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Methods of Improving Effectiveness of Agrolandscape Utilization in Zaporizhia Oblast (Ukraine)

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Abstract – We examine the issues concerning the rational use of the potential of agrolandscapes in Zaporizhia oblast. Among the new promising techniques of improving effectiveness of their utilization, it is necessary to highlight an increase in the percentage of forest land on the territory concurrently with the introduction of soil-protection systems of crop farming. There is a need to pay more attention to melliferous plants in crop rotations and in the composition of field-protective afforestation in order to drive up earnings from apiculture as well as to promote rural (green) tourism in agrolandscapes which is becoming an increasingly popular kind of recreation. Furthermore, an enhancement in efficiency of agricultural nature management is aided by clearly defined and legislatively established responsibility of land users for non-purpose-oriented use of lands.

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FORMULATION OF THE PROBLEM

Zhaporizhia oblast has a significant naturalresource potential; however, many years of agricultural exploitation of lands led to a loss in their primary natural productivity, i.e. to soil dehumification, erosion development and deflation of soil cover, disturbances in the natural mechanisms of soil recovery and enrichment, soil salinization caused by incorrect irrigation, the emergence of negative changes in the structure and indicators of surface and groundwater flow, and to a degradation of the hydrographic network. The existing package of challenges strongly calls for a concerted approach towards their resolution. In world practice there are many methods to raise effectiveness of the exploitation of

agricultural lands, such as the use of different farming systems (contour and organic farming), and a combination of different, yet mutually reconciled, types of land use depending on a particular type of land. From the geographical perspective, the case in point is a better choice with regards to the use of a particular taxon: locality, stow or facies. Usually, agronomists prearrange land use schedules on the basis of plans of an agricultural enterprise or land use plans. Under contemporary circumstances, however, when, in addition to mere use, it is becoming important to conserve the natural potential and the environment in general, it is necessary to coordinate agricultural and environmental measures. To achieve this goal requires the interaction of scientific geographers and agrarians.

OBJECT AND METHODS

The objects for study are the agrolandscapes of Zaporizhia oblast. We explored the possibilities of rationalizing the utilization of natural resources of landscapes in conjunction with measures for enrichment of the resource potential, specifically its important component such as soil fertility. This paper uses data of field investigations made by these authors in the study territory, and analyses the findings of previous investigations, statistical reports as well as remotesensing research (aerospace images of the territory).

RESULTS AND DISCUSSION

In Zaporizhia oblast, the neglect of the soil antierosion and antideflation measures is responsible for the increasing areas of eroded arable lands. Starting in the 1960s, the total area of agricultural lands in Zaporizhia oblast was gradually decreasing from 2261.9 thou ha in 1961 to 2116 thou ha in 1993. From 1994 and on, the area of agricultural lands increased abruptly to 2246.1 thou ha, which was associated with the development of farm enterprises. The area of arable lands remained around 1925 thou ha until 1988, whereas during 1989–1993 it decreased by 80 thou ha and increases further to date. The period from 1961 to 1993 saw a decrease in the areas of perennial crops (from 87.7 to 32.6 thou ha) and fallow lands (from 7.8 thou ha to zero). Beginning in 1961, the area of pastures was decreasing gradually from 248.4 to 201.5 thou ha [1]. According to data from the

Zaporizhia Oblast Main Department t for Land Resources, as of January 1, 2006, the agricultural lands for Zaporizhia oblast in general accounted for 2248.25 thou ha, or 83.5% of the total area of lands [2].

Thus there is a clear tendency for a reduction in the area of arable land caused by erosion and deflation. In conditions of the steppe landscapes of Zaporizhia oblast, the main directions of optimization of agrolandscapes, including land improvement measures, could imply changes in the pattern of lands, and raising effectiveness of their utilization. Zaporizhia oblast launched the Program of the introduction of the measures for the preservation, protection, reproduction and rational use of the land resources for the year 2007, and implemented the Comprehensive Program of land improvement and bettering of the ecological state of irrigated and drained lands for the period into 2010. Furthermore, an optimization of agrolandscapes implies (in addition to avoidance of unfavorable natural processes, and the preservation and reproduction of existing landscapes) an intensification of exploitation of the natural components of landscape. For instance, if the areas of eroded and low-productivity lands are withdrawn and transferred to other types of lands, it is necessary to compensate the resulting losses (abandoned harvest, and the impossibility of future harvest) through a more effective utilization of the resources of remote lands.

For instance, the transfer of eroded arable lands to pastures involves subsequent losses of grain crop harvests, yet there arises a possibility for livestock grazing. However, the grazing standards ensuring a stable vegetation cover impose constraints on livestock hear, so that pasture livestock husbandry is less profitable than plant-growing. It is therefore necessary to seek additional possibilities of improving profitability of these lands. For this purpose, they can accommodate agricultural farms, also rendering ecological tourism services.

In addition, the eroded areas can be used for horticultural establishments. It is important to employ in this case the technologies of tending trees foreseeing the presence of a constant grass cover in a garden, and a limited application of mechanical treatment of the soil in order to avoid deflation and erosion. In such

gardens, it is advisable to sow low-growing grasses to be used as green manure preventing the soil from being eroded and deflated. Cultivation of melliferous crops, which can also serve as green manure, in the space between rows in the garden, along with an improvement of the forage reserves for bees, is an important agrotechnical measure aimed at improving soil fertility. For the period of flowering of melliferous plants to the ploughingin of the green mass of plants, bees gather in such a garden additional amounts of nectar and pollen. It is recommended that the melliferous green manure crops should be sown at the end of May or at the beginning of June, and ploughed in late autumn. Also, it is advisable to sow green manure winter plants that retard erosion and deflation in the wintertime and especially in early spring where dust storms most often occur. Green manure grasses at the time of flowering can produce nectar and pollen which attract honey bees and entomophages. The latter eat aphids and caterpillars, which is a biological method of pest control [3].

A next method to raise effectiveness of arable land use involves growing forage grass mixtures of a definite composition on full fallows. Of interest in this connection is experience of the agrarians from Krasnodar krai where they successfully cultivate lucerne-phacelia, lucerne-melitot, lucerne-sainfoin and rye-melitot mixtures. Good results were also shown by phacelia-cucurbita and phacelia-pea mixtures as well as by the mixture of spring vetch with oats and phacelia. The rye-rape mixture is sown to obtain extraearly (the last ten-day period of April) green forage for horned cattle. The best forage mixture is thought to include lucerne and phacelia, because at the time of flowering it provides good honey gathering for bees; after mowing, it is good forage for horned cattle. The Lucerne-melitot and sainfoin-lucerne mixtures are equally useful, but they are cultivated in the driest northern waterside steppe areas of Krasnodar krai [4]. Experience of cultivation of grass mixtures in this region whose agroclimatic conditions are highly similar to those of Zaporizhia oblast can be used within its boundaries with a further improvement of agrotechnologies. The introduction of new forage grasses and improved varieties of existing grasses in agricultural

production holds much promise. In Ukraine, specialists from the Mykola Grishko National Botanical Garden and National Agrarian University have now developed recommendations for cultivation of new species of herbaceous plants which can be used as valuable forage for livestock and, at the same time, as good melliferous plants (southern galega [5], Dracocephalum moldavica [6], borage, comfrey, and others). The economic effect in this case provides additional possibilities for the development of beef and dairy animal husbandry and apiculture.

By introducing the varieties of agricultural crops with high nectar yield, it is possible to increase honey yield without allocating additional cultivation areas, and with no material losses. The difference between varieties of individual crops is relatively high. In Kirovohrad oblast, for example, the sowing of the best variety of coriander («Kirovohradskyi»), compared to the «yantar» with medium nectar yield, can increase the reserves of honey yield by 538.5 t. An increase in homey productivity of the widespread crops by 10–20 kg/ha through the introduction of varieties with high nectar yield across the country in general will secure a significant increase in honey yield and, accordingly, the revenues from agriculture and apiculture which are based on the resources of agrolandscapes [7]. Sowing melliferous plants on waste land (slopes of ravines and gullies, hills, cliffs), where erosion control measures are required, turns these areas into a rich source of nectar and pollen for bees. The plants recommended for sowing are white and medicinal sweet clover, common bruise, annular sage, mixtures of sage, thyme ordinary, field gland and clover. Small seeds of these plants retain their germination for a long time. In addition, such crops have the ability to self-repair for several years. For the purpose of combating soil erosion, a method of cultivation was developed at the Pridesnyanskaya Experimental Station in the Chernigov Region by planting narrow-leaved chameneri on sandy low-fertile areas. Three to four years after sowing seeds or planting rhizomes, continuous thickets form, which fix the soil well and have rich reserves of nectar [8].

In the south of the Zaporizhzhya region, lithium (dereza) possesses similar properties, which, being drought-resistant, is most often used to fix steep slopes

within and around settlements. In order to increase the efficiency of the use of the territory, it is advisable to grow melliferous herbs in occupied vapors as siderates or for livestock feed. It is promising the cultivation of grass mixtures for silage, the introduction of new fodder plants, which are simultaneously melliferous. Mowing herbs for silage should occur at the end of flowering plants, but before their seeds ripen. Multicomponent herbal mixtures for sideration are scented after flowering plants. Thus, an analogue of the permanent grass cover is created, which is the basis for the enrichment of the soil with organic matter and the restoration of the humus content in the soil. Pure vapors in the conditions of the Zaporizhzhya region should be completely excluded from the crop rotation system, since it is on them that erosion and deflation intensively develop, leading to losses of the fertile soil layer. In addition, the presence of areas with open and unsecured vegetation can be considered unnatural: the vegetation cover has existed in the steppes from their very formation, and even the steppe fires disturbed it only for a short time [9]. According to our observations, the scorched part of the steppe is covered with shoots of grass after about a month, and under favorable conditions of moisture, the first sprouts appear in a week. The lack of vegetation is economically disadvantageous: on the one hand, humus is lost, and on the other hand, such lands do not bring profit. The presence of vegetation in any form in the fields contributes to the continuous process of accumulation of organic matter and humus, which prevents soil depletion and contributes to its conservation. Sowing on meadows and pastures of fodder, melliferous plants increases the yield and nectar productivity of the land. For this purpose, white, hybrid and meadow clover, hop-alfalfa and other crops are used. Their seeds are sown with superficial or radical improvement, which increases honey harvests in June – July before mowing grasses up to 2-3, sometimes up to 4–5 kg per day for one bee family. The total honey productivity of meadows is from 10–13 to 25–64 kg / ha [7].

Reclamation of lands after mining for honey plants and bushes not only allows you to create greenery, but also increases the resources of nectar. In the Zaporizhzhya region, such events are required near the dumps of the mines of the

Belozersky iron ore deposit, a quarry for the production of refractory clays near the town of Pologi, as well as near numerous stone quarries. When creating and updating shelterbelts and coastal forest belts, they can be made more profitable. Of course, the main task of the forest belts is to prevent the formation of dust storms and reduce the wind speed in the surface air layer. They also contribute to the conversion of surface runoff into groundwater, increasing the roughness of the earth's surface, the loss of additional rainfall due to better moisture and warming the air [10]. However, they usually do not bring material benefits: dried trees are cut down for firewood to the population. Deforestation has recently become a serious problem, as farmers and the rural population do not consider it appropriate to invest funds and efforts in their restoration. Obliging land users to monitor the state of shelterbelts is possible only through the introduction of strict legislative norms. For careless attitude to forest belts, their misuse, material liability should be provided in full amount of the damage caused. In addition, the economic efficiency of shelterbelts can be increased, for example, by using trees in beekeeping: many types of plants suitable for creating such stands are melliferous and, during flowering, can produce beekeeping products (honey, pollen), which are a source of additional income from agrolandscape. The use of trees that well secrete nectar in field-protecting, roadside, and greening plantations contributes to a significant improvement in the honey base of beekeeping. Such types of plants as field maple, Tatar, holly leaved, linden hearty, broadleaf, fluffy, white acacia, aylanthus, heledia, Sophora, Amur cork tree, catalpa, horse chestnut, narrow-leaved and silver, dogwood, honeysuckle, amorphous, willow, currant, snow berry, cotoneaster, dogrose, etc. For new forest belts, it is necessary to use tree species that stand during flowering they produce a lot of nectar and pollen and are well adapted to the natural and climatic conditions of the region, namely ash-leaved maple, white acacia, aylanthus, Japanese Sophora, three-throated gledia, etc. These species are characterized by drought tolerance, unpretentiousness to soils, and self-healing ability. According to our observations, their seeds in the steppe zone have high germination, seedlings and seedlings of these trees take root well. From

shrubs for protective and decorative plantings in the steppe zone, specialists of the National Botanical Garden named after N. N. Grishko is recommended for use with dogwood, Japanese genomeles, silver and narrow-leaved sucker, tamariks, dogrose, deytsiya, amorpha, bushy pink rose, vesicle, mock [8]. Plantations created from the listed species of trees and shrubs require minimal maintenance, which also increases the effectiveness of the implemented forest reclamation measures. For use in beekeeping, it is advisable to create forest belts with a mixed composition of trees or alternate single-species forest belts within the territories of agricultural enterprises and rural (settlement) councils. To create single-species stands, the most persistent and unpretentious are suitable acacia, aylanthus, gledichiya, maple. In the forest belts with a mixed species composition, any of these tree species grow well. In addition, the species diversity of forest-forming tree species contributes to an increase in the species diversity of the animal world, and, hence, biodiversity as a whole. Restoration of valuable honey plants in forests is a reserve for the development of beekeeping. An additional 3-5 trees of linden or white acacia in adulthood increase the honey productivity of 1 ha of forest by 10 kg [7].

The described measures are aimed at increasing the number of nectar reserves on various types of land, which is associated with the existence of not only honey bees, but also wild bees, bumblebees and other useful entomophilous insects, including those listed in the Red Book.Domestic and foreign experience indicates that rural incomes are higher where it is possible to engage not only in crop and livestock production, but also in the processing of agricultural products, handicrafts and other non-agricultural activities. One of these species is rural (green) tourism. Modern Ukrainian legislation allows personal farm owners to provide rural tourism services using personal farm property. It is beneficial for the state to develop this sphere: the employment of the rural population is increasing, and it becomes possible to earn additional income through the sale of personal farm products. The owners of estates that host vacationers improve the structure of crops and planting in their plots, taking into account the needs of guests, expand

the assortment of vegetables, fruits and berries, develop home-breeding livestock, create greenhouses, etc. [11]. In addition, urban residents expect that during the holidays they will receive comfortable housing, home-made food and the opportunity to engage in active types of recreation - fishing, picking mushrooms and berries, riding bicycles, boating, riding horses, etc. [12]. The effectiveness of this direction of use of agricultural landscapes by the following figures: in 2008 g . It was known about two officially operating rural tourism estates, in 2010 . the number of such estates was already 19. Now there are several dozen estates providing tourism services and having various specializations. This indicates the progressive development of the market for services of this type of tourism in the region. Thus, when organizing environmental management within agrolandscapes, it is necessary to introduce environmental protection and restoration measures. At the same time, it is necessary to master new areas of land use, the provision of services, which contributes to increased income from the use of natural and man-made landscapes. Losses from transfer of arable land to other types of land, especially to the nature conservation fund, only at first glance seem significant, but if this is not done, then in the future there will be a significant reduction in the area of productive land.

CONCLUSIONS

Based on the analysis of the leading directions of increasing the efficiency of using the resources of agricultural landscapes of the Zaporizhzhya region, a number of conclusions can be drawn. 1. When optimizing agrolandscapes, one should proceed from the positions of conservation, restoration and more efficient use of natural resources of landscapes. 2. It is advisable in agricultural production to switch to a non-arable technology for growing crops, since it helps to reduce fuel consumption for cultivating the land and at the same time makes it possible to develop a natural humification process in the fields due to over-ripening of crop residues in the field. 3. Pure vapors should be completely excluded from field crop rotation with replacement for occupied ones to prevent the development of deflation and soil erosion.4. In agricultural practice, it is necessary to introduce

new species of fodder and green manure plants, which are simultaneously melliferous. It is also necessary to create afforestation afforestation from melliferous trees, since an increase in the food supply for beekeeping makes it possible to obtain large incomes from the use of agricultural landscapes. 5. It is necessary to develop such a promising area of land use as rural tourism, with the expansion of the range of services and the improvement of their quality.

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