative way. It can also help participants to recognize the personally most suitable way of involvement into problem solution, planning process, development or operation to achieve the best productivity. Not only individual, but communal learning is also needed to get to this point. The participators – can be decision makers, stakeholders, local people – have to endeavour to understand each other, bring their enthusiasm into life and acquire the necessary skills, these are the principles of the beneficial guide-application.

The main innovative questions and elements of this guide:

- How to find, identify and valorise the potentials and values in landscape and in local community?
- Elementary steps and processes of local and community-based knowledge management and communication regarding landscape management;
- How to design the participatory process in cooperation with the other stakeholders?

- How to develop a local participation and communication strategy?
- How to manage and harmonize of different landscape management process, organizational requirements?
- Assessing the achievements of the process and participation strategy.

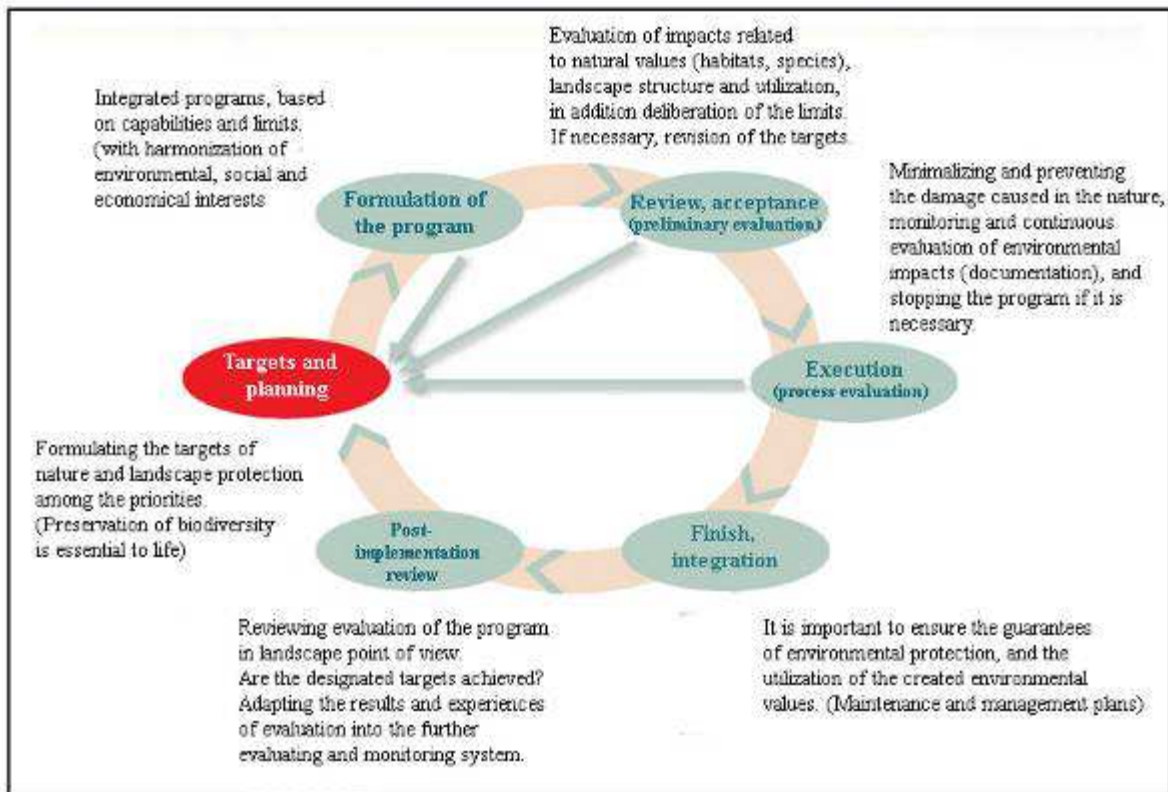


Fig.12: A figure from the Guidebook: Sensibility towards landscape aspects in the development circle

The guide supports local communities, professionals, decision-makers in cooperation, in favour of achieving better life-condition, and to render real vital landscapes. The handbook reflects on the main aspects of becoming alive and valuable, with accentuating the importance of community and value based landscape management. This tool is going to be a guide for stakeholders how to implement complex landscape management in complicated situations where the interests of inhabitants, farmers, tourists and decision makers are different. The main chapters of the guide are:

- **Recognition, evaluation and monitoring of the capabilities regarding landscape and local society.** It helps to outline a value and capability recognition based approach, and promotes conversation between communities and decision-makers about common values.
- **Public, regional landscape maintenance and program management (Chapter2.).** It contains the conditions, general aspects and

approaches about community learning, landscape related issues, program managements.

- **The aspects of arranging and executing certain plans and programs.** This part introduces the implementation of several factual devices. At the same time, the range of plans and programs can be extended.
- **Tool-kit of participation-based social learning.** The tool-kit of community-based landscape maintenance contains methods, which can support local decision-making and communication culture founded on dialogues and continuous interconnection. The implementation of devices requires practise and workmanship on the part of the organiser. The range of devices can be improved, experiences can be shared. The descriptions of demonstrated implementations are easy to print, review and use.

The written guideline concentrates on various situations of landscape management and give advices for stakeholders. Through using of this guide could be achieved the following results:

- Building up trust among the different stakeholders;
- Developing a common view on the issues at stake;
- Resolving conflict;
- Arriving at joint solutions that are technically sound and implemented in practice;
- Ensure the transparency and calculable process management;
- Arranging, plan, evaluate processes;
- Understanding, getting involved or initiating, regarding landscape and regional program management, or factual categories of plans;
- To select, use, evaluate and improve the proper public involving tools;
- The perception and collection of good examples.

The knowledge and skills of communal learning can be useful – used in a proper way – for professionals qualified in landscape maintenance, regional management, and settlement-operation areas. The general goal is to avert or resolve conflicts, get non-statistical information about landscape, progressions and impacts of different activities; and to help the community becoming the part of planning, operational and landscape management processes. Recognizing development, planning, operational steps and methods of participation; citizens, members or leaders of civil organisations, contractors will be able to represent their opinions more effectively and help to develop reciprocative resultful – in one word –, win-win situations.

2.4 Innovative elements of GIS based decision support system

Development of GIS based participatory decision support system aims to involve all stakeholders in local and regional landscape transformation discussions and in the management process. Its goal is to offer scenarios to be discussed for a pilot project. This made it necessary to apply very innovative tools.

Decision support system is a set of tools that provides information of landscape in such a constellation that the stakeholders can choose from various types of landscape scenarios. They can participate in the system and decide which kind of management (represented by scenarios) they prefer as an alternative future landscape. Actually the decision, to choose a favourable future landscape, is supported by a land use modelling system.

The decision support system developed by PP6 is **very innovative** as:

- it makes land use predictions for future scenarios
- it uses GIS data input representing landscape characteristics
- it has scientific background on past landscape change analysis
- it uses software of land use modelling
- it has an online platform that presents the results
- its user interface is interactive any users can individually browse between scenarios and years.

The Vital Berek website is able to interpret the essence of this tool and the results of the pilot application. The online version is a free and interactive decision support version of scenario based landscape management. It is called “Decision Berek”. The tool uses an integrated approach, comprising land use and geophysical-social drivers with statistical tests, designed to enable the simulation, evaluation and extrapolation of land use management practices and planning policies. The proposed tool enables the identification of the potential impacts of future land use changes on future land use patterns and geophysical-social components in the area.

The basic elements of this tool are:

a) Input GIS and statistical data pre-processing software

The input data are prepared and processed by Geographic Information System, by **ArcGis 9.3 software**. The analysis of the input variable of the allocation module is done by **statistical methods (SPSS)**.

b) Land use change modelling software

The basic element of this tool is the scientific system of **CLUE** dealing with future land use modelling. The land use modelling procedure takes into consideration the current landscape characteristics, the present landscape development tendencies and the future scenarios. The CLUE

model is able to evaluate the future's land use structure from the input data, parameters influencing the land use and considering the spatial policies, and tendencies.

Visualisation software

The output files of the CLUE model are txt text files converted into shp file format. These are not able to be published to the users. Visualisation platform is needed, which is able to prepare colour maps from text files. We used **ArcMap** software for creating maps from text files and Google Earth to offer a 3D view.

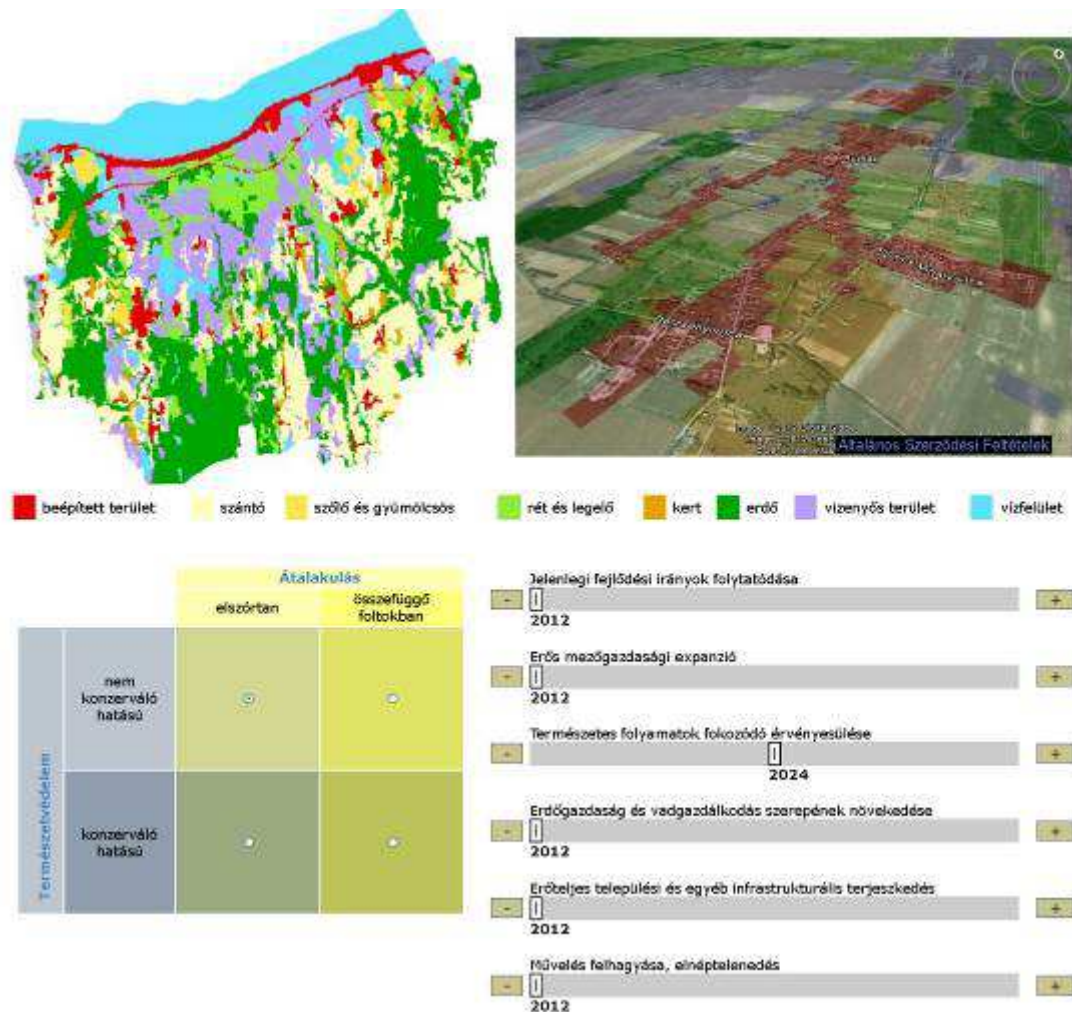


Fig.13: User interface of Decision module

PP6 evaluated the effects of different economic and social activities, as well as examine the social, economic and also the geophysical drivers of land use changes. The primary purpose was to determine the most important factors that generate the land use changes, to analyze the interactions of key processes, and finally to understand the dynamics of land use changes and those contribution to the sustainable methods of land-management. The research analyzes the complex process of land-use change and tries to integrate the social and economic

spheres in the analysis. The method based on the interaction between landscape ecological, social, environmental and economic processes. Integrating multidisciplinary knowledge the results of assessments of land-use change and social, environmental and economic drivers provide the data to evaluate the effects of land-use change.

The main goal was to define the most important social, environmental and economical factors, furthermore to estimate the effects of land use change and finally to analyze the effects of spatial planning policy based on different scenarios.

The main phase of land use change simulation:

- **Determining scenarios**
- **Analyzing driving forces**
- **Simulation**

During the simulation we prepared the configurations of the executed land use models for 25 years long period (2012-2037) according to the different land use policies. We determined **six different scenarios** considering the area-specific tendencies, the facilities of the area and the characteristic land uses. These scenarios are:

- „Baseline scenario” (SC0): **Present tendencies going on**
- Scenario 1 (SC1): **Strong agricultural expansion**
- Scenario 2 (SC2): **Increasing role of nature protection**
- Scenario 3 (SC3): **Intensification of forestry and wildlife management**
- Scenario 4 (SC4): **Urban sprawl and infrastructural development**
- Scenario 5 (SC5): **Abandonment and depopulation.**

In general the tool supports various interpretation of landscape development to inform stakeholders, and offer alternative futures to choose from. It provides insight into the spatial variability of land use and its determinants. It indicates which (proximate) factors determine the spatial distribution of land use, and the potential near-future ‘hot-spots’ of land-use change for realistic scenarios

As a result of innovative solutions in visualisation PP6 experienced that

- local people became interested in future landscape changes.
- stakeholders become interested in solutions modelling future state of the environment
- land use as the actors of the application and driving forces became interesting to media.

2.5 Innovative aspects of “New visualisation channels”

The visualisation channels mean an innovative solution to increase public understanding of landscape development and planning because landscapes are very complex systems with many actors, who have generally different levels of knowledge and various attitudes towards landscape development processes. Nevertheless these visualisation and illustrative platforms help to find common visual language and to extend the knowledge about landscape and to enhance public involvement in landscape management and planning. Visualisation of landscapes helps to find the common language and raises awareness on landscape topics and encourages public participation in landscape management and planning. : **“a pilot landscape visualisation”** is already an innovative tool in the region, and the solutions to interpret results on the **Vital Berek website and Visual Berek sub-site** are also innovative as:

- these concentrate on landscapes and their visual characteristics, but these also visualise the non-visual characteristics of landscapes, like the spatial differences of demography and economy.
- these use a special combination of free available data and software.
- these use an online platform available for everyone with internet access.
- these can be used individually and interactively. These are not predefined, preset images, and video files, but various viewpoints can be set by the users
- these differentiate between landscape built elements and intangible characteristics
- these provide platform for community members to comment visualisation applications



Fig.14: Visualised buildings, historical monuments and motorway with SketchUp in Pilot Area Nagyberek, Hungary (PP6)

Visualisation channel is an application that is able to show landscape elements, landscapes and landscape development visualised in a three-dimensional view. Two different type of visualisation channels applied in the Vital Berek web-site (e-berek.hu in Hungarian language: Élő Berek) are such applications, such platforms, which visualise one or more different aspects of landscape, landscape development / management at a common platform. Its development and dataset extension with more information and additional applications is continuous during the project life set to user's needs. PP6 developed two different free available, online visualisation channels at our Vital Berek website (<http://www.e-berek.hu/lb3>). These channels are such applications, such platforms, which visualise one or more different aspects of landscape, landscape development/management at a common platform. These two channels are:

- **“Time and Space”** module provides information about the past, present and future of the landscape, interpreting historical maps, landscape transformation, present development tendencies, and outlook to the future. Besides the huge amount of cartographic information it is necessary to explain landscape changes and development process.
- **“Visual landscape”** module provides a 3D visualisation of landscape with help of Google Earth. Landscape characteristics and distinct landscape elements are visualised GIS layers in three dimensions. Various image and vector data is shown for the territory of the pilot landscape. Layers of Google Earth like road network, boundaries, panoramio photos, 3D buildings, sunlight etc. are integrated. Vital Landscape Project developed photo-realistic models of buildings in villages of pilot area, and made it visible on Google Earth.



Fig.15: Screenshot from the website: Visual Berek Module visualisation of village Táská

The users of visualisation channels can view various information visualised online via the help of layers. PP6 used categories of layers like topography maps, historical maps, statistical data and prepared 3D building models, 3D vegetation models, 3D focus areas etc. placed on GoogleEarth interface to present landscapes. In each category you can find different layers that present landscape characteristics or landscape change information.

A visualisation channels have **three main elements**:

1. **Visualisation tools:** software (like Google SketchUp and Visual Nature Studio), which can visualise objects, regions, data about a landscape etc. These provide functions to generate visualisation of landscape elements and thus to give inputs (building models, terrain models, tree models etc.) for the visualisation platform.
2. **Inputs:** various models of visualisation, and any other spatial data, like maps, vector models, etc. These can be historic maps, digital landscape models, digital topographic and administrative data etc.
3. **Visualisation platform:** a surface, where the different inputs (Nr 1 and 2) can be placed. This case this is Vital Berek website with integrated modules: Visual Berek (Látvány-Berek) and Time-Space Berek (Tér-Idő Berek). The platforms are available on the Hungarian website here: e-berek.hu . The visualisation platform is based on Google Maps and Google Earth these give the body of the application.



Fig. 16: Screenshot from the website: One of the focus areas - Visualised landscape of Boróca cellar hill with protected monuments

PP6 combined web technology (online availability), Geographic Information System (Google Earth software) and visualisation tool (Google SketchUp, VNS 3 softwares) to interpret landscapes to public and that aimed to show the drastically transformed landscape of Nagyberek region. These applications (visualisation channels) operate at Vital Berek website for free, thus anybody can use it easily via internet connection. PP6 used free software during modelling as well, because it can **strengthen public activity in modelling**. These are available for free, not only for the experts, but also for inhabitants. Even stakeholders can use these software, they can also create models and can extend the visualisations of the area. This application is made especially for local lay-people and decision makers to understand landscape development and management and to analyse landscape changes in the Pilot region, but useful for scientists too.

The visualisation included the following innovations:

- visualisation of historical land use and historic maps
- administrative boundaries and demographic statistical data is spatial extension.
- digital models of built environment, vegetation and elevation
- visualisation of landscape values and intangible heritage
- complete visualisation of focus areas like cellar hills village centres.

If the people can see their environment digitally in 3 dimension, maybe they will be more interested to its management. Visualising and interpreting landscape can strengthen public understanding. All in all the application has the potential to enhance the connection between stakeholders and landscape.

As a result of innovative solutions in visualisation PP6 experienced that

- local people became interested in their landscape characteristics.
- stakeholders become interested in other visualisation solutions and the extension of current solutions in other aspects (tourism, land ownership)
- visualised landscape elements as the products of the project became interesting to media.
- the project managers are thinking to extend the application in the pilot area to many fields of landscape management and to other pilot areas as well in future.

2.6 Innovative aspects in application of a Geo-referenced database

The geo-referenced database is a collection of different geographically referenced data digital thematic layers of landscape characteristics. The database collects and provides many kind of information about the PP6 pilot area and shows these geographically located in space. Most of PP6 applications base on the geo-referenced dataset of the pilot area and use geo-located information in different website-modules like visualisation channels in “Visual Berek” or community based knowledge management in “Landscape Values” and “Intangible Heritage” modules.

Geo-referencing is an innovation of landscape topics in the sense that:

- locate spatially relevant information at the accurate site
- the geo-referenced landscape information can be compared, analysed, and assessed spatially.

This geo-database can help for stakeholders to understand the different landscape development processes in spatially relevant form; it extends the knowledge about landscapes and increases public understanding; and encourages the public participation in landscape management and planning. Geo-referencing provides wide range of information about the area, so it supports the decisions; it can be a fundamental base of decision support processes.

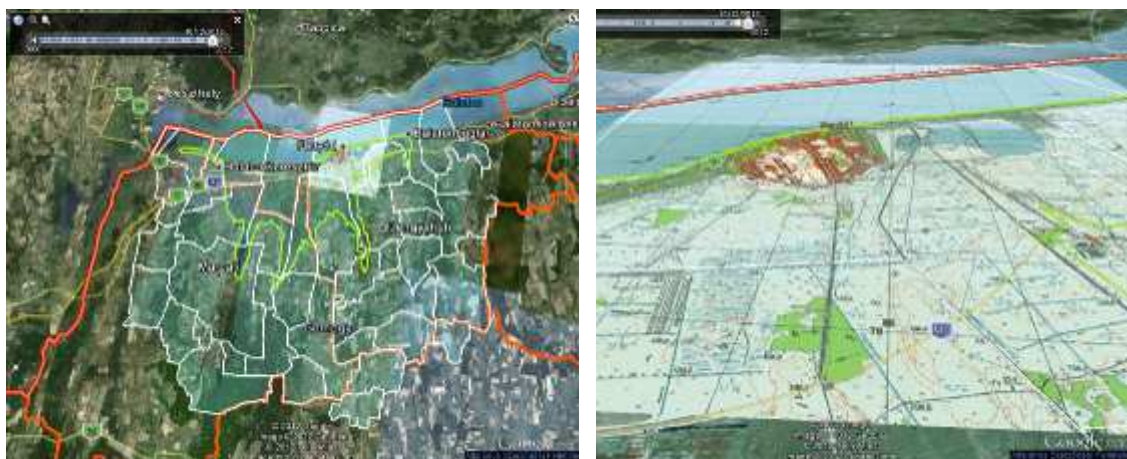


Fig. 17: Print screen of the website: Different maps in Visual Berek module

The pilot website related to the Hungarian pilot area in Nagyberek developed by PP6 (Vital Berek) functions as an online geo-referenced database; it consists of many different modules, which presents and interprets the landscape's different aspects, and provides information in thematic layers. Different modules were created according to the goals, the function and the topic of the information, but these are based on the same spatial data. A lot of presented info is shown on geographically referenced maps organised in different thematic layers. **Use of geo-**

referencing in all modules of the website development is already an innovative aspect. In the pilot landscape management process on the **Vital Berek website and sub-sites** are also innovative as:

- **“Visual Berek” module** provides a 3D visualisation of landscapes and landscape elements **geo-referenced**. (<http://www.e-berek.hu/lb3>)
- **“Photo Berek”** shows photos of the area in different categories and the **geo-location** where the photo was taken. It allows registered users to upload landscape photos **geo-referenced**. (<http://www.e-berek.hu/fotopalyazat>)
- **“Time and Space Berek” module** provides information about the past, present and future of the landscapes, interpreting **geo-referenced** historical maps, landscape transformation, present development tendencies, and outlook to the future. (<http://www.e-berek.hu/lb4>)
- **“Landscape value Berek”** presents appreciated elements of the pilot landscape. It gives descriptions, photos about the values and shows their exact **location even with the list of the coordinates**. (<http://www.e-berek.hu/tajertekberek>)
- **“Intangible Heritage Berek”** deals with the landscape-specific, incomprehensible, immaterial values, which cannot be exactly characterized by physical parameters, but can be approximately **geo-located to settlements or micro-regions**. (http://www.e-berek.hu/ee_berek)
- **“Decision Berek” module** is a set of tools that provides information of future's landscape development in such a constellation that the stakeholders can choose from various types of landscape scenarios and see how landscape will transform in each situation **geo-referenced**. (http://www.e-berek.hu/dontes_berek)
- **“I form Berek”** encourages stakeholders to participate with their subjective approach in landscape management. Stakeholders of the pilot landscape as registered users can mark places **with flags, as geo-located place-marks** to express their feelings their evaluation concerning the landscape. (http://www.e-berek.hu/alakitom_berek)

The basic elements of the database's modules:

- GIS datasets are used **in an innovative combination** in the website modules
 - Different linear (vector) data, like road structure etc.;
 - Different image (raster) data, like historic maps etc.;
 - Orthophotos, satellite images;
 - Geo-referenced statistical data;
 - Geo-referenced 3D digital models of landscape elements;

- Geo-referenced field photos.
- **GIS systems** as basic elements of user interface in the website. PP6 used Google Earth and Google Maps software as a GIS system. The data, maps, etc. appear on their surface. These provide the frame (the coordinate system) and the platform for the thematic information.



Fig.18: Print screen of the website: Visualised statistical information - Population of the settlements

As a result of innovative solutions in geo-referencing PP6 experienced that:

- the applications with geo-referencing are and do seem more scientific than without
- the solutions and results are more accurate and exact concerning the spatial relevance of any landscape characteristics.
- the information can be searched or browsed spatially by users and decision-makers.
- local people became interested in their location relation to landscape characteristics and landscape values and other visualised elements.
- all elements of the web-site (visualisations, values, heritage) as the products of the project became interesting to media and other local stakeholders.

2.6 Innovative aspects in use of digitised historic maps

Historic maps are any map (can be topographic or thematic) prepared in the past about landscape. These can help us to understand landscape development processes, can give information of past land use and of landscape character; or formerly existing landscape elements can be surveyed. Especially in case of Vital Berek website where PP6 uses historic maps in an innovative form of browsing maps integrated in a website online. By comparing historic maps from different ages the land use change processes can be detected; the reason of present state, the drivers of the changes can be explored; and the future states will be much more predictable. The historic maps are important data sources of landscape analysis and determine the landscape development processes and they influence the landscape management decisions.

PP6 developed an online module at Vital Berek website, called "Time and Space" module where the geographically referenced historic maps are shown. This module provides information of the past, present state of the landscape, interpreting historical maps, landscape transformation, present development tendencies, description of landscape changes and development process. Main elements of this application are:

- **Inputs:** The historic maps from different ages.
- **Visualisation platform:** Google Earth and Google Maps.
- **User interface:** It presents historic maps in a geo-referenced database. In the menu the maps from different ages are organised thematically.

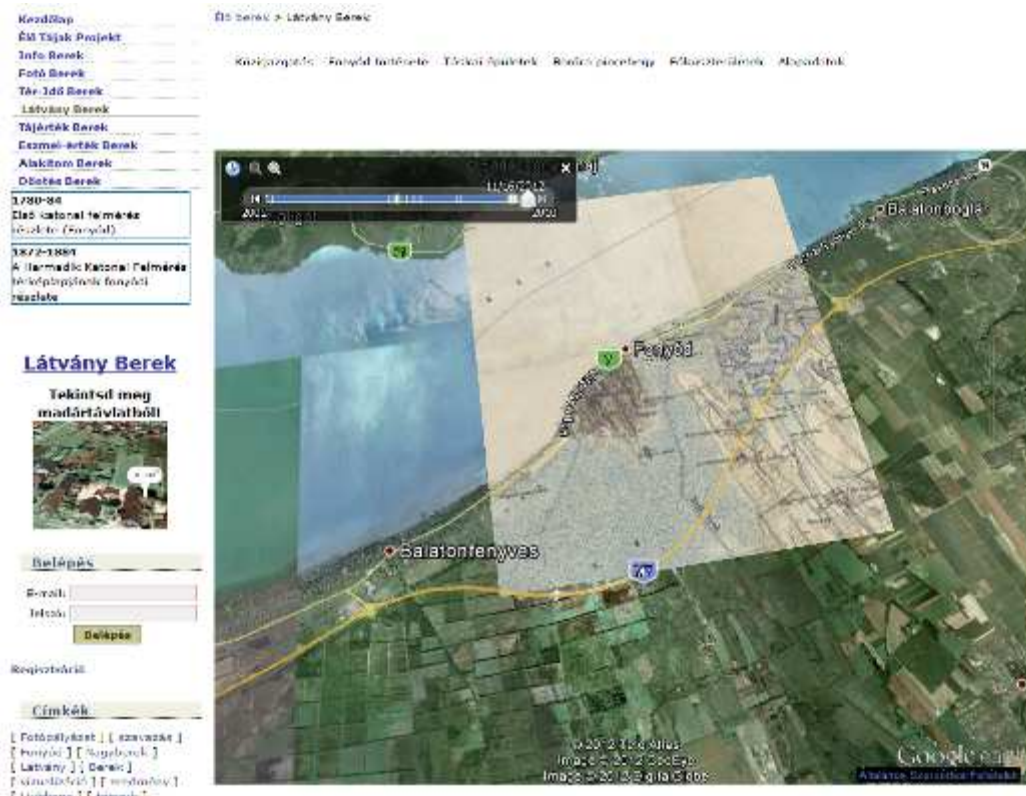


Fig.19: Digital geo referenced historic map on Google Earth surface on Vital Berek website

The use of **historic maps** in case of PP6 was **innovative** as:

- the maps appeared on the website
- the process of landscape transformation can be scientifically documented and illustrated by the sequence of historic maps.
- the application is visual way to explain landscape development.
- being aware of the past decisions, future situations can be judged easier, thus historic maps provide feedback on former decision's results.

PP6 uses many historic maps to present landscape development, land use changes. The most important historic maps, which are available at the website in "Time and Space" module are maps of:

- The First military survey (1780-84)
- The Second military survey (1806-69)
- The Third military survey (1872-84)
- The fourth (or third revised) military survey 1910
- Topographic maps of 1922-1929
- Topographic maps of 1987-89

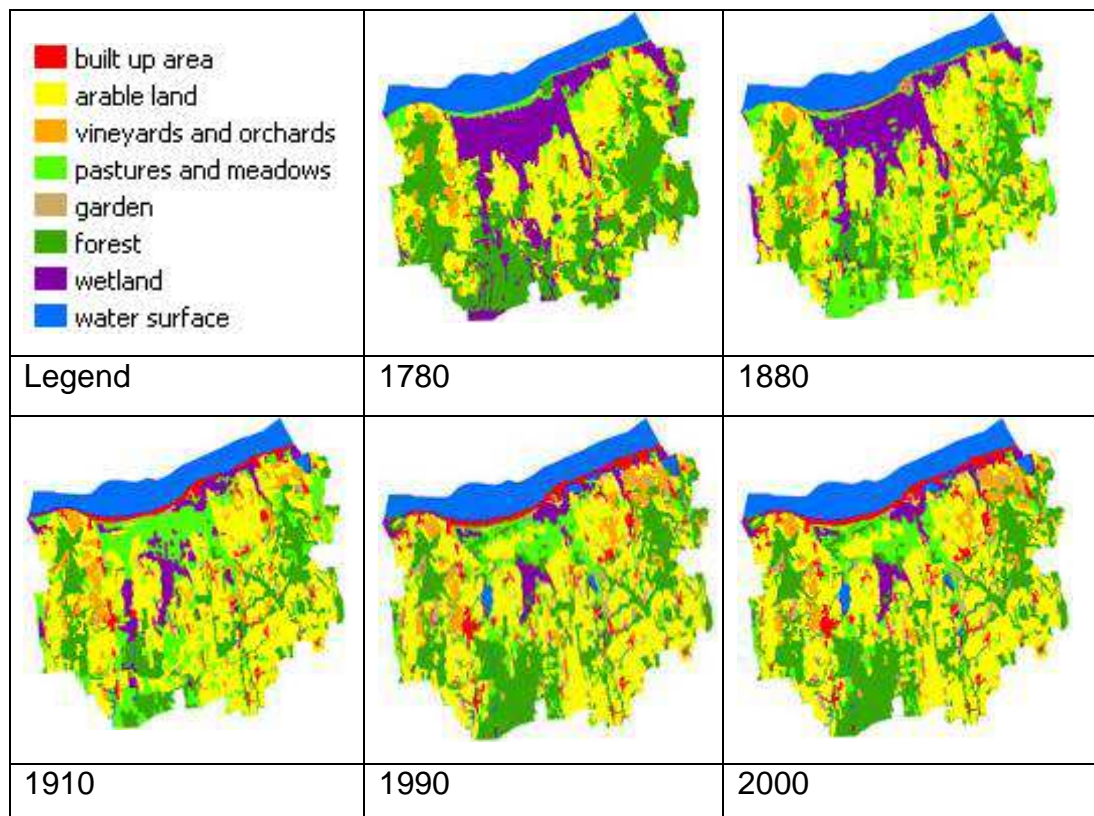


Fig.20: Past and predicted future transformation of Nagyberek Landscape, based on GIS based decision support system generated land use map. Future tendencies are driven by forces enhancing forestry and hunting activities scenario for the future years.

These historic maps can be bought for the whole territory of Hungary and well known in Central Europe. There are available any other kind of historic maps, which are available for only a smaller areas. These maps are usually prepared for the territory of a settlement or a farm; or they are profession-specific maps, like water management maps. PP6 used mostly historic topographic and military maps.

Only the First, the Second and the Third military maps are available digitally and geographically referenced. Generally most of these historic maps are paper based, so for the digital, online availability first it is needed to be digitalised them. The historic map digitalisation has the following steps:

1. Scanning;
2. Quality improvement works;
3. Geo-referencing;
4. File format transformation.

The first step of the process is the scanning. These old maps on old paper are often in bad condition; they are faded, blurred, etc. The best available quality is important, thus after the scanning the next step is the quality improvement works, like setting, brightening, re-colouring, cropping the unnecessary parts, etc. These works can be achieved by graphic software, like Photoshop or Gimp. The next phase is the geo-referencing. In this step the scanned maps have to be matched to a coordinate system; they get coordinates. This step can be done by GIS software, like Mapinfo or ArcGIS.

We have to pay attention to choose the right coordinate system depending on the visualisation platform. At the website we use Google Earth, as base map, for the visualisation. Google Earth uses WGS 84 coordinate system, thus we used this reference system; the historic maps had to be converted into this system. The final step is the saving in the suitable file format depending on the visualisation platform. Google Earth can visualise its own file format (kmz/kml), so we saved the geo-referenced, digital maps in this format.

As a result of innovative activities with historic maps PP6 experienced that:

- the land use change process could be mapped correctly.
- the solutions and results are very innovative with using GIS in mapping.
- the information can be searched or browsed online by users and decision-makers.
- local people became interested in landscape changes and present transformations
- all elements of the landscape changes as the products of the project became interesting to media and other local stakeholders.
- a scientific work on land use modelling could be based by digital mapping of historic maps.

3 Summary and outlook

Visualisation is an important tool in landscape planning (and especially in participation planning) to make it understand the planning concept. As a result of rapid technological progress, there are a lot of interesting solutions on the market. However, due to rapid innovation this market is permanently developing and due to the diverse offers also confusing. Moreover, the 'ideal conception' of producing diverse lifelike future views of a given location by advanced data processors and modern software is principally possible, but still requires a high effort to scan and to model the existing situation (e.g. landscape elements, buildings), and necessary software solutions still are expensive and complex to handle.

Against this background, the main finding of the VITAL LANDSCAPES Project regarding the use of digital tools is: There is no single solution that perfectly fits to all requirements. Depending on the practical needs, the region concerned, the actors involved, and the resources available, quite different solutions may be recommended. Therefore, the tools described above provide different approaches ranging from relatively cost expensive and complex 3D software up to free available Web solutions. Their benefits and limits in short may be the following:

3.1 3D visualisation software VITAL LANDSCAPES TOOLS:

The software adaptation developed by the Project simplifies the decision-making process in landscape development by facilitating the assessment of landscape dominants, open views, etc. It facilitates the search for architectural forms for new objects. The 3D visualisations make communication with project customers more effective. Local inhabitants find it easier to understand and interpret the final result of the study in the form of visualisations and 3D animations than traditional project documentation. It supports building public participation through active involvement of local inhabitants and decision-makers.

However, there are also special requirements to be taken into account:

- There are currently no software packages to carry out the whole process from start to end. This is caused by the multiplicity of sources for particular data used in the project proposal, publication and presentation to all interested parties.
- It turns necessary to use multiple computer tools: CAD software in the case of designers and dedicated 3D graphic editing programs in order to generate final images and animations. At the same time, there is a perceptible difference between CAD programs and programs for editing 3D graphics.
- It was necessary to develop a special scripting language to exchange data at the level that enabled their full utilization in *3D Studio Max*. This opened new opportunities for convergence between the two systems: it was possible to make full use of all the opportunities offered by modern CAD software, while ensuring full integration of data in a typically graphic program.

3.2 Community based knowledge management

The community based knowledge management is a webpage that provides an overview of landscape value relevant knowledge, offered by a common platform. It raises the number of well-informed inhabitants, stakeholders, and has the potential to emerge an up-to-date summary of landscape management know-how. Its community developing background helps to enhance local awareness and active local stakeholder participation.

Thanks to this platform the knowledge of the community and the individuals can be highlighted, preserved and can be presented to all interested members of the community. This information can be useful for landscape development and local community awareness raising too. The database can be extended and the values can be evaluated or validated by the community. This management method is a renewable, visual, simple, and continuously developing vital system.

As a result of innovative solutions PP6 experienced that local people as well as the media became interested in their landscape values and intangible heritage.

3.3 Electronic manual on community based landscape management

The web-based guide supports local communities, professionals, decision-makers in cooperation, in favour of achieving better life-condition, and to render real vital landscapes. This tool is going to be a guide for stakeholders how to implement complex landscape management in complicated situations where the interests of inhabitants, farmers, tourists and decision makers are different.

Using of this guide may have the following benefits:

- Building up trust among the different stakeholders;
- Developing a common view on the issues at stake;
- Arriving at joint solutions that are technically sound and implemented in practice;
- Ensure the transparency and calculable process management;
- Arranging, plan, and evaluate processes;
- Understanding, getting involved or initiating, regarding landscape and regional program management, or factual categories of plans.

3.4 GIS based decision support system

GIS based participatory decision support system helps to involve all stakeholders in local and regional landscape transformation discussions and in the management process. It offers scenarios to be discussed for a pilot project by using innovative tools. Basically, it is a set of tools that provides information of landscape in such a constellation that the stakeholders can choose from various types of landscape scenarios. They can participate in the system and decide which kind of

management (represented by scenarios) they prefer as an alternative future landscape. Actually the decision, to choose a favourable future landscape, is supported by a land use modelling system.

The users of the decision support system experienced that local people and regional stakeholders became interested in future landscape changes and solutions modelling future state of the environment. Furthermore, land use as the actors of the application and driving forces became interesting to media.

3.5 New visualisation channels

Visualisation channel is an application that is able to show landscape elements, landscapes and landscape development visualised in a three-dimensional view. The users can view various information visualised online via the help of layers like topography maps, historical maps, statistical data, 3D building models, 3 D vegetation models etc. placed on GoogleEarth interface to present landscapes.

The benefits of this tool are the following:

- local people became interested in their landscape characteristics.
- stakeholders become interested in other visualisation solutions and the extension of current solutions in other aspects (tourism, land ownership)
- visualised landscape elements as the products of the project became interesting to media.

3.6 Geo referenced database

The geo-referenced database is a collection of different geographically referenced data digital thematic layers of landscape characteristics. It can help for stakeholders to understand the different landscape development processes in spatially relevant form; it extends the knowledge about landscapes and increases public understanding; and encourages the public participation in landscape management and planning. Geo-referencing provides wide range of information about the area, so it supports the decisions and can be a base of decision support processes.

Special benefits of this tool are the following:

- The applications with geo-referencing are more scientific than without.
- The solutions and results are more accurate and exact concerning the spatial relevance of any landscape characteristics.
- The information can be searched or browsed spatially by users and decision-makers.
- Local people become interested in their location relation to landscape characteristics and landscape values and other visualised elements.
- Elements of the web-site (visualisations, values, heritage) as the products of the project became interesting to media and other local stakeholders.

3.7 Digitised historic maps

Historic maps can help to understand landscape development processes and can give information of past land use and of landscape character. They are important data sources of landscape analysis and determine the landscape development processes and they influence the landscape management decisions.

Special benefits of this tool are the following:

- The land use change process can be mapped correctly.
- The information can be searched or browsed online by users and decision-makers.
- Local people became interested in landscape changes and present transformations.
- All elements of the landscape changes became interesting to media and other local stakeholders.
- A scientific work on land use modelling could be based by digital mapping of historic maps.

What kind of outlook, what recommendations may be given based on the experiences of the common work? The main conclusion we drew: Do not unreflecting trust the 'promises' of new technologies. Do not completely rely on software and computers. Look at your target groups, clearly define your goals, and take into account your individual abilities and the resources of your institution/organisation. In that sense, this handbook hopefully may be helpful to other users to find suitable solutions of using advanced visualisation tools in landscape development, quite in the sense of the key message of the VITAL LANDSCAPES Project:

Vitalize your landscape! We are all part of our landscape and its development. The face of our future landscapes depends on us!

Further information about the tools described above is available free of charge via Internet (see www.vital-landscapes.eu).

