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EXPLOITATION OF AGRICULTURAL LAND - RESULT OF THE INTENSIFICATION OF LAND SUBJECT TO DEGRADATION IN THE NISPORENI DISTRICT

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Abstract

In recent decades, the intensification of multiple forms of soil degradation has been recorded, especially that through erosion due to inappropriate intensive exploitations. The purpose of the research is to examine the condition of the agricultural lands in the Nisporeni district and what is the weight of their exploitation, by proposing measures to remedy them. Nisporeni district is located in the central part of Moldova, in the wooded area. Nisporeni district is a component of the „Siret-Prut-Nistru" Euroregion. The geographical position favors access, communications and trade of the district at the border with the European Union. In the structure of agricultural holdings, the lowest share of multi-year plantations is in Frontier and in the North-West. Over 50% of the district`s land fund is concentrated in the Nisporeni and Nord-Est microzones, which also own over 46% of agricultural land and approx. 60% of the forest fund. The cost of washed soil is about 1.85 billion lei, and the cost of agricultural production losses - about 0.873 billion lei. Thus, the direct and indirect damage caused by erosion is 2.723 billion lei.

Key words*: agricultural lands, exploitation, degradation, Nisporeni district.*

INTRODUCTION

Land resources are considered not only as a territorial and natural basis, but also from the point of view of economic content, as an object of ownership and management: land is the basis of agricultural production, a type of real estate and a spatial basis for the construction of buildings, structures, infrastructure. Without the participation of land in the production process, it is impossible to obtain material benefits, which is a unique quality of nature. It is the spatial limitation of the land that is its specific feature as a production resource. The earth cannot be reproduced or artificially increased its resources. And finally, land resources are the main component of natural resources, and land use, respectively, is the main type of nature management. The purpose of land management is to provide the population with a high level of economic, social and environmental living conditions, taking into account the conservation and restoration of natural resources. Due to the fact that any human activity is inextricably linked with the earth, it can be concluded that the earth is a fundamental element for any human activity (Cerbari et al., 2010; Ursu, 2000; Антропов et al., 2018; Васильева, 2018; Шубич et al., 2019).

Any human activity is regulated by his rights. Land plots, in turn, are objects of civil rights. Land is a reliable investment object, a basic element of property relations and the main component of the real estate market. For this reason, land protection and rational land use are an essential condition for the development of the state and the growth of the welfare of its citizens (Сидоров, 1965; Татаринцев, 2011).

Rational land use is ensured as a result of the organization of land use management. In the economic literature, there are many definitions of management (management), which focus on its individual features, a special type of activity, the process of creating stimulating production conditions, impact, etc. (Комова, 2020).

Effective land management makes it possible to develop entrepreneurial and social activities, form an economically sound taxation system with subsequent collection of budget revenues, attract investments in the development of municipalities and regions, and create an effective system for ensuring rights and guarantees for subjects of land relations. Therefore, when analyzing land use, it is

necessary to take into account the socio-economic situation in the country, national characteristics, as well as historical traditions and the mentality of citizens (Антропов et al., 2018).

The depletion of land resources due to their scarcity leads to the identification of problems related to land ownership and taxation of land resources. Therefore, the main element of the system of state economic regulation of land use is the valuation of the land plot and land payments determined on the basis of its results, since the land management mechanism is based on payment, an important element of economic regulation of land use (Будина, 2013).

In the 19th century, the acceleration of urbanization led to an increase in the concentration of the population in cities, which became possible due to the development of industry, transport and communications, the intensification of agricultural production, the improvement of knowledge in the field of medicine, etc. The share of the urban population in the world for the period from 1800 to 1990 increased from 5.1 to 41.3% of the total population (Ursu, 2006; Дмитриев et al., 2018).

It should be noted that human life processes have negative environmental consequences, which, for the most part, affect the state of land resources (Меньших et al., 2016).

Anthropogenic activities are mainly associated with the land, which is irrefutable proof of the paramount importance of this natural resource. In particular, the ecological component of land use is also important; therefore, special attention has been paid to the ecology of cities in recent years. The development of urbanized territories is accompanied by the development of land plots, the change (technical re-equipment) of buildings, structures and other real estate objects. So, the trend that is relevant today, which appeared in the last century, involves the acquisition of land plots with obsolete enterprises or production stopped on them, and then the demolition of old buildings and the construction of new investment-attractive real estate objects. This process of real estate transformation is called redevelopment and is one of the methods of managing urban land use of industrial areas (Andrieș, 2011).

The founder of genetic pedology, V. Dokuceaev, about 120 years ago found that the soils of Moldova contained from 5 to 9% of humus. Humus reserves in the 0-30 cm layer constituted about 200 t/ha. During 50-70 years of extensive exploitation of agricultural lands, without soil fertilization, the humus content decreased by 1-3% and at the beginning of the 50s it was 4-5%. Towards the period of intensive chemistry (1965-1970) the amount of organic matter was reduced to 3.5-4.0%. In a period of 90 years, humus reserves decreased by 70 t/ha, nitrogen by about 3.5 t/ha. It is predicted that the amount of humus will decrease considerably by 2025 and will constitute only 2.5-3.0%, and the total nitrogen reserves - 4 t/ha. Currently, about 41% of the total area of agricultural land is characterized by a low content (less than 2%) of humus, 40% moderate (2-3%) and only 20% with a relatively high content (more than 3%). About 80% of soils have a very low and low nitrification capacity. The situation is identical with the 80% of soils, which contain less than 3.0% of humus. Of the nutrients, the first minimum is nitrogen and phosphorus. The surface of soils with low content of mobile phosphorus constitutes 31%, moderate 34% and only 35% high. In the last 10-12 years, the volume of mineral fertilizers incorporated into the soil has decreased by 15-20 times, organic fertilizers by 25-30 times. The balance of humus and nutrients is profoundly negative. Soil fertility gradually decreases, as a result the phenomenon of desertification, biological and chemical degradation intensifies (Andrieș, 2011; Bejan, 2010; Cerbari et al., 2010; Ursu, 2000).

Nature management is the practice of human use of the natural environment and natural resources, which is a system of relationships between man and nature. The most important element of nature management is land resources - this is the surface of the earth on which a person conducts economic activities: lives, builds, cultivates (Васильева, 2018; Шубич et al., 2019).

Anthropogenic activity causes damage to the soil layer, which leads to insufficient restoration of soil formation functions and a negative change in its structure. Over time, soil properties tend to deteriorate, change their

chemical composition, become polluted, degrade and, in some cases, become unusable. It is worth noting that the basis of land use management is the rational use of natural resources, the prevention of a decrease in its productivity and quality (Ursu, 2000).

Every year in the spring, work is carried out on the agricultural lands for the sowing of agricultural crops. Farmers prepare seeds and soil for sowing. These works are characteristic of any farming system and no one at this time is interested in what processes or products in the field in the period after the harvest and until the beginning of the spring works. It is obvious that knowledge about the rational use and conservation of soil moisture is necessary for all economic agents in agriculture. For these reasons, knowledge regarding the rational use of soil water needs to be provided by scientific research in this direction (Kuharuk et al., 2015).

MATERIALS AND METHODS

The research was carried out in the Nisporeni district, which includes 23 town halls, within which there are 39 localities (Figure 1). The seat of the district is the town of Nisporeni. The main materials used: normative legislative acts related to the research object; Regional Development Strategies for the period: 2020-2022; Statistical yearbooks on the quality of environmental factors. The annual reports of the Ecological Agencies and Inspections. Main methods used: administrative sources; statistical data, bibliographic sources, comparative analyses of assessment of climatic conditions, assessment of soil condition under the influence of anthropogenic factors.

The district comprises 2.4% of the total area of the Republic of Moldova (62.9 thousand ha), being adjacent to the North - with Ungheni and Călărași districts; to the South - with Hâncești district; to the East - with Strășeni district; in the West - with Ungheni district and Iasi county in Romania. Nisporeni district is a component of the "Siret-Prut-Nistru" Euroregion. The geographical position favors access, communications and trade of the district at the border with the European Union. The district is crossed by the transport route - international car: M 1 - Chișinău-Leușeni. The total area of the district is 62.9 thousand ha, of which: arable land - 21.6 thousand ha, perennial plantations - 8.6 thousand ha, the lands of the state forestry fund - 15.4 thousand ha; the lands of the state water fund - 1.6 thousand ha.

Nisporeni district is located in the central part of Moldova, in the wooded area. To the North it borders Călărași district, to the South with Hîncești district, to the West with Ungheni and Romania districts, to the East with Strășeni district.

Figure 1. Administrative-territorial representation of Nisporeni district

RESULTS AND DISCUSSIONS

The physical-geographical position of the Nisporeni district is advantageous, the relief, the mild temperate continental climate, the fertile chernozem soils favored the population and exploitation of this territory. The relief is hilly and fragmented by valleys, ravines, which occupies most of the arable land. Near the village of Bălănești is the highest hill in the country with an altitude of 429.50 m and which bears the same name as the village - Bălănești.

The climate is moderate-continental, characterized by an unstable character. The average air temperature is equal to 8-9°C, and at the surface of the soil between 10 and 11°C. The sum of positive temperatures is maintained for 9 months. The average temperature of January in the region is -4°C. The absolute minimum of temperatures is 33^0C, and the maximum is + 40°C. The cold periods of the year are short. The first frosts appear in October, the last in April. The duration of the frost-free temperature period is 174-179 days.

The largest annual amounts of precipitation are 500-550 mm, which fall on the western slopes

of the central Moldavian plateau. The annual amount of precipitation in Nisporeni is 479 mm. The largest amount of precipitation (55-85%) falls during the vegetation period (April - November). Solid precipitation is especially characteristic for the months of January - February. The first snow falls at the end of October, in December the snow cover becomes stable. In the central part of the country, including Nisporeni, the snow lasts 60 days. The Nisporeni district is one of the regions of the country with an increased risk of hail. The highest number of days with hail per year varies from 4 to 8. Nisporeni district has rich agroclimatic resources, which favors the development of all cereal and vegetable crops; vines and fruit trees.

The main branches of the economy of the Nisporeni district are (Figure 2): agriculture and the processing industry of agricultural production, services and trade.

The degree of diversification of the economy is extremely low, especially through small trade and service enterprises.

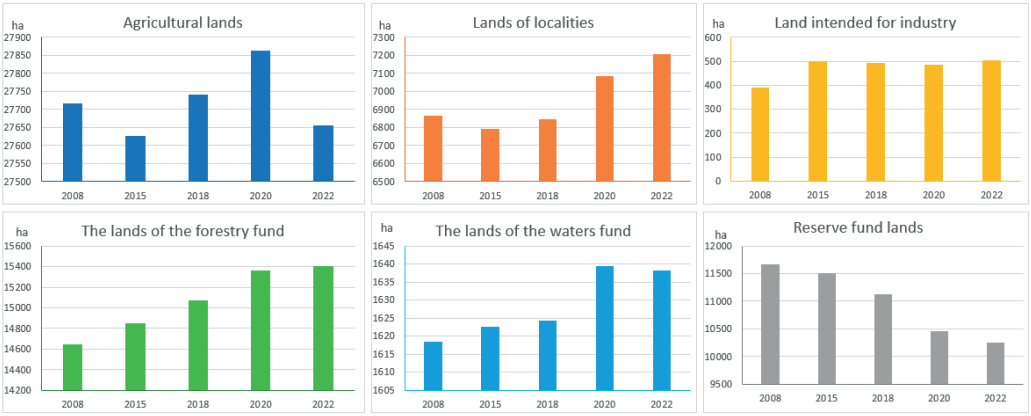

Figure 2. Representation of the land use gap from 2008-2022 on the territory of the Nisporeni district

The Nisporeni district is predominantly agricultural based on small individual agricultural owners and a limited number of enterprises that process local production up to the finished product. SMEs recently have a sustained growth trend (approx. 18%), and the number of peasant households has decreased by over 20% due to reorientation towards other types of activity or due to migration. The basic activity in the economy of the district is agriculture, but in most cases the entrepreneurs and peasant households practicing agriculture do not respect the ecological and agrotechnical rules, most of the agricultural households are located on steep slopes (up to 25 - 30 degrees and more) in most in some cases, the lands belonging to small households are cultivated along the slopes, thus spreading the layer of fertile soil. At the same time, lands located on slopes with an inclination greater than 10 degrees are not excluded from the circuit of intensive processing. There is a danger that for 5-6 years a considerable part of the lands will be completely degraded and removed from the agricultural circuit. In the total area of agricultural crops, plowing prevails - 46.7%, including 10.8% grass crops and 42.5% fallow. Of the perennial plantations, orchards and vineyards predominate. Some households have 30-40 ha of arable land and 10-20 ha of perennial plantations on degraded soils. Threshold systems are not created in the complex with the planting of forest protection sheets. The gullies are not leveled, the surfaces subject to landslides are aired and the ravines are not covered with vegetation. Scientifically based crop rotations are not respected, basically they have switched to simple crop rotation. On the privatized lands, corn is mainly grown in monoculture. The massive cultivation of cereals and technical plants is determined by market demand, and is quite difficult to influence.

The management of land resources includes a wide spectrum of public relations, social, economic, ecological and other types of

management. For this reason, the management of land resources represents a systematic, conscious and strictly directed action of the state and society regarding land relations. Land resources represent not only the territorial, spatial and natural basis for the ethnic location of a society, but also an object of ecological and economic management.

The main conclusions from Figure 3 regarding the land structure by microzones are the following: - over 50% of the district's land fund is concentrated in the Nisporeni and NordEst microzones, which also own over 46% of agricultural land and approx. 60% of the forestry fund; - in the structure of agricultural holdings, the lowest share of multi-year plantations (vineyards and orchards) is in the Frontier and in the North-West; - in the northern part of the district, most of the reserve lands are located; - the water basins are distributed almost evenly in three microzones – Nisporeni, Frontiera and North-West, in the other two microzones the share of water basins is lower; - the smallest forested area is at the Border and along the district segment of the Chisinau-Leuşeni highway.

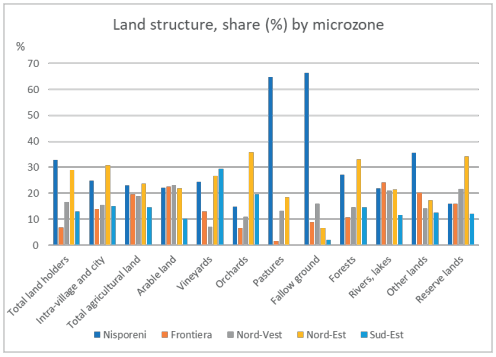

Figure 3. Representation of the land structure, share (%) by microzone of the Nisporeni district

The problems and discrepancies of the microzones represented in Figure 3: - the Nisporeni microzone (3 localities, including one city) occupies an extensive area, including the built-up area, it concentrates approx. 1/4 of the vineyards and orchards of the district, as well as over 27% of the forests, however it has a large number of fallow land and relatively small land reserves; - the Frontiera microzone (6 communes, 6 localities) is small, with a low degree of afforestation and a small share of perennial plantations; - the North-West microzone (4 communes, 11 villages) is small, has the highest share of arable land, but with the lowest degree of perennial plantations (vineyards, orchards) and forest areas; - the North-East microzone (6 municipalities, 10 villages) is the largest and occupies approx. 1/3 of the territory of the district, including the built-up area, has the most vineyards and orchards, the highest degree of forestation, but also the smallest area of water basins; - the South-East microzone (5 municipalities, 9 villages) is the smallest in the district, including built-up area, with few water basins and reserve lands, instead with the highest gad coverage with perennial plantations and the lowest share of fallow land.

Economic agents in agriculture (Figure 4) are largely peasant households, relatively homogeneously distributed on the territory of the district, but with a greater share in the North-East and the Frontier (approx. 50% of peasant households). Most of the agricultural cooperatives and associations of peasant households are in the Nisporeni microzone. This fact denotes the need to strengthen the capacities of small farmers in larger households towards the outskirts of the district

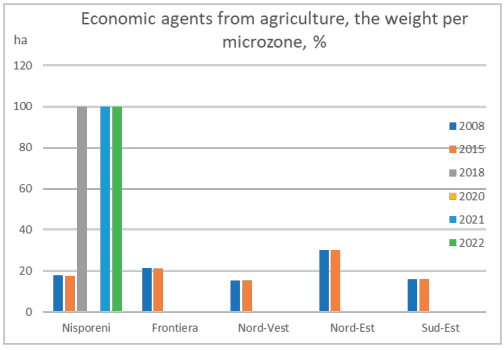

Figure 4. The division of economic agents from agriculture, the weight per microzone, % per year in the territory

Agriculture has an important role in the economy of the district. Agricultural lands occupy 48.0% of the total area of the district. The private sector owns most of the agricultural land and also provides most of the agricultural production. According to the

statistical data for the district, in 2012 the agricultural production (in current prices) amounted to 571.7 thousand lei, but this amount has increased drastically nowadays. Agricultural production per capita is 4.8 thousand lei. The average soil quality is 52 degrees. The anti-erosion protection system consists of 435 ha of protective forest strips.

The total area treated with chemical preparations is 11342 ha (approx. 4.1% of the total). In 2012, 210 tons of mineral fertilizers were introduced into the soil on 1620 ha (7.8% of the total), or 129.6 kg/ha.

The structure of agricultural land is relatively stable. The largest share is held by arable land - 71.8% of the total area of land intended for agriculture. Arable land makes up 19,578.2 ha (according to agricultural statistics), or 68.2% of the total area of land intended for agriculture.

Grapevines are grown on 4.6 thousand ha, orchards on 2.5 thousand ha. The level of planting vines is much higher than the level of planting orchards. The dynamics of agricultural holdings registers a slight increase due to the reserve fund of the municipalities.

The total area of eroded and damaged agricultural land is 22,934 ha, including by category - slightly eroded agricultural land - 10597 ha, medium eroded - 5312 ha, heavily eroded - 4562 ha, another category of land is landslides that occur from due to deforestation, earthquakes and heavy rains in the district are present on an area of 2025.27 ha, the formation of ravines constitutes an area of 437.39 ha.

Agricultural production is carried out at local, district markets and in Chisinau. A small volume of products is exported fresh abroad. Most of the peasant households satisfy only the family's own needs. There are no large enterprises for the collection and processing of agricultural production in the district, with the exception of wine-growing and plum drying enterprises. We need cooperatives, commercial companies, which would collect, process and deliver the agricultural production harvested by the land owners in the localities of the district.

The share of people employed in the industry is approx. 13.8%, but with some fluctuations depending on the situation on the regional markets. There are 64 enterprises processing local products in the district. At the same time, the Nisporeni district is characterized by a low level of development of the industrial sector. The district's industrial sector is represented by the manufacturing industry (91.8%, with sales revenues of 100,151.6 thousand lei) and light industry (8.2%, sales of 3.4 million lei) specialized in the manufacture of clothing. The share of people employed in the industrial sector in the district is 11.8%. The average number of employees in industrial enterprises is over 700 people, with an average monthly salary of 3183.3 thousand lei. The private sector in industry a

ensured 90.5% of the total production volume, manufactured in the district; the mixed one – 9.4%.

The main achievements in the field of soil protection were the following project carried out with the help of IFAD, namely the project called „Works to create the protective forest plantation within the Selişte town hall, Nisporeni district", which was also carried out with the help of IFAD, works of planting were carried out in an area of degraded land, according to the contract the planting works were carried out by the Forestry Enterprise „Nisporeni - Silva" with an area of 10 ha.

The main capital investment achievements provided for the protection of soils and the implementation of projects in this field, including the funded ones, are the massive planting within the „A tree for our survival" campaign during the given period, a number of 29315 shrubs were planted on an area of approximately 36, 5 ha with the aim of expanding forestry crops and reducing eroded land surfaces and with an increased degree of landslides. The given actions contribute to the regeneration of forests and the expansion of areas with forest vegetation as well as to the improvement of environmental conditions.

During 2022, in the Nisporeni district, the following violations were detected that caused damage to soil resources, namely the case of stubble burning in the village of Grozești, which through his actions the fined villager caused damage to land resources following the burning of vegetable waste in the open field of 2500 lei and paid in full.

The problem of soil erosion and degradation are increasing, while efforts aimed at restoring the fertility and productive functions of the soil

are not producing the expected effects, which causes an increasing impact on other sectors of the environment, as well as on human health and animals. Ecological and economic advantages regarding the implementation of environmentally friendly agricultural practices.
The creation and establishment of grassy canals along the natural path of the drains has the following advantages: - they can be created with the farm's own equipment and forces; - protects the drainage path against erosion and the formation of ravines; - acts as a filter, absorbing part of the chemicals and nutrients from the draining water; - provides shelter for birds and small animals; - allows to obtain green and fibrous fodder for feeding animals.
The priority would be the rotation of agricultural crops (rotation). This agricultural practice has a favorable influence on the environment, namely: - it reduces consumption for the procurement and application of pesticides by naturally interrupting the growth cycles of weeds, insects and the development of diseases; - the pasture/hay crops (perennial grasses and legumes) and thatched cereals, which accumulate sufficient plant residues in rotation, considerably reduce soil erosion; - crop rotations that include grasses (crested pyrites, barberry, golomat, orchard grass) and perennial legumes (alfalfa, clover) protect water quality by preventing the infiltration of nutrients and chemicals into water sources.
Irrigation of agricultural crops has become a necessity, given the conditions in which drought and lack of precipitation are increasingly common phenomena. The success of farmers in the Nisporeni district depends a lot on the availability, condition and functionality, as well as the development prospects of the irrigation infrastructure. The irrigation system in the village of Grozești, which covers an area of about 1000 hectares for agricultural producers in the villages of Grozești, Bărboieni and Soltănești in Nisporeni district, was renovated within the Compact Program of the US Government. For the reconstruction of this system, the Compact Program invested more than 8 million USD. It was put into operation in 2015, and in 2016 the activities started.
The high instability of agricultural production in the district is a consequence of poorly developed instruments for mitigating risks related to climate conditions, including insufficient access to irrigation, the low level of application of modern agricultural technologies (drought-resistant varieties, hail protection tools) and the lack of innovative insurance schemes in agriculture, such as the climate index insurance programme. Another reason for the slowdown in agricultural production is the economic crises, which lead to an increase in the prices of inputs (for example, fertilizers, fuel, cars), causing difficulties for agricultural producers.
Soil degradation is another factor that determines the low profitability of the agricultural sector, as well as the dominant position of low-value crops in agricultural production at the expense of high-value crops (fruit growing, vegetables, viticulture). A significant part of the agricultural production is represented by the 4 main products: cereals, grapes, legumes and fruits.
The structure of the sown lands for the year 2022, ha: cereal crops - 1061 ha; corn - 8560 ha; sunflower - 2590 ha; grapes - 4689 ha; fruits - 2690 ha; vegetables - 175 ha.
It is obvious that cereals (including wheat, barley, corn and sunflower) are the first on the respective list, due to the large share of arable land - about 40% of the total sown area. Reasons why producers focus on grain include large-scale mechanization, relatively low capital requirements, low labor intensity, reliable markets and profit opportunities, and the limited need for irrigation—all of which show that large agricultural enterprises are the dominant form of organization.
The emphasis on the cultivation of agricultural products with high added value (grapes, vegetables, fruits) is imperative for the Nisporeni district. recently walnuts are cultivated in the district. This product has access to EU markets as well as to other markets. The attractiveness of this sector is largely explained by the mild climate, resistance to pests, diseases and droughts, as well as limited resources for maintenance.
Priority measures and actions for the Nisporeni district: - optimizing the exploitation of land resources by improving the cadastral system, consolidating land, repairing access roads to land located at great distances from the locality,

modern land processing technologies; - attracting priority investments in the planting of vines and intensive orchards (at the Border and in the North-West) and for the highly technological processing of agricultural products in the economic growth centers of each micro-region; - the revitalization in the border area of vegetable growing, viticulture, fruit growing, the animal husbandry sector, where traditionally it was developed, and currently these branches are practically destroyed. In order to attract investments in agriculture in the Prut area, where the soils have high fertility, it is necessary to build the road Bărboeni-Bălăureşti with a length of 12.7 km and Bălăureşti-Nisporeni - 12.1 km; - combating soil erosion on disadvantaged lands (approx. 70% on slopes) with modern agro-pedological technologies (Nisporeni, North-West).

CONCLUSIONS

The main branches of the economy of the Nisporeni district are: agriculture and the processing industry of agricultural production, services and trade. The degree of diversification of the economy is extremely low, especially through small trade and service enterprises.

The Nisporeni district is predominantly agricultural based on small individual agricultural owners and a limited number of enterprises that process local production up to the finished product.

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