BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg
BG PULSE JOURNAL

ASSESSMENT OF THE RESISTANCE OF AGRICULTURAL LANDS TO CLIMATE RISKS AND IMPROVEMENT OF DIRECTIONS FOR SUSTAINABLE USE (ON THE EXAMPLE OF BUKHARA REGION)

Nosirov Akbar Haydarovich
International Relations Specialist at the
Bukhvilyerloyiha Scientific Design Institute
doi:https://doi.org/10.5281/zenodo.22327245

Annotation This article examines the issues of assessing the resilience of agricultural lands to climate risks and improving the directions of their sustainable use using the example of the Bukhara region. The study analyzed the impact of factors such as drought, high temperatures, water scarcity, high evaporation, soil salinity, and wind erosion caused by climate change on the ecological condition and production potential of agricultural land. It is proposed to comprehensively consider climatic risk, land vulnerability, and adaptation potential when assessing the climatic resilience of lands. The importance of widespread introduction of water-saving irrigation technologies, maintaining soil fertility, improving reclamation, selecting drought-resistant crops, developing agroforestry, and monitoring based on GIS and remote sensing technologies is also justified. The results of the study will serve to develop practical recommendations for the environmentally and economically sustainable use of agricultural land in the Bukhara region.

Keywords: agricultural land, climate risk, climate change, drought, water scarcity, salinity, land degradation, soil fertility, sustainable use, water-saving technologies, GIS, remote sensing.

Introduction

Today, climate change is becoming one of the most important factors affecting the sustainability of natural resource use. Globally, increasing air temperatures, changes in the spatial and seasonal distribution of precipitation, increased drought periods, and increased demand for water resources are having a significant impact on agricultural production.

Agricultural land resources are one of the natural resources most sensitive to climate change. Because the fertility of the land, moisture regime, reclamation status, and yield are directly related to temperature, precipitation, water supply, and evaporation processes. The increased risk of climate change increases the likelihood of agricultural land degradation and reduced productivity.

In the conditions of Uzbekistan, this problem is especially relevant for regions with a dry climate. In the Bukhara region, a significant part of agricultural production depends on irrigation, and limited water resources, high summer temperatures, high evaporation, and soil salinity significantly affect the use of land resources.

Therefore, assessing the resilience of agricultural lands to climate risks and developing adaptive approaches to managing them are important for ensuring the long-term ecological and economic sustainability of the region.

Purpose of the study

The main purpose of the study is to assess the resistance of agricultural lands to climate risks and to develop scientific and practical recommendations for improving the directions of sustainable use and management of land resources in the conditions of Bukhara region.

Research objectives

To achieve the stated goal, the following tasks will be implemented:

Identify the main climatic risks affecting agricultural lands;

Assess the agroclimatic conditions of the Bukhara region;

study the impact of drought and high temperatures on agricultural land;

analyze water scarcity and irrigation efficiency issues;

assess soil salinization and land degradation processes;

development of criteria for determining the climatic resistance of soils;

grouping of territories according to the level of climatic danger;

development of proposals for improving mechanisms for sustainable use of land and Water Resources.

Research techniques

In the study, methods of systematic analysis, comparative-geographical, statistical, cartographic, expert assessment and territorial analysis can be used.

When assessing the climatic resilience of agricultural land, it is advisable to take into account the following group of indicators:

Ko‘rsatkichlar guruhi	**Asosiy indikatorlar**
Iqlimiy	Harorat, yog‘in, qurg‘oqchilik, bug‘lanish
Suv resurslari	Sug‘orish suvi bilan ta’minlanganlik, suv sarfi, suv tanqisligi

Ko‘rsatkichlar guruhi	Asosiy indikatorlar
Tuproq	Sho‘rlanish, gumus, unumdorlik, eroziyaga moyillik
Meliorativ	Drenaj holati, yer osti suvlari sathi va minerallashuvi
Qishloq xo‘jaligi	Hosildorlik, ekin tarkibi, suv talabchanlik
Moslashuv	Suv tejovchi texnologiyalar, zamonaviy agrotexnologiyalar, monitoring

By standardizing these indicators, the Earth's climatic Resilience Index can be calculated.

Conditionally, resilience is expressed through the following relation:

ICh = (MS + TS + SS) / (IQ + ZD

Here:

ICh — climatic resilience index;

MS — meliorative stability;

TS — soil stability;

SS — water supply;

IQ — climatic risk;

ZD is the level of weakness of the Earth.

In a practical study, standardizing the indicators from 0 to 1 and giving each indicator a weight factor makes the results more reliable.

Natural and climatic features of the Bukhara region

Bukhara region is one of the regions of Uzbekistan with dry and continental climatic conditions, with high temperatures and strong evaporation in the summer months. The low and uneven distribution of precipitation determines the limited natural moisture.

Under such conditions, the productivity of agricultural land largely depends on the efficiency of irrigation systems. At the same time, high temperatures and strong evaporation increase the amount of water required for irrigation.

In some regions of the Bukhara region, the reclamation status of the land and soil salinity are important factors affecting the efficiency of agricultural use. Therefore, when assessing climatic risks, it is necessary to take into account, along with natural-climatic factors, the anthropogenic effect.

The main climatic risks affecting agricultural land

Drought

Drought is one of the main factors that reduce the climatic resilience of agricultural land. Low precipitation and high temperatures cause rapid depletion of soil moisture.

In irrigated agriculture, the effects of drought are mainly manifested through increased demand for irrigation water. Interruptions in the water supply can cause crops to become stressed during the growing season and lead to a decrease in productivity.

High temperature

High temperatures increase the water demand of plants and enhance the process of evapotranspiration. Excessive hot periods can negatively affect plant flowering, pollination, and fruit formation.

Therefore, when placing crops, it is necessary to take into account their agro-climatic requirements, features of the growing season and heat resistance.

Water scarcity

The limited availability of water resources in the Bukhara region directly affects the sustainability of agricultural land use.

In water-scarce conditions, the high proportion of water-intensive crops, losses in irrigation networks, and inefficient irrigation methods can exacerbate existing problems.

Therefore, improving the efficiency of the use of Water Resources should be the main focus of the policy of adaptation to climatic risks.

Soil salinity

In dry climates, the upwelling of salts in the soil as a result of strong evaporation can enhance salinity processes. The state of irrigation and drainage systems also affects this process.

Saline soils make it difficult for crops to absorb water and nutrients. As a result, the natural and economic productivity of the land decreases.

Therefore, it is necessary to regularly monitor soil salinity and carry out reclamation activities based on the real state of the area.

Wind erosion

In dry and windy conditions, wind erosion of the soil can occur. The risk of losing the fertile layer of soil is especially high in areas with sparse vegetation cover, open and unprotected areas.

To prevent wind erosion, it is important to establish windbreaks, minimal tillage, cover the soil surface with crop residues, and introduce agroforestry elements.

Regional approach to assessing climate resilience

The resilience of agricultural land varies from region to region. Therefore, it is advisable to use a regional differential approach instead of assessing all land in the Bukhara region based on a single criterion.

Land can be conditionally divided into three groups:

High-resilience areas — areas with relatively good water supply, high soil fertility, low salinity, and the use of modern irrigation technologies.

Moderately resistant areas are lands where climatic hazards exist, but where the impact of these hazards can be reduced through reclamation and agrotechnical measures.

Areas of low tolerance are land with limited water supply, high levels of salinity or degradation, and sensitive to drought and high temperature effects.

Such a classification makes it possible to determine what adaptive measures should be given priority in the regions.

Directions for improving the sustainable use of land resources

1. Widespread introduction of water-saving technologies

One of the most effective ways to increase resilience to climate risks is to improve water use efficiency.

Technologies such as drip irrigation, sprinkler irrigation, laser leveling, and digital irrigation management allow for reduced water loss.

In addition, excessive watering can be prevented by adjusting the irrigation to the actual water demand of the crop.

2. Optimization of crop composition

When selecting crops in the face of climate change, it is important to consider their water requirements and tolerance to high temperatures.

The use of varieties that are drought-resistant and suitable for growing season Area conditions increases the stability of agricultural production.

Crop diversification, on the other hand, reduces the risk of becoming too attached to a type of crop.

3. Maintaining soil fertility

Maintaining soil fertility is a key condition for the long-term sustainability of agricultural land.

To do this:

crop rotation;

use of organic fertilizers;

minimum tillage;

retention of plant residues in the soil;

green fertilization;

anti-erosion agrotechnical measures

expansion is necessary.

An increase in the amount of organic matter in the soil improves its moisture retention capacity and increases drought resistance.

4. Improvement of reclamation systems

It is important to increase the efficiency of collector-drainage networks in the fight against salinization.

It is necessary to continuously monitor groundwater levels and mineralization, scientifically plan saline leaching measures, and adapt irrigation rates to soil conditions.

5. Shelterbelts and agroforestry

Ihota Groves reduce wind speed, prevent soil from flying and improve microclimate.

The rational use of trees and shrubs in agricultural landscapes serves to maintain biodiversity while increasing environmental sustainability.

6. Use of GIS and remote sensing technologies

The use of geographic information systems and remote sensing data is important in assessing the climatic resilience of agricultural land.

Through satellite data:

land cover change;

vegetation status of crops;

soil moisture;

drought stress;

salinity indicators;

degradation processes

can be determined.

By combining this information with meteorological and agroecological indicators, it is possible to create climate risk maps of agricultural land.

Proposed model of sustainable management

The following system is proposed to be introduced in the Bukhara region to improve the sustainable use of agricultural land:

Earth monitoring → Climate risk assessment → Calculation of resilience index → Territorial zoning → Selection of adaptation measures → Monitoring of results.

In the first stage, information about the soil, water and reclamation of the lands is collected.

The second stage determines the risk of drought, high temperatures, water shortages, salinity and erosion for each area.

The third stage is an endurance index based on risk levels, Earth weakness, and adaptive potential.

In the fourth stage, areas are mapped according to endurance levels.

In the fifth stage, an individual adaptation strategy is developed for each region.

The effectiveness of the activities carried out in the sixth stage is assessed on the basis of environmental and economic criteria.

Discussion

The study shows that the resilience of agricultural land to climate risks is not determined solely by natural conditions. The method of land management, the technical condition of irrigation systems, crop composition, reclamation measures, and the level of use of modern agrotechnologies are also important.

For example, two agricultural areas in the same climate zone may have significantly different levels of climate resilience due to the use of water-saving technologies or the efficiency of the drainage system.

Therefore, the triad of "risk – vulnerability – adaptation potential" should be adopted as the main methodological approach in assessing climate resilience.

In the conditions of the Bukhara region, saving water resources, controlling soil salinity, and maintaining soil fertility are interrelated tasks. Neglecting one of these areas can lead to the exacerbation of other problems.

Therefore, it is necessary to prioritize not only increasing productivity, but also ensuring the long-term ecological sustainability of agricultural land in agricultural land management.

Summary

The resilience of agricultural land to climate risks is determined by the impact of factors such as drought, high temperatures, water scarcity, soil salinity, and wind erosion.

In the dry and continental climate of the Bukhara region, the efficient use of water resources is one of the key factors in ensuring the sustainability of agricultural land.

When assessing the climatic resilience of lands, it is necessary to take into account not only climatic risks, but also soil conditions, reclamation conditions, water supply, and the adaptive capacity of farms.

The widespread introduction of water-saving irrigation technologies will reduce the negative impact of water scarcity and increase the climate resilience of agricultural land.

Maintaining soil fertility, combating salinization, and improving drainage systems are important conditions for the long-term use of land resources.

Introducing drought- and heat-resistant crop varieties and diversifying crop composition increases the adaptability of agricultural production to climate risks.

The use of GIS and remote sensing technologies allows for rapid assessment of land conditions, identification of hazardous areas, and improved territorial management decisions.

It is advisable to form a continuous management system based on the principle of "monitoring - assessment - zoning - adaptation - monitoring" for sustainable use of agricultural land in the Bukhara region.

Overall, ensuring the sustainability of agricultural land in the face of climate change requires a comprehensive approach. Rational use of land and water resources, preservation of soil fertility, improvement of land reclamation, expansion of water-saving technologies, and development of digital monitoring should be considered as the main directions for ensuring the long-term ecological and economic sustainability of agriculture in the Bukhara region.

REFERENCES

1. O‘zbekiston Respublikasi. Yer kodeksi.
2. O‘zbekiston Respublikasi. Suv kodeksi.
3. O‘zbekiston Respublikasi Qishloq xo‘jaligi vazirligining qishloq xo‘jaligini rivojlantirish va yer resurslaridan foydalanishga oid materiallari.
4. O‘zbekiston Respublikasi Ekologiya, atrof-muhitni muhofaza qilish va iqlim o‘zgarishi sohasidagi rasmiy materiallar.
5. IPCC. Climate Change: Impacts, Adaptation and Vulnerability.
6. FAO. The State of the World's Land and Water Resources for Food and Agriculture.
7. FAO. Climate Change and Food Security: Risks and Responses.
8. World Bank. Uzbekistan bo‘yicha iqlim xavflari va qishloq xo‘jaligiga oid tahliliy materiallar.
9. O‘zbekiston Respublikasining yer va qishloq xo‘jaligi resurslariga oid statistik ma’lumotlar to‘plamlari.
10. Buxoro viloyatining yer, suv va qishloq xo‘jaligi resurslariga oid hududiy statistik materiallar.