троенергетики, до якої зможуть звертатися й інші урядові організації); планування потреб енергоспоживання та розвитку електричних мереж; впровадження енергозберігаючих технологій; скорочення часу на проектування та реконструкцію ЛЕП за рахунок автоматизації багатьох процесів; налагодження стійкої кооперації між окремими енергосистемами та їх складовими — обласними енергетичними компаніями; допомога керівництву компанії у прийнятті більш обгрунтованих та ефективних оперативних та стратегічних рішень.

Висновки. ГІС в енергетиці сьогодні це основа для систем підтримки прийняття рішень, моніторингу стану та управління в галузі електроенергетики. Вони використовуються на всіх етапах життєвого циклу функціонування енергетичних підприємств — планування, проектування, будівництво, експлуатація. Потужна, працездатна корпоративна ГІС — це міцний фундамент для повноцінного впровадження «розумних мереж» і отримання максимальної віддачі від наданих ними переваг. Впровадження ГІС у вітчизняну енергетику є одним з важливих етапів її модернізації.

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USING STATISTICAL DATA ANALYSIS TO IMPLEMENT NORMATIVE MONETARY LAND VALUATION OF SETTLEMENTS

The article describes the main aspects of the implementation of the monetary normative land valuation of settlements based on geographic information systems. A modification of the technique of normative monetary land assessment of settlements through the introduction of statistical data analysis methods that are based on geoinformation software ArcGIS 10 is suggested. The implementation of the statistical data analysis methods and spatial analysis can improve the quality of valuation of urban areas and, therefore, the efficiency of the land use system.
Keywords: statistical methods of analysis, normative monetary valuation, GIS technologies

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ПРИМЕНЕНИЕ МЕТОДОВ СТАТИСТИЧЕСКОГО АНАЛИЗА ДАННЫХ ПРИ ВЫПОЛНЕНИИ НОРМАТИВНОЙ ДЕНЕЖНОЙ ОЦЕНКИ ЗЕМЕЛЬ НАСЕЛЁННЫХ ПУНКТОВ
В статье рассмотрены основные аспекты выполнения денежной нормативной оценки земель населённых пунктов на основе геоинформационных систем. Предложена модификация методики нормативной денежной оценки земель населенных пунктов путём внедрения методов статистического анализа данных на базе инструментальных средств геоинформационного программного обеспечения ArcGIS 10. Применение методов статистического анализа данных, пространственного анализа позволяет повысить качество оценки городских территорий, как следствие, эффективность системы землепользования.
Ключевые слова: статистические методы анализа, нормативная денежная оценка, ГИС-технологии

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ЗАСТОСУВАННЯ МЕТОДІВ СТАТИСТИЧНОГО АНАЛІЗУ ДАНИХ ПРИ ВИКОНАННІ НОРМАТИВНОЇ ГРОШОВОЇ ОЦІНКИ ЗЕМЕЛЬ НАСЕЛЕНИХ ПУНКТІВ
У статті розглянуті основні аспекти виконання грошової нормативної оцінки земель населених пунктів на основі геоінформаційних систем. Запропоновано модифікацію методики нормативної грошової оцінки земель населених пунктів шляхом впровадження методів статистичного аналізу даних на базі інструментальних засобів геоінформаційного програмного забезпечення ArcGIS 10. Застосування методів статистичного аналізу даних, просторового аналізу дозволяє підвищити якість оцінки міських територій, як наслідок, ефективність системи землекористування.
Ключові слова: статистичні методи аналізу, нормативна грошова оцінка, ГІС-технології

Introduction. To create an effective land use system is a major goal of the campaign for the implementation of the land reform, one of the fundamental elements of which should be an effective mechanism of economic regulation of land relations, free redistribution of land, its transition to a more efficient user, while taking into account the price factor of the land market.

Features of the legal framework that regulate economic and financial aspects of land relations in Ukraine are determined by the prospect of the land market formation, the relationship between paid land tenure and land usage and marketability of land. The formation of a land market defines the areas of usage of the results of its monetary valuation.

The task of the monetary valuation of land is to determine the cost of the differentiated values for certain areas of the city, for some plots of land, in order to determine the land tax and rent, form a profitable part of the city and district budgets, define the price of the sale of land after its privatization, put the starting sale price of land at the land auction, the sale price of land plots under construction in progress, rationalize investments and design decisions, justify the cost of land operations, while the main task of land use system is to develop a permanent mechanism of monetary valuation of land under real conditions of management [1]. The provision of the effective functioning of this mechanism is impossible without application of modern technologies, particularly geographic information systems (GIS), which allow solving a wide range of tasks, make sophisticated analysis, and ensure an informed decision-making.

Study background. In recent years, the GIS technologies application area has expanded greatly in various fields. The monetary valuation of land is allocated among the areas where implementation of GIS occurs the most rapidly. The development of methodological approaches of GIS technologies is being actively pursued, authors such as J. Karpinski, E. Kuts, N. Lihogrud, A. Ljashenko, Y. Palekha, V. Sotnikov and others made attempts to generalize the existing methods [2]. The focus of GIS elements application in their work is the economic-planning zoning of settlement territories. The results of work of the specialists of the Institute "Giprograd" (Kyiv) developed into a range of methods and techniques of GIS technologies applications for the process of monetary land valuation [3].

The purpose of research. The purpose of this article is to modify the techniques of normative monetary land valuation of settlements through the introduction of statistical data analsis methods based on geo-information software ArcGIS 10.

Materials and methods. Valuation of land in Ukraine is based on specific techniques, procedures and standards; legislative and legal acts govern the usage of the results of monetary valuation in the course of market transactions with the land in accordance with the Land Code, which regulates the assignment of land to certain categories of use, and urban development norms define indicators that influence land monetary value.

The cost of a land plot is determined by its location, position of the settlement in the national, regional or local system of production and settlement, development of its territory and land quality taking into account the natural and climatic, engineering-geological and architectural and landscape value, historical and cultural value, environmental conditions, and functional use of land [1].

Because the initial data for the execution of monetary valuation of land is represented by a natural spatially distributed structure, collection of cartographic and tabular materials that cover different factoral characteristics of the territory, it is appropriate to use a wide range of GIS tools for their processing.

The application of electronic maps and GIS spatial analysis techniques allows improving the quality of collecting data significantly. Today, only some separate elements of GIS technologies are used in many projects related to normative monetary evaluation of both land settlements and agricultural land, while the enforcement of the monetary valuation of the land with the geoinformational technologies allows to fully solving problems caused by using a general methodology. The basics of the technological solutions proposed in this paper are based on the facilities and means of the ESRI software. The rapid development of geographic information technologies in recent years, the emergence of new opportunities and implementation of mathematical methods allows to employ a new problem-solving approach in conducting monetary land valuation based on GIS.

Methods and procedures of statistical analysis and simulation are now widely used in the spatial research. Along with the use of standard non-spatial statistical algorithms, methods of spatial statistics are being actively implemented. The main advantage of GIS statistics is vast statistical analysis visualization opportunities at all stages [4].

Application of statistical analysis in the execution of the monetary valuation of land helps professionals carry out qualitative analysis of the data, obtain additional, non-obvious information, and identify patterns and trends. ArcGIS software product has a wide range of tools for statistical analysis of data, both spatial and non-spatial.

The methodology for the normative monetary evaluation of settlement lands using ArcGIS software consists of the following steps:

1. Collection and processing of data, including collection of initial spatial, economic and regulatory information, as well as creation of cartographic base.

2. Data analysis, carried out in order to identify factors that influence land valuation, as well as the operations of spatial analysis.

3. Performing calculations of the cost parameters, taking into account the factors identified and characteristics obtained by the means of spatial analysis.

Thus, the first step is the preparatory work, the collection of initial data and its introduction to the infor-

mational system of spatially distributed objects. Spatial objects are grouped in data layers of geodatabase; attribute information is presented in the form of relational tables of each layer. Informational base for the implementation of the normative monetary valuation of land settlements is their master plans and projects of planning and development of settlements, the materials of territory economic evaluation, materials of the land settlements inventory, development projects, distribution of the residential areas, and local building rules [1]. Geodatabase is composed as a result of the first stage completion; it includes spatially distributed and attributive information about the objects to be evaluated.

According to the method of implementation of the normative monetary evaluation, assessment of a certain plot of land is carried out by performing complicated calculations that take into account a large number of coefficients of factor analysis within a zone of land evaluation, taking into account the area of land.

The normative monetary evaluation of land is based on a method of rental income capitalization. According to the order of the normative monetary value of land settlements, calculation of monetary evaluation of 1 sq. m. (Mv) is performed considering the costs of development of the territory (Cd), the location of the land plot (Lp), its functional use (Fn), the rate of profit $(Pr = 6\%)$, and capitalization rate $(Cr = 3\%)$:

$$Mv = Cd \cdot Pr \,/\, Cr \cdot Fn \cdot Lp.$$

Expenditures on exploration and development of the territory include the replacement cost of engineering infrastructure, including facilities and backbone networks of water supply, sewerage, heat, electricity, low-power devices, gas supply, drainage, sanitary purification costs, green areas, road network, and urban transport.

Functional use of land takes into account the relative profitability of existing economic activities within its boundaries.

Three groups of rent-generating factors - regional, zonal and local, characterize location of land [1].

Thus, the cost of 1 sq. m. of land is affected by a specific set of factors, objective consideration of which is a difficult task.

At the stage of data analysis, assessment of spatial objects and their characteristics is carried out; the ranking of objects is performed; additional indicators are calculated based on the initial data for further operation. At this stage, the analysis of factor indicators and functional zoning of the territory is held.

It is appropriate to use a factor analysis, as a method of statistical processing of information. The main objective of the factor analysis is to determine the relationships between variables and their classification; and to reduce the number of variables. Factor analysis is used to determine the level of influence of the specific factor to perform further calculations, as well as to explore the relationships between the factors.

Implementation of the monetary regulatory assessment involves the usage of different methods of factor analysis, namely classification and a method of principal components.

Classification analysis is performed at the functional zoning of the territory. Among the city's functional zones, there are residential buildings, industrial buildings, communal and warehouses, health care facilities, and others. There are two types of classification: with training and without it. The purpose of classification is to identify the affiliation of each cell to the known class in the study area (classification with training) or cluster (classification without training). The input data for classification is the signature file that contains the multivariate statistics of each class or cluster. The result of each classification is a map that divides the study area into the known classes, related to training samples, or naturally occurring classes, corresponding to clusters identified by clustering [5].

The method of principal components is used to analyze the pricing factors. These include communication, transport accessibility, environmental factors, infrastructure, natural and landscape, historical and cultural factors, etc. Principal component analysis is based on determination of the minimum number of factors that contribute to data variance in a large measure. An important characteristic of the method is the possibility to use the most informative principal components exclusively, so that the rest of them are excluded from the analysis [5].

The results obtained during the second stage are displayed in a number of analytical maps, and the cost of the land is estimated based on them.

The third step of calculation includes application of a group of Map Algebra tools that allows getting a detailed map of the cost parameters not only the basic costs within the planning area. The application of tools of the module Map Algebra involves two main steps: the construction of the initial interpolated raster surfaces of the given parameters and application of raster calculator that estimates an integrating function. Under the current methodology, coefficients of components, monetary evaluation of the residential areas are calculated using GIS [6], while using Map Algebra allows determining the cost of 1 sq. m. of the settlement lands by performing arithmetic operations on thematic layers, taking into account the identified factors of influence and refined spatial characteristics.

Conclusions. The advantage of the modified technique is the visualization of the statistical analysis of spatial data, the ability to identify factors that have the most significant impact on the land value assessment, therefore, a possibility to reduce the number of variables in order to optimize the process. This technique allows professionals to get a detailed map of the cost parameters estimates of land settlements, taking into account the results of the statistical analysis and calculated spatial characteristics, it is assumed to use GIS at all stages, not just to calculate a normative monetary

evaluation. Application of the method will improve the quality of regulatory assessment of land settlements, the mechanism of economic regulation of land rela-

tions, and the efficiency of land use system in whole.

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USING GIS FOR THE EVALUATION OF THE CROP RESIDUES ENERGY POTENTIAL

This article suggests some features of the use of geographic information systems to assess and to analyze the energy potential of crop residues. The features of the analysis of this type of potential are defined at different levels of government: national, provincial, and district. Methods for assessing the energy potential of crop residues in this study suggest the use of a series of satellite images to identify crops that takes into account the nature of the areal distribution of this type of waste.

Keywords: crop residues, energy potential, bioenergetics, GIS, satellite imagery

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ВИКОРИСТАННЯ ГІС ДЛЯ ОЦІНКИ ЕНЕРГЕТИЧНОГО ПОТЕНЦІАЛУ ВІДХОДІВ РОСЛИННИЦТВА
У статті розглянуті деякі особливості використання геоінформаційних систем для оцінки та аналізу енергетичного потенціалу відходів рослинництва. Визначено особливості аналізу цього типу потенціалу на різних адміністративних рівнях: загальнодержавному, обласному, районному. Методи оцінки енергетичного потенціалу відходів рослинництва в цьому дослідженні базуються на використанні серії супутникових знімків для ідентифікації сільськогосподарських культур. Це дозволило врахувати характер площинного розподілу цього виду відходів.

Ключові слова: відходи рослинництва, енергетичний потенціал, біоенергетика, ГІС, супутникові знімки

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ИСПОЛЬЗОВАНИЕ ГИС ДЛЯ ОЦЕНКИ ЭНЕРГЕТИЧЕСКОГО ПОТЕНЦИАЛА ОТХОДОВ РАСТЕНИЕВОДСТВА
В статье рассмотрены некоторые особенности использования геоинформационных систем для оценки и анализа энергетического потенциала отходов растениеводства. Определены особенности анализа этого типа потенциала на различных административных уровнях: общегосударственном, областном, районном. Методы оценки энергетического потенциала отходов растениеводства в этом исследовании предполагают использование серии спутниковых снимков для идентификации сельскохозяйственных культур. Это позволило учесть характер площадного распространения этого вида отходов.

Ключевые слова: отходы растениеводства, энергетический потенциал, биоэнергетика, ГИС, спутниковые снимки

Introduction. Bioenergy is one of the most promising types of renewable energy sources in the world and in Ukraine. Significant components of bioenergy are agricultural waste, particularly crops.

The urgent problems still are increasing percentage of biomass in the total energy consumption of the

country in general and the practical aspects of scheduling bioenergy plants that leads to the need to assess the energy potential at various levels, from the national to the regional and local. GIS is an effective tool at such critical stages as capacity assessment, analysis of the potential distribution, scheduling facilities on the