ANNOTATION

Bazarbayev Sultan Orazbayuly's thesis work on the topic "The study of the degree of degradation of pastures of gray terrestrial, grey-brown and sandy soils of the suburban semi-desert and desert zones of Kazakhstan and development of techniques for their restoration", submitted for the degree of Doctor of Philosophy (PhD) in specialty 6D080800 - Soil science and agrochemistry.

Relevance of the research topic

Kazakhstan is the largest livestock farming country in Central Asia and has enormous resources for its further development. In Kazakhstan, large areas (186.4 million hectares) of natural pastures are of great economic importance, as livestock production accounts for about 54% of all agricultural products. Kazakhstan ranks fifth in the world after Australia (460 million hectares), China (400 million ha), the U.S. (251 million ha) and Brazil (196 million acres), and by the ratio of the area of pastures to the head, cattle occupies the first place. However, due to the fact that a significant part of pastures (76%) are in semi-desert and desert zones, in the conditions of general aridification of the planet's climate and their unsystemic use there is a rapid increase in the scale of their degradation.

According to official statistics, on the territory of the republic 27.1 million hectares of land occupy very heavily degraded (the last stage of degradation) pastures. Currently, their productivity has decreased by about 50%. This, in turn, is one of the main factors limiting the growth of the feed base of cattle breeding. Despite the fact that the area of pasture in Kazakhstan is large, due to their transition into private ownership, the area that is pasted for livestock is decreasing every year.

The reason is that the country has not yet developed a complete system for monitoring the state of pastures and their effective use. Moreover, there is currently no information on the degradation of pasture land in state or other sources. Planned monitoring of pastures will not only improve the condition of the available feed base for farmers, but will also contribute to the growth of livestock and its productivity.

Kazakhstan 18.3% are highly and highly sensitive of 76.1% of the territory exposed to desertification. Moreover, a significant part of pastures is located in the territories of semi-desert and desert regions of the Republic. Therefore, the development of highly effective measures for the sustainable management of the resources of degraded pastures of gray terrestrial, gray-brown and sandy soils of the pre-mountain-desert and desert zones of Kazakhstan is very relevant both from a scientific and practical point of view. In addition, Kazakhstan has not yet developed scientific, practical and methodological recommendations for the management of degraded pastures, based on digital technologies. Their development and use will complement existing scientific knowledge in the field of management of pasture resources and further application in practice.

The purpose of the dissertation research.

Assessment of the degree of degradation of pastures of pre-mountain-desert and desert zones of Kazakhstan on the basis of the study of data of remote land and soil and plant indicators for pastures and the development of effective techniques for their restoration.

Research objectives:

- determination of field monitoring points for the survey of pastures;
- study of the pastures soil cover of the suburban desert and desert regions, their chemical composition and physical properties;
- determination of indicators of soils and vegetation used in determining the degree of degradation of pasture lands;
- assessment of the degree of degradation of pastures of suburban desert and desert territories on the interrelationship of surface and remote sensing data surveillance;
- preparation of M 1:1000000 digital map of degraded pastures of suburban desert and desert regions based on camera and field data;
- development of effective measures for the restoration of degraded pastures lands on gray terrestrial, gray-brown and sandy soils of the pre-mountain-desert and desert zones of our republic.

Research methods

Using field research data and quantitative technologies, studies on pasture degradation in the suburban desert and desert areas were conducted on a fundamentally new methodological and methodological basis. Among them, methods of space research and methods of agricultural sciences (soil science, geobotany, pasture management) were used. For the first time, all phases of the study were based on regional and local characteristics of degraded pastures. In these studies, cartographic methods are the leading method for mapping degraded rangeland resources. This method of research allows to study pastures in their relationship with other natural components of agricultural systems.

Using digital technologies and remote sensing methods of field research, it is possible to assess the restoration of the condition of pasture resources. This is necessary to solve the problem of increasing the productivity of animal husbandry, land use and sustainable food security of the republic.

Studies were conducted on soil and plant cover indicators at each monitoring site (selected by satellite images). As a result of the obtained data, the degradation of pasture lands was determined according to the levels of slight, medium, strong and very strong degradation. Traditional methods were mainly used in the studies conducted with indicators of soil cover. In order to determine the effects of pasture degradation on the morphogenetic features and compositional properties of soils in field expedition research, complete core images were excavated in slightly degraded pasture soils, and fossils were excavated in moderately and strongly degraded areas, and soil samples were taken from all of them. The study of the chemical, physico-chemical composition of soil samples was carried out by analyzing the obtained soil samples in laboratory conditions.

A geodata system project was created, drawing all available cartographic materials into the research area and supplementing them with thematic maps obtained by satellite data processing. As their basis, maps of the degraded pasture lands of the desert and desert regions were made on a scale of M 1:1000000.

Basic rules (proven scientific hypotheses and other findings that are new knowledge)

1. Features of the chemical composition and physical properties of the gray terrestrial, gray-brown and sandy soils distributed in the pastures of the suburban desert and desert regions of Kazakhstan and the effects of slight, medium, strong and very strong degrees of degradation on them were determined;

2. The adverse effect of anthropogenic factors and global climate warming on the condition of pastures in the suburban desert and desert regions, the load of livestock on pasture fodder species, the effect of the degree of degradation of pastures on the botanical composition of plants, and the decrease in productivity was determined, and the way was opened for the interconnection of remote sensing of the earth and ground research;

3. M 1:1,000,000 interactive digital maps were created on the basis of space and ground surveys of degraded pastures of the suburban desert and desert regions, measures to improve mildly, moderately, strongly and strongly degraded pastures and their gray, gray-brown and desert sandy soils were compiled and a geo-information system was developed based on them.

Characteristics of the main results of the study

In order to develop effective ways to evaluate and restore the gray terrestrial, gray-brown and sandy soils of the highland desert and desert regions of Kazakhstan by monitoring the degree of degradation of pastures, soil and plant indicators of the degree of degradation of pastures were studied by remote sensing of the earth's surface and field conditions. Before conducting field research, monitoring sites (points) were identified, images were dug in them, morphological characteristics of the image layers and the full name of the soils in them were determined, and a detailed description of their composition and properties was given.

In 2018-2020, interactive electronic maps of the degrees of degradation of pastures were created using the ArcGis information program as a result of remote sensing of the land and field surface surveys carried out in pastures of gray terrestrial, gray-brown and sandy soils in the mountainous desert and desert regions. They show objects with water sources and other attributive information characteristic of all maps, surface conditions of pasture soils and vegetation with varying degrees of degradation.

In addition, on the basis of the collected data and their evaluation of soil and plant indicators, their spectral characteristics of pastures subjected to slight, medium, strong and very strong degradation in the research areas of Lepsi, Koksu, Koskudyk, Aidarly, Moyinkum, Zhambyl, Akkol, Kyzylkum in the upland desert and desert regions and An online interactive geo-information system has been developed, with ways to improve pastures.

The difference of this system from others is that it has several interactive windows, if you choose the one you need, you can visualize, study and analyze the information of conducted terrestrial and space research. The considered unified geo-information portal is a new information tool that allows to manage the interactive maps, data of the geo-information system and their integration. A special interface has been developed for the convenience of using interactive maps on desktop computers, laptops, smartphones and tablets.

The following measures are recommended for restoration of degraded pastures on gray, gray-brown and sandy soils in lowland desert and desert areas:

- in order to fundamentally improve very strongly winded pastures that have lost their ability to recover naturally, and the gray, gray-brown soils there, it is necessary to treat them without turning them to a depth of 15-18 cm. In the sandy soils of the desert, depending on their sandy granulometric composition and the thinness of the humus layer, the loosening depth should be 10-12 cm. It is sown at a rate of 15 kg/ha for clean sowing or other recommended crops in the months of November-January to a depth of 0.5-1.5 cm of the soil. At the same time, during the entire period of restoration of pastures, it is advisable to completely refuse grazing and mowing;

- in order to restore the soil and plant cover in strongly windy pastures, it is necessary to introduce a three-season, four-year rotational grazing system. In addition, it is recommended to plant valuable fodder grass in places where pasture grass is rare. In contrast to the final improvement of pastures, here the soil is cultivated with a disc harrow to a depth of 4-6 cm. Harrowing is done on the sandy soils of the desert;

- three-season three-year rotational grazing should be carried out together with inter-seasonal rotational grazing to improve moderately irrigated pastures. Here, the pasture area is divided into three areas, and cattle are grazed there alternately. The load on pasture is 10% lower than calculated.

- three-season, three-year rotational grazing should be used in slightly windy pastures. Pastures are optimally used once a season. The coefficient of use of grass is 70% of the total mass.

Justification of the novelty and significance of the obtained results

For the first time, new principles and methods of assessing the state of pasture fodder resources and effective ways of their restoration were developed using ground surveys of the vegetation cover of pasture lands in the gray, gray-brown and sandy soils of the upland desert and desert regions of Kazakhstan and using modern digital technologies.

The boundaries of the study areas of pastures degraded to different degrees in the gray, gray-brown and desert sandy soils of the mountainous desert and desert regions of our republic were determined, and their physical and biological indicators were studied in the context of route field research. On the basis of the received data and the achievements of the geoinformation system, interactive digital maps of strong, medium and slightly degraded pastures on a scale of M 1:1000000 and a geoinformation system for their management were developed. The results of the research can be used by district and regional akimats, all

agricultural collectives and farmers engaged in animal husbandry in their pastures in Kazakhstan and in the steppes and desert regions using their available electronic devices.

The cartographic model showing the degree of degradation of pastures in the upland desert and desert regions, developed using modern advances in remote sensing technology, is the only one that can be used to reduce, restore and improve the degraded pastures of the researched area, and is very necessary for further long-term monitoring. is a database.

Correspondence of science to directions of development or state programs

Dissertation work on the study of the degrees of degradation, fodder value and soil cover of pasture lands approved within the program-targeted funding of the Ministry of Agriculture of the Republic of Kazakhstan for 2018-2020 "Building a geo-information system for monitoring and evaluating degraded pastures of Kazakhstan, providing management of ways to restore them" (state registration No. 0118 RK 01223) was made within the framework of the scientific program.

Contribution of the doctoral student to the preparation of each publication

During the dissertation work, the doctoral student took part in the development of the research program and methodology, field research and their conduct. He carried out the goals and objectives of the research work with great interest. In the course of the research, images were dug from gray, gray-brown and sandy soils in the monitoring areas in field conditions and their coordinates were established. Morphological characteristics of genetic layers were determined and samples were taken from them. He carried out phenological observations of pasture fodder plant species and determined their productivity. Fully participated in the laboratory analysis work, analyzed the results obtained from the research, managed to solve the given tasks by using the research methods correctly, monitoring and recording the research objects. All research results and conclusions presented in the dissertation were formulated by the researcher with his direct participation. The author took an active part in publishing the obtained results in domestic and foreign publications. According to the topic of the dissertation, a total of 8 scientific works on the final results of research work, including 4 articles in scientific publications recommended by the Control Committee in the field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 1 article in scientific journals included in the Scopus database, 2 articles in domestic scientific journals and 1 in production the proposal is published.

Dissertation volume and structure

The dissertation consists of 164 pages of computer text, including normative references, definitions, symbols and abbreviations, introduction, 5 sections, conclusion, bibliography, recommendations and appendices. The bibliography contains 189 domestic and foreign items. The structure of the dissertation consists of 36 tables and 38 figures.