ABSTRACT
dissertation for the degree of Doctor of Philosophy (PhD)
on specialty «6D060900 – Geography»

ALDAZHANOVA GULNAR BULATOVNA

«Geographical basis for managing landscapes of agricultural use in Zhambyl region to ensure food security»

The study is aimed at achieving sustainable development of landscapes of agricultural use in Zhambyl oblast of the Republic of Kazakhstan and is aimed at: ensuring food security and production of high quality agricultural products, preservation of natural resource potential and increasing the profitability of farms.

Relevance of the research study. In the system of concepts for the development of agro-industrial complex of Zhambyl region, the most important task is to restore and preserve the productivity of agricultural landscapes, which are subject to different degrees of degradation. In these conditions, the development of the basis for the management of landscapes of agricultural use in Zhambyl region in the conditions of modern management is relevant, both for the future planning of the agricultural sector of the economy, and for decision-making in the field of environmental and food security.

Object of study – landscapes of agricultural use in Zhambyl region of the Republic of Kazakhstan.

Subject of study – studying the mechanism of functioning of agricultural landscapes and their management in the context of ensuring food security in Zhambyl region.

Purpose of the study – To develop a geographical basis for managing landscapes for agricultural use in the Zhambyl region of the Republic of Kazakhstan to ensure food security and increase the profitability of agricultural formations.

To achieve this goal, the following **tasks** were identified**:**

– provide an analysis of approaches, principles and methods for assessing the state of landscapes used for agricultural development;

– analyze the current state of land and water resources;

– conduct assessments of the structural organization of modern landscapes and natural resource potential;

– assess the degree of degradation of agricultural landscapes and develop their functional zoning;

– develop the main directions of sustainable development of landscapes of agricultural use and their management scheme to ensure food security.

Research methodology. The theoretical and methodological platform of the dissertation research is a synthesis of systemic, landscape-ecological and GIS-technological approaches, including a set of leading principles and methods of geoecology, landscape science, agricultural environmental management, etc. The dissertation research is interdisciplinary, complex in nature. The use of an integrated geographical approach made it possible to identify the nature, scale and speed of development of degradation processes in landscapes of agricultural use. To assess the degree of landscape degradation, the following methods were used: landscape-indicative, comparative-geographical; assessment of the ecological state of landscapes based on integrated and specific parameters; laboratory tests (soil and water); mathematical modeling, processing of statistical data, etc. The use of field research methods, monitoring observations, interpretation of remote sensing data and GIS technologies made it possible to solve a number of research problems and create a series of thematic assessment maps.

Sources of research materials – archival, cartographic, literary and statistical materials - land resources department and the Statistics Agency of the Zhambyl region of the Republic of Kazakhstan, etc.; cartographic material: Geomorphological map of Kazakhstan, scale 1:1,500,000

(authors: Visloguzova A.V., Medeu A.R. et al.); Soil map of Zhambyl region of the Republic of Kazakhstan, scale 1:300,000; Vegetation map of Kazakhstan and Central Asia, scale 1:2,500,000 (author: Akzhigitova N.I., Arystangaliev S.A. et al.); Topographic basis, scale 1: 500,000; Landscape map of Kazakhstan, scale 1:2 500 000 (author: Chupakhin V.M., Veselova L.K., Geldiyeva G.V.); stock materials of JSC «Institute of Geography and Water Security» of the Ministry of Education and Science of the Republic of Kazakhstan; factual material obtained during field research for 2018-2020); remote sensing data, including multispectral satellite images of Landsat, Sentinel, etc. for 2015-2020.

The scientific novelty of the research is determined by the following positions:

– for the first time for the Zhambyl region, an assessment of the natural resource potential was made, which is the basis for determining priority areas for agricultural development and makes it possible to make decisions to ensure sustainable development and food security;

– For the first time in the Zhambyl region, research was carried out to identify patterns of development of degradation processes in landscapes of agricultural use and a series of assessment and application maps were created aimed at the sustainable development and profitability of agricultural formations;

– For the first time, functional zoning of landscapes for agricultural use in the Zhambyl region was developed for the purposes of sustainable development and improving the living standards of the rural population;

– for the first time, a scientifically based scheme for managing landscapes of agricultural use in the Zhambyl region has been developed based on indicators reflecting the main directions of activity to achieve food security and sustainable development.

Main provisions submitted for defense:

1. Agricultural nature management in the territory of Zhambyl region should be carried out on the basis of taking into account the regularities of structural organization of landscapes and assessment of their natural resource potential, which allows to ensure food security of the region.

2. Violation of the ecological balance between natural-territorial complexes and agricultural natural resource use leads to degradation of landscapes of agricultural use and reduction of their productivity, affecting the food security of the region.

3. Implementation of the developed directions of activity on rational use of landscapes of agricultural use is aimed at their stabilization and ensuring food security of the region.

Theoretical and practical significance of the work. *The theoretical significance of the research results* is to obtain new scientific knowledge in the field of agricultural environmental management, in particular landscapes of agricultural use, characterized by varying productivity and degree of degradation.

The practical value and significance of the work lies in solving a number of problems associated with a decrease in the productivity of agricultural landscapes by providing management structures, agricultural formations and public organizations with cartographic support, scientifically based requirements and recommendations. The results of this study will allow: to fill the deficit of scientific and practical knowledge when developing integrated plans for the development of rural areas in the context of food security, etc.

The results of the dissertation research were introduced into:

1. «Ecoservice-S» LLP – «Map of the natural resource potential of landscapes of the Zhambyl region», scale 1:1,500,000 (Act of implementation dated July 17, 2023 No. 786), which was used in the development of measures for the sustainable use of land resources in Southern Kazakhstan.

2. «Renaissance Plus» LLP – «Map of degradation of landscapes for agricultural use in the Zhambyl region», scale 1:1,500,000 (Act of implementation dated July 11, 2022 No. 18/07), which was used in the development of long-term plans for territorial agricultural environmental management in the Zhambyl region.

The author's personal contribution to solving the objectives of the dissertation research is:

– in assessing the natural resource potential of landscapes in the Zhambyl region of the Republic of Kazakhstan;

– in conducting field research to study land and water resources, the degree of degradation of agricultural landscapes in the Zhambyl region of the Republic of Kazakhstan together with scientists from the JSC «Institute of Geography and Water Security» of the Ministry of Education and Science of the Republic of Kazakhstan;

– in the development and creation of a series of evaluative thematic cartographic models for the territory of Zhambyl region;

– in the development of a landscape management scheme for agricultural use in Zhambyl region;

– in the preparation and publication of the obtained scientific results on the topic of the research in rating journals (Geojournal of tourism and Geosites - Q2, Oxidation Communications - Q3). The main provisions of scientific articles are reflected in the sections of the dissertation for the PhD degree.

The dissertation research is presented in the following sections:

Scientific and methodological basis for assessing the state of agricultural landscapes. An analysis of approaches, principles and methods for assessing the state of landscapes used in agricultural environmental management is given. Criteria and indicators for assessing the degradation of agricultural landscapes are presented.

Current state of land and water resources in Zhambyl region. An analysis of the state of land and water resources in the Zhambyl region was carried out, which showed that the entire land fund of the region is 11938.7 thousand hectares, agricultural lands predominate (39.3% of the land fund area). Agricultural land is located in all categories of land and amounts to 9235.4 thousand hectares or 77.3% of the area of the region's land fund. The structure of agricultural land is represented by - arable land, occupying 834.2 thousand hectares (9.0% of the land area), of which 205.0 thousand hectares are irrigated; pastures 8142.2 thousand hectares (88.2%); hayfields 251.9 thousand hectares (2.7%) and perennial plantings (0.1%). It has been established that the sustainable functioning of agriculture in the Zhambyl region is determined by the water availability of the Asy, Shu and Talas rivers. The flow of the Shu and Talas rivers is formed on the territory of Kyrgyzstan, the volume of actual water supply along the river. Shu on the territory of Kazakhstan on average accounts for 57.2% of the volume of water allocation, and along the river. Talas - 78.2%, respectively. In this regard, over the past 5 years compared to the period 2008-2012. The volume of water supply for environmental releases in the lower reaches of the Shu and Talas rivers decreased by 8.5 and 16.7%, respectively, and the amount of water intake for watering hayfields on average in the region decreased by 3.6%, which affects the development of agriculture. A series of cartographic models has been compiled, reflecting the state of land and water resources of the Zhambyl region, on a scale of 1:500,000.

Natural resource potential of landscapes of Zhambyl region. A landscape map was developed for the territory of the Zhambyl region on a scale of 1: 500,000, on the basis of which a qualitative and quantitative analysis of the spatial landscape structure of the region was carried out, which made it possible to establish patterns of distribution of the predominant types of landscapes that play an important role in their agricultural development. In total, 86 types of landscapes have been identified in the region, of which only 35% of species diversity have natural resource potential corresponding to agricultural production characteristics for the development of irrigated and rainfed agriculture. The conducted integral assessment of the natural resource potential of landscapes established that the territory of the region is characterized by their uneven distribution. The greatest resource potential is found in semi-desert and steppe foothill, steppe and dry-steppe low-mountain landscapes, occupying 1802.7 thousand hectares (15.1% of the entire territory of the region), and the lowest - flat desert landscapes, occupying 6494.4 thousand hectares or 54.4 % area of the region. Almost all natural complexes of the region are suitable for grazing farm animals; About 1910.1 thousand hectares (16% of the region's territory) are suitable for haymaking. Irrigated and rain-fed agriculture, according to a cumulative analysis of the landscapes

that make up the natural resource potential, is possible on 2,745.8 thousand hectares (25% of the region's territory).

Assessment of degradation of agricultural landscapes in Zhambyl region. Based on the results of field research (2018-2020) and remote sensing data, a map of Degradation of agricultural landscapes in the Zhambyl region on a scale of 1:1,500,000 was developed. An assessment of the degree of degradation of agricultural landscapes showed that very highly degraded landscapes are observed in an area of 418. 7 thousand hectares (4% of all lands), which are confined to tectonic-denudation, small-hilly-tectonic-denudation, alluvial-proluvial types of landscapes, are located in the southern regions of the region and are represented by pockets of irrigated arable land with secondary soil salinization; manifestation of water and wind erosion, knocked down rural pastures; heavily degraded landscapes are noted on an area of 2721.2 thousand hectares (26% of all lands), represented mainly by landscapes of aeolian and basement plains located on saline and eroded irrigated areas in the valleys of the Shu and Talas rivers, as well as overgrazed pastures of the foothills and floodplains and above-floodplain terraces of valley landscapes; Moderately degraded landscapes occupy an area of 5861.3 thousand hectares (56% of all lands), occur on all types of landscapes, and are represented by pastures and arable areas. The leading processes of landscape degradation here are deflation, overgrazing by livestock, salinization and water erosion; slightly degraded landscapes – 1465.3 thousand hectares (about 14% of the region's territory), located in the north and northeast of the region on basement, tectonic-denudation, strata, denudation types of landscapes, used mainly for pastures. The leading natural and anthropogenically caused processes of their degradation here are deflation and unregulated grazing.

Functional zoning of landscapes in Zhambyl region. To ensure food security, based on a combined analysis of the results of assessments of the natural resource potential and the degree of degradation of landscapes for agricultural use in the Zhambyl region, its functional zoning was carried out, where the entire territory is divided into zones: economically feasible use of landscapes: with an intensive regime of agricultural use of landscapes of better and good quality , with an extensive regime of agricultural use of landscapes of good and average quality; ecologically adaptive use of landscapes; use of landscapes in conservation mode; landscapes of agricultural use in restoration mode.

Main directions of sustainable development of agricultural landscapes in Zhambyl region. A set of environmental proposals has been developed to prevent the development of degradation processes of landscapes of agricultural use in the region, which was created on the basis of a systemic analysis and structuring of regional environmental problems in the field of agricultural environmental management, is targeted, systematized taking into account the degree of land degradation and is represented by environmental proposals for: rainfed and irrigated arable land, pasture and hay lands, forest plantations. The developed scientifically based scheme for managing landscapes for agricultural use in the region is aimed at: regulation and rational use of water resources for agricultural purposes; strengthening environmental protection activities in areas of agricultural production, etc.

Based on the results obtained, the following conclusions were made:

1. Integral assessment of the natural-resource potential of landscapes in Zhambyl oblast is a prerequisite for rational nature management and creation of an effective system of agricultural nature management, as well as the basis for the development of priority areas of agriculture.

2. Based on the conjugate analysis of the results of assessments of natural-resource potential and the degree of degradation of landscapes of agricultural use of Zhambyl region, functional zoning was carried out, which is a plan of natural-economic organization of the territory, contributing to sustainable development and food security of the region.

3. The developed series of assessment cartographic models of Zhambyl oblast (landscape, natural-resource potential, landscape degradation, etc.) promotes decision-making on optimization of agricultural nature management and food security provision.

4. The scientifically-based scheme of management of landscapes of agricultural use in Zhambyl region is developed on the basis of indicators reflecting the main directions of activities

to achieve sustainable agricultural nature management and food security, and is the basis for the formation of regional policy aimed at maintaining environmental stability of the natural environment.

Approbation of the study. The main results of the dissertation research were reported:

– at the International Scientific and Practical Conference: “Farabi Alemi” (2019, Almaty, RK);

– at the 19th International Multidisciplinary Scientific GeoConference “SGEM 2019” (2019, Albena, Bulgaria);

– at the 20th International Multidisciplinary Scientific GeoConference “SGEM 2020” (2020, Albena, Bulgaria);

– at the International Scientific and Practical Conference «Environmental problems and sustainable development of regions and cities of the Republic of Kazakhstan» (2021, Astana, RK);

– at the International Scientific and Practical Conference «The Problem of Development of Natural Sciences and Education in the Context of Sustainable Development Goals» (2022, Almaty).

Based on the dissertation research materials, 10 printed works were published, including 2 articles in journals included in the Scopus database, 3 articles in republican scientific journals from the list of the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 5 articles in materials of international conferences.

Structure of the dissertation. The dissertation is presented on 197 pages and consists of normative references, definitions, symbols and abbreviations, introduction, 5 sections, conclusion and a list of sources used from 212 titles, of which 29 are in foreign languages; contains 27 tables, 65 figures and 9 appendices.