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CONCEPT OF INFORMATION SYSTEM FOR LAND CONSOLIDATION PROJECTS

KONCEPT INFORMAČNÉHO SYSTÉMU PRE PROJEKTY POZEMKOVÝCH ÚPRAV

Mária LEITMANOVÁ, Zlatica MUCHOVÁ, Anna STREĎANSKÁ

Slovak University of Agriculture in Nitra, Slovak Republic

Land consolidation projects have reached the state where there is sufficient sample of projects with lots of valuable information in the Slovak Republic (planimetric and hypsographic measurements, updated maps of soil-ecological units, concepts of local territorial systems of ecological stability, plans for the general principles of functional organization of the territory, etc.). However, their longer-term utilization is questionable, because there is no central data archiving of the projects. Documents remain on a CD somewhere in the documentation of land offices in most cases. In worse cases, documentation might have been lent and later irretrievably lost. This paper describes concept for a new system that would provide a coherent overview, especially for the graphical outputs of land consolidation projects. It is called System OKTOPUS, and with its help we can analyze, process and archive the data generated in land consolidation projects and/or in other documentation. Spatial data are included into the catalog of topics and the topics are divided into registries in the OKTOPUS System. The presented model area is the catchment area of Žitava river, on which we illustrate the OKTOPUS System, including examples of possible use cases. The final aim of the OKTOPUS System is publishing data on the web using platform(s) that allow users sharing/editing the geographic data.

Keywords: land consolidation, geographic information systems (GIS), general principles of functional organization of the territory, System OKTOPUS

The implementation of land consolidations in the Slovak Republic (SR) is anchored in the Act 330/1991 Coll. on landscape consolidation, land ownership organization, land offices, Land Fund and Land Associations as amended (the Land Act amendments). Land consolidations (LC) include identification and rearrangement of ownership and usage status and other related rights in the area of land consolidation and land reallocation (blending, separation or other land arrangements), technical, biological, ecological, economic and legal measures relating to the new configuration of relationships.

LCs are a key tool not only of rural development in the Slovak Republic (SR), but also in most countries of the European Union (EU). The EU approved the measure Land Consolidation in Sectorial Operational Program Agriculture and Rural Development for the period 2004–2006. Nowadays, it has been continued in the form of the National Strategic Rural Development Plan for 2007–2013. It is assumed that there will be continuation of the measures as Investment in fixed assets in sub-measure Land consolidation for the years 2014–2020.

The SR is divided into 3559 cadastral areas. Nowadays, land consolidations are carried out in 421 cadastral areas in the Slovak Republic. Projects in 186 territories have already been completed, and in 235 territories, they are in different stages of their development (Urban et al., 2013).

This paper describes a new concept, called System OKTOPUS (S-OKTOPUS), in order to create homogeneous, complete set of (not only) land consolidation project data which would be able to provide extensive and comprehensive information on the area of interest from the perspective of the potential users.

Material and methods

We formed spatial space data base for the S-OKTOPUS in the program ArcGIS 10.0 (http://www.esri.com). We have been using highly exact data on land consolidation projects for the creation of the maps. We used data from excerpted sources/documents where data are not available and where land consolidation projects are not under way.

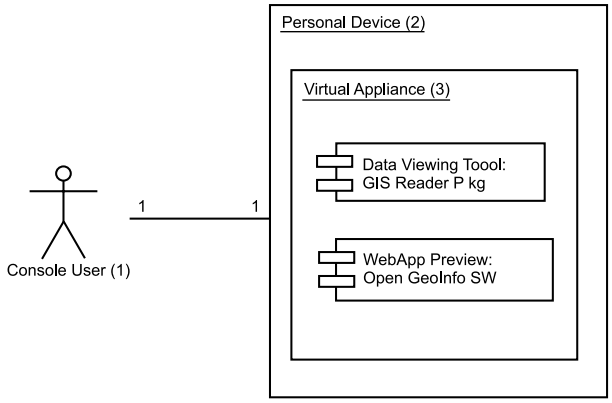

Figure 1 Diagram of deployment the S-OKTOPUS locally on the user device in the form of virtual devices („snapshot") providing web-view as well as native GIS viewer (GIS-reader)

Obrázok 1 Diagram lokálneho využívania S-OKTOPUS-u v zariadení používateľa vo forme virtuálneho zariadenia poskytujúceho WebView ako aj GIS prehliadač
(1) používateľ, (2) zariadenie používateľa, (3) virtuálne zariadenie

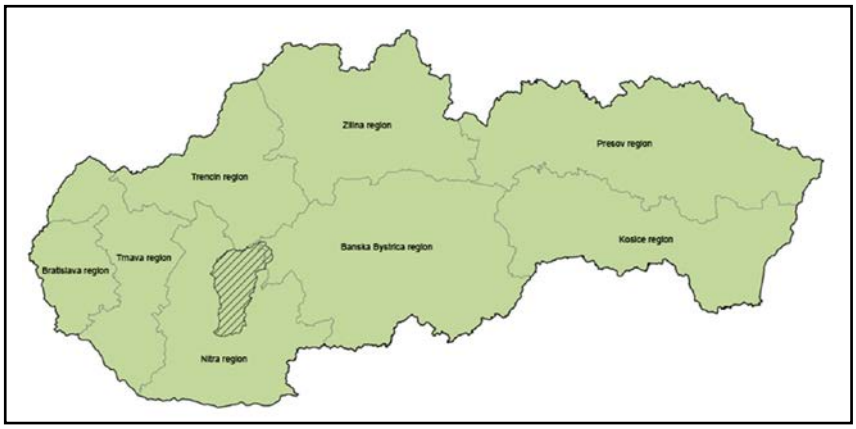

Figure 2 Location of the catchment area of Žitava river in Slovakia
Obrázok 2 Poloha povodia Žitavy v rámci Slovenskej republiky

The aim of the S-OKTOPUS is to allow for browsing data via a web browser. The OpenGeo Suite is a complete web mapping platform built on powerful, cutting-edge, open source geospatial components (http://opengeo.org/).

The OKTOPUS System will use OpenGeo „only" for web presentation layer and may use any other suitable instrument according to current preferences, requirements and options.

The system will help to clarify the already processed data from land consolidation projects, they will be archived, and that will also run on application servers and have a web-interface. The system will be able to provide information to people in a generally accessible and intuitive way.

The system provides information via the web-interface on intranet/internet and locally on the console of adequate devices (Fig. 1).

The catchment area of river Žitava (Fig. 2) from Nitra region (Nitra, Zlaté Moravce, Nové Zámky, Komárno) and Banská Bystrica region (Žarnovica) is used for basic design illustrations. As much as 125 cadastral territories with total area of 162,801.74 ha are located in the river basin of Žitava.

In the model/selected territory, land consolidation projects are or have been developed in 13 cadastral areas on the area of 5,179.29 hectares. Projects are under way in the cadastral areas Požba, Bardoňovo, Malá Maňa, Černík and Golianovo, LC projects are completed in the cadastral areas Oponice, Ladice, Klasov, Vieska nad Žitavou, Malé Vozokany, Veľké Vozokany, Melek and Mojzesovo. The construction of some proposed devices and measures of communication character has begun in the cadastral area Melek.

Results

We have created and filled a system called 'System about the country, creation and land consolidation in Slovakia' (shortcut S-OKTOPUS). The designed logo is shown in Fig. 3.

S-OKTOPUS is designed and filled by data in order to provide clear and broad spectrum of information about area for users who wish to buy, protect or manage land. S-OKTOPUS users might be found among farmers, small growers, land tenants, land owners, mayors, developers, foresters, planners, designers of land consolidations, engineers in the area, environmentalists, and academics or just anyone interested in related issues/topics.

S-OKTOPUS will be operated through the Department of Landscape Planning and Ground Design (http://fzki.uniag.sk/oktopus) of the Horticulture and Landscape Engineering Faculty at the Slovak University of Agriculture in Nitra.

S-OKTOPUS is designed in order to offer wide application in various fields. Whole catalog is based on the principles of national infrastructure for spatial information and consists of four themes:

- Key topics.
- Basic analytical topics.
- Derived analytical topics.
- Design topics.

Key topics are based on primary sources/background materials from various areas. The data are either created directly for the S-OKTOPUS or obtained from other information systems, via they interfaces, or as WMS. Some data come from the scientific papers of the Department of Landscape Planning and Ground Design (e.g. Kliment a Kliment, 2012; Varga a Halva, 2012; Kaletová a Šinka, 2012; Barek et al., 2006).

The data have been available only in analog formats in some cases and thus had to be scanned for further processing, transformed and vectorized in order to be prepared as a background for analysis. The basic analytical topics came from simple GIS tools from the key topics. These made the background for the creation of complex derived analytical maps. Subsequently, design topics based on the key, basic analytical and derived analytical topics were created.

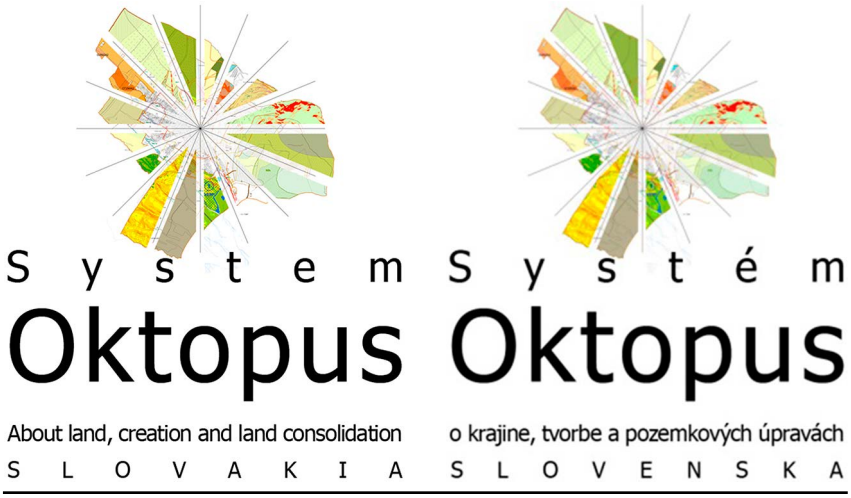

Figure 3 Logo of the OKTOPUS System (English and Slovak version)
Obrázok 3 Logo system OKTOPUS (anglická a slovenská verzia)

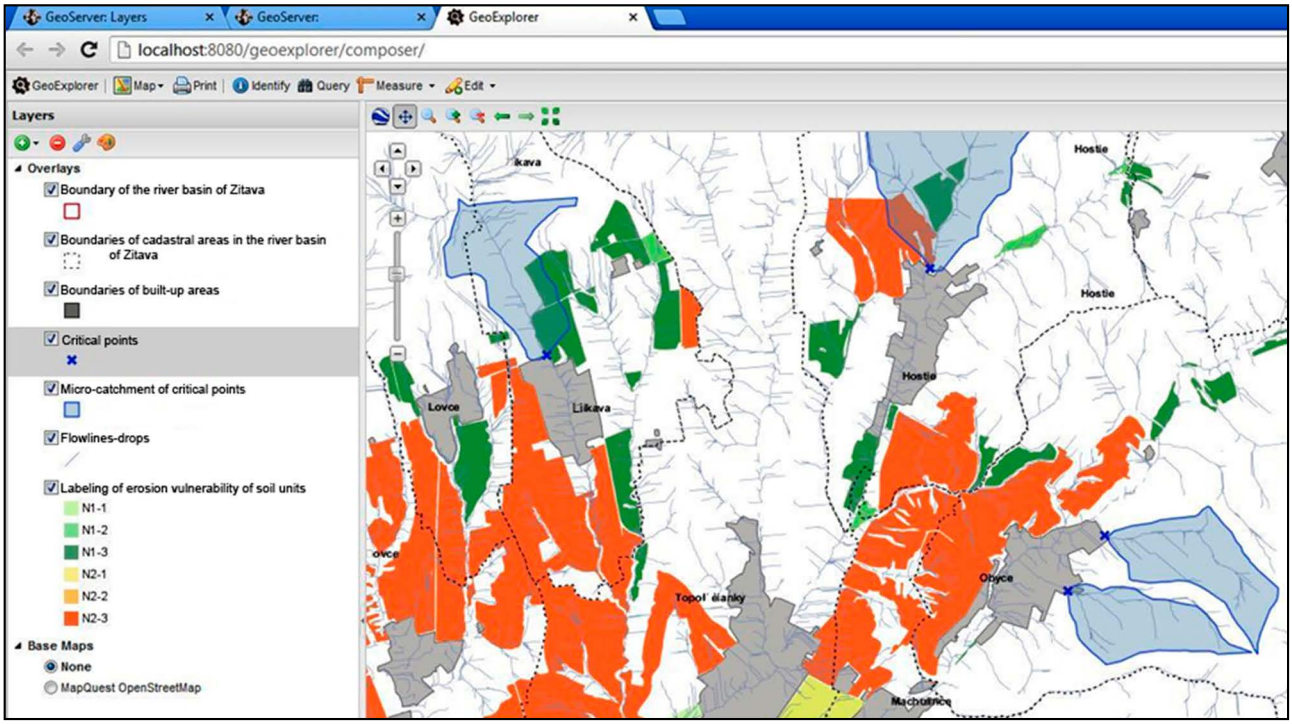

Figure 4 The combination of information from which the user can, at the cadastral area, check the information on land units (e.g. how many critical points are located in the administrative area, etc.)

Obrázok 4 Kombinácia informácií, pomocou ktorých si používateľ môže v katastrálnom území skontrolovať informácie o pôdnych jednotkách (napr. koľko kritických bodov je umiestnených v administratívnom území a pod.)

S-OKTOPUS has registers based on themes. The registers contain the individual stages of land consolidation projects but also master documents of the projects as a basis for the development of stages. We have set up following registers in the S-OKTOPUS: Register Reports and additional material (includes 3 topics), Register Raster (includes 3 topics), Register Soil (includes 20 topics), Register Ecology (includes 7 topics), Register Land uses (includes 10 topics), Register DMR (includes 11 topics), Register Water (includes 11 topics), Register Proposals.

We have included/drawn maps into the registers according to the relevance for the particular register, e.g. Register Water contains the following topics: The revitalization of the country and Integrated River Basin Management, Vulnerable river basin, R factor, K factor, LS factor, Flow lines (drops), Potential intensity of water erosion, Soil loss allowable by STN, Soil loss allowable by the law, Degree of soil erosion endangerment by STN, Degree of soil erosion endangerment by the law, Capacity of surface runoff from basin (Leitmanová, 2013).

The key topics and the basic analytical topics represent a relatively comprehensive characterization of area. They represent thematic information on a topic. They provide purposeful information on a single topic.

Their appropriate combinations are derived analytical topics. On their background, we can create/find information and derive the downstream restrictions for an area of interest. The system is operated by logical combinations/criteria. The combinations/criteria are able to tell us what would be appropriate to propose for protection of an area. We have prepared a presentation of selected topics of Register Proposals at the local level in the environment of the OpenGeoSuite. The sample includes the structure of topics together with the corresponding legend. We have published verified, tested and filled S-OKTOPUS via its data-management web interface. Fig. 4 illustrates the structure of the web view as seen by users in a web browser.

S-OKTOPUS is in its initial stages of development and its continuation will include the verification of discovered results in terrain. The factors relating to the selected critical points, the value of the calculated coefficient of ecological stability, the areas with identified point for protection against water erosion, etc. will be verified and documented. It is expected that an interactive system that enables the comparison of our results with the users of the system through tag support (tags) will be created. These tags would represent information from others that would be saved to the working layer and at the discretion of the administrator would be incorporated or rejected. The aim of the system is to build a database with live feedback for continuous development of metadata.

Conclusion

We have designed, defined and provided complete set of (not only) land consolidation project data which should be able to provide extensive and comprehensive information on the area of interest from the perspective of the potential user. We call it System about the country, creation, and land consolidation in Slovakia, S-OKTOPUS for short. S-OKTOPUS users might include farmers – land tenants, small growers, land owners/subjects renting or managing the land, but also mayors, developers, foresters, planners, designers of land consolidations, engineers in the area, environmentalists, academics or just anyone interested in related issues/topics.

The system will help to clarify the already processed data from land consolidation projects, the data will be archived and presented via web-interface in a generally accessible and intuitive way.

The system's web-interface has following URL: http://fzki.uniag.sk/oktopus.

Súhrn

Pozemkové úpravy sa v Slovenskej republike dostali do fázy, keď je k dispozícii dostatočná vzorka projektov s množstvom hodnotných údajov (polohopisné a výškopisné zameranie územia, aktualizované mapy bonitovaných pôdno-ekologických jednotiek, návrhu miestneho územného systému ekologickej stability, plán všeobecných zásad funkčného usporiadania územia a pod.). Ich využiteľnosť je však otázna, nakoľko žiadna centrálna archivácia dát z projektov doposiaľ nikde neexistuje. Vo väčšine prípadov všetky podklady ostávajú na CD nosiči niekde v dokumentácii na pozemkových úradoch. V horšom prípade sa dokumentácia zapožičala a nakoniec nenávratne stratila. Príspevok popisuje návrh nového systému, ktorý by ucelene poskytoval prehľad, najmä o grafických výstupoch pozemkových úprav. Projekt je nazvaný Systém OKTOPUS, pomocou ktorého dokážeme analyzovať, spracovať a archivovať údaje vytvorené v projektoch pozemkových úprav, resp. v iných dokumentáciách. Priestorové dáta sú v Systéme OKTOPUS zaradené do katalógu tém a na základe tematických okruhov sú delené do registrov. Modelové územie, na ktorom Systém OKTOPUS demonštrujeme, je povodie rieky Žitavy. V povodí sú uvedené príklady možných scenárov jeho využitia. Výsledným efektom je zverejnenie Systému OKTOPUS na webe pomocou platformy, ktorá umožňuje používateľom zdieľať, ale aj upravovať geografické informácie.

Kľúčové slová: pozemkové úpravy, geografické informačné systémy, všeobecné zásady funkčného usporiadania územia, Systém OKTOPUS

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Contact address:
Mária Leitmanová, Slovak University of Agriculture in Nitra. Horticulture and Landscape Engineering Faculty, Department of Landscape Planning and Ground Design, Hospodárska 7, 949 76, Nitra, Slovakia, e-mail: zlatica.muchova@uniag.sk