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USE OF GAT TECHNOLOGIES IN THE IDENTIFICATION AND ASSESSMENT OF SOIL DEGRADATION

Annotation

This article discusses the state of degraded soils, types and reclamation-ecological conditions of soils associated with degradation processes. Also, when assessing the condition of irrigated sierozem-meadow soils common in the Khavast district of the Syrdarya region, data on certain types of degradation, the main causes and negative consequences of the degradation process are provided. As a result of processing data on the agrochemical and chemical properties of the soils of the Pakhtakor massif of the Khovos district, electronic maps of the distribution of humus, nitrogen, phosphorus, potassium, and the amount in the upper soil layer distributed over the territory were compiled based on the GAT programs.

Keywords: soil fertility, salinization, degradation, granulometric composition, dry residue, humus, nitrogen, phosphorus, potassium, GAT technologies, electronic maps.

ИСПОЛЬЗОВАНИЕ ТЕХНОЛОГИЙ GAT ДЛЯ ВЫЯВЛЕНИЯ И ОЦЕНКИ ДЕГРАДАЦИИ ПОЧВ

Аннотация

В данной статье рассматривается состояние деградированных почв, типы и мелиоративно-экологические условия почв, связанные с процессами деградации. Также при оценке состояния орошаемых сероземно-луговых почв, распространенных в Хавастском районе Сырдарьинской области, приводятся данные об отдельных видах деградации, основных причинах и негативных последствиях процесса деградации. В результате обработки данных об агрохимических и химических свойствах почв Пахтакорского массива Ховосского района на основе программ GAT были составлены электронные карты распределения гумуса, азота, фосфора, калия и количества в верхнем слое почвы, распределенного по территории.

Ключевые слова: плодородие почв, засоление, деградация, гранулометрический состав, сухой остаток, гумус, азот, фосфор, калий, технологии GAT, электронные карты.

TUPROQLARNING DEGRADASIYAGA UCHRAGANLIK HOLATINI ANIQLASH VA BAHOLASHDA GAT TEXNOLOGIYALARIDAN FOYDALANISH

Annotasiya

Ushbu maqolada degradasiyaga uchragan tuproqlarning holati, turlari va degradasiya jarayonlari bilan bog‘liq tuproq meliorativ-ekologik holatlari yoritilgan. Shuningdek, Sirdaryo viloyati Xovos tumanida tarqalgan sug‘oriladigan bo‘z-o‘tloqi tuproqlarning holatini baholashda degradasiyaning ayrim turlari, degradasiya jarayonini keltirib chiqaruvchi asosiy sabablari hamda salbiy oqibatlari haqida ma'lumotlar keltirilgan. Xovos tumani Paxtakor massivi tuproqlarining agrokimyoviy, kimyoviy xossalari bo‘yicha olingan ma'lumotlar GAT dasturlari asosida qayta ishlash natijasida xududda tarqalgan tuproqlarning ustki qatlamida gumus, azot, fosfor, kaliy, miqdorini tarqalishi bo‘yicha elektron xaritalar tuzildi.

Kalit so‘zlar: tuproq unumdorligi, sho‘rlanish, degradasiya, granulometrik tarkib, quruq qoldiq, gumus, azot, fosfor, kaliy, GAT texnologiyalar, elektron xaritalar.

Introduction. Nowadays the increasing threats of the global environmental crisis in the world leads to an acceleration of soil degradation processes. “As a result of soil degradation, an average of 8-10 million worldwide, and according to maximum estimates, even 15-20 million hectares of fertile land are being withdrawn from agricultural use per year”. In the world, “saline soils occupied large areas - about 25% of the entire land surface. Large amounts of saline soils are found in Central Asia, in the western United States, in some arid regions of South America and Australia, and in North Africa. At the same time, the soils of desert and semi-desert areas in arid and arid climates are characterized by a particularly high degree of salinity.” Therefore, when the area of saline lands increases as a result of natural processes and anthropogenic influences, the identification of factors causing salinization, its prevention, conservation, restoration of fertility of saline soils and their rational use in agriculture is one of the urgent tasks.

For this reason, regulation and optimization of biological processes occurring in the soil are considered important in the search for scientifically sound practical solutions to issues aimed at improving the efficiency of degraded land use, as well as protecting soil cover [1,2].

Scientific research is being conducted worldwide to prevent the salinization process that occurs in the context of global climate change and mitigate its consequences, taking into account natural and climatic conditions when determining the influence of external factors on soil properties [3, 4, 5].

Climate change regionally will increase by the number of extreme weather events, periods with droughts and high summer temperatures, fluctuations in the regime of water resources formation, and land degradation [6, 7, 8].

In this regard, special attention is paid to the use of modern geoinformation technologies in order to quickly and efficiently identify the area of saline lands and assess the degree of salinity, and to the widespread use of biodiagnostic methods for assessing the degree of resistance of saline soils to external factors based on informative indicators [9, 11].

The object of the research is to varying degrees saline irrigated sierozem-meadow soils common in the Khavast district of the Syrdarya region. These are informative indicators of the properties of saline sierozem-meadow soils.

Research methods. Irrigated glacial meadow soils have been selected in Southern Mirzachul (Kharovsky district). The research used genetic-geographical, profile-geochemical, stationary-field and chemical-analytical methods.

Chemical, physico-chemical, agrochemical and agrophysical analysis of soils was carried out according to the generally accepted methods “Manual on chemical analysis of soils”, “Methods of agrochemical analyses of soils and plants of Central Asia”). Field experimental studies were conducted on the basis of the manuals “Methods of field experiments with cotton under irrigation conditions”, “Methodological manuals for conducting field experiments”.

Of the agrochemical and chemical properties of the soil, humus is according to the I.V. Tyurin method; total nitrogen - according to the Keldal method; total phosphorus and potassium - according to the Metsheryakov method in one sample; mobile phosphorus P_2O_5 and exchangeable potassium K_2O - according to the Machigin - Protasov method; CO_2 carbonates - by the asymmetric method; amount of salts - through aqueous absorption; the mechanical composition of the soil-by treatment with a sodium hexametaphosphate dispersant. ArgGIS 10.6.1 software was used to create maps of various subjects.

Analysis and results. Thermal conductivity, water permeability, density, and capillarity of the soil are closely related to its mechanical composition and affect many, including physical, physico-chemical, agrochemical, chemical, and biological properties of the soil.

According to the mechanical composition of the irrigated sierozem-meadow soils studied in the course of the research, medium and light loams predominate, and sometimes there are layers of a different granulometric composition.

The area under the research is the 1st section of irrigated sierozem-meadow soils with light and medium loamy mechanical composition, we can also observe heavy loamy mechanical composition going into the lower layers. In the upper layer of the section, coarse sand (>0.25 mm) is 0.9%, medium sand (0.25-0.01) 4.6%, fine sand (0.1–0.05) 19.5%, coarse dust (0.05–0.01) 45.1%, medium (0.01–0.005) 11.9%, fine dust (0.005–0.001) 12.6 to %. It was found that the amount of Il particles (<0.001 mm) is 5.4%, and the amount of physical sludge (<0.01 mm) is 24.2%. According to the mechanical composition of sections 11-18, light and medium loams are distinguished, and in some layers we can see heavy mechanical compositions (Table 1). In the upper layers of these sections, coarse sand (>0.25 mm) ranges from 0.4 to 1.0%; medium sand (0.25-0.01)– from 0.1 to 4.2%, fine sand (0.1–0.05)–from 8.2 to 24.2%; coarse dust (0.05-0.01) - from 34.0 to 58%; average dust (0.01-0.005) From 7.9 to 9.0%; fine dust (0.005–0.001) occurs from 11.4 to 15.4%. The content of Il particles (<0.001) ranges from 12.2 to 14% .

The content of physical clay(<0.01 mm) ranges from 24.2 to 32.6%. During the observations, it was found that, in general, large dust particles (0.01-0.05 mm) predominate in the described soils, and the amount of clay is unevenly distributed over the cross-section of the soil (Table 1).

Humus is considered one of the most important indicators of soil fertility. Humus is also a source of energy necessary for various biochemical and chemical processes occurring in the soil, as well as for metabolism and circulation in agricultural landscapes [10].

In the course of our research, using GAT systems, an electronic map was created characterizing the humus content in the soils of Pakhtakor massif of Khavast district, which reflects the area of distribution and levels of availability (Fig.1).

As can be seen on the electronic map, the humus content is low to medium. The low humus content is associated with a variety of salinity levels in these soils and low biological activity. During the grouping, it was noted that the area of 2762.56 hectares is a group of soils with a low nutrient content, and the area of 3008.16 hectares is a group of soils with an average nutrient content.

According to the analysis results, the humus content in the upper arable layer of slightly saline irrigated glacial meadow soils of the region is 0.88-1.02%, in the sub-arable-0.70 - 0.90%, in the lower layers of the profile its content decreases (Table 2).

In the moderately and heavily saline soils of the region, the humus content decreased to 0.64-0.98%, in the sub-arable areas-up to 0.42-0.84%, in the deep horizons its content decreased sharply.

The content of carbonates was 7.0 -, 7.8% in the upper layer and 8.0-8.6% in the lower, one can see the relative predominance of carbonates over the content of calcium carbonate (CaCO3).

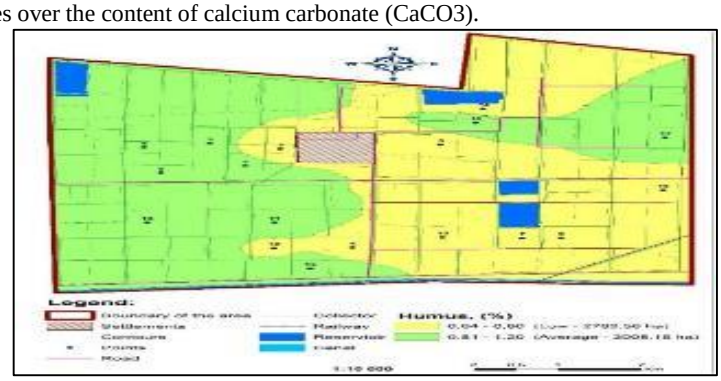

Figure 1. *Electronic maps describing the content of humus in the soils of the studied area*

Nitrogen is found in the soil in the form of organic matter, and a slightly smaller amount is found in mineral form. According to the analyses obtained, the highest values of the total nitrogen content were found in the upper layers of the studied soil sections, while their amount decreased in the lower layers. Fluctuations in the gross nitrogen content were observed from 0.078-0.090% in the upper arable layer of lightly salted irrigated sierozem-meadow soils to 0.060-0.086% in the sub-arable layer. Towards the lower layers of the profile, its content was 0.012-0.024%.

The salinity of medium and high salinity soils decreased to 0.056-0.084% in the upper arable layer and 0.038-0.072% in

the sub-arable layer. In the deep horizons, the total nitrogen content decreased sharply, its content was 0.010-0.016%. Towards the lower layers of the profile, its content was 0.012-0.024%. Such a sharp decrease in the total nitrogen content is due to the low content of organic matter in these layers, as well as due to salinity.

The soils of the region are divided according to mobile forms of phosphorus into groups of soils with very low and low phosphorus content. Analysis of mobile forms of phosphorus in the soil showed that on slightly saline soils its content is 20,8-30.0 mg/kg in the upper arable layer and 9.8-26.4 mg/kg in moderately and heavily saline irrigated gray meadow soils. The soils of the region are divided into a group of soils with low and medium content of exchangeable potassium.

On the electronic maps created during our research, Pakhtakor massif is reflected by the degree of soil salinity, as well as by the area of distribution by salinity levels (Fig.2).

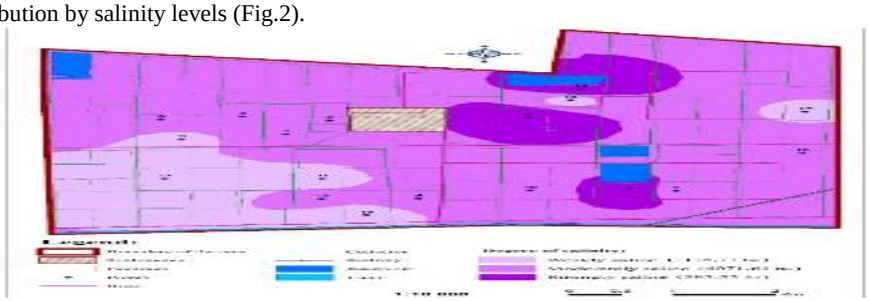

Figure 2. Electronic maps characterizing the content of humus and mobile phosphorus in the upper soil layers of the investigated area

According to the data presented on these maps, it was found that the soils of the Pakhtakor massif have different degrees of salinity: out of the total area of 5,570.71 hectares, the area of 1,115.77 hectares is Slightly saline, the area of 4071.61 ha is moderately saline, and the area of 583.33 ha is highly saline.

It was found that on irrigated glacial meadow soils scattered throughout the territory, the dry residual surface layers range from 0.314-1.580%, respectively, weak and moderate salinity. Sometimes you can find heavily saline soils.

In accordance with this, in most cases, the type of salinity (by chemical composition) It was sulphated, and sometimes the salinity of the chloride-sulfate and sulfate-chloride types was also determined.

Conclusion. To summarize, we can say that the soils of the studied territory are not rich in humus, poorly supplied with the amount of basic nutrients, and we can also see a significant impact of unfavorable climatic conditions of the area, rising temperatures in the summer, a high degree of evaporation of moisture in the soil, and soil salinity.

In the upper arable layer of slightly saline irrigated sierozem -meadow soils of the territory, the humus content was 0.88-1.02%, in sub-arable-0.70-0.90%, and in medium-arable and highly saline soils the humus content was 0.64-0.98%, in sub-arable-0.42%.It was found that its amount decreases sharply towards the deep horizons, decreasing to 0,42-0,84%.

It is advisable to use various thematic electronic maps characterizing territorial changes in the parameters of diagnostic indicators of soil fertility based on a geoinformation system when determining agro-reclamation measures aimed at improving the properties, regulating and optimizing biological processes while ensuring sustainable soil fertility, taking into account the specialization of farms in the area and soil and climatic conditions.

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