Monitoring and certification of agricultural land by creating a bank of information resources for the rational use of steppe landscapes of the Western Ciscaucasia

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Abstract. The improvement of economic efficiency and reproduction of soil fertility require today a comprehensive study, qualitative characteristics, quantitative and cost assessment of the land. A certain imbalance exists today in the use of land and the preservation of soil fertility. Certification contributes to the rapid development and adoption of management decisions, as well as operational monitoring of agricultural landscapes. The subject of the research is the main integral indicators of soil fertility and degradation processes of agroecological monitoring in the system of land evaluation procedures within the steppe landscapes of the Western Ciscaucasia. The authors have identified the need for a number of measures: to analyze the structure of the lands of administrative districts, which are part of the IV accumulative plain landscape of the Chelbas and Beisug rivers basins with plowed steppes in 2017, to monitor the main integrated indicators of soil fertility of agricultural land steppe landscapes of the Western Ciscaucasia, to substantiate the approval of form “Passport of quality of soils of Krasnodar territory» by legislation.

1. Introduction
The creation of environmentally sustainable natural systems is one of the most important socio-economic tasks of Russia. The Ministry of agriculture of the Russian Federation defines the Krasnodar territory together with the Samara, Kaluga, Volgograd regions, the Republic of Mordovia and the Stavropol territory as the regions with positive experience in monitoring agricultural land and the creation of regional information systems. Integral changes assessment of agricultural land is necessary in the development of biogeochemical approaches to the agro-ecological monitoring of land, rationalization of land use, which is especially important for regions of intensive agriculture. The use of objective information of land resources on the agro-landscape basis in the cadastral valuation of land is a very important issue. Cadastral valuation of land is aimed at the introduction of economic methods of land management and improvement of rational land use. At the same time the cadastral valuation of land does not take into account such significant factors as soil contamination, the development of wind and water erosion, flooding of the territory and other factors that worsen soil fertility.
2. Optimization of the Land Fund structure to maintain an acceptable balance between different lands

Geographically the study subject is IV Accumulative plains landscape of the Chelbas and Beisug rivers basins with plowed steppes, which were formed within the Krasnodar territory and administrative districts: Korenovsky, Vyselkovsky, Bryukhovetsky and Timashevsky (figure 1).

Figure 1. Soil-ecological Atlas. Landscapes of the Krasnodar territory.

The territory which is considered to be the most productive agricultural area of the Russian Federation [5].

Table 1. The structure of the lands of administrative districts that are a part of the IV landscape in 2017 (hectares).

| District      | Total area of agricultural land | Arable land | Multi-year planting | Gardens | Grape | Deposit | Hayfields | Pastures | Total agricultural lands | Irrigated land | Arable land (out of them) |
|---------------|---------------------------------|-------------|---------------------|---------|-------|---------|-----------|----------|--------------------------|----------------|--------------------------|
| Korenovsky    | 124295                          | 110514      | 1064                | 629     | 4     | 0       | 0         | 896      | 112474                   | 3436           | 3342                     |
| Vyselkovsky   | 152759                          | 140986      | 1553                | 1300    | 4     | 0       | 0         | 780      | 143319                   | 5359           | 4550                     |
| Bryukhovetsky | 115119                          | 102344      | 550                 | 342     | 5     | 0       | 0         | 2153     | 105047                   | 5548           | 5548                     |
| Timashevsky   | 125185                          | 105929      | 2514                | 2178    | 0     | 0       | 0         | 7707     | 116150                   | 12828          | 11692                    |
| Total         | 517358                          | 459773      | 5681                | 4449    | 0     | 0       | 0         | 11536    | 476990                   | 27171          | 25132                    |

Plain landscapes, which used to be grass, fescue-feather-grass, forb-grass steppes. Now, 85-96% of them are ploughed. [7] This confirms high-quality soil and favourable agro-climatic resources. The total area of agricultural land in the research region is 517 thousand hectares. This is a significant part – 86% (Table 1) in the structure of the lands of the four administrative districts. The largest share in the structure of agricultural land is arable land – 89% or 459.7 thousand hectares. 2.2% or 11.5 thousand hectares are natural forage land. Only pastures are available out of them.

The total area of irrigated land is 27.2 thousand hectares. 5.5% of the total area of arable land is irrigated.

3. Soil structure and agrochemical characteristics of the agricultural landscape

Parent materials on the territory of the agricultural landscape are represented by quaternary loose carbonate clays, holocene and modern alluvial and alluvial-liman sediments of plain streams,
pleistocene alluvial deposits of plain streams with a cover of forest-like materials, as well as pleistocene aeolian-deluvial forest-like materials. The main soils of the agricultural landscape — chernozems typical, have been formed on loose clays occupying almost the entire flat area of the agricultural landscape. Meadow and meadow-chernozem soils, lying on the bottom of the beams and the lower part of the slopes, have been also formed on forest-like loams. Grassland ecosystems have been formed in the floodplains of the Beysug and Chelbas rivers, in the mouths of some of the beams, on the gleyed clay. [8]

In terms of geographic zoning, the territory of the agrolandscape is included in the temperate zone of the Ciscaucasia area of the Kuban-Priazovsky steppe region of ordinary and typical black soil. Common and typical chernozem occur on very flat and wavy plains and occupy about 90% of all land in the region. Part of this type of soil is subject to weak and moderate wind or water erosion. [4] On the slopes, predominantly planar water is common, wind erosion is common on flat lowland peaks and wind-impact slopes of the east and north east exposure.

Studies in agricultural landscape assessment were being carried out with the help of local monitoring. It took into account the natural conditions of the study area, the terrain, the boundaries of extensive agricultural enterprises, lands of rural administrations, farms. It also included the land resources information gathering, operational monitoring of land use, processing and storage, analysis and assessment of the quality of the land taking into account the anthropogenic load and the impact of negative processes on the agricultural landscape [2]. Quantity soil index is used to determine the quantitative assessment of soil fertility level. The agrolandscape was used as a basis according to which average quality soil index rate of agricultural land, arable land and pastures was calculated.

Table 2. Agrochemical characteristics of the soils of the agrolandscape.

| District       | S(hec.) | humus, %  | pH salt | P₂Os | K₂O | N     | S     | Mn    | Zn    | Cu    | Co    |
|----------------|---------|----------|---------|------|-----|-------|-------|-------|-------|-------|-------|
|                |         |          |         |      |     |       |       |       |       |       |       |
| Donetsk        | 240123  | 3.7      | 6.2     | 30   | 422 | 13.5  | 5.7   | 6.5   | 0.5   | 0.09  | 0.07  |
| Bryukhovetsky  | 123386  | 3.56     | 6.8     | 30.5 | 407 | 17.9  | 5.8   | 9.5   | 0.33  | 0.20  | 0.09  |
| Timashevsky    | 101202  | 3.7      | 6.8     | 30   | 472 | 20.7  | 7.3   | 5.9   | 0.4   | 0.10  | 0.64  |
| Average        | 222614  | 3.6      | 6.9     | 32   | 515 | 18.4  | 14.1  | 3.9   | 0.4   | 0.09  | 0.07  |

The content of micro, macro, and other nutrients within the framework of the agrolandscape is medium and high (table 2). During the five-year survey cycle, it has never dropped to a low level, which significantly distinguishes this territory within the framework of the Krasnodar Territory and requires its further study.

Analysis of the balance of nutrients in agriculture shows that its main feature is scarce, but not pronounced. [3] One of the reasons for this is the insufficient level of use of mineral and organic fertilizers.

Table 3. Accounting of the quantitative soil index during cadastral valuation (2015).

| District      | Area of agricultural land, (hectares) | Quantitative soil index | Cadastral cost of land (roubles / square meters) |
|---------------|--------------------------------------|-------------------------|-----------------------------------------------|
| Korenovsky    | 124295                               | 85                      | 16.00                                         |
| Vyselkovsky   | 152759                               | 84                      | 14.93                                         |
| Bryukhovetsky | 115119                               | 83                      | 15.09                                         |
| Timashevsky   | 125185                               | 82                      | 15.95                                         |

State cadastral valuation of land is a necessary component of the land reform. The average soil index in the Krasnodar territory is 76. The cadastral cost of agricultural land in Kuban is 540.2 billion rubles. The cadastral cost of agricultural land in the Krasnodar territory is 127.8 thousand rubles / hectare (Order of Property Department of Krasnodar territory- No. 1609 of 11/27/2015.) The data from table 3 allows
us to consider the cost of land within the studied agricultural landscape as higher, since the average soil index is 83.5. Evaluation of agricultural land and quality accounting should be made on the following land: arable land, hay, pastures. As a result, the obtained materials serve as the initial basis for the land cadastre, land use registration, land inventory, etc.

Certification is one of the most effective methods of state land control. The essence of the concept: a system of state monitoring of all agricultural land will be created. According to the latest initiatives of the President of Russia, the Government was instructed to develop a "road map" for the implementation of the state policy in the land usage until 2020. In the future, the issues of creating a passport of agricultural land, as well as the approval of the certification body will be considered, which will accelerate the development of legislative acts on soil protection.

Krasnodar territory will be among the first regions of the Russian Federation which will approve the »Passport of soil quality of Krasnodar region "by legislation. The most important place in the evaluation of agricultural land will be given to the Passport of soil quality of the land. It will be an official document on the state of soil fertility of land. The introduction of the Passport allows to control and regulate quality indicators and objectively apply economic stimulation measures for land users.

The system of state monitoring of all agricultural land and the legal basis for the creation of the land fertility system in the region have been created in the Stavropol territory. The regional authorities, twill be able to increase the information content of land fertility cartograms, taking into account all the shortcomings and well-established work with a significant amount of systematic data. It will be the final result of the monitoring.

The relevance of soil quality certification in the Krasnodar territory is not in doubt, the indisputable proof of this is the adoption and approval of legislation of soil fertility provision by other country subjects.

The most important place in this mechanism is the Passport of soil quality of the land plot. [6] Passport of soil quality of the land plot is an official document on soil fertility quality of the land plot. Owners, users, including tenants of land plots have the right to have a Passport of soil quality of the land plot. According to the Federal law "On state regulation of ensuring fertility of lands of agricultural purpose" the passport will allow owners, users, including tenants, to receive information from Executive authorities of Krasnodar territory on a condition of fertility of soils fertility on their plots of land and on dynamics of its qualitative indicators changes. According to international standards (ISO 11074-1), soil quality is a combination of positive and negative properties related to soil use and soil functions. The information contained in the Passport is used to maintain the documents of the state land cadastre; to do cadastral evaluation of land plots; to obtain information on the state of soil fertility and the dynamics of its change on the land; to provide before courts, legislative and Executive authorities, local governments and other organizations in the event of disputes on soil fertility provision. Creation of the program complex of soil quality certification of land plots will automate the process of obtaining and storing the accumulated information.

The presence of information resources bank on the land fertility quality will serve to ensure full monitoring of fertility. [1]

Numerous information resources are quite versatile and sometimes have a narrow monitoring zone. So, full monitoring of soils fertility of agricultural lands is maintained in proprietary systems, provided to specific agricultural producers are provided with it. It makes impossible to assess the fertility quality on the scale of individual municipalities and regions as a whole.

Database design usually consists of geographical objects and phenomena identification. Then an adequate reporting on them is selected.

The organization of Information and consulting service of agro-industrial complex in the region and a single center for remote satellite monitoring of the Krasnodar territory made it possible to combine disparate data on soil fertility indicators. At the same time the list of these systems does not include all soil fertility indicators approved by the Order of the Ministry of agriculture of the Russian Federation №150 dated May 4, 2010 “On approval of the Procedure for state registration of agricultural land fertility indicators”. Therefore, these systems are not sufficient to ensure full monitoring of fertility.
4. Conclusion

In connection with the current situation, it is necessary to develop a set of measures for the organization of large-scale monitoring of soil fertility of agricultural lands of the Krasnodar territory. These measures should improve the quality of the soil cover.

The adoption of measures for preservation and increase of soils fertility of the Krasnodar territory will allow:

- to realize the rights of land owners and land users established by the Federal and regional legislation to receive the information on the soil fertility quality of their land plots and its changes. This information shall be presented by authorized executive authorities of the Krasnodar territory;
- to make timely management decisions on ensuring the fertility of agricultural land by the state authorities of the region and local authorities due to the increase in the efficiency of obtaining and reliability of information;
- to implement timely measures to preserve and improve soil fertility, increase its efficiency on the basis of updated information.

The intensity of erosion processes in the modern era is caused either by direct or indirect consequences of anthropogenic origin.

Thus, when carrying out the state cadastral assessment of lands of agricultural purpose we believe it is appropriate to consider the average indicator of soil fertility, and also the agrogenic factors reflecting both spatial, and degradation manifestations of all stages of anthropogenic soil formation.

As you can see, it is better to do cadastral valuation in the context of agricultural landscape systems structure. Assessment of the agricultural landscapes fertility is a necessary factor in the implementation of cadastral valuation of land.

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