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Express assessment of environmental impact of agriculture technologies on the soils of Cherkasy Oblast

S.P. Sonko

Uman National University of Horticulture
1 Institutska St. Uman, Cherkasy Oblast, Ukraine, 20305
Email: Sp.sonko@gmail.com, Tel.: +380662239156, ORCID: 0000-0002-7080-9564
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Agriculture is the closest branch to natural ecosystems by the type of substance-energy relations. That is why the search for forms of its management (specialization) which would correspond to natural opportunities of a certain territory is the main task. Its solution will promote balanced environmental use in the agricultural sphere. Cherkasy Oblast belongs to the region in which a considerable part of agricultural production of Ukraine is produced. Therefore, an important problem is the definition of areas in which the impact of agriculture is an environmental hazard. Our research is aimed at it. The harmful effect on the soil of certain combinations of branches within each farm was determined. Based on information on the cultivation of crops by enterprises of Cherkasy Oblast, a method was developed for assessing the degree of environmental impact of both individual crops and their combinations. Zoning of territories by specialization (agricultural areas) and environmental impact is carried out. Application of this methodology has made it possible to establish that the current state of agricultural land use in the region does not meet requirements of rational nature management. Excessive load on soils in the process of agriculture led to the intensification of erosion processes which was facilitated by the unjustified increase in cultivated crops, in soil-exhausting sunflower and rape. For many decades, the extensive use of lands (especially arable lands) was not offset by equivalent measures for the reproduction of soil fertility and its rational use. According to the results, ways of reducing the harmful environmental impact of agricultural enterprises of Cherkasy Oblast are proposed.
Keywords: rural; economy; ecological; evaluation; impact; data; statistics; information; plant production

Introduction

In the process of interacting with nature, humanity has always solved its primary task - food production, which is perhaps the only source of human energy for metabolism. In the modern biosphere, anthropogenic canal created by humans and domestic animals receives $1.6^{*}\ 10^{16}$ W energy which is 25% of the total primary production of plants (ArskijJu, 1997). A significant increase (by 10 times) of primary products consumed by mankind is nowadays not only due to solar energy but also under the influence of additional energy sources (energy subsidies) used in agriculture in the form of mineral fertilizers, pesticides, toxic chemicals, fuel and lubricants, etc. (Gomiero, 2008). However, such "anthropogenic energy" introduced does not replace (and cannot replace) the energy balance of food chains but it is a kind of catalyst that stimulates more active assimilation in various sectors of agriculture. In fact, it is the introduction of additional energy subsidies in terms of classical ecology that a man violates environmental relations not only in agricultural ecosystems but also in the entire biosphere (Gorshkov V.G., 1995). The most striking violation of such a ratio is reflected in the production specialization of individual agricultural enterprises. In artificially created agricultural ecosystems the quantitative composition and the energy ratio at individual trophic levels are unbalanced today (Sonko, 2015b). Under the conditions of a market economy, the desire to get more profit induces manufacturers to sometimes absurd steps from the point of view of agricultural ecology, such as the development of a rice sowing or viticulture in the forest steppe (Sonko, 2015a,c).

Traditionally, an agricultural ecosystem (agro ecosystem) is understood as a natural complex changed (transformed) by the human activity (ShapiroJa.S., 2005). The natural ecological system is understood as an integral natural unit formed because of the interaction of components of groups of living beings and inorganic environment of their habitat. Agricultural ecosystems are different from natural ones by the nature of their regulation and management. Today, it is a man who acts as the "internal" and "external" regulator of material and energy flows in agricultural ecosystems. The main negative result of such "regulation" is the violation of the ecological balance (Sonko, Maksymenko, 2012).

A quantitative indicator showing the level of ecological balance of agriculture has traditionally been considered as the content of soil humus (*Orlov et al., 2004).* The average annual loss of humus in typical black chernozems of Ukraine ranges from 0.3 to 1.2 t/ha. Results of measurements of humus content at "Mytnytsia" agricultural station (Kyiv Oblast) showed that for 54 years

plowing the humus content from 9.12% has decreased to 5.6%. The losses were 3.46% or 0.64% over the decade (Shikula, 1987). Similar data are given in Moldavia and Odesa Oblast (Zaslavskij, 1987), in Cherkasy Oblast (Kryvda et al., 2009).

Therefore, the main goal of agricultural ecology is to find the formula of the best optimum ratio in the cultivation of plants and animals under certain environmental conditions. From the point of view of balanced nature use it is important to achieve the maximum possible harmony between the certain type of soil and the nature of its use. This is the relevance of our scientific work.

Agriculture of Ukraine is the most "nature-friendly" branch which according to the scale and nature of the environmental impact belongs to the most powerful "perturbers" of the biosphere (Gorshkov V.G., 1995). The main danger of this branch is the slow (and, therefore, invisible) impact on natural landscapes which is a direct evidence of the gradual loss of soil fertility (from 10-12% in the beginning of the XX century to 3.1-3.5% at the beginning of the XXI century and 1.5-2.5% today (Sonko S.P., Maksymenko N.V., 2012). To a large extent, the negative component of this process is formed under the influence of modern specialization of agricultural enterprises. Cherkasy Oblast being the oldest region of agricultural development can be the "indicator" in the study of these processes.

The purpose of the study is to analyze the specialization of agriculture in Ukraine in terms of its ecological danger and outline ways of ecologization of this branch on the example of farms of Cherkasy Oblast. The object of the study is the agriculture of Cherkasy Oblast.

The subject of the study is the environmental impact of the specialization areas of individual farms of Cherkasy Oblast on agricultural landscapes. At the same time, the greatest attention is paid to the most important component of agricultural landscapes – soils.

The main tasks of the study are:

- Definition of specialization (production type) of individual farms of Cherkasy Oblast;
- Development of geo information model of production types, agricultural districts and ecological influence of farms of Cherkasy Oblast on agricultural landscapes;
- Assessment of the harmful ecological impact of agriculture in Cherkasy Oblast at the level of individual farms;
- Assessment of the possibility of environmentalization of main branches of crop and livestock production in farms of Cherkasy Oblast, both at the expense of the latest ecologically tolerant technologies and due to the ecological diversification of existing specialization.

This study is carried out within the framework of the research program of Uman National University of Horticulture "Development of methodological approaches and practical mechanism of ecologically balanced use of natural resources in the field of agrarian production" (state registration number – 0108U009772). Over the past 10 years, the author has published more than 60 scientific papers on this topic (http://lib.udau.edu.ua/handle/123456789/5320/). The proposed article is a continuation of the cycle of these works.

Methods

Given that agriculture is the closest branch by the type of substance-energy relations to the natural ecosystems, the search for such forms of its management (specialization) which would correspond to natural capabilities of a certain territory is the main task which solution will promote the balanced environmental use in the agricultural sphere. This problem is best suited for an adaptive approach, or a system for obtaining agricultural products that ensures maximum return on biological products of each unit introduced into the agricultural ecosystem of anthropogenic energy. In the adaptive approach, varieties of cultivated plants and breeds of agricultural animals are selected which are most appropriate to the soil-climatic conditions of the area (Almeida et al., 2016).

Attempts to "incorporate" the agricultural activity into existing biological climatic conditions have a long history; these researches were lasted for many years started from the first works on agricultural zoning and typology of agriculture (Krjuchkov, 1978; Rakitnikov, 1976).

In methodological way the comparative and geographical approach to the study of agriculture is most effective to establish such compliance. It includes a comparative economic analysis of natural conditions, methods of agricultural zoning, classification of agricultural systems and forms of organization of the territory. Therefore, in addition to traditional methods related to the processing of statistical materials, the method of geoinformation modeling is used, implemented by the author in the previously developed method of elementary GIS (Sonko, 2000a). This method allows us to apply integrated estimates of the ecological state of agricultural ecosystems which is quite convenient when using a large amount of information (Shiliang et al., 2012). The methodological basis of the work also consists of the author's scientific approaches related to the study of the dynamics of agricultural ecosystems, as ecotopes of our species (Sonko, 2010). According to them, the "search" of such ecotopes is possible at the lowest levels of the landscape organization – terrains, natural boundaries and eco-elements. Theoretical approaches shown in the well-known work of the agrarian economist O.V. Chayanov (1989) in relation to the size (area) of the peasant household interpreted from the standpoint of ecosystem dynamics allow us to "define" the "human ecotope". In most cases it must coincide with boundaries of the primary landscape spatial units. This methodological approach is very relevant at the current stage of development of the Ukrainian state, since it concerns land ownership issues (Sonko, 2016a), administrative-territorial arrangement (Sonko, 2016b), demographic crisis of the Ukrainian village (Sonko, Golubkina, 2012).

We performed the ecological assessment of the impact of agriculture in Cherkasy Oblast on each farm presented in our study (374 units) to identify main environmental problems characteristic of the study area and determine the degree of influence of each individual territory of the enterprise. Selection of criteria used to assess environmental problems is important.

Based on the information about the cultivation of crops by enterprises of Cherkasy Oblast, their specialization, the results of previous studies (Sonko, 2000; 2015), expert evaluation of prominent specialist methods for assessing the degree of impact of crops and their combinations on soils for each enterprise are developed (Table 1). The role of crop in the crop rotation was also assessed. The impact of each crop (or branch) was estimated on the total score: the greater score the more harmful effect.

Table 1. Methods of evaluating specialization areas of individual agricultural enterprises by their impact on natural soil fertility*

№	Crop and presence of livestock	Role in crop rotation **	Crop contribution to the general impact***	NPK consumption			Erosion hazard		Points amount
				N	P	K	Soil removal with harvest (underground/ ground)	Promotion of linear erosion (row crop/ complete)	**142**
1	Sunflower	5	900/9.5%/3	3	5	4		5	25
2	Sugar beet	4	950/10%/3	3	4	5	5	5	29
3	Corn	2	7600/79.5%/5	5	3	4		4	23
4	Rape	1	100/1%/1	3	4	5		-	14
5	Wheat	-		4	3	3			10
6	Barley	-		4	4	3			11
7	Soy	-1		2	2	2		-	5
8	Peas	-2		1	2	2			3
9	Potato	3		3	4	5	4	5	24
10	Cattle	-2							-2
11	Swine breeding	-1							-1

* 5 points – high degree of negative influence; 0 points – no negative impact; ** - (minus) points – favorable effect of crop as a precursor (with the restoration of the share of natural fertility) or «+» points – the last crop in the crop rotation (the most debilitating); *** "defined" by the gross collection of crop.

The main criteria for evaluation were:
1. Crop and availability of livestock in the household;
2. Crop role in the crop rotation. Thus, the point marked with "-" characterizes the favorable influence of a crop as a precursor (with the restoration of the share of natural fertility); otherwise, when the point marked with "+" means that the last crop in the crop rotation is the most exhausting and has a negative impact on the next crop.
3. Crop contribution to the general influence. This point evaluates the contribution which is defined by the gross collection of culture according to the farm for all species of plants grown there.
4. NPK consumption determines each crop requirement in nitrogen, phosphorus and potassium.
5. Erosion hazard. Soil removal with harvest (underground/ground) means that the possibility of soil erosion because of its removal together with the root (underground) system of crop (tubers, root crops) is considered. Such crops as sugar beet and potatoes are highly appreciated, since they require eradication during harvesting which negatively affects not only the removed soil, but also on the natural structure of the remaining soil.
6. Promotion of linear erosion (row crop/ complete) is the possibility of removal by wind or ablation of the upper layer of soil that is not covered by cultivated vegetation. Therefore, cultivated crops (sunflower, sugar beet, corn, potatoes and vegetables) get 4 and 5 grades.
Determination of the number of points was carried out using the expert estimation method. That is, the experts involved in plant growing, agriculture, livestock farming and agrarian economics have assigned one or another point to a certain criterion during the discussion.
From these 6 criteria, we counted the number of points for each farm in Cherkasy Oblast (Table 2).
As a result, the elementary GIS (EGIS) "Production types and agricultural areas of Cherkasy Oblast" was developed (http://lib.udau.edu.ua/handle/123456789/374/).
During implementation of these methodical procedures, some features were identified that led to certain complications at the primary data processing stage. On the territory of Cherkasy Oblast, the establishment of a specific land use configuration of farms was impossible due to the lack of large-scale mapping information. Cartographic data of the land cadastre required additional labor-intensive adaptation to our tasks and therefore were deliberately not used. This will probably be the subject of further research. Instead, we used the tool of modern GIS – "Thiessen-Voronoi Polygons", the application of which almost does not lead to information misunderstanding, since boundaries of farms "imposed" on other layers (landscapes, soils), it is possible to get real information about the configuration and thus save properties of the cartographic model as an analytical tool.

Table 2. Assessment of the environmental impact of agricultural enterprises in Cherkasy Oblast (fragment)

№	Name	Address	Area, ha×10^3	Specialization	Total points
		Gorodysche district			
1	PE Agrofirm Tsar	Cherkasy Oblast, Gorodysche town, 106 Petrovskogo Street	0.20	Sunflower, soy and rape technical crops	52
2	FE PE Agrofirm - Schultz	Cherkasy Oblast, Gorodysche town, 12 Dalekoskhidna Street	1.7	Cereals (wheat, corn and barley), legumes (peas, and soybeans), cattle breeding (dairy line, 800 cows),	73
3	Bereg LTD	Cherkasy Oblast, Gorodysche district, Ksaverove village, 13 Tsentralna Street	1.3	Cultivation of cereals (heat and corn) and technical crops (sunflower and rape)	67
4	Valiava SED LTD	Cherkasy Oblast, Gorodysche district, Valiava village, 5 Zhovtneva Street	0.3	Mixed crop and livestock breeding Cultivation of technical oilseeds (sunflower); pig production (3300 pigs)	28
5	Vilshanka ALTD	Cherkasy Oblast, Gorodysche district, Vilshana urban village, 37 Shevchenka Street	3.2	Mixed crop and livestock breeding Growing of cereals (corn) and technical crops (sugar beet) Cattle breeding (dairy and meat line, 400 cows); pig production (600 pigs)	49
6	Vilshanske Repair-Transport Enterprise JSC	Cherkasy Oblast, Gorodysche district, Orlivets village, 258 Shevchenka Street	0.3	Mixed crop and livestock breeding Cultivation of technical crops (sunflower); apiculture	29
	Viazovske AFE	Cherkasy Oblast, Gorodysche district, Viazivok village, 1-A Myru Street	1.2	Growing of cereals (wheat and corn) and technical oilseeds (soybeans, rape and sunflower)	85
8	SE Experimental farm of Institute of Pomology named after L.P. Simirenko NAAS of Ukraine	Cherkasy Oblast, Gorodysche district, Mliiv village, 9 Symyrenka Street	0.4	Cultivation of cereals (corn) and technical crops (sunflower)	60
9	Zhuravske LTD	Cherkasy Oblast, Gorodysche district, Zhuravka village, 22 Lenina	1.3	Growing of cereals (heat and corn) and technical crops (winter rape, and sunflower)	70
10	Institute of Pomology named after L.P. Simirenko NAAS of Ukraine	Cherkasy Oblast, Gorodysche district, Mliiv village, 9 Symyrenka Street	0.3	Growing fruit gardens	116
11	Poultry Farm – Orlovska LTD	Cherkasy Oblast, Gorodysche town, Dalekoskhidna Street	2.3	Growing of cereals (wheat and corn) and technical crops (sunflower, soybeans and rape); poultry breeding	82
12	Symyrenkivske ALTD	Cherkasy Oblast, Gorodysche district, Mliiv village, Kolgospna Street	1.3	Mixed crop and livestock breeding Cereals (wheat, corn and barley) and technical crops (sunflower, soybeans and rape); cattle breeding (dairy line 500 cows); pig production (100 pigs)	96
13	AFE Zhugan Ivan Mykolayovych	Cherkasy Oblast, Gorodysche district, Petropavlivka village	1.2	Mixed crop and livestock breeding. Cereals (wheat and corn) leguminous (peas) and technical crops (sunflower and soybean). cattle breeding (dairy line, 100 cows); pig production (300 pigs)	77
14	AFE Tsaryna	Cherkasy Oblast, Gorodysche district, Tovsta village	1.6	Growing of cereals (wheat and corn) and technical crops (sunflower, soybeans and winter rape)	82
15	Cherkasy-Dnipro LTD	Cherkasy Oblast, Gorodysche district, Kalynivka village, 2 Lenina Street	2.2	Growing of cereals (wheat and corn) and technical oilseeds (sunflower).	57

The territory zoning during the construction of the cartographic model with the use of Thiessen-Voronoi Polygons is to create polygons constructed around a network of point objects in such a way that for any position within the range of polygons the distance to the central point object is less than to any another object of the network under consideration. The peculiarity of the application of this method can be considered on the example of Uman district (Fig.1).

The main production types of agricultural enterprises of Cherkassy Oblast (377 units) are two main directions: plant production and plant and livestock production which in turn are divided into 9 subtypes (Fig.2). Each of highlighted and studied production types in previous publications has a different effect on the state of the environment. According to expert estimates, the greatest influence is made on crop production farms especially with a significant proportion of technical crops (Sonko, 2017).

Results and discussion

In agriculture, there are already some examples of the development of systems of "biological agriculture", which provide environmental sustainability and where one of "green" areas are the preservation of biota and regulation of its livelihoods (Gudz et al., 2014).

One of the main criteria in assessing "stability", "tolerance", and "balance" of the agrosphere is the productivity of natural ecosystems (Sonko, Golubkina, 2015). This is exactly the optimum that nature has made in the process of its evolution.

From other areas of ecologization of agriculture it is worth considering environmental optimization of the landscape and preservation and development of traditional methods of management. In the unification of the landscape, biological diversity is drastically reduced, as for the existence of most species of animals and plants and certain varieties (heterogeneity) of natural conditions are required. Unplowed forested areas among fields, uneven cavities with water, unmowed plots with boulders, live barriers, laylands overgrown with shrubs and grass roadside – all these "islands" of intact nature are not only islands of salvation for many species of animals but also a springboard for an offensive species that causes damage to the crop. Here, nests of birds and Hymenoptera insects that are important pollinators of flowering plants can be stored (Conway, 1993).

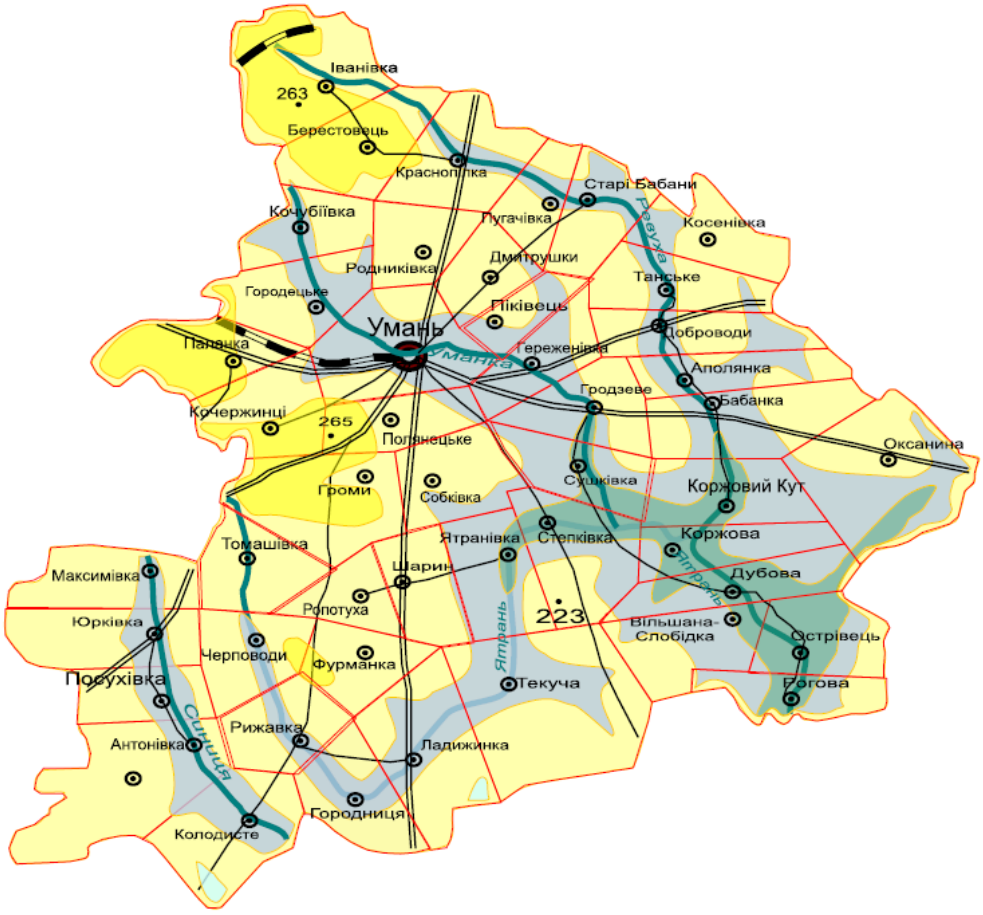

Fig. 1. Zoning of the territory with the help of Tissen-Voronny landfills on the example of the Uman district

Another possible area of ecologization of agriculture is preservation and development of historically composed for these types of traditional ecosystems – "primitive" but the most environmentally "soft" ways of managing. This ensures the most complete preservation of local varieties and breeds, as well as more fully used "inconvenient" landscapes for the modern economy (Pfeiffer et al., 2006).

So, we can say that agriculture today can be ecologically combined with natural landscapes and its neighborhood with wildlife will only be in favor of agriculture if it is properly organized. In the future, in society, without a doubt, many of our usual forms of management will become a place for polycultures, phytodromes or other forms of obtaining food and industrial raw materials. In some places, the "primitive" economy without pesticides and mechanization will continue. The most important thing is that the notion of inevitability of absorbing last unoccupied spaces which preserve the gene pool of wildlife can be justified in no way (Bengtsson et al., 2012). The problem of "including" specialization of economy in the corresponding natural landscape can play a decisive role in greening agricultural production.

Specialization (production orientation) of agricultural enterprises in the region is determined by the main (leading) industry which has the largest (from 25 percent and higher) share of commodity products and for which there are the most favorable natural and economic conditions.

During the study, it was found that by the end of 2014, there were 377 agricultural enterprises operating in Cherkasy Oblast which specialize mainly in plant production branches (Fig. 2).

In most of them there are two or three leading branches and each of them is not dominant and in the structure of commodity products ranges from 10-15 to 30-35% (Ibatullin et al., 2014). Therefore, the production direction is determined for such enterprises. It is expedient to include two or three branches relatively prevailing in the industry in its name. If, for example, in Lany Drabivschyny LTD of Drabiv district the largest share in the structure of commodity products is occupied by grain crops (about 35%), the second place is technical crops (30%) and the third is livestock production with the direction of sheep breeding (25%), so the production direction of the enterprise can be formulated as a grain economy, cultivation of technical crops and livestock production, directly, sheep breeding.

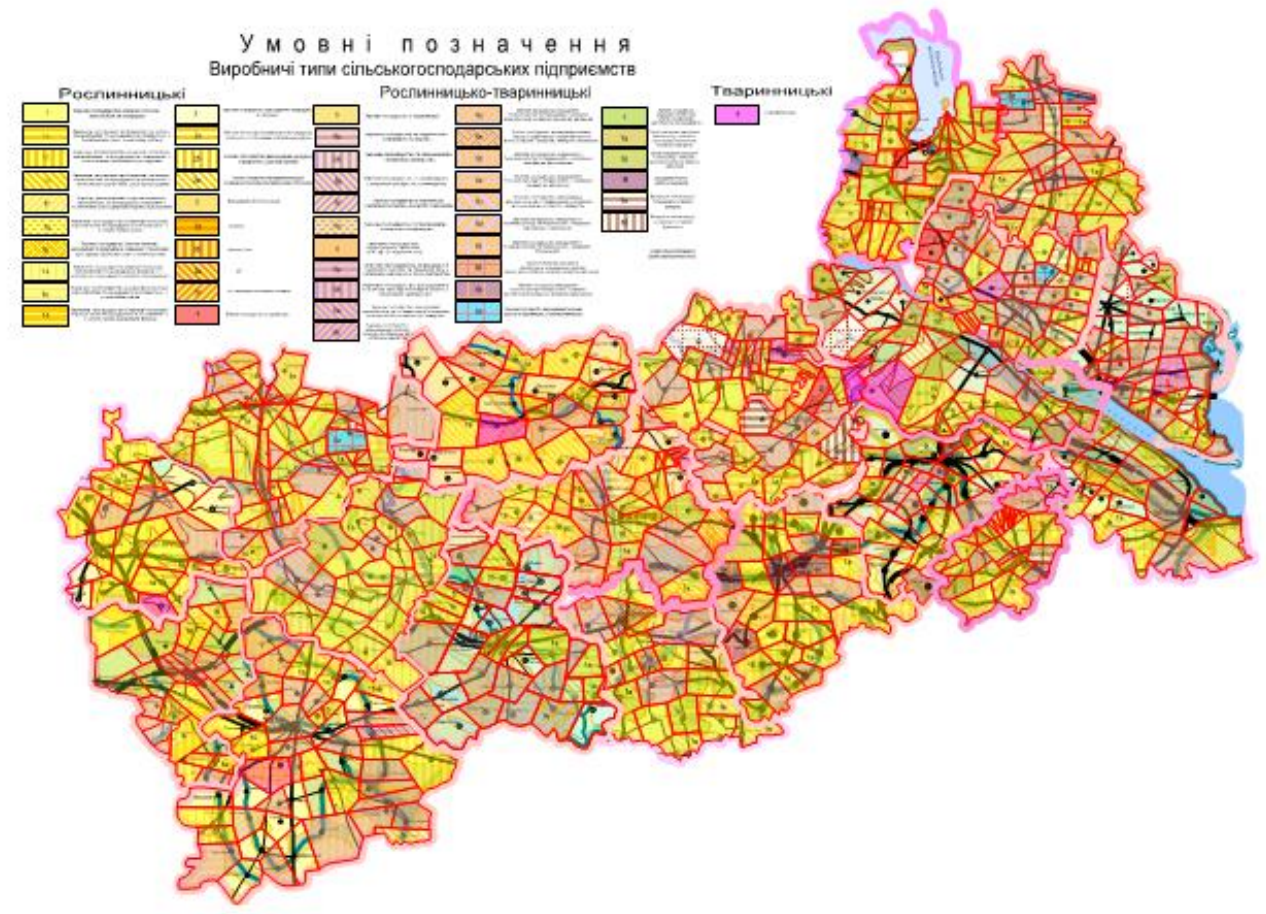

Fig. 2. Production types of agricultural enterprises of Cherkasy Oblast (2012-2014)

The pre-established EGIS (http://lib.udau.edu.ua/handle/123456789/374) proved to be an effective tool for identifying production types of agricultural enterprises with further agricultural zoning of the territory of Cherkasy Oblast (Sonko, 2015a). In particular, there are 5 agricultural districts:

I. Prydniprovsky-Cherkasy district (in the territories of Cherkasy, Zolotonosha, Chornobay, Drabiv, eastern part of Gorodysche, northern part of Smila and eastern part of Chyhyryn administrative districts) with high-intensity agriculture of the valley-suburban (azonal) type with the specialization in crop production on: grain farming, fodder production, vegetable growing of open soil and gardening; in livestock production on: dairy and meat cattle breeding, pig breeding and poultry farming.

II. Central-Forest-Steppe district (in the territories of Kaniv, Korsun-Shevchenkivsky, Zvenygorodka, Lysianka, the northern part of Gorodysche and the northern part of Shpola administrative districts) with intensive agriculture of the zonal type with a predominant specialization in crop production (cereal farming combined with cultivation of various technical crops, mainly oilseeds) and with less developed livestock production (pig and meat and dairy cattle breeding).

III. South-Forest-Steppe district (in the territories of the southern and western parts of Chygyryn, Kamianka, southern part of Smila, central and southern parts of Shpola and Katerynopil administrative districts) with medium intensive agriculture of the zonal type with a predominant specialization in crop production (developed grain farming with technical crops) and livestock production of the mixed (self-supporting) type (cattle breeding, pig breeding, sheep breeding, beekeeping and poultry farming).

IV. Northwest Forest-Steppe district (in the territories of the Zhashkiv, Monastyrysche and Mankivka administrative districts) with medium intensive agriculture of the zonal type with a predominant specialization in crop production (grain farming and growing of various technical crops) and livestock production of the semi-extensive type (dairy and meat cattle breeding with trans-humance livestock keeping and pig-breeding as an additional branch).

V. Southwest Forest-Steppe district (in the territories of Talne, Uman and Khrystynivka administrative districts) with highly intensive zonal agriculture of the plant-livestock type with a specialization in crop production on: grain farming and growing of technical (mainly oilseeds) crops; in livestock farming including intensive cattle breeding of dairy and meat and meat and dairy sectors and pig breeding.

Establishing correspondence of the agricultural specialization to types of natural environment requires special detailed research (mainly expeditionary) using data from specific farms. However, establishment of general patterns of distribution of certain types of agriculture is possible due to the analysis of our developed EGIS of agricultural areas (http://lib.udau.edu.ua/handle/123456789/374/).

So, there are zonal production types of farms based on grain farming and meat and dairy cattle breeding for the central part of the forest-steppe zone of Cherkasy Oblast. When moving to the southern forest-steppe, this type is supplemented by developed pig production and production of technical crops. However, this type is subjected to local influences which are expressed in the effect of economic factors such as large settlements (district centers), as well as enterprises for the processing of agricultural products (Shpola, Vatutine, Kamianka, and Katerynopil).

In forest-steppe landscapes of the western part of Cherkasy Oblast, the type with grain farming and meat and dairy cattle breeding is transformed into the type in which dairy and meat cattle breeding is predominant (probably due to an increase in the structure of rations of fodders from pastures of the Girsky Tikych, Ruda, Syniukha and Yatran rivers). However, the fuzzy differentiation of natural factors when moving from the forest-steppe to the steppe zone (Southern Forest-steppe district) causes the same unclear change in specialization. Thus, in the southern farms of the region, grain farming with meat and dairy cattle breeding is complemented by pig farming, sheep breeding, beekeeping and poultry farming as additional (self-supporting) branches. It is important to note that in this district (III) the specialization is formed that is more characteristic for the steppe zone. It has a logical explanation in some works, in which "removal" of boundaries of the steppe and forest-steppe zone to the north is due to global warming of the climate (Holopcev, 2009).

Using data on the point assessment of environmental impact (Table1), we have developed a system of symbols in which the degree of environmental impact is determined (in points). This made it possible to develop an appropriate geoinformation model (Fig. 3).

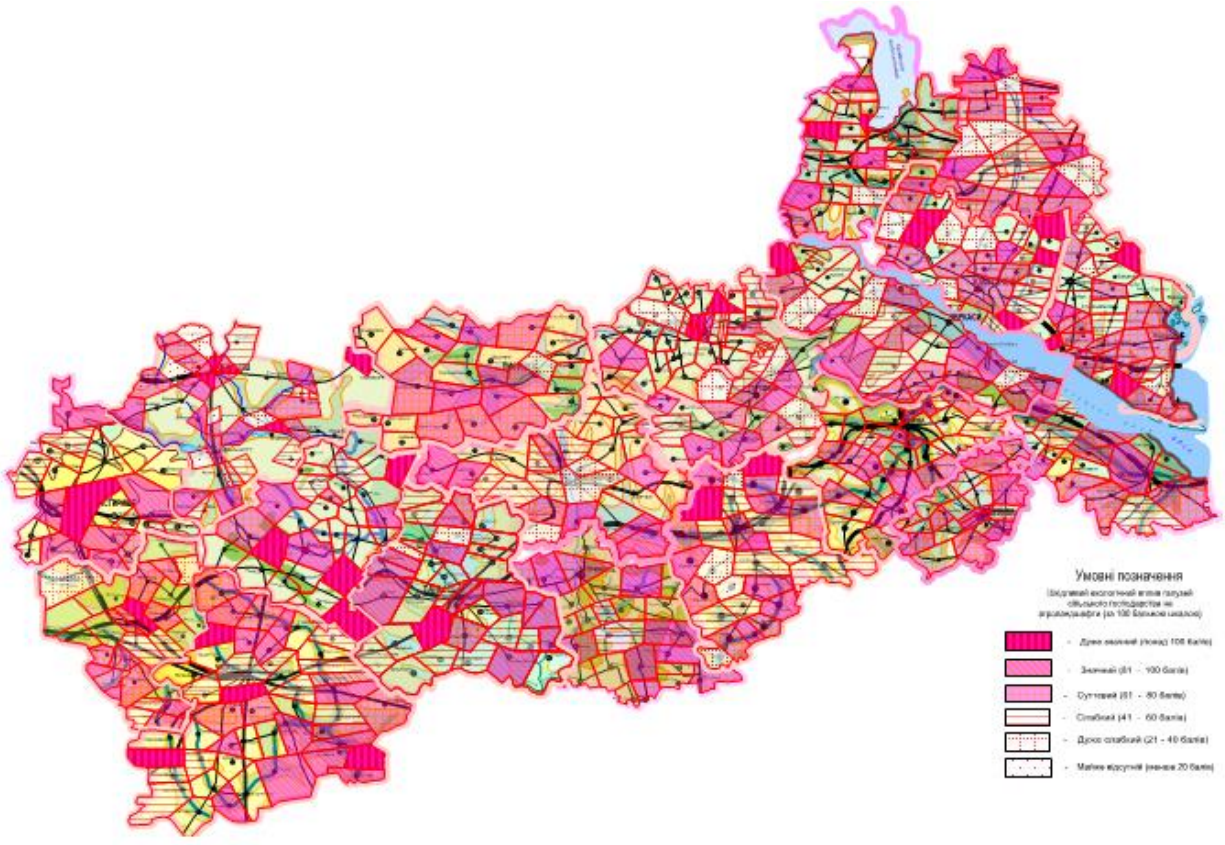

Fig. 3. Assessment of environmental impact of agriculture technologies on the soils of Cherkasy Oblact (2014-2016).

By the level of influence of agriculture on natural landscapes, the territory of Cherkasy Oblast can be divided into:
I. Prydniprovsky district (Cherkasy, Chygyryn, Kaniv, Zolotonosha, Drabiv, and Chornobay administrative districts) has a relatively high environmental impact with the predominance of crop and livestock farms and a high proportion of industrial crops (sunflower, sugar beet, and rape).
II. Central district (Korsun-Shevchenkivsky, Smila, Gorodysche, Kamianka, Shpola, Katerynopil, Zvenygorodka, and Lysianka administrative districts) has a relatively low ecological impact on the environment with the predominance of grain farms in combination with cattle breeding and pig breeding.
III. Western district (Uman, Zhashkiv, Monastyrysche, Khrystynivka, Mankivka, and Talne administrative districts) has the average environmental impact on the environment with the predominance of farms of grain specialization and cultivation of technical crops (soybeans, rape, sunflower and sugar beet) and multi branch livestock production.

Conclusions

The research on the specialization of agricultural enterprises in Cherkasy Oblast revealed that there are 374 agricultural enterprises in the region which specialize mainly in the branches of plant production. In most of them there are two or three leading branches and each of them is not dominant and in the structure of commodity products ranges from 10-15 to 30-35%. Therefore, it is expedient to include two or three relatively prevailing branches in the name of such farm enterprises for determining their production direction.
As a result of the ratio of production types of farms, 5 agricultural areas are defined that are the most characteristic for the territory. We developed the method of estimation of the degree of agricultural crop influence on soils for each enterprise based on the information of growing crops towards enterprises of Cherkasy Oblast, their specialization, expert conclusions, and literary sources.
After analyzing the data obtained within the framework of the developed EGIS, it can be concluded that agricultural landscapes of Monastyrysche, Uman, Talne, Zhashkiv, Mankivka, Gorodysche, Zolotonosha, and Katerynopil districts undergo the highest degree of harmful environmental impact (more than 80 points). According to the estimation on the influence of activity of most of enterprises in the given territory, a relatively less influence (up to 60 points) is observed in Zvenygorodka, Drabiv, and Shpola districts.
According to the evaluation results, it is concluded that the current state of land use in Cherkasy Oblast does not meet the requirements of rational nature management. The ecologically acceptable ratio of arable land areas and natural forage lands which negatively affects the stability of the agricultural landscape has been violated. The agricultural reclamation of lands exceeds the ecologically acceptable one. As a result of the election of a non-optimal ecological point of view of specialization by the overwhelming majority of farms, the negative tendency towards a decrease in the amount of humus in the soil will only deepen over time. Reducing the harmful environmental impact of certain combinations of specialization branches is possible both by introducing the latest soil-saving technologies and measures of the organizational and legal nature, in particular:
- Increase in the share of livestock production in the structure of commodity products;
- Reduction of average values of the total area of a separate economy;
- Increase the number of private farms.

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