HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

ASSESSMENT OF THE RESILIENCE OF AGRICULTURAL LAND TO CLIMATE RISKS AND IMPROVEMENT OF SUSTAINABLE USE PRACTICES IN BUKHARA REGION

Nosirov Akbar Haydarovich

International Relations Specialist at the Bukhvilyerloyiha Scientific Design Institute

Abstract: This article discusses the issues of assessing the resilience of agricultural lands to climate hazards, in particular, high temperatures, drought, water scarcity, strong evaporation, wind erosion and soil salinity in the Bukhara region. The natural and climatic conditions of the region, the characteristics of agricultural land use and the impact of climate change on land resources are analyzed. The study proposes the integrated use of agroclimatic, hydrological and soil-reclamation indicators to assess the resilience of lands to climate hazards. Scientific and practical recommendations have also been developed on the expansion of water-saving irrigation technologies, maintaining soil fertility, preventing salinity, introducing drought-resistant crops, strengthening digital monitoring and agro-ecological approaches.

Keywords: Bukhara region, agricultural lands, climate change, climate risk, drought, water scarcity, soil salinity, erosion, land degradation, sustainable use, water-saving technologies.

Introduction

Today, global climate change is significantly affecting the natural and economic sustainability of agricultural production. Rising temperatures, uneven distribution of precipitation across regions and seasons, repeated droughts, increased pressure on water resources, and increased extreme weather events are among the main factors reducing the efficiency of agricultural land use. These problems are especially acute in regions of Uzbekistan with desert and dry continental climate conditions. Bukhara region is also one of the regions with limited water resources, high air temperatures in the summer months, and strong evaporation. Therefore, the productivity of agricultural lands directly depends not only on soil fertility, but also on water supply, land reclamation status, and the level of adaptation to climatic hazards. Irrigated agriculture plays an important role in the Bukhara region. However, long-term intensive use of irrigated lands, inefficient use of water resources, and insufficiently efficient operation of drainage systems can exacerbate soil salinization and degradation processes in some regions. From this point of view, assessing the resilience of agricultural lands to climatic hazards by region and developing scientifically based mechanisms for their sustainable use is an important scientific and practical task.

Purpose and objectives of the study

The main purpose of the study is to assess the resilience of agricultural lands in the Bukhara region to major climatic hazards and to improve the ecologically, economically and socially sustainable use of land and water resources.

To achieve this goal, the following tasks were set:

HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

Study the natural-climatic and agro-ecological characteristics of the Bukhara region;

Identify the main climatic hazards affecting agricultural lands;

Assess the impact of drought, high temperatures, water scarcity and soil salinity on land resources;

Develop criteria for a comprehensive assessment of the resilience of lands to climatic hazards;

Determine the level of risk by region;

Substantiate priority areas for sustainable use of agricultural lands;

Develop proposals for improving climate change adaptation measures.

Research methodology

It is advisable to use systematic, regional, comparative-geographical and statistical analysis methods in the study. The following main groups of indicators can be taken into account when determining the resilience of agricultural lands to climatic hazards:

Climatic indicators: average and maximum temperature, precipitation amount, drought duration, evaporation rate and frequency of heat waves.

Water resource indicators: irrigation water supply, water consumption, irrigation efficiency, water shortage level and groundwater status.

Soil and land reclamation indicators: soil salinity, humus content, soil fertility, erosion susceptibility, groundwater level and drainage status.

Agricultural indicators: yield variability, crop composition, crop water demand and drought resistance.

Adaptation capacity: the level of implementation of water-saving technologies, the use of modern agricultural technologies, digital monitoring and the economic potential of farms. Based on these indicators, regions can be divided into “high”, “medium” and “low” levels of resilience. In this case, the resilience index is assessed as low in regions with high climate risk, limited water supply and high salinity.

Main climatic hazards in Bukhara region

The dry continental climate of Bukhara region increases the impact of a number of natural hazards on agricultural lands.

Drought

Drought is one of the most important climatic hazards for agriculture. As a result of low rainfall and high temperatures, soil moisture quickly decreases. In irrigated agriculture, crop productivity largely depends on the availability of irrigation water. Intensification of drought increases the need for crops for water during the growing season. As a result, in conditions of water scarcity, productivity may decrease, production costs may increase, and the efficiency of some land use may decrease.

High temperature

High temperatures in the summer months have a negative impact on the physiological processes of plants. Especially during the flowering and fruiting periods, excessive heat can reduce the

HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

productivity of agricultural crops. High temperatures increase evaporation from the soil and water surface, increasing the need for irrigation. This creates additional pressure in conditions of limited water resources.

Water scarcity

Since a large part of agriculture in Bukhara region relies on irrigation, the issue of efficient use of water resources is of strategic importance. In conditions of water scarcity, the use of traditional irrigation methods can increase water losses. Therefore, modernization of irrigation systems and widespread introduction of water-saving technologies are one of the main conditions for increasing resilience to climate hazards.

Soil salinization

Soil salinization is one of the important agro-ecological problems affecting the fertility of agricultural lands in Bukhara region. Strong evaporation, mineralized groundwater, and the condition of irrigation and drainage systems are closely related to salinization processes.

Increased salinity makes it difficult for plants to absorb water and nutrients and reduces productivity. Therefore, the condition of the soil should be one of the main indicators when assessing resilience to climate hazards.

Wind erosion

The risk of wind erosion increases in dry climates and areas with sparse vegetation cover. Strong winds can worsen the agroecological condition of the land by blowing away small and fertile soil particles.

Methods such as establishing hedgerows, covering the soil surface with plant residues, and minimal tillage are important against wind erosion.

Assessing the climate resilience of agricultural lands

The resilience of lands to climate hazards should be assessed not based on a single indicator, but taking into account the relationship between risk, vulnerability, and adaptive capacity.

Conditionally, climate resilience can be expressed by the following formula:

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

where:

ICh — climate resilience index;

MS — reclamation potential;

TS — soil stability;

SS — water supply;

IQ — climate risk level;

ZD — land vulnerability level.

HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

In applied research, standardizing each indicator and assigning them weighting coefficients using expert or statistical methods allows for more accurate results.

For example, lands with high resilience may have a stable water supply, low salinity, high soil fertility, and water-saving technologies. Although some risks exist in lands with medium resilience, the ability to manage them remains. In lands with low resilience, the risks of drought, water scarcity, salinity, and degradation are manifested simultaneously.

Directions for improving sustainable use of land resources

Expanding water-saving irrigation technologies

One of the most important directions for increasing the climate resilience of agricultural lands in the Bukhara region is to increase water use efficiency.

The use of drip irrigation, sprinkler irrigation, laser leveling, and digital irrigation control technologies can reduce water consumption and improve water supply to crops.

Crop diversification

In the context of climate change, an excessive share of water-intensive crops can increase the vulnerability of the region to climatic hazards. Therefore, it is necessary to select crop varieties that are resistant to water scarcity and high temperatures, and adapt crops to the agro-climatic conditions of the region. Crop diversification not only reduces climatic hazards, but also increases the economic sustainability of agricultural production.

Soil fertility restoration

To maintain soil fertility, it is necessary to rationally use organic fertilizers, introduce crop rotation, store plant residues in the soil, and develop minimal tillage technologies. Increasing the amount of organic matter in the soil improves its moisture retention capacity. This increases the resilience of crops in drought conditions.

Strengthening reclamation measures against salinization

In the restoration of saline lands, it is necessary to ensure the effective operation of drainage systems, optimize irrigation standards, implement salt leaching measures on a scientific basis, and regularly monitor groundwater levels. In this case, a differentiated approach based on soil and hydrogeological conditions is more effective than a uniform land reclamation approach to all lands.

Development of perimeter tree plantations and agroforestry

In order to prevent wind erosion and improve the microclimate, it is important to establish perimeter tree plantations around agricultural areas. Protective strips consisting of trees and shrubs reduce wind speed and limit soil erosion under the influence of wind. At the same time, the agroforestry approach serves to increase biodiversity and ensure the ecological stability of agricultural landscapes.

Introduction of a digital monitoring system

It is advisable to use remote sensing, geographic information systems and satellite data to continuously monitor the climate resilience of agricultural lands.

HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

With the help of such a system, it is possible to monitor:

the state of crop vegetation;

soil moisture;

salinity processes;

water stress;

land degradation;

The risk of drought can be observed in certain regions.

Based on this data, a map of the resilience of agricultural lands to climate hazards can be created and regularly updated.

Proposed practical mechanism

To improve the sustainable use of agricultural lands in the Bukhara region, it is proposed to introduce the following sequence:

Stage 1 — inventory. Integrate data on the soil, land reclamation and agroclimatic conditions of agricultural lands into a single geodatabase.

Stage 2 — risk assessment. Identify the risks of drought, high temperatures, water scarcity, salinity and erosion for each region.

Stage 3 — resilience indexing. Calculate the climate resilience index taking into account the level of risk, land vulnerability and adaptation potential.

Stage 4 — zoning. Divide lands into high, medium and low resilience categories.

Stage 5 — identify adaptation measures. Development of individual agrotechnical, land reclamation and water management measures for each region.

Stage 6 — monitoring. Regular assessment of the ecological and economic effectiveness of the measures taken.

The main advantage of this mechanism is that land resource management is carried out not on a general basis, but on the basis of the real ecological and climatic conditions of the region.

Discussion

The resilience of agricultural lands in the Bukhara region to climate hazards depends not only on natural conditions, but also on human activity. The level of resilience of two agricultural regions located in the same climatic conditions may differ due to the state of the irrigation system, soil fertility, drainage efficiency, crop composition and technological capabilities of farms.

Therefore, it is necessary to assess climate resilience not only as a “natural hazard”, but also based on the interrelationship of hazard + vulnerability + adaptive capacity.

In addition, increasing the efficiency of water resource use is a central element in ensuring the climate resilience of lands. Saving water can not only reduce irrigation costs, but also reduce the risk of soil salinization and secondary degradation.

HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

Conclusion

Based on the results of the study, the following conclusions can be drawn: Drought, high temperature, water scarcity, soil salinity, and wind erosion are the main factors affecting the resilience of agricultural lands to climate hazards in the Bukhara region. The increase in climate hazards can negatively affect the productivity of agricultural lands and the economic efficiency of their use. When assessing land resilience, it is necessary to comprehensively take into account not only climatic indicators, but also water supply, soil fertility, salinity, drainage conditions, and the adaptive capabilities of farms. Expanding water-saving irrigation technologies is one of the most important areas for increasing the climate resilience of agricultural lands in the Bukhara region. Maintaining soil fertility, crop rotation, using organic matter, minimal tillage, and developing perimeter tree plantations against wind erosion ensure long-term ecological stability of lands. The use of GIS, remote sensing and digital monitoring technologies in agricultural land management allows for rapid identification of regional risks and increased efficiency of management decisions. It is advisable to develop and implement a regional assessment system based on the principle of “climate risk - land vulnerability - adaptive capacity” for the Bukhara region. In general, sustainable use of agricultural land requires the integration of climate change adaptation, water resource conservation, prevention of soil degradation and modern digital monitoring into a single system. This approach will serve to increase the environmental and economic sustainability of agricultural production in the Bukhara region.

References

1. O‘zbekiston Respublikasi. Yer kodeksi.
2. O‘zbekiston Respublikasi. Suv kodeksi.
3. O‘zbekiston Respublikasi Qishloq xo‘jaligi vazirligi materiallari.
4. O‘zbekiston Respublikasi Ekologiya, atrof-muhitni muhofaza qilish va iqlim o‘zgarishi vazirligi materiallari.
5. FAO. The State of the World's Land and Water Resources for Food and Agriculture.
6. FAO. Climate Change and Food Security: Risks and Responses.
7. IPCC. Climate Change: Impacts, Adaptation and Vulnerability.
8. World Bank. Climate Risk Country Profile: Uzbekistan.
9. O‘zbekistonning qishloq xo‘jaligi, suv xo‘jaligi va yer resurslariga oid statistik ma’lumotlar to‘plamlari.
10. Buxoro viloyatining yer, suv va qishloq xo‘jaligi resurslariga oid hududiy statistik ma’lumotlar.