MATHEMATICAL MODELING THE LANDS

OF ADMINISTRATIVE-TERRITORIAL UNITS

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Formulation of the problem. Making administration decisions in the field of using land resources in most cases isn`t completely justified, which leads to negative ecological and socio-economic consequences.

Hence there is a need for the formation in the state on the national, regional and local levels, the system of economic decision-making in land relations sphere, which will be based on scientifically grounded principles of complex cadastral land zoning, which, in its turn, includes various forms of land ownership, cultural, ecological, socio-economic and other factors, which affect the sustainable development of territories.

Connection between important scientific and practical tasks

Improving the methods of administration of land resources should take place considering the modern legislative and regulatory framework of Ukraine, taking into account the principles of integration of our state into the social and economic European space. In particular, It concerns the compliance with the requirements of Constitution of Ukraine, Ukrainian laws "About state local administrations", "About local self-government in Ukraine" and others.

The practical value of this research consists in providing the state authorities and local self-governments with scientifically grounded mechanism of administration of land resources, which is based on cadastral information using modern technologies.

Analysis of recent researches and publications devoted to solving the problem

Scientific developments of O. Melnychuk [1, 2] are dedicated to resolving issues related to the modeling of rural territories. Modeling of optimization of composition soil-protective crop rotations are considered in the monograph of D.Dobryak and D. Babminder [3] .

The questions of land resources` administration in world`s scientific literature are widely illustrated in the monograph "Land Administration for the sustainable development" [4] of I. Williamson, S.Enemark, G. Wallace and A. Rajabifard.

Unsolved parts of the general problem

The problem of coordination of state authorities, local self-government, community in the field of administration of land resources needs scientifically grounded approach, that resulted in the implementation of the given research.

The basic material of the research

Solving this problem, under the term territory of administrative-territorial formation we mean a part of the earth's surface with clearly established boundaries. In this case, the general mathematical solution of this problem for different administrative -territorial formations (rural, settlement, urban and regional) will be identical. The difference will consist only in forming and filling the bank of database by the qualitative and quantitative indexes, which characterize the territory of administrative-territorial formation.

Let`s represent the territory of administrative-territorial formation as a totality of areas of categories of the land in accordance with the existing classification: agricultural, forestry, nature reserve assignment and nature protection, health- protection, recreational, historical and cultural destination, residential and public buildings, of communication, of Energy, transport and defense and Water Fund.

Thus, It`s logical to write:

$$S_T = \sum_{i=1}^{9} (S_a, S_f, S_b, S_i, S_t, S_d, S_r, S_h, S_n, , S_w), (1)$$

where S_T - area of the territory of administrative-territorial formation;

i - the number of the categories of land;

$S_a, S_f, S_b, S_i, S_t, S_d, S_r, S_h, S_n, , S_w$ - pursuant areas of the land of agricultural; forestry; residential and public buildings; industry; transport; communication; defense; recreational; health- protection; nature reserve assignment and nature protection; historical and cultural destination and Water Fund.

In its turn, the area S_i of every category of the land we can represent as a sum of the areas of land parcels of a certain objective usage:

$$S_i = \sum_{j=1}^{n} S_j , \quad 2$$

where S_j - area of the land of certain functional usage according to the normative document and code of the types of economic activity regarding to the classification of the land categories` structure, and to the area of zones of the limited use and burdened lands, areas with low productivity and degraded lands;

n – a number of land parcels of the certain functional usage in the defined "i"-category of the land.

Hence the formula (1) may be represented as

$$S_T = \sum_{i=1}^{9} \sum_{j=1}^{n} S`_j , \quad (3)$$

So, the reliable determination of the areas of certain functional usage requires the implementation of the inventory, and then the cadastral zoning of all territories with determination of the areas of certain categories of land, zones of the limited use and burdened lands, implementation of cadastral planning of functional usage of the land, the final result of which is creation the scheme of economic and functional structure of the territory of the administrative formation. Created scheme of economic and functional structure of the territory of the administrative-territorial formation
in such a way can be the basis for the organization of the territory of the administrative-territorial formation in conditions of maximum efficiency of using the land resources taking into account a number of restrictive factors.

We can write the objective function in general:

$$Z_{max} = \sum_{i=1}^{9} \sum_{j=1}^{n} C_j S_j , \quad (4)$$

where C_j - income (payment) from the land of the certain objective use of "i" – category.

At the same time the maximum value of the function (4) we find as:

$$\sum_{i=1}^{9} a_{ij} S_i \le b_1$$

$$\sum_{j=1}^{n} a_{ij} S_j \le b_2 \qquad 5$$

$$\sum_{i=1}^{n} a_{ij} S_i \le b_3$$

where $b_1 -$ areas of the transformation of the land categories;

$b_2 -$ areas of the transformation of the objective use of the land inside one of the category;

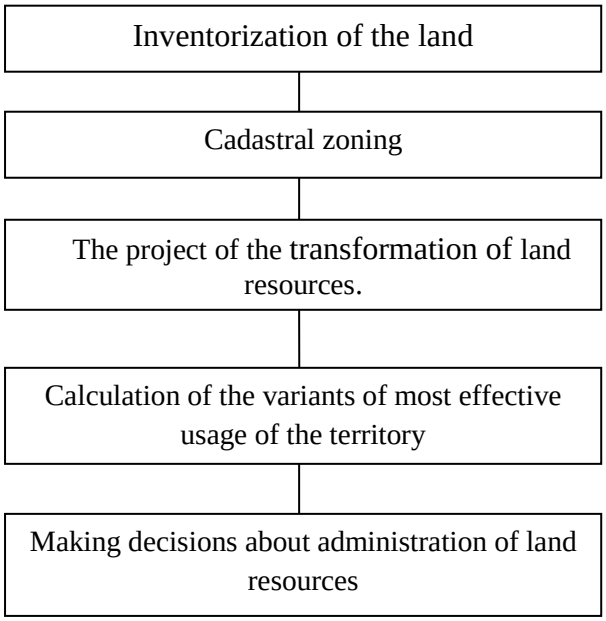
$b_3 -$ expenditure of cash resources for carrying out the works of the transformation of land resources.

$a_{ij} -$ coefficients which express, in of the first two - units of measure the area, in the last - expenditure of cash resources for the transformation of a unit of area.

The maximum value of the function (4) with restrictions (5) is easy to find using the methods of linear programming and, in particular, the simplex method.

In general case, technological scheme of solving the problem of maximum efficiency of using the land of certain administrative-territorial formation we can see at the picture.

Inventorization of the territory should include determination and accounting of the land of all categories which belong to the certain territory and establish the main factors that create the rent by them: functional planning, engineering and infrastructural, engineering and geological, historical and cultural, natural landscaped, sanitary and hygienic ones. Furthermore, the structure of inventorization should consist the factors, which characterize the demographic situation-availability of working-age population, its age and professional structure; legal - forms of ownership or using of land resources; ecological – ecological system, technogenic and anthropogenic load; natural – climatic, soil, geobotanical and morphological.



Pic. Technological scheme of administration of land resources

Cadastral zoning of the territories involves displaying on cartographic materials the boundaries of land categories and their functional usage with restrictions and encumbrances, which are installed in accordance with current legislative and regulatory documents.

The basis for perspective designing and effective use of land resources within the settlements is the urban planning documentation as general plans, but beyond – the materials of cadastral zoning.

Important criteria for effective land using that is shown in increasing of the welfare of the population, improvement of indicators of the socio-economic development of territories, their investment attractiveness is a determining variant, in which the objective function Z_{max} is maximal. Thus, the area of the territory of administrative-territorial formation is unchanged. The structure of the area of the objective usage and the categories of land can change in this formation.

An argument C_i deserves a special attention. It represents the monetary value of unit of area of certain functional usage. For determining the values of C_i two fundamentally different approaches can be used: the first - C_i is determined on the basis of normative average annual economic effect, which is set at the state level based on statistical data for the land of different categories and their functional usage; the second - C_i market value of a unit of area.

Setting the value of the function Z_{max} using C_i , defined by the second methodological approach, is effective at present time, because it depends on market conditions concerning demand and supply of land parcels of a certain objective usage. C_i , defined by the first methodological approach is a more stable magnitude. Hence, in our opinion, solving this problem we should give the preference to the first approach.

Calculation of the variants of the most effective and socially directed solution is advisable to carry out using a methodological approach of the simplex method.

Making important decisions by local self-governments and state authorities concerning the administration of land resources of the territories should take place based on the analytical review of all calculated variants with the involvement of a wide range of experts and the public.

Conclusions

On the basis of the research we have done, It is proposed to carry out administration of land resources taking into account the cadastral zoning of the land in regard to their category, objective usage, restrictions and encumbrances, and ecological, socio-economic and another factors belonging to the territory. For practical solution to this problem It is provided for using the simplex method and normative values of the monetary evaluation of the land.

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Matematical modeling territories administration distriks

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Are propose model of the land administration on the base of the cadastral zone to take into consideration ecological, natural, social end economic factors.
Maximum purpose-oriented function of effective land use provided to determine of the simplex method.