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ANALYSIS OF SCIENTIFIC RESEARCH ON CATTLE GRAZING SYSTEMS IN ORDER TO SAVE PASTURE RESOURCES

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Agriculture is one of the most significant sectors of the economy. In each region, weather and geographical conditions allow the cultivation of certain crops. Also, at present, Kazakhstan pays close attention to the livestock industry. Since ancient times, the Kazakh people have been considered a nomadic people, and the vast grazing lands allowed people to raise livestock in environmentally friendly conditions. Kazakhstan has great potential in terms of exporting livestock products, and in particular, in the supply of meat. The presence of vast natural pastures in the country provides an excellent opportunity to produce competitive and, importantly, environmentally friendly livestock products [1].

Currently, animal husbandry accounts for 45% of the total gross agricultural output of Kazakhstan. In 2019, the industry finished the year with an indicator of 2.3 trillion tenge, and in the meantime, crop production produced almost 600 billion tenge more. As part of the development of the agro-industrial complex for 2017-2021, about 30% or 35.9 billion tenge was allocated for subsidizing investment projects in the field of animal husbandry. Based on the analysis and comparison of the potential of the markets of neighboring states and the domestic production capabilities of the country, the main and long-term priority of the development of the agro-industrial complex will be determined to be beef cattle breeding.

The target indicators of the sectoral development program foresee an increase in beef exports by dozens of times by 2028 - up to 372 thousand tons, that is, the country's entry into the top ten largest beef exporters in the world.

Existing scientific works claim that the main factors in the decline in soil fertility of arable land are the improper use of land and the lack of use of mineral and organic fertilizers, as well as non-compliance with crop rotation and agrotechnical measures [2]. As a result of non-compliance with these agrotechnological measures, 21.7 million hectares. pasture lands are subject to the process of gradual degradation [3]. Pasture degradation occurs when the anthropogenic factor of impact on them has exceeded the threshold of self-recovery ability. Disturbed ecosystems must be restored by taking measures to improve these lands (overseeding of grasses or replanting with sowing of perennial grasses, the introduction of pasture rotations, etc.). Unregulated grazing of livestock (excessive load), cutting down of shrubby vegetation, disorderly

movement of vehicles off the roads contribute to the intensification of deflationary processes that change the structural composition, bulk mass and humus content, causing soil degradation with loss of fertility [4].

In these works, special attention is paid to the use of geoinformation systems and technology for monitoring the target land use of agricultural land and identifying the main parameters of pasture biomass.

Moreover, the observance of rotation of pasture lands or pasture pasture with the use of progressive agrotechnological solutions is a priority for ensuring the sustainable development of the agro-industrial complex of the Republic of Kazakhstan. Some of the scientific work carried out focuses special attention on the use of a pasture-grazing system and the use of environmentally friendly production technologies and the principles of smart and green farming.

Thus, there is a need to introduce modern technological solutions that contribute to rational land use, cattle breeding and ensuring the sustainable development of the agro-industrial complex as a whole. It is also worth noting the lack of intelligent systems to support the adoption of agrotechnological decisions.

The development of methods for non-contact diagnostics of the state of pastures and crops creates the need to develop not only theoretical, but also new methodological and technical approaches to the implementation of field experiments, as well as a software and hardware base for monitoring the soil and plant complex based on geoinformation systems. Remote monitoring and sensing of the earth not only makes it possible to improve the collection of agricultural statistics, increasing the accuracy, uniformity, objectivity and frequency of observations, but also significantly improves the options for timely monitoring of the state of crops and crop forecast. Since remote monitoring data are non-contact information, for a correct understanding of the data obtained from remote sensing, it is required to use data from ground-based contact observations of the state of crops for comparison.

The development of progressive methodological approaches to the use of modern digital technologies for remote sensing of the earth and monitoring allow solving various challenges to restore the bioresource of soil and pastures for animals. The development of tools for the mass assessment of the pasture condition is an important step in optimizing the work on determining the pasture resource and reducing the labor intensity of these activities.

According to the digital business platform "QOLDAU" (Koldau), 60.6 million hectares of pastures or 80.2% of the total area were digitized using the "SuperVision Technology" service for digital land monitoring. This service was developed as part of the execution of the instructions of the Head of State K.K. Tokaev on the introduction of digital monitoring and control over the rational use of agricultural land.

This dissertation work analyzes existing articles in order to derive the main directions and existing methods in the field of application of earth remote sensing technology for pasture resource management. new solutions in this dissertation work.

Thus, there is a need to introduce modern technological solutions that promote rational land use, livestock breeding and ensure the sustainable development of the agro-industrial complex as a whole. It is also worth noting the lack of intelligent systems to support the adoption
agrotechnological solutions.

The articles considered in this literature review can be divided into the following problems:

- Harms and benefits of using electric and virtual fences to control livestock grazing. Efficiency of using these technologies.
- Derivation of the main factors of influence on the pasture resource, as well as proposals for recommendations (methods) for solving the main problem areas.
- Consideration of the effectiveness of the use of technology for controlling livestock grazing using virtual fences.
- Assessment of the state of the vegetation cover (perennial herbage) using satellite images using the vegetation index NDVI.
- To test ground and air platforms for non-destructive high-throughput biomass phenotyping and their potential to replace traditional visual assessment.
- Establishment of basic phenological indicators. Comparative analysis and relevance of the use of remote sensing for the assessment of vegetation biomass.
- Classification methods using machine learning and remote sensing to determine the quality of vegetation cover.

The above analysis of the articles allows us to conclude that the development of a decision-making model using remote sensing technology, coupled with machine learning methods based on a web portal, with the correct selection of the key parameters of the system under consideration, can give positive results in determining pasture biomass.

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