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Land use changes in border regions of Czechia

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In this article, we are going to present results of two analyses of landscape in border regions of Czechia. The first one is based on a long-term development of land use in 8.903 Czech “Basic territorial units” (BTU’s) recorded in the “Database of long-term land use changes in Czechia” (1845 – 2000, see <http://lucc.ic.cz/>). In this database, areas of eight basic land use categories (arable land, permanent cultures, meadows, pastures, forested areas, water areas, built-up areas and other areas) are recorded for the years 1845, 1948, 1990 and 2000 for each of the BTU’s. For the purpose of our study, we have defined four sub-sets of BTU’s in relation to their position towards the state border. Set A are BTU’s adjoining the border; set B are BTU’s adjoining the BTU’s of set A; set C are BTU’s adjoining BTU’s of set B; and set D are remaining BTU’s (interior of the country). The sub-sets A, B and C (together n = 1.546) were further divided according to which country they adjoin – former West Germany, former East Germany, Poland, Slovakia and Austria. This presentation seeks to examine and explain land use changes between the years 1845 – 1948 – 1990 – 2000 in all these sub-sets of BTU’s. It was found that border regions of Czechia show a distinctively different structure and different changes of land use when compared to the interior of the country. The border regions are less intensively used and land use changes in border regions are faster.

The second part of this article uses the CORINE land cover database to assess changes of land cover in a 30 km wide belt along the former Iron Curtain (15 km on each side), stretching from the Baltic Sea to former Yugoslavia, between the years 1990 – 2000. There are interesting differences in land cover changes if we compare the belts on the both sides of the former Iron Curtain. Much more intensive land cover changes occurred in the eastern belt after the year 1990 when compared to the western one. There are also significant differences when comparing the observed countries.

Settlement Spatial Analysis and Rural and Urban Area Delineation in the European Union

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From the perspective of settlement spatial distribution analysis and rural and urban area definition and delineation, settlement system consists of three main components: population, its activities, and built-up objects. Rather than substituting the variety of human activities in this three-fold scheme just by the residential activity, it might be more appropriate to measure the total intensity of human activities in terms of built-up objects area (or preferably volume) required, and to represent its spatial distribution, similarly as the temporally weighted population density, through a built-up objects spatial distribution model. Because built-up objects data can be collected through remote sensing independently of national censuses and irrespectively of administrative boundaries, they are particularly suitable for international projects covering area of several countries. Moreover, the finest spatial resolution of such data is much higher than the spatial resolution of the smallest census output areas. This is particularly important with respect to the use of a built-up objects spatial distribution model as a settlement spatial distribution model for the sake of rural/urban area delineation, where the assessment of landscape composition (in terms built-up/non-built-up) and fine resolution spatial configuration (of elements of these two classes) is of high importance.

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Keywords: settlement, population, land cover, spatial analysis, landscape metrics

Importance of Stabil Cadaster in landscape structure studying

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There are two basic studying principles of historical landscape structure, for one thing we use statistics of land use and for another map sources, photographs taken from airplane etc. The Stabil Cadaster, as was completed more than 180 years ago, links both of these possibilities together and enlarges them for economical characteristics, because primarily it was created to make levying land tax simpler.

The Stabil Cadaster is a unique piece of work for its completeness and complexity as well. The landscape structure quantity and quality are described in details which could not be found in any other work. The data summary of written, map and valuing part gives us possibility of landscape condition studying at the beginning of agricultural and industrial revolution and creates the starting point for comparing to newer landscape structure data.

An example of the Stabil Cadaster use for studying the landscape evolution is the landscape structure research in area of Dolní Kounice town in the Czech Republic. This small town is situated cca 20 km to south-east from Brno city.

Keywords: dynamic land use, landscape, Stabil Cadaster, Dolní Kounice

Methodology of Evaluation Land-use Changes by Application of the Historical Maps and Remote Sensing Data)

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One of methods possible for the identification of land-use changes is the interpretation of historical maps and remote sensing data using GIS. The maps and aerial photos take a valuable position because they express the study phenomenon in time and space. They enable to monitor and understand the genesis and function of land-use changes elements according to landscape conditions, spatial aspects (position, shape, extent, structure) and socio-economical context. These result from the map contents and special-purpose interpretation. In particular, the 1st and 2nd military mapping (18th and 19th century) at scale 1:28 000 by their exactitude and content fulfill the strict criteria of correct interpretation in the basic or applied research. The historical maps include the unique information about land-use forms in certain time horizon. The development during the chosen period can be specified by the comparison of 2 or more maps of the same area or by adding the interpretation of recent maps and aerial photos. The interpretation of land-use changes depends on the detailed analysis, accuracy and the way of depiction.

The evaluation of land-use development is performed by the overlay of thematic maps or aerial photos in GIS. It is necessary to unify the diversities in land-use forms considering the maps of different time horizons to the identical categories. The older maps usually serve as limiting criteria. The study of land-use development is important especially for the landscape-ecological analyses and syntheses that result in outlines depicting the sustainable development of an area. The identification of changes, their causes and consequences in landscape contribute to the determination of its potential and carrying capacity.

Keywords: land-use changes, historical maps, remote sensing, GIS

Land-cover Fragmentation: Comparison of Two Methodological Approaches based on CORINE Land Cover Data

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The dynamically changing land cover configuration and its impact on biodiversity have aroused interest in analysis of land-cover fragmentation and its consequences. In the contribution we present forest fragmentation maps related to the years 2000 and 2006 created by two different methodical approaches. The CORINE Land Cover data layers CLC 2000 and CLC 2006 converted to raster format were used as the input data in the process of forest fragmentation assessment. The first approach is based on the methodology presented by Riitters et al. (2002). Forest pixels were classified according to two fragmentation indices: “forest proportion” and “forest connectivity” measured within the surrounding landscape. In the second approach Morphological image analysis was applied using the Landscape Fragmentation Analysis tool (LFA) developed by Parent and Hurd (2008). Both methodological approaches require aggregation of CORINE Land Cover classes into three groups: 1- land cover type of interest (in our case it was “forest” – CLC classes ‘broad-leaved forest’, ‘coniferous forest’ and ‘mixed forest’), 2 – fragmenting land cover (urban areas, agricultural areas, etc.) 3- non-fragmenting land cover (water and bare rocks). In both analyses, we identified four fragmentation components: Core, Patch, Perforation and Edge. Tatra region (Slovakia) was selected as a study area to illustrate the forest fragmentation changes. In November 2004, the territory was affected by calamity windstorm, which destroyed around 12,000 ha of forest at altitudes between 700 m to 1,350 m above sea level and substantially changed the vegetation cover in the whole area of the Tatra National Park.

Keywords: forest fragmentation, CORINE Land Cover, Tatra region

Evolution of the “pastoralismo” in Sardinia and management of the territory: geo-economic analysis

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The life of the shepherd, the his relationship with the external world and all the other components of the pastoral culture that give motivation to the "Pastoralismo", they are recognized by the Unesco as cultural patrimony of the humanity today. The recognition allows to legitimate the dignity of a secular patrimony that has produced a culture almost disappearance in Europe, but that it persists today still in Sardinia in its actual form of economic production, social organization, cultural conscience. In such context, the Pastoralismo sets the matter of a positive relationship among local and global and it is questioned if this secular civilization were able of to insert him in the process of mondializzazione, elaborating some distinctive characters of his own culture to suit for the new demands of the contemporaneity. Also in his simplicity he has been able in the time to modify vast areas of the island territory, above all those less proper for the agriculture, producing a specific ecosystem constituted by species of the flora and fauna typical. The relationship between the pastoralismo and the territory has become so strongly that in the areas in which this regresses, the disappearance of these kinds is assisted to that for their tipicità they are often rare and in Sardinia they find, by now, their only vital spaces. With this job we want to show as the management of the natural resources of the territory must pass through a development of the pastoralismo from simple economic activity to motor of the sustainable development.

Keywords: pastoralismo, natural resources

Sensitising rural policy: Identifying potentials in rural regions using typologies with a special focus on agricultural land abandonment

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The European Union's reorientation of the Common Agricultural Policy, differential phased decoupling of subsidies with agricultural production levels towards land stewardship incentives, has caused uncertainty for many rural areas in terms of future landcover and use. Regions of particular concern for policymakers and scientists are those undergoing land abandonment, rural depopulation and agricultural marginalisation. Such landuse changes are viewed as a loss of valuable aesthetic, cultural, historical and ecological societal goods. For the management of economic development in these rural areas tools that identify endemic rural potentials in alternative production functions are needed, which are tailored to the variation of spatially favourable environmental and human diversity across Europe. This paper presents a European wide typology for that purpose showing potentials, pressures and the present situation of rural areas. Potentials for agricultural intensification, off-farm work, tourism, nature conservation and multiple functions are investigated, given regional endemic environmental and human capacities. The typology appears to be course but effective in broadly measuring the pressures and potentials of rural Europe. The tool also groups regions with similar challenges, allowing for more generalised policy recommendations. Finally it is concluded that lower scale investigation is needed in order to test such potentials by investigating local constraints and determinants of alternative rural functions.

Keywords: Landuse/cover change, Rural potential, Rural functions, Typology, Land Abandonment

Land Cover Change of Slovakia in 1970/2006 by Application of CORINE Land Cover Data

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The paper brings an overview of methodology applied in CORINE Land Cover (CLC) Projects for acquisition of land cover data of Slovakia from the years 1970 (CLC1970), 1990 (CLC1990), 2000 (CLC2000) and 2006 (CLC2006) and its changes in three time horizons – CLC1970/1990, CLC1990/2000 a CLC2000/2006 by means of visual interpretation and computer aided visual interpretation of the Landsat, SPOT and IRS satellite images. Activities of the CLC coordinated by the European Environment Agency (EEA) seated in Copenhagen and the Joint Research Centre (JRC) of the European Commission seated in Ispra became part of the all European monitoring programme Global Monitoring for Environment and Security (GMES) and its servicing parts referred to as Fast Track Service Precursor Land Monitoring (FTSP Land Monitoring) in 2008.

The obtained data will saturate the requests of users on the all-European and national levels for preparation of various environmental strategies, assessment of commitments ensuing from agreement about the climate change, assessment of the common European agricultural policy and promotion of the rural area, preparation of infrastructure for INSPIRE (Infrastructure for Spatial Information in Europe) etc. Analysis of results shows that in the period of 1970-1990, the most intensive changes that took place in Slovakia were those in agriculture with the dominating change of heterogeneous agricultural areas in favour of arable land (371,500 ha) and meadows (417,100 ha) and vice versa, meadows changed into arable land (157,300 ha) and heterogeneous agricultural areas (431,900 ha). These changes are the results of the agrarian policy promoted by the State. In the period 1990-2000, the dominating changes were those in the forest landscape which manifested by the diminishment of forest (58,032 ha) in favour of transitional woodland/scrub (areas after logging and damaged forest, enlargement of the woodland/scrub areas by 18,600 ha, overgrowing/abandonment of meadows above all in mountain and submountain regions, heterogeneous agricultural areas, as well as natural meadows. Privatisation of forests and the market mechanism were the decisive factors identified along with changes of the forest landscape. Changes in the forest landscape were still most important during the six-year period of 2000-2006 when the area of the transitional wood/scrub increased by 54,842 ha at the cost of forest and meadows (by overgrowing). The identified scope of changes in the forest landscape was also definitely affected by the windstorm of 19th and 20th November 2004 which struck the regions of the Vysoké Tatry and Nízke Tatry Mountains followed by logging and the process of overgrowing (abandonment) of originally agriculturally exploited meadows in the consequence of the new economic conditions set by the EU. The data about changes of land cover in Slovakia identified under the CLC projects apart from spatial precision also offer the advantage of a supranational compatibility and the option of their comparison in almost all-European context.

Keywords: CORINE land cover project, satellite data, land cover change, Slovakia

Agricultural Impact on Land Use/ Cover Change and biodiversity in Russia

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Agriculture is the major driver of land use/land cover change in Russia where more than 220 million ha (13 % of the total country territory) are designated for agricultural use. The structure of agricultural lands exhibits significant geographical diversity. The best agricultural lands are located in the steppe zone, which ensure producing more than 40% of the total Russia's harvest and provides employment for 30% of the country rural population.

Agriculture restructuring during the last fifteen years have put severe strains on the agricultural production: degradation affects more than 70% of agricultural lands, many fields were abandoned or dramatically impacted by changed management practices. Agricultural intensification creates new threats to biodiversity, that includes plowing mostly of all tillable lands, increasing of soil erosion, overgrazing and pasture degradation, landscape fragmentation by the fields and infrastructure.

A complex present-day landscapes methodology is used to study land use/cover changes in Russia under agricultural impact. The agrolandscapes' applications were done at macroregional, regional and local scales on the base of cartographic, remote in-field data.

The agrobiodiversity conservation and ecologically sound agriculture development should help to reconcile social needs with the requirements of the environment and to avoid the unfavorable consequences of land degradation.

Keywords: agriculture restructuring, agrolandscape approach, agrobiodiversity

Agriculture and climate change in Russia (input to IGU-LUCC Atlas)

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Land use and land cover change (LUCC) is a complex process, driven by both natural and anthropogenic transformations. Between the natural factors that shape the agriculture in Russia, climate is the most important one. In the European North and the most of the Asian part of the country, the most important factor is temperature. Long season with negative temperatures leads to a short growing period and low growing degree days, which puts strong restraints on crop varieties and average yields. In warmer European South region, agriculture is primarily controlled with the spatial and temporal precipitation pattern. Evidently the future of agricultural land use in the country will be determined by the temperature and precipitation shifts, that will be explored in this chapter.

Since the effect of global warming is even more profound at high latitudes, northern countries, like Russia, can reasonably expect even higher temperature rise. The five different Global Circulation Models (GCMs) were used for three pre-set time periods: 2020s, 2050s, and 2080s. All climate change scenarios show significant increase of temperature and moderate increase of precipitation.

Yield models based on GCM simulations show an increase in potential yield in central and northern regions and a drop in yields, due to increasing frequency of droughts in currently the most productive southern European region of Russia. It is likely that the most productive regions will have to cope with increasing crop failure by shifting their strategy from producing crops for export to local consumption.

Keywords: agriculture, climate change scenarios, yield models

Sprawl up or sprawl down? A SLEUTH application for Spatial Entropy.

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One of the critical challenges contemporary society is facing is the uncontrolled spread of cities into surrounding rural land. The so called “sprawl” is conceptually well known, but it is controversial because there are not universally shared definitions about its etiology, hence of the causes and variables related to it.

The aim of this study is to depict the temporal trend of sprawl, so as to identify a sort of “sprawl evolution signature” for the area under investigation, the Italian Province of Pordenone. The dataset considered is based on a new method of land cover classification techniques using satellite imagery from 1985 to 2005 and on a reliable cellular automata modeling method to predict future urban scenarios up to 2050.

In this study we analyze the growth trend relating it to the concept of general spatial entropy, which is not a scale dependant variable and is the only almost universally shared concept concerning urban sprawl.

How spatial patterns of urban growth are identified is crucial for urban planners, since it lets them efficiently calibrate policies to control and drive the change in order to satisfy specific needs of the population and to prevent risks related to sprawl.

KEYWORDS: sprawl, SLEUTH, entropy, Pordenone, landcover.