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An inventory database, evaluation and monitoring of especially valuable lands at the regional level in Ukraine

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Abstract

On the one hand, the relevance in studying the Especially Valuable Lands (EVL) at the Regional Level is determined by their key role in ensuring food security. On the other hand - the irrational use of EVL and the lack of EVL's information in the cadastral-registration system in the cartographic materials. Also there is the lack of information in on-line mode on their spatial distribution, assessment and of course the current state. In the result of lack formed GIS data of EVL at the Regional Level it is almost impossible to conduct quantitative and qualitative recording, analysis of the condition of their using, assessment, management and protection of it.

The main idea of this paper is to develop methodological and practical approaches to inventory, evaluation and monitoring of EVL at the Regional Level. Also approbation the results of the study on the example of the land resources of Vasylykiv District of the Kyiv Region are important.

The main research methods were the following: statistical, cartographic, mathematical and cartographic methods of modeling.

The result of the study is to develop methodological approaches in inventory of the EVL, their evaluation and monitoring at the Regional Level, based on extensive use of Remote Sensing and GIS technologies. In conclusion, the authors emphasize that the results will allow a deeper study of land-resource potential of the region and potential of its economic, environmental and other use. It will increase the investment attractiveness of the region; establish measures and guidelines for land management. As a result it will simulate the effects of human activities.

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1. Introduction

Ukraine is one of the largest countries in Europe, its area is 60,4 million hectares. Approximately 69,9% territory of Ukraine is agricultural land. More than 53,6% (32,4 million hectares) of the Ukrainian territory is used for arable farming. Much of the arable lands are represented by black soils with enriched humus: called “chernozem” (www.president.gov.ua).

In all lands singled out, the most valuable are especially valuable lands (EVL). They are the most valuable part of the national wealth of Ukraine. EVL play a key role in ensuring stable social-economic development in growing global threats to human development. They concentrate in itself as the most productive lands available for natural and acquired properties and can generate high yields of crops, environmental, health and recreational area; lands that are the subject of research at the prospect of long-term, lands of historical and cultural significance etc.. (Anonymous 2001). EVL characterized by high levels of socio-economic and environmental values need their rational use and protection. At the same time, currently in approaches to the formation, registration and protection of EVL. Also as there is a lack of information about their current status, geographic distribution and the cost it does not always provide them with effective protection, conservation and management. (http://static.rada.gov.ua/zakon/skl6/11session/par_sl/sl2303111.htm, <http://zakon4.rada.gov.ua/laws/show/2897-iv>).

Currently, there is ripened necessity to conduct an inventory EVL and also forming the information and analytical base of EVL (different territorial levels - local (point), local, regional, national, global) and its integration into the cadastre system. This database will serve as an effective tool for accelerating the development of priority sectors of production and non-production areas and agricultural production. In addition, this tool allows a fundamentally new level of monitoring of land-resource potential of the region and ensures its sustainable use and protection for future, forecasting changes in the technology and rationale for management.

Examples of studies of land-resource capacity of a whole Ukraine and its regions, administrative and natural geographic regions may serve (B.Danylyshyn, S. Doroguntsov, V. Rudenko, M. Hvesyk). Concentrated their attention on the study of the problems of land use and land protection (D. Babindra, D. Dobryak, O. Canash, A. Martyn, L. Nowakowski, A. Tretiak, M. Fedorov). However, remain scarcely explored issues related to the study of EVL, especially at the regional level.

It should be noted that the relevance of the study EVL at regional level increases a total lack of cadastre and registration system of accurate and objective information about the presence of EVL. It is practically impossible to exercise quantity and quality of accounting of their spatial distribution. The analysis of the use of EVL, monitoring, rational use and protection of EVL predict changes in their condition and support technologies for their future use.

2. Material and Method

Information base for the study serves different time mapping and statistical information on the Vasylkiv District of the Kyiv Region in many terms. In such terms of administrative units, works of all kinds of scholars to the specified research topic, legislative and legal acts of the Verkhovna Rada of Ukraine, the Cabinet of Ministers of Ukraine, orders the State Land agency of Ukraine.

Rational use and conservation of EVL should be based on scientific research related to their subsequent learning, development database on EVL (at the global, national, regional, local, local-point levels). It should also contain the creation of geo-mapping models that reflect their distribution and properties determination of their environmental and economic assessment of others. The most important feature is their high EVL material and immaterial value compared with other states. The material due to their high economic assessment, as intangible value, is associated with such characteristics as uniqueness, socio-economic and environmental significance, powerful spiritual potential, scientific and natural value etc. In general, these signs EVL outline the strategic potential for the development of the state and of the society.

It is necessary to be noted that the basis for further knowledge EVL at national and global levels presents their study at the regional level - forming inventory database of EVL. It will be the basis for further planning their management, effective public policy for rational use of EVL and improving the ecological status of land resources in the region.

EVL divided on especially valuable soils national level, especially valuable regional soils (<http://zakon1.rada.gov.ua/laws/show/z0979-03>). This model allows us to include in the first group are EVL, which are determined by the highest fertility within all countries, despite their geographic location. That is their productive potential and it is highly compared to other soils. The second group includes soils that are the quality indicators. They are the most fertile in a particular region (appropriate single out in the context of natural agricultural provinces), but in other areas can be yield substantially by different productivity in fertile soils (O. Kanash, A. Martyn, 2003). In the development of these approaches at agricultural natural areas may produce locally most valuable soils (O. Kanash, 2009).

Inventory of EVL, creation of information base at EVL regional level should be approached with extreme caution and carefull: on the one hand - the logical basis for separation of EVL is natural with agricultural zoning and agricultural industrial grouping soils (O. Kanash, 2001), on the other hand we must remember that in Ukraine land resource administration is carried out by the executive authorities of the relevant political subdivisions and local authorities within their powers.

Therefore, to further study and protection of EVL, ensuring effective management must search for ways and mechanisms for combining the principles of land management (based on administrative-territorial division) and the principles of separation of EVL (based on natural and agricultural zoning).

We think and know that the algorithm of study the spatial distribution of EVL and create inventory database EVL regional level (administrative district) must include the following:

- setting objective and forming tasks aimed to create inventory database EVL;
- the choice of research objects (pay special attention to the definition of the list of village councils, located in one or another natural agricultural areas and the presence in their territory EVL);
- the choice of research methods and their integration in research techniques;
- determination the list of the most valuable agricultural industrial groups of soils (including (<http://zakon1.rada.gov.ua/laws/show/z0979-03>) within the relevant taxons natural and agricultural districts located within the administrative district);
- introduction to the database mapping and semantic information about the distribution of valuable soil agroindustrial groups within rural (village) councils and administrative districts;
- analyzing the results (definition of areas especially agroindustrial groups of soils (for agricultural land and soils agroindustrial groups) within a rural the so-called village councils, their properties and characteristics;
- generalization of information (definition of total area, the patterns of distribution, structure, especially of groups of soils within the rural (village) councils in the whole region).

The next step is evaluation and monitoring EVL.

The main research methods were the following: monographic (used in the study of scientific approaches to the selection EVL at regional and national level research in natural resources areas), statistical (when processing the results), mapping (during development and conclusion of cartographic models (cards) that displays available spatial information on the distribution of EVL and their evaluation, and their subsequent processing methods mathematical and cartographic modeling will provide a new (original) information).

3. Results and discussions

Approbation of the proposed approaches to study the spatial distribution and create inventory database EVL regional level (administrative district), their assessment and monitoring was performed by us on the example of the land resources of Vasytkiv District of the Kyiv Region.

The object of our study were EVL placed in the 43 administrative territorial units located within Vasytkiv District of the Kyiv Region. The total area of Vasytkiv District is 118.44 thousand hectares.

Most of the Vasytkiv District area is under agricultural land 91.60 thousand hectares (or 77.34% of the total area), agricultural land covers 89.35 thousand hectares (or 97.5%) under farm buildings and yards - 1.57 thousand hectares (or 1.7%), in economic ways and run - 0.66 thousand hectares (or 0.7%) and 6.6 thousand hectares of farmland are polluted, they are not used in agricultural production, as having undergone anthropogenic pollution.

Further study EVL of Vasytkiv District of the Kyiv Region needs an inventory of rural (village) councils placed in appropriate natural agricultural areas and identify areas EVL in their territories.

According to the plans of natural-agricultural zoning of Ukraine (1985) Vasytkiv District is within two natural agricultural areas, which are named as Fastivskiy and Bilotserkivska-Mironivskiy (Fig. 1). Both are members of the Bugska-Middle-Dnieper of forest-steppe district at the right bank province.

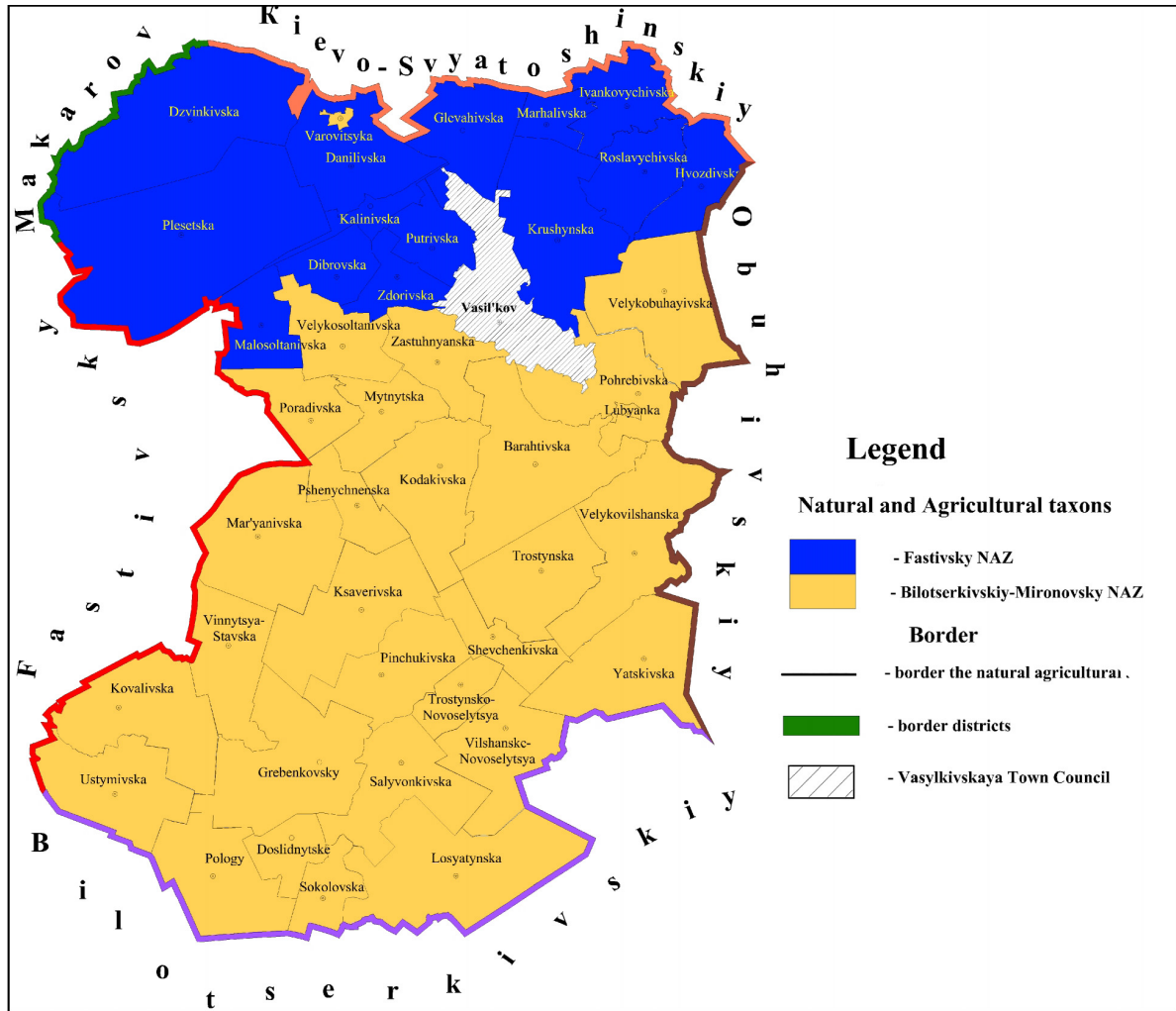


Fig. 1. Map the natural-agricultural taxons in Vasytkiv District of the Kyiv Region

The next step in the study of the spatial distribution of EVL and create inventory database EVL Vasytkiv District was the creation of an electronic database of map information on the distribution of especially groups of soils. For doing such work, we used the existing planning and cartographic material past (mainly land management projects to form the boundaries of settlements, projects of farm land, land sharing schemes, Maps agroindustrial groups of soils) that were digitized and included into the database. As a result, distribution map was prepared by EVL in the respective rural (village) councils and the general distribution map EVL within the Kyiv region. Example concluded maps shown in Fig. 2. The next step was to analyze the distribution of EVL within the rural (village) councils and making of relevant explications (Table 1-3).

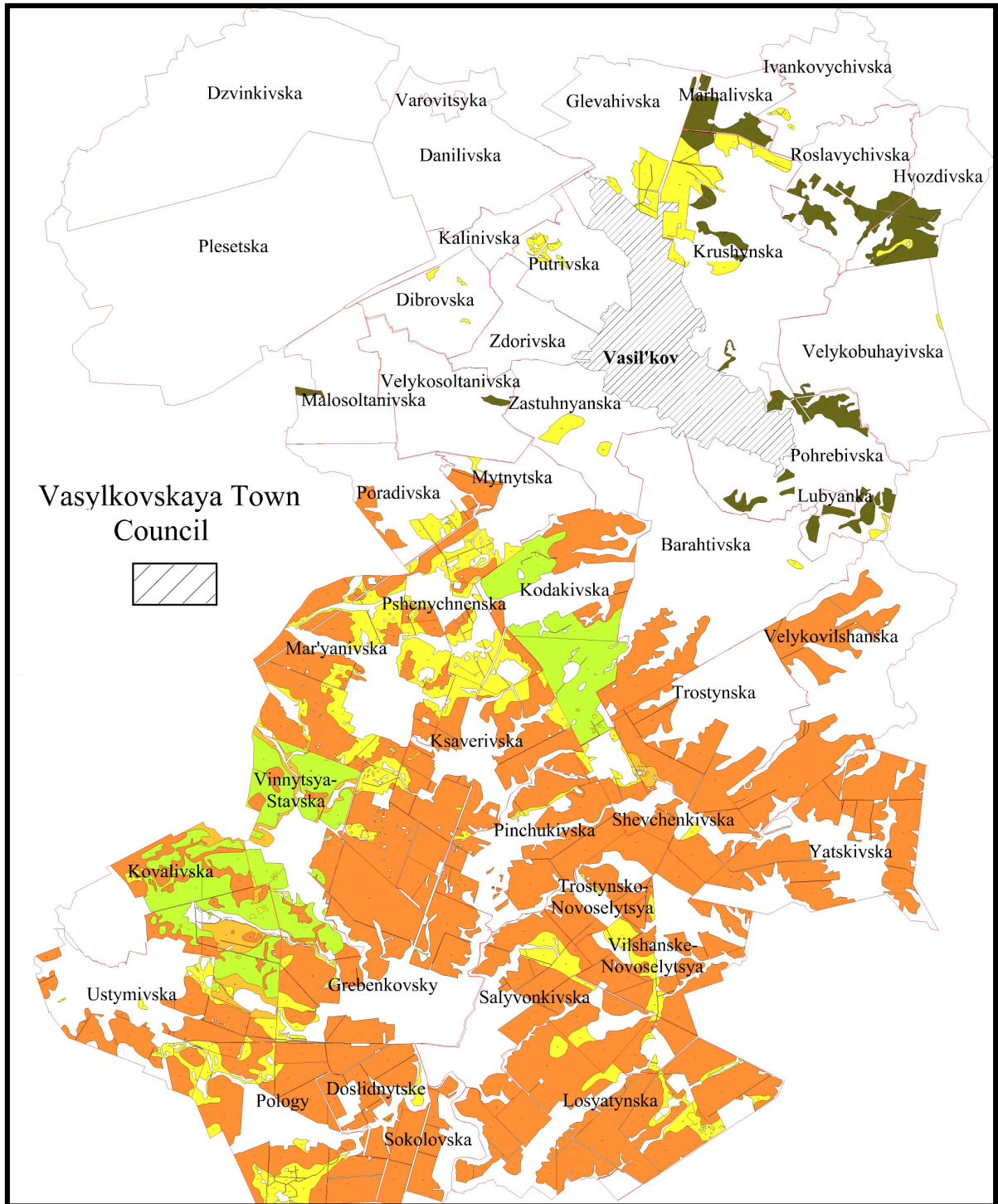


Fig. 2. Map of distribution of especially valuable lands (soils) in the Vasytkiv district of the Kyiv Region

Within each rural (village) councils defined contours of land which especially valuable spread soils and established the area occupied lands. Example composed explication spread EVL within Velykivilshanskoyi village are presented in Table 1.

According to the data distribution of EVL for farmland and agricultural industrial groups of soils in terms of rural (village) councils were compiled and summarized explication of the analysis of the spread of EVL within the Kyiv Region for agroindustrial groups of soils (Table 2) and land.

The total area of EVL located within the Vasytkiv District is 41,638.40 hectares or 35.16% of the total area of the district. They represent such agro-industrial groups of soils as chernozem and weakly degraded and dark gray highly degraded loamy soils (41g) with a total area of 1970.76 hectares typical black soil humus and black highly degraded, loamy (53g) - 29094.21 hectares typical chernozem humus and highly degraded chernozem, medium loam (53d) - 4158.80 hectares meadow-chernozem soils of different cancellation, loamy (121g) - 5756.26 hectares meadow-chernozem soils of different cancellation, medium loam (121d) - 658.37 hectares.

Table 1. Distribution of EVL (for agricultural land and agricultural industrial groups of soil) by Velykivilshanskoyi village council Vasytkiv District of the Kyiv Region

№	Code	Name of the agro-industrial group	Area, ha	Estate
1	53g	Typical black soil humus, loamy	26,23	Arable lands
2	53g	Typical black soil humus, loamy	467,94	Arable lands
3	53g	Typical black soil humus, loamy	93,64	Arable lands
4	53g	Typical black soil humus, loamy	5,6	Arable lands
5	53g	Typical black soil humus, loamy	99,25	Arable lands
6	53g	Typical black soil humus, loamy	135,94	Arable lands
7	53g	Typical black soil humus, loamy	20,6	Arable lands
8	53g	Typical black soil humus, loamy	824,98	Arable lands
Total			1674,18	

Table 2. Distribution of EVL by administrative-territorial units of the Vasytkiv District of the Kyiv Region (fragment)

№	Name of the administrative-territorial units (village councils)	The total area, ha	Code especially valuable lands (soil), ha					Out of all especially valuable soil, ha		
			Total	Code agro-industrial groups of soils				regionally EVL	EVL of national importance	
				41g	53g	53d	121d			121g
1	Barahivska	5108,80	680,70	-	668,47	-	-	12,23	-	680,70
2	Varovitsyka	106,00	0,00	-	-	-	-	-	-	-
3	Velykobuhayivska	3723,00	20,98	14,40	-	-	-	6,58	14,40	6,58
....
35	urban village Grebinky	4554,40	2920,34	-	2694,41	-	-	225,93	-	2920,34
36	urban village Doslidnytske	1126,60	749,22	-	709,85	-	-	39,37	-	749,22
....
41	Ustymivsky	3085,80	1292,10	-	1071,15	-	-	220,95	-	1292,10
42	Shevchenko	1490,60	810,24	-	706,39	-	-	103,85	-	810,24
43	Yatskivska	3611,20	2042,21	-	2042,21	-	-	-	-	2042,21
Total:		118439,00	41638,40	1970,76	29094,21	4158,80	658,37	5756,26	1970,76	39667,64

Largest area among EVL occupy Chernozem typical low humus and chernozems are highly degraded, loamy - 69.9% of the total surface area of EVL. Chernozem ashed and weakly degraded and dark gray highly degraded soils,

loamy extended to 10.0% of the total area EVL), and meadow-chnozem soils and cancellation, loamy 13.8% of the total area EVL. The lowest area occupy chernozem ashed and weakly degraded and dark gray highly degraded soils, loamy - 4.7% of the total surface area of EVL and meadow-chnozem soils and weakly degraded and slaboosolodili serednosuhlynkovi - 1.6% of the total surface area of EVL Vasytkivsky .

Table 3. Value EVL to the total area of village (village) councils of Kyiv

№	Name of the administrative-territorial units (village councils)	The total area, ha	The Area of EVL	
			Ha	to the total area of village councils,%
1	Barahivska	5108,80	680,70	13,32
2	Varovitsyka	106,00	-	-
3	Velykobuhayivska	3723,00	20,98	0,56
4	Velykovilshanska	4196,10	1674,18	39,90
5	Velykosoltanivska	2079,10	24,57	1,18
6	Vilshanske-Novoselytsya	2851,90	1918,46	67,27
7	Vinnytsya-Stavska	2599,80	1813,43	69,75
8	Hvozdivska	1666,90	417,05	25,02
9	Danilovskaya	3138,00	-	-
10	Dzvinkovska	6113,70	-	-
11	Dibrovska	1299,60	19,50	1,50
12	Zastuhnyanska	2008,40	121,47	6,05
13	Zdorivska	1278,40	-	-
14	Ivankovychivska	1803,70	21,93	1,22
15	Kovalivskiy	3678,40	2544,52	69,17
16	Kodakivska	3366,40	2280,25	67,74
17	Krushynska	4792,20	877,72	18,32
18	Ksaverivska	3949,10	2946,77	74,62
19	Losyatynska	5165,30	3860,28	74,73
20	Lubyanka	97,70	-	-
21	Malosoltanivska	1601,30	26,09	1,63
22	Mar'yanivska	4316,50	2997,80	69,45
23	Marhalivska	831,10	274,55	33,03
24	Mytynska	1814,00	535,53	29,52
25	Pinchukyvka	2750,50	1722,82	62,64
26	Plesetsk	8822,00	-	-
27	Pohrebivska	3329,80	564,55	16,95
28	Pology	3015,30	2212,67	73,38
29	Poradivska	1676,90	300,62	17,93
30	Putrivska	1537,50	79,04	5,14
31	Pshenychnevska	1397,60	746,44	53,41
32	Roslavychivska	2107,00	321,03	15,24
33	Salyvonkivska	3235,20	1768,01	54,65
34	urban village Glevaha	3071,70	407,74	13,27
35	urban village Grebinky	4554,40	2920,34	64,12
36	urban village Doslidnytske	1126,60	749,22	66,50
37	urban village Kalynivka	716,00	-	-
38	Sokolovsky	1144,30	711,03	62,14
39	Trostynska	3085,10	1231,15	39,91
40	Trostynsko-Novoselytsya	1096,10	703,41	64,17
41	Ustymivsky	3085,80	1292,10	41,87
42	Shevchenko	1490,60	810,24	54,36
43	Yatskivska	3611,20	2042,21	56,55
	Total:	118439,00	41638,40	35,16

Out of all EVL Kyiv region, soils are especially valuable national importance which occupy 39667.64 hectares (95% of the total area EVL), regionally especially valuable soils 1970.76 hectares (5% of the total area EVL).

Further analysis of the spatial distribution of EVL within Vasylkiv District in Kyiv Region made for me the conclusion that the most part EVL (over 60% in the structure of land resources administrative units) are in rural councils such as Vilshanske-Novoselytsya - 1918.46 hectares, Vinnitsa, Stavska - 1813.43 hectares Kovalivskiy - 2544.52 hectares Kodakivska - 2280.25 hectares Ksaverivska - 2946.77 hectares Losyatynska - 3860.28 hectares Mar'yanivska - 2997.80 hectares Pinchukyvka - 1722.82 hectares Pology - 2212.67 hectares, and in Grebenkovsky village council - 2920.34 hectares and Research soviet - 749.22 ha (Table 3). Areas listed above administrative units cover an area of 39,614.60 hectares or 33.4% of the total land area Vasylkivsky. At the same time, in their most concentrated area within the EVL - 27381ha or 65.8% of the total area of EVL.

In separate administrative units Vasylkiv District of the Kyiv Region (Varovytska, Danilovskaya, Dzvinkovska, Zdorivska, Lubyanka, Plesetsk Kalynivka village councils and village councils) are no EVL. Total area of the territory is 20,271.80 hectares or 17.1% of the area. They are located mainly within Fastiv natural and agricultural area.

Should be noted that the highest percent EVL within certain administrative territorial units of region centered in Losyatynskiy (74.7%) and Ksaverivskiy (74.6%) rural councils. The smallest area in the structure of land resources EVL occupy Velykosoltanivskiy, Velykobuhayivskiy, Ivankovychivskiy village councils from 0.6 to 1.2% of the total area of the territories.

Inventory database EVL regional level is a powerful tool for analysis and further studies and serve as the main prerequisite for the rational use and conservation and management decisions.

In particular, it will allow:

- creation of figurative and symbolic, logical-mathematical, model mapping and distribution of EVL;
- performing testing the EVL (ballroom, ballroom-hectare, monetary, environmental and economic assessment) and determine their place in the structure of land-resource potential of the region;
- predicting the economic efficiency of the agricultural production;
- justifying and making management decisions aimed at improving the efficiency of land use, settlement of social, economic and environmental problems of the region;
- ensuring the functioning of the monitoring indicators of rural development transformation processes, the effects of the adoption and implementation of management decisions;
- adjusting the plans of social, economic, economic development, protection of land, water and other resources and more.

We calculated the average scores growth class and other especially valuable arable land within the relevant natural and agricultural area (held for 100 point scale and assesses the quality of soil). In an area with the highest weighted average score growth class especially valuable arable land there are rural (village) council Zastuhnyanska (61 points), Vinnitsa, Stavska (58 points), Ksaverivska (56 points) and Losyatynska (56 points), Mar'yanivska (57 points), Mytnytska (58 points), Pology (57 points), Poradivska (58 points), which is mostly rural (village) councils which are placed in Bilotserkivska-Myronivka NAZ. Within this figure Fastiv NAZ within 42-45 points.

The calculations indicate that all rural councils average score growth class especially valuable arable lands is higher than the average score growth class of arable land area, thus confirming their better quality characteristics.

The next stage of research was to determine the monetary value of especially valuable lands Kyiv region, including in the context of rural (village) councils. It was found that the total value of EVL Kyiv region, occupying 35% of the amounts to 1,052.81 million, or 59% of the value of arable land.

Further research EVL requires extensive use of modern GIS technology and Remote Sensing data (the RS). Last played an important role in updating the information and create models of the objects. The existing system of data collection (cartographic and statistical) do not meet modern requirements and can not be fully used as a basis for monitoring EVL.

These are the uncontested RS information sources. They serve as a source of timely, accurate and objective information that can be used to analyze situations in land use associated with inappropriate use of land, including EVL. They are characterized by high reliability and relevance, coverage of the study area, the high frequency of new information, the possibility of accumulation, generalization and standardization. Specifications of land RS data

allow to solve complex problems in land management - from mapping the boundaries of areas to analyze the level of land use [5].

The effectiveness of the above approach was tested during our analysis using EVL Kyiv region. It is a territory with a high probability of manifestation of anthropogenic risks violating the norms of use and EVL. Initial data were satellite images in different time (in the period of 2002-2012), material planning and mapping of land use, topographic maps at the site of the study. The main objective of the study was to identify adverse change (existing and potential) use in areas with EVL.

Using as an RS-date information (and more - projects forming the boundaries of rural (village) councils cartogramms agroindustrial groups of soils), we have analyzed the spread of EVL within the Kyiv region and conducted a field test sites, which identified negative changes. In particular, it was found that:

- within Roslavychivskoyi village council are instances extraction and inappropriate use EVL. In particular, in the eastern part of the village council identified areas with a total area of 11.7 hectares with an existing cottage development. From project development and establishing the limits the territory of Roslavychivskoyi village council shows that it is agricultural land and used as farmland - arable land, it confirms the picture space in the study area, dating from 2002. Field studies of the area and the analysis of satellite images (2010, 2012). Indicates that these areas withdrawn from agricultural use and converted into residential development (Fig. 3).

- within Glevahivskoyi village council we found instances extraction and inappropriate use EVL in the north-eastern part. In particular, the identified plot of 53.5 hectares with the existing residential development. From the fragment project formulation and establishing the limits the territory of Hlevahivskoyi soviet are visible (Fig. 4), agricultural land located on ashed and slaborehradovanyh and dark gray selnorehradovanyh lehkosuhlynkovyh soils (code agro-industrial group - 41) and are used as farmland - arable land.

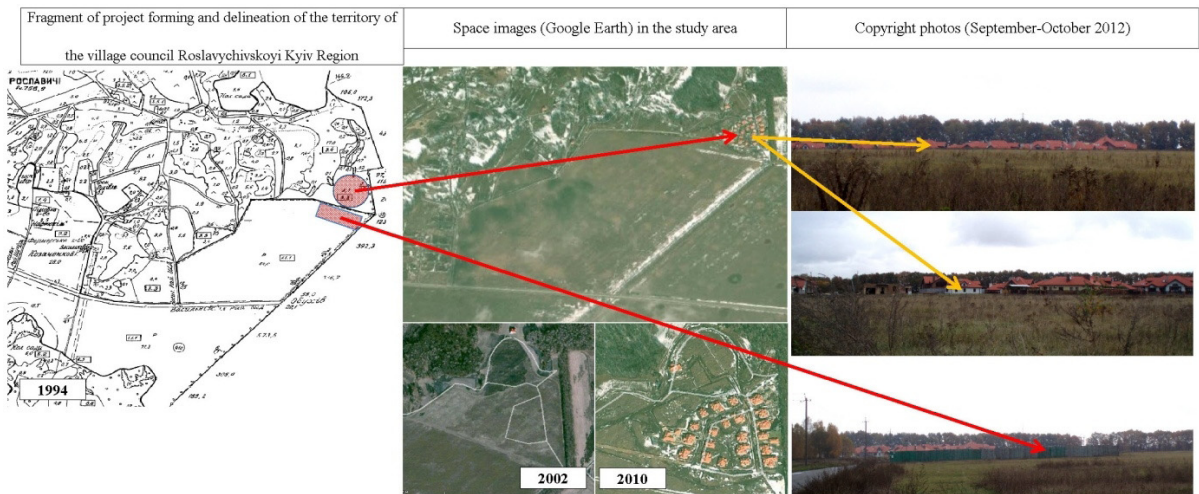


Fig. 3. Example extraction (misuse) EVL for non-agricultural purposes within Roslavychivskoyi village council the Vasylkiv District of the Kyiv Region (cottage development on arable EVL)

On satellite images, dated 2002, there is the beginning of construction work, are based on analysis of satellite images of 2010, 2012. They conducted their own field studies of the area revealed that this site was withdrawn from agricultural use and allocated for residential buildings (Fig. 4).

Thus, monitoring EVL Vasilkiv District Kyiv Region with the use of RS data revealed the facts gross violation of the use of EVL, their extraction and use for residential (including cottage) construction, building stations, land use inappropriately. In general, violations of use EVL within Vasylkivsky area revealed an area of 69.9 hectares, that is, land that removed from agricultural use forever.

In the current environment the effective monitoring EVL at all territorial levels for us, is impossible without using GIS. GIS, integrating with other information technology (satellite navigation, Internet, RS), allowing in very

short time get and use actual information about the location and condition of spatial objects, which in its turn, makes it possible to provide a new level of performance works excluded from the production cycle individual technological stages and therefore reduce the cost and time experts at the same time getting better quality results.

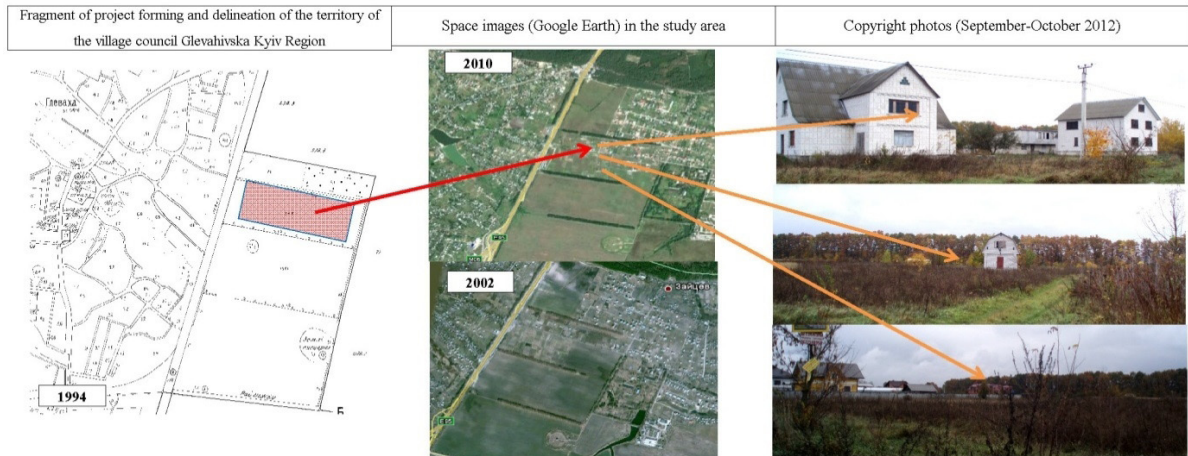


Fig. 4. Example extraction EVL agricultural land for non-agricultural purposes within Glevahivskoyi soviet of Vasylkiv District of the Kyiv Region (residential buildings)

4. Conclusions

Inventory EVL, evaluation and monitoring at the regional level will allow a deeper explore of land-resource potential of the region, its potential economic, environmental, cultural, spiritual, recreational and other uses. These activities are necessary for the formation of EVL investment attractiveness of the region, development of recommendations for sustainable land use its forecasting and modeling the effects of human activities. In addition, these databases will give the possibility to determine the social and economic, natural and integral value of EVL region.

Established that in the Vasilkiv District Kyiv Region EVL occupy 35.16% of the total area of the administrative region; EVL majority concentrated in the southern part of Vasylkivsky area. Some areas of especially groups of soils (mostly regionally valuable) stretches in the north-eastern part of the district. Occupying 35% of the total area, the total cost lands EVL is more than 59% of the total value of arable land Vasylkivsky area.

In connection with the sharp necessity it would be good to get objective information about the condition and use of EVL for preventing negative changes in their condition and compliance ecosafety their use should be monitored EVL lead-based GIS and RS technologies. Within the Vasilkiv District Kyiv Region revealed facts extraction and use of inappropriately EVL (mainly for individual residential and cottage development, building stations, expansion of the airport runway, etc..) The total area is 69.9 ha. The total estimated value (money value) withdrawn from cultivation of especially valuable soil groups reached the point of 2.4 million UAH (\$ 0.3 million).

Using different time satellite images of high resolution increases the effectiveness of monitoring EVL, allows to obtain objective information about their use, to identify cases of inappropriate use EVL. We hope that the technique will be useful for monitoring the EVL for the state authorities, local self-control services.

The algorithm research the spatial distribution of EVL and development base inventory, assessment and monitoring EVL regional level we tested on the example of Vasilkiv District Kyiv Region and can be implemented in similar facilities.

Information-analytical framework EVL at regional level should be integrated into the cadastre registration system, thus accounting EVL should be performed using GIS technologies that integrate both semantic and cartography syde.

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