

## CREATION OF BROWNFIELD RESTORATION MODELS

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### ABSTRACT

Modelling in brownfield restoration is the next step in development of information technology utilization for project managers to realize revitalization projects more effectively. To enable the creation of models for brownfield restoration and reuse (models for landscape restoration, models for so-called “ecological loads”, architectonic models, etc.), a sufficiently extensive database should be available. The article builds on already published texts dealing with information systems and landscape restoration modelling, including visualization, but it brings new insights from the point of view of management of brownfield restoration and use. It describes the application of models linked with an information system, their connections with individual steps in brownfield restoration design. The existence of brownfield revitalization models together with the database of revitalization projects is a precondition for the creation of an expert system in this area.

**Keywords:** brownfield, COBRAMAN, model, post-mining landscape

### INTRODUCTION

The creation of the information system for the management of post-mining landscape restoration and post-industrial, brownfield is the subject of a long-term project of our workplace. Originally a system dealing with coal mines was designed. The design of this system is described in [1].

In order to use information technology in the landscape redevelopment process, we are developing a database system that uses a maximum extent of landscape data characteristics, including relevant metadata to allow selective access to the data. The final application of the database and visualization must allow displaying the development of the area over time, as well as generation of visualizations that provide access to the potential of both natural and urbanized environments at any given point in the past, present, and, alternatively, the future.

The creation of the system for modelling a landscape corresponds to the trend of information system applications in such organisations, within whose competency problems of area administration, area planning, ecology, exploitation and processing of mineral raw materials (including e.g. exploratory and design activities) lie. The base for designing the system is an exhaustive analysis of existing information systems in the mentioned organisations, the extent and mode of computing technique employment, and primarily data models and database implementations in these organisations.

## **MODELS OF BROWNFIELD AND LANDSCAPE RESTORATION**

Brownfield is defined as sites that have been affected by the former uses of the site or surrounding land, are derelict or underused, are mainly in developed urban areas, require intervention to bring them back to beneficial use and may have real or perceived contamination problems. Integral part of solution the projects of redevelopment the brownfields are models. The models make possible speed up the decisions in solving the projects.

The models make possible access to spatial relation with all variants of solving.

Within building the information and expert systems, were to be designed and realized needed models.

Models arose from spatial data, stored in information system [2] based on GIS.

In general terms, a model is a representation of reality. Models are created as a simplified, manageable view of reality. Models help you understand, describe, or predict how things work in the real world [3].

There are two main types of models:

- those that represent the objects in the landscape representation models
- those that attempt to simulate processes in the landscape process models.

Representation models try to describe the objects in a landscape. The representation models are created in a GIS through a set of data layers.

The representation model attempts to capture the spatial relationships within an object the shape of a building and between the other objects in the landscape the distribution of buildings [3].

Process models attempt to describe the interaction between the objects that are modelled in the representation model [3]. The relationships are modelled using spatial analysis tools. Process modelling is sometimes referred to as cartographic modelling.

Types of models:

- Suitability modelling – the most spatial models invoke finding optimum locations, such as finding the best location to build a new school, landfill, or resettlement site.
- Distance modelling
- Hydrologic modelling
- Surface modelling

### **In case of need may be designed next models:**

- The model of the allotment area and the protected deposit area;
- The model of the access:
  - transport,
  - electricity,
  - heat,

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- water,
  - team,
  - Telecommunications;
  - The model of regional connections:
    - power station,
    - heat station,
    - distribution;
  - The model of the details of the deposit:
    - geological situation,
    - tectonic structure,
    - coal reserves, the quality of the coal;
  - The model of the drops in the landscape, the estimate of future development and the prediction of the final state;
  - The model of the bent of the slopes in the waste banks,
    - safety measures taken against infusions,
    - fires and flooding the subsidence basins, etc.;
  - The model of surface structures – the operation facilities, additional operation, social services and others;
  - The model of workforce, economic indicators;
  - The model of geological and hydrological details (before, during and at the end of mining process);
  - The model of ecological indicators and details, including biological information (abiotic and biotic factors: historical data, current state, migration routes, the permeability of the environment for genetic information, etc.);
  - The models of solving the minimize of negative externalities from ecological functions;
  - The models of the landscape of the areas of interest according to the topographic information;
  - The models of the landscape ordered according to the time
  - The models of the reclamation projects implemented before;
  - The models of characteristic elements of the landscape and the components of the geological landscape;
  - The models of the course of real or planned subsidence processes;
  - The models of the hydrological situation;

- The models of the anthropogenic terrain shapes (e.g. quarry walls; residual pits, mine dumps, waste piles, downward basin, sedimentation tanks, etc.);
- The models of ecological links between particular landscape elements;
- The models of buildings, communications, etc.;
- The models of the final versions of the terrain during and after the reclamation works (in time lines).
- The model of final time a and final version restoration of area
- The model of architecture of buildings

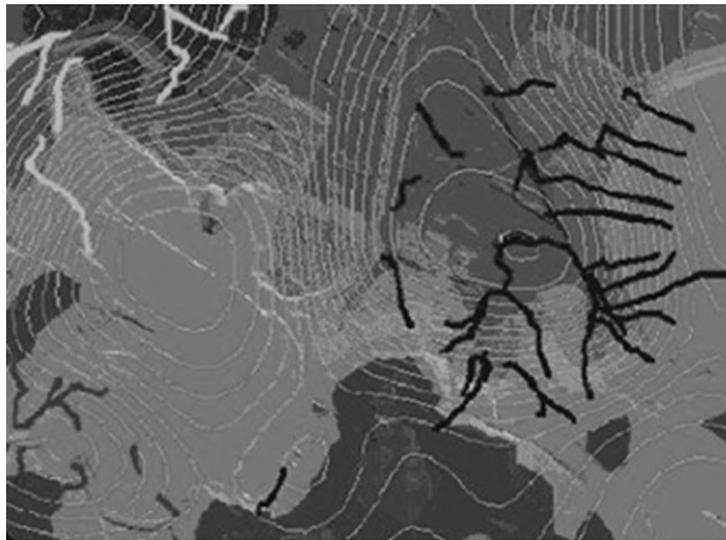
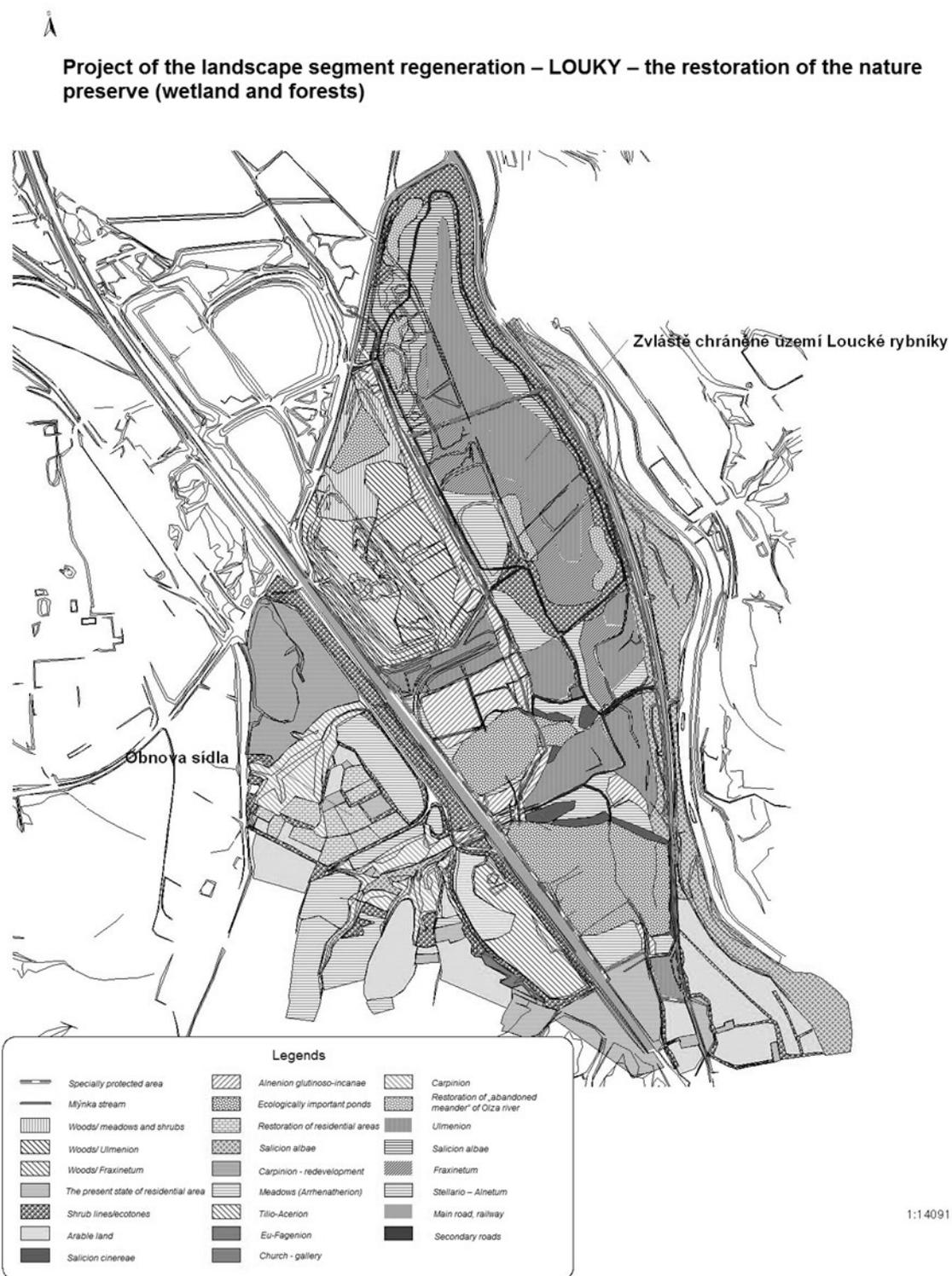


Fig. 1 Model of directing surface waters due to subsidence



Fig. 2. Model and 3D visualization of final regeneration



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Fig. 3. Model of variant of landscape biological regeneration

## CONCLUSION

This paper briefly summarizes the results of the research and development in the area of application of the information systems and modelling the reclamation of brownfield and landscape exploited by mining.

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- b) Project GACR 105/08/1242 “Research of Externalities Quantification by Biotopes of Cultural Landscape CR and Preparing of GIS data models”;
- c) European Union project No 1CE014P4 “Manager Coordinating Brownfield Redevelopment Activities”, COBRAMAN

The paper brings results that point to the definite need to use modelling in the area of landscape reclamation and brownfield restoration. The research and development in the area of application of the information systems and modelling in the landscape reclamation is certainly not completed yet. This concerns mainly the problems with the authorization of individual processes, data communication and building up the knowledge databases and expert system.

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