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Ecosystem Provisioning Services Automated Valuation Process Model for Sustainable Land Management

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Abstract

For effective management of natural capital, it is necessary to identify all ecosystems provisioning services (supply of food, wood, etc.), evaluating each of them. The article presents ecosystem provisioning services' automated valuation process model. As data sources are proposed to use information from the European Union member states institution's data registers, integrating it using classical data base, XML schema definition and geographic information systems technologies. The proposed model provides industry professionals with the opportunity for online decision making, that is based on actual data, and as well fuzzy logic based assessment method for sustainable land management. The article defines the data sources that are available for modeling and describes the specific problems with data integrating. As a result of the study information system architecture for ecosystem provisioning services' valuation for land management is developed.

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1. Introduction

At present there is no consensus about terms “ecosystem services” and “ecosystem”, so in this article is used terminology adopted from “Ecosystems and Human Well-being: Synthesis”¹. Ecosystem services (ES), they are potential gains or losses which a person can receive from ecosystems, while the ecosystem – is a plant, animal and

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micro-organism dynamic interaction with inanimate objects (for example, soil, terrain, weather conditions). Ecosystems can be divided in two major categories: subsistence ecosystems (not affected or almost not affected by human) and modified ecosystems, which are intensively managed by human (for example, agricultural land and urban areas) and four sub-categories: provisioning services, regulating services, cultural services and supporting services so-called as ecosystem functions¹. After work “The Limits to Growth”² publication in 1972, it became clear that humanity at closed or localized area cannot grow indefinitely without negative consequences to the environment and future generations. In 1987 at “Brundtland’s”³ report appears idea about sustainable development strategy, where “Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs³”.

There are economic and ecological concepts for assessing ES⁴. The article dealt with provisioning ES valuation models, based on digitally stored datasets. The evaluation accuracy is primarily depended on the concept, as well on the level of detail of valuation model and on data quality and actuality. Building the correct model’s architecture is very time-consuming and expensive process. Evaluation model should be based on a significant amount of data, where for each separate dataset are responsible mostly individual organization. No one organization has all necessary for modeling data in one place.

Harmonization of classifications will greatly facilitate data interoperability between the institutions, thus facilitate the construction of valuation model’s architecture for all European Union (EU) Member States (MS) national territory. The data in institutions registers overlaps. For example, “Rural blocks” (polygons) that accumulated in the Rural Support Service may be overlapped by “forest land plot” from State Forest register. In this case coordination (harmonization) of data registration process between the two institutions can solve overlapping and gaps problems in data. Currently, the Latvian cadastre data on land use, for the MS territory, is available only as a text. And new data continues to be collected only as text. But the data in “Rural Support Service” and the “National Forest Register” are also available as a graphics. The need to combine text and graphic information also complicates the assessment model. Implementation of unified data specifications for all registers can greatly facilitate data processing. Despite the global trends on data opening, so called open data approach, in Latvia data from many registers are still not publicly available. This makes difficult data inventory for non-industry professionals. For example, the data from many state registers or institutions are not available for universities or is available for a fee, which significantly complicating research activities. EU MS data register’s financing from the state budget could improve this situation.

The aim of the article is to define provisioning ecosystem services automated valuation process model for sustainable land management. The following tasks are defined: 1) to perform provisioning ecosystem services assessment tools analysis; 2) to define land management tasks; 3) to develop the information system’s (IS) architecture for land development; 4) to develop an automated process for land management to maximize provisioning ecosystem services monetary value (based on cadastral value).

2. Materials and methods

For data monetary value determination many methodologies can be applied, for example direct market pricing, production function, avoided cost, hedonic pricing, travel cost, contingent valuation and other methods and combinations⁵. Robert Costanza claims, the problem is that the valuation is implicit in the decision and hidden from view⁶. Improved transparency about the valuation of ES (while recognizing the uncertainties and limitations) can only help to make better decisions⁶. Despite that Rudolf de Groot found that provisioning services are more often values through direct market pricing methods⁵.

Most people understand values expressed in monetary units, this is often a convenient denominator for expressing the relative contributions of the other forms of capital, including natural capital⁶. Estimating of aggregate accounting value for ES in monetary units have a critical role to play in heightening awareness and estimating the overall level of importance of ES relative to and in combination with other contributors to sustainable human well-being⁷. As a result, spatial development specialists and the land consolidation specialists, creating spatial development documents, will be able to apply this model for planning and decision making, including tasks like maximizing the cadastral value of land, according to the cadastral valuation methodology. If planning specialists as

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