Global Water Partnership Central Asia and Caucasus
(GWP-CACENA)

Project Name: National Oceanic and Atmospheric Administration (NOAA) funds to support process of establishing a regional IDMP program for the CACENA region

UZBEKISTAN COUNTRY SURVEY REPORT

DRAFT CONCEPT FOR REVISION THE NATIONAL ACTION PROGRAM TO COMBAT DROUGHT AND LAND DEGRADATION IN REPUBLIC OF UZBEKISTAN

Prepared by:

Hodjimurat Tolipov, National consultant, Deputy head of the department for combating desertification and drought in the State Committee for Forestry of Uzbekistan

and Dr. Vadim Sokolov, Head of Agency of IFAS for project implementation in Uzbekistan

Ordered by: Mansur Abduraimov, Coordinator of the Country Water Partnership of Uzbekistan

Tashkent – June 2022

Report content

Brief introduction of Uzbekistan’s situation
1 Section: General information about issues and definition of drought
1.1. Definitions of drought
1.2 National approaches to monitoring drought in agriculture (e.g. soil moisture content, SPI, surface water balance, etc.)
1.3. Weaknesses and gaps in national drought monitoring.
Section 2: National Drought Management Legislation Materials
2.1 The Umbrella Drought Management Papers
2.2. National IWRM Plans, National Action Plans (UNCCD) - is there a drought?
2.3 The Drought Management Plan Preparation Phase.
2.4. Drought laws, regulations and work programs.
2.5. Links with national programs and instruments
2.5.1. Environmental Policy
2.5.2. Drought Management Policies and Activities
2.5.3. Mobilizing financial resources
2.6. Importance of the National Drought Plan
2.7. Weaknesses and Gaps in National Legislation / drought control. Suggestions for improvement.
Section 3: Responsibility for Drought - National Institutions Involved
3.1. Role of institutions involved in drought monitoring and control
3.2. Response and action
3.3. Stakeholders
3.4. Stakeholder Participation Mechanisms
3.5 Public awareness in case of drought; Drought reporting before, during and after drought
3.6. Weaknesses and gaps in drought communication
Section 4: The Drought Assessment Process
4.1. Drought Indices
4.2. Monitoring and collecting data on drought impacts
4.3. Forecasting
4.4. Drought Early Warning System (DEWS)
4.5. Drought Risk Assessment and Vulnerability Socio-Economic Assessment of Drought Impact (GDP); Drought Costing Process
4.6. Drought recovery; Post-drought actions (technology measures, subsidies, briefings, etc.)
4.7. Weaknesses of the current drought impact assessment. Improvement suggestions
Section 5 Looking Ahead - Programming
5.1. Ongoing research / scientific programs that may contribute to a better understanding of drought.
5.2. Educational programs that can contribute to a better understanding of drought
5.3. Weaknesses in the Drought Management Programming Framework
5.4. National and regional initiatives proposed for the IDM (Integrated Drought Management) program.
List of used literature

EXECUTIVE SUMMARY

The Republic of Uzbekistan is an arid country located in the center of Central Asia in the Aral Sea basin and with no access to the ocean.

One of the reasons of drought is the stationary anticyclone over a large land area, characterized by low cloudiness, an abundance of sunshine, lack of precipitation and dry air. Atmospheric drought increases plant transpiration and soil drying, which leads to soil drought. Lack of soil moisture leads to agricultural drought, reducing crop yields. Reduced river flow, lack of water for irrigation also leads to agricultural drought.

According to the World Resources Institute, Uzbekistan ranks 25th among countries suffering from water stress.

In the last decade drought becomes more frequent in the summer and autumn seasons, especially in the lower reaches of the Amudarya River and in the vicinity of the former Aral Sea.

According to the World Bank regional survey, the losses caused by the agricultural drought in 2000-2001 in Uzbekistan amounted to 130 million US dollars. According to other sources, the amount of damage is estimated at 38-40 million USD. Significant losses were noted in the livestock sector.

The Global Water Partnership (GWP) expressed its readiness to provide technical and methodological support for the preparation of the concept of a national plan to combat drought in Uzbekistan. This support is funded by the US National Oceanic and Atmospheric Administration.

From December 2021 to March 2022, with the involvement of national experts, an Overview of the current state of drought management in Uzbekistan, as well as the concept of the National Drought Management Plan, was prepared. The goal of the national plan is to address drought-related issues through monitoring and early warning, vulnerability and risk assessment, and drought mitigation and adaptation measures.

On April 5, 2022, a workshop was held in Tashkent to discuss the necessary steps to develop a National Drought Management Plan 2023-2030. The workshop was attended by representatives of all ministries, authorities, research institutes, non-governmental organizations involved in the problem of droughts.

As a result, recommendations were given on the content of the national plan, namely:

The first priority area is capacity development for monitoring, risk assessment and drought prevention: strengthening the technical base of the Hydrometeorological Service and introducing innovative solutions for drought monitoring and forecasting; development of a drought monitoring and early warning system that will improve the decision-making process for planning and managing risks regarding the impact of drought on food and water security.

The second priority is drought mitigation. This includes the development of measures to address water scarcity issues based on monitoring and early warning data: the degree of expected low water and drought (a set of indicators) is a criterion for the adoption of certain action plans to mitigate the effects of the expected drought.

The third priority area is capacity building and awareness raising: it is important to raise the awareness of the rural population (including women) about climate change adaptation and effective agricultural practices.

The fourth priority area is to actively develop regional cooperation: given the transboundary nature of the effects of drought, cooperation between the countries of the region is extremely important. In this regard, participants turned to the Global Water Partnership to provide all possible assistance in activating regional and international cooperation on drought risk reduction.

BRIEF INTRODUCTION OF UZBEKISTAN'S SITUATION

Of the 5 newly independent states in Central Asia that emerged from the break-up of the Soviet Union in 1991, Uzbekistan is the largest in terms of population (35 million in October 2021) and second largest in land area (447,000 square kilometers).

Figure 1. Map of Republic of Uzbekistan

More than 85 percent of the territory of Uzbekistan consists of desert or semi-desert. Approximately 47 percent of the land area consists of meadows and pastures; another 10 percent is arable, and 1 percent has permanent crops. A third of the land is "not used", and the balance is utilized for non-agricultural uses. Water is the basis for intensive irrigated agriculture, which is the mainstay of the economy in Uzbekistan, as in the other Central Asian Republics.

Land degradation is caused by geological, geo-morphological and man-made factors. The lands of Bukhara, Navoi, Kashkadarya and Fergana regions suffer from soil degradation. Water erosion strongly affects the agricultural lands of Surkhandarya, Tashkent, Namangan and Andijan regions. During the past 15-20 years, there has been an extensive degradation of pasture lands, due to the unsustainable use of pasture in cattle breeding, lack of maintenance of pastures and other human activities

Uzbekistan is located in arid and semi-arid lands which are affected by frequent droughts. Over the past two decades, Uzbekistan has experienced several extreme hydrological droughts that have resulted in between 50% and 75% of crops killed in drought-impacted areas (Drought characteristics and management in Central Asia and Turkey: FAO Waters Report. - 44. - Rome, Italy: FAO, 2017).

The drought has had a significant negative impact on the livelihoods of the population and food security and is a serious risk to the country's economy. According to available data, during the drought of 2000-2001, the production of cereals decreased by 10%, cotton - by 17%, rice - by 60%; drought damage is estimated at about USD 130 million (World drought management and

mitigation assessment for Central Asia and the Caucasus. Phase two. Country drought management and mitigation profile and strategy. - Tashkent, Uzbekistan: WorldBank, 2006).

According to surveys, the absolute number of farmers (94%) in Uzbekistan experienced drought-related shocks.

International obligations of Uzbekistan related to drought risks

The Republic of Uzbekistan was the first of all states in the Asian region and the CIS to ratify the United Nations Convention to Combat Desertification (UNCCD) and took an active part in all stages of its preparation. In 1995 Uzbekistan joined this Convention (Resolution of the Oliy Majlis (Parliament) of Republic of Uzbekistan # 125-I from 31.08.1995 "About Ratification of the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa").

The Main Administration of Hydrometeorology (UzHydromet) located in the Cabinet of Ministers was appointed by Government in 1995 as a Focal Agency for the implementation of the UNCCD in Uzbekistan.

In accordance with the policy of the Government and in fulfillment of the priority obligations assumed under the Convention, in 1999 the Republic of Uzbekistan developed a National Action Program to Combat Desertification (NAP). The NAP advocated action on three priority areas to combat land degradation:

(i) prevent or reduce the scale of land degradation;
(ii) restore partially drained lands; and
(iii) reclaim lands affected by desertification.

The NAP was however weak in policy and programmatic content. The NAP process received some funds and technical support from the United Nations Environment Programme (UNEP) for its preparation, and from the United Nations Development Program (UNDP) and the Government of Finland for its implementation, mainly for the purpose of organizing awareness building workshops. However, substantive implementation of UNCCD/NAP activities were constrained by lack of adequate funds from budgetary sources.

By 2016, it became clear that Uzhydromet, due to its powers, cannot fully fulfill its obligations under the UNCCD - NAP. The authorized body for the implementation of the convention should be authority with appropriate resources, expertise and representation in the fields, capable of collecting and analyzing information on agricultural areas and crops, on the social and economic situation, capable of training the local population, interacting with other authorities, associations, educational institutions and to coordinate actions not only at the national but also at the sub-regional and regional levels. An early warning system should at the same time be part of the overall risk analysis activities. Uzhydromet can perform only some of these functions, in particular, in forecasting meteorological processes, but does not have the full authority, resources and expertise to perform other functions.

Some actions already done by Government of Uzbekistan

In the end of 2017, there was organized a special observation the general opinion about issues related to drought in Uzbekistan. During the study, the following stakeholder groups were interviewed: farmers, farmers councils, water consumer associations, rural advisory services, national agricultural banks and insurance companies, local administrations, the Ministry of Agriculture and Water Resources, the Ministry of Emergency Situations, Uzhydromet, research

institutes, agricultural universities and international partner organizations. Based on the survey results, key policy measures in the field of drought risk mitigation in Uzbekistan were identified:

- the need to improve the efficiency of water resources use by cleaning, repairing and maintaining irrigation and drainage systems;
- introduction of drought-resistant varieties of agricultural crops;
- introduction of water-saving technologies for irrigation;
- helping farmers to enter new markets, including ensuring access to insurance against drought risks.

On February 2019 President of the Republic of Uzbekistan approved the special Resolution # PP 4204 “On measures to improve effectiveness of work to combat desertification and drought in the Republic of Uzbekistan”. By this resolution it was stated:

“In order to improve the efficiency of work to combat desertification, restoration of degraded land, and ensuring the effective implementation of international obligations Republic of Uzbekistan related to the UN Convention to Combat Desertification to allocate to the State Committee of the Republic of Uzbekistan for Forestry the following additional functions:

- implementation of measures to prevent desertification, reforestation and protective afforestation in the country;
- fulfillment of international obligations of the Republic of Uzbekistan to combat desertification and drought;
- ensuring effective interaction with international and regional organizations to combat desertification and drought;
- coordination of actions by ministries, departments and local authorities involved in design and implementation of programs and projects to combat desertification and drought in the Republic of Uzbekistan;
- implementation of functions as the National authorized body of the Republic of Uzbekistan responsible for fulfilling the requirements of the Convention”.

Currently prepared draft of the second National Action Program to Combat Desertification (NAP-2). This Program as well as the National Strategy on sustainable development are the dominant strategies to combat desertification. The NAP-2 is addressing to combating desertification, water resources management, and a forestry management program. Combating drought and land degradation in Uzbekistan there were proposed specific measures to improve the reclamation state of lands within the framework of the reclamation program, the use of experience and best practices in balanced use of land for ecology and consumption, the introduction of new innovative resource-saving technologies in the land and water use system, attracting investment in sustainable land management practices for provision, development, creation and maintenance of sustainable food systems.

1 Section: General information about issues and definition of drought

1.1. Definitions of drought

Global warming has a negative impact to water supply of agricultural systems. In many regions of the world, including Uzbekistan, the regularity and amount of precipitation have changed, droughts are becoming more frequent, and because of this, water shortages are more often and competition for water resources is growing. Uzbekistan is one of the countries especially affected by droughts and water scarcity. In the ranking of countries suffering from water stress, published by the World Resource Institute, Uzbekistan ranked 25th.

There are the following definitions of drought. According to the UNCCD, “drought is a natural phenomenon that occurs when precipitation is below normal, resulting in hydrological imbalances that negatively affect land production systems”. The World Meteorological Organization (1986) defined drought as “a prolonged dry period in the natural climate cycle that can occur anywhere in the world. In 2007, the IPCC defined drought as “a prolonged lack of precipitation or a large deficit, a lack of precipitation that results in a lack of water for any economic activity, or a period of time that is abnormally dry due to lack of precipitation and long enough to cause serious hydrological imbalance”.

In Special Global analytical report about drought 2021 there were highlights that while drought poses a significant threat to achieving Sustainable Development Goals 2030 and targets of the Sendai Framework for Disaster Risk Reduction 2015-2030, those impact can be significantly reduced by applying proactive and innovative approaches for drought risk management. Based on the findings of case studies around the world, the authors of report argue that with current knowledge about drought and its impacts to society, economies and ecosystems, we should be better able to straggle. They call for more attention to preventive measures: moving from reactive to proactive approaches that address the roots of drought phenomena and social and environmental vulnerabilities, to avoid and minimize risks. The report notes that increase in greenhouse emissions, as well as the vulnerability of people and ecosystems by drought, are important factors for development of drought risk plans. Addressing these issues is central to reducing the risk of drought. However, it is essential to pay serious attention to those types of human activities that lead to intensification and scaling up of drought effects.

Arid events are influenced by a variety of natural and anthropogenic factors and are classified in terms of specific land and water use activities. Drought can vary greatly in intensity, duration, severity and spatial extent, and local impacts on human livelihoods and habitats.

A review of UNCCD guidelines and publications (2015) shows that, despite the diversity of approaches, two broad frameworks are identified as a way of understanding the multiple definitions of drought. The first and more common system identifies drought as a natural hazard. This is based on the notion that rainfall deficits lead to water scarcity and subsequent negative impacts on any economic activity, or ecological process (White and Walcott 2009, Wilhite 2000).

1.2. National approaches to monitoring drought in agriculture (e.g. soil moisture content, SPI, surface water balance, etc.)

Systematic observations of characteristics and various parameters of the climate system serve as an information basis for assessing vulnerability, impact and developing measures to prevent, mitigate and adapt to drought risks, etc.

In Uzbekistan, climate monitoring is carried out by Uzhydromet, which has a network of meteorological, hydrological, agrometeorological observations, as well as observations of the state and quality of atmospheric air, surface water and soil. The priority areas of activity of Uzhydromet within the framework of climate services are the following:

- Collection of data characterizing the climate system, management of these data, monitoring and assessment of climate change;
- Improving of information flows is provided by improving the quality of climate services;
- Assessment of environmental vulnerability to climate change and development of various socio-economic programs in the context of climate change adaptation measures;
- Assessment of climate change for long terms in the face of increasing anthropogenic pressures.

Uzhydromet has the following network of observations, methods and tools for forecasting, sharing and disseminating information.

The ground observation network includes 130 hydrological posts; 79 meteorological stations on a daily and ten-day basis; agrometeorological observations are carried out at 61 stations and 30 posts; observations of the snow cover are carried out at 12 ground stations and 138 aerial visual stations. The WMO Global Network includes 21 stations, 6 stations have more than 100 years of observations.

Hydrological observations are carried out on rivers, lakes and reservoirs. On the rivers, observations are made to fix level, flow discharge and temperature of water, sediment content, the state of water body, natural hydrological phenomena, and evaporation from water surface (10 observation points). The frequency of observations of water level - 2 times a day, in points with water level recorder - hourly; for the state of water body and temperature - 2 times a day; for sediments - 3-4 times a month.

However, hydrological network needs to be expanded and modernized in order to obtain better hydrological forecasts and assess water resources in the zones of river flow formation, both on territory of Uzbekistan and on the territory of neighboring states.

Agrometeorological observations are carried out once every 2 days according to the following parameters:

- soil temperature and humidity in agricultural fields at root depth within the arable layer;
- state of soil and snow cover in winter: depth of freezing and thawing;
- monitoring the phases of agricultural crops vegetation;
- assessment of productivity elements and crop yield structure;
- survey of agricultural crops during winter season;
- monitoring crop damage, adverse weather events, agricultural pests and diseases;
- monitoring of field work;
- general and quantitative assessment of the state of agricultural crops.

According to the results of agrometeorological observations the following products obtained:

- the impact of weather on the development and condition of crops, pastures, pests and diseases is assessed;
- recommendations for agricultural works are given;

- various types of agrometeorological surveys are compiled with a quantitative assessment of the actual state of main agricultural crops and a forecast of their development for the near future, depending on weather conditions and the state of water resources.

Remote sensing. Uzhydromet receives and processes satellite information from American NOAA satellites and geostationary Earth satellites of the European Space Agency (Meteosat-7, Meteosat-9), Chinese satellites Feng Yun-2C and FengYun-2D (the system for receiving and processing data was provided by the Chinese Meteorological Administration). The complex of works with remote sensing data includes:

- round-the-clock obtaining, processing and archivation of data;
- analysis and forecasting of synoptic processes and associated weather conditions over the region;
- forecasting the movement and development of cloud formations;
- monitoring of snow cover areas in the mountains of Central Asia.

Within framework of the Investment Program of the Republic of Uzbekistan for 2010, the equipment of information obtaining system of the MODIS instrument allows Uzhydromet to receive data from TERRA and AQUA satellites. Based on MODIS data, the following are carried out:

- Operational assessment of the state of snow cover in zone of flow formation of the Amudarya and Syrdarya rivers;
- Monitoring of agricultural lands;
- Operational assessment of the state and degree of degradation of agricultural and pasture lands;
- Operational monitoring of the Aral Sea, the Aidar-Arnasay system of lakes, large reservoirs located both on territory of the republic and beyond its borders.

According to Uzhydromet, in the plains of Uzbekistan, a very severe drought occurs every 10 years, a rainfall deficit of more than 20% is observed every five years. In many areas with water deficit, meteorological drought is almost constant.

Analysis of atmospheric drought monitoring data for the period 1961-2020 at 34 meteorological stations located in different regions of the country, showed that the largest number of days with atmospheric drought in Uzbekistan is observed in Surkhandarya (Termez meteo station - 65 days), Navoi (Mashikuduk meteo station - 56 days), Kashkadarya (m/station Mubarek - 55 days) and Bukhara (m/station Dzhangeldy -50 days), where a large number of days a year with air temperatures above 40°C are also observed. [1]

In the last decade, there has been an increase in frequency of drought in the country, it becomes more frequent in summer and autumn seasons, especially in lower reaches of the Amudarya River. In 1980s and 1990s, drought occurred on average twice every ten years. For the period 2000-2012. extreme meteorological drought was recorded 4 times - in 2000, 2001, 2008 and 2011. The severe drought of 2000-2001, which became especially dangerous in terms of the scale of distribution, impacts and consequences for agriculture and water management and other sectors of economy, the environment and rural population, motivated the Government to take decisions and response measures, and subsequent analysis and assessment of impacts and drought vulnerability.

According to the Third National Communication of the Republic of Uzbekistan on climate change [1], the increase in average annual air temperatures in Uzbekistan occurs against the

background of high natural variability, which causes significant interannual fluctuations. The highest rates of warming are observed in the north of country and in large cities (0.30-0.43°C for 10 years), the lowest in the mountain zone (0.10-0.14°C for 10 years). The average warming rate in Uzbekistan was 0.27°C over 10 years. Average rates (ΔT /10 years) of increase in seasonal air temperatures from 1950 to 2013 were 0.13°C in winter, 0.39°C in spring, 0.25°C in summer, and 0.31°C in autumn.

Below are the long-term changes in annual precipitation in the regional centers of Uzbekistan for period 1961-2020.

The air humidity regime in Uzbekistan is influenced by various local anthropogenic impacts (shrinking/drying of the Aral Sea, the presence of irrigation systems and irrigated areas, the emergence of lakes created in natural depressions by return water from irrigation areas). The greatest increase in water vapor elasticity was noted in foothills of the Gissar-Alay (17%), where observed increase was almost 2 times higher than the natural variability, in foothills of the Western Tien Shan and the Ferghana Valley, the increase in water vapor elasticity also exceeded the natural variability. In the Aral Sea region and the lower reaches of the Amudarya, an average decrease in relative air humidity by 11% was observed, in the rest of territory there are small upward trends, and in the last 10-15 years there has been a downward trend. The air humidity deficit has undergone the greatest changes during period 1950-1980: an increase of 28% was recorded in the Aral Sea region and the Khorezm region, in the rest of territory the increase in humidity deficit was 8-13%. It can be concluded that reduction of the Aral Sea has led to a strong aridization of the climate not only in the Aral Sea region, but also in the lower reaches of the Amu Darya [1].

Uzbekistan, as a country with a transitional economy, located due to its geographical position in an arid region, is significantly vulnerable to the impacts of climate change. The consequences of climate change are expressed in an increase in the vulnerability of ecosystems, an increase in the frequency of dangerous hydrometeorological events, including droughts, melting glaciers, fluctuations in river flow. Climate risks seriously threaten the development of agriculture, which is reflected in loss of crop yields, especially in dry years. In conditions of further climate aridization, an increase in demand for water is expected as a result of development of industry and agriculture, while maintaining high population growth rates.

The most serious consequences are caused by droughts, which follows by enormous damage and posing a threat to livelihoods of the population, security and socio-economic development of the country.

Agriculture is the most vulnerable sector of Uzbekistan economy in relation to drought [1,3,13,17]. The share of the agricultural sector accounts for about 17% of the gross national product (GNP), more than 30% of employment. Irrigated arable land, the most valuable and multifunctional category of land and the main means of agricultural production, is 4.1 million hectares, and 0.745 million hectares are rainfed. Over 21.6 million hectares (85% of the total agricultural area) are occupied by low-productive pastures concentrated in desert and semi-desert zones and very sensitive to lack of moisture [18,19]. Crop production is almost completely dependent on irrigation and over 95% of the sown area falls on irrigated arable land, with 3.4 million hectares occupied by the cultivation of annual crops (cereals, barley, wheat, rice, corn, cotton, potatoes, vegetables) [18]. Cotton and cereals are the most important agricultural crops in Uzbekistan. Fruits, vegetables are grown in significant volumes and the production of milk, silk and livestock is carried out.

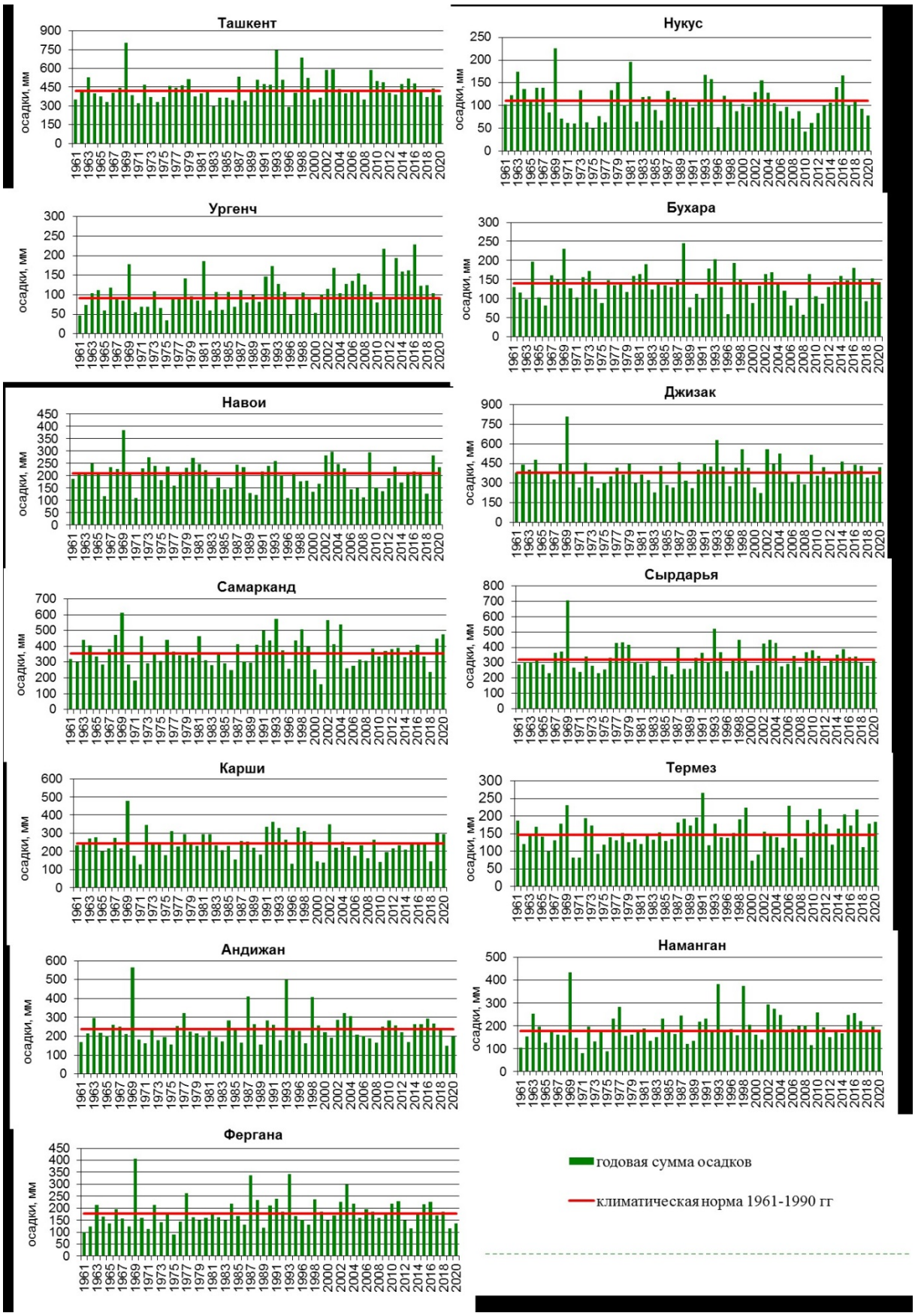


Fig. 2. Long-term changes in annual precipitation in the regional centers of Uzbekistan (https://hydromet.uz/ru/node/41)

Analysis of the consequences of the drought in 2000-2001 (UNDP, 2003) for Karakalpakstan and Khorezm region shows that the most dramatic declines in agricultural production occurred due to insufficient planning, forecasting and control over water resources at the regional, republican and local levels, which led to a decrease in water supply by 20-30% and 35 - 80% respectively, compared to the approved water limit. Drought 2000-2001 was a catalyst for the processes of desertification and environmental degradation, especially in the lower reaches of the Amudarya River. By the end of 2001, the systems of lakes and wetlands in the northern part of Karakalpakstan, with an area of about 160,000 ha, had almost completely dried up. As a result of the disappearance of the wetland habitat the 46 species were included in the Red Book of Uzbekistan in 2000-2001. The level of groundwater in areas affected by drought dropped to 10-15 meters, as a result, most of the artesian wells were useless. The quality of water has deteriorated [3]. In fact, the drought of 2000-2001 formed gradually, was unusual due to the lack of precipitation combined with high levels of evaporation caused by hot weather for several years. Precipitation levels reached only 40-60% of the norm, which led to an extreme reduction in river flow (by 35-40% of the average level). River runoff in the lower reaches of the river. The Amu Darya was at a record low – Karakalpakstan received only 20-30% of its water needs during the growing season of 2000.

The hydrological and socio-economic effects of drought were active until the end of 2003, while precipitation and agricultural production returned to normal in most areas in 2002 (WB, 2005, FAO, 2013). Expected yield losses of main agricultural crops by 2050 according to the TNC, 2016 [1] due to water shortage will average 35-50%. Cotton yield losses due to increased evaporation alone will vary from 4% (2030) to 10% (2050). For winter wheat, rice and other food crops, yield losses will range from 4% (2030) to 7-14% (2050). For rainfed agriculture in unfavorable weather years, crop yields will be reduced to 50% or more. Due to the increase in air temperature, the spring-summer vegetation of all types of vegetation on desert pastures will begin 5-10 days earlier and the total evaporation will increase, which will lead to a faster decrease in soil moisture reserves and, accordingly, biomass. It is obvious that climate warming, declining land productivity and population growth will increase the threat to the country's food security. By 2050, a complex of negative factors may lead to a shortage of agricultural products by 10-15% compared to the current period. Population growth, decline in fertility of land and water resources in the future give reason to expect aggravation of problems in the agricultural sector due to climate change, and hence destabilization of food security [12,17].

Livestock. Pasture animal husbandry is concentrated mainly (81.4%) on desert pastures, the productivity of which is very low (0.1-0.27 t/ha). In unfavorable years, pasture productivity decreases by 2-3 times, while the cattle load on pastures especially increases. The impact of drought on livestock sector is manifested through changes in pasture productivity, forage stock formation, grazing conditions and physical the condition of the animals. During periods of severe drought in 2000-2001 and 2011 excessive grazing pastures around rural settlements and villages were completely deprived of water supply. As a result, the harvesting of fodder grasses was reduced by more than half. In some affected areas of Karakalpakstan, drought has forced farmers to sell a significant part of their livestock or agricultural equipment [3,19,20]. The expected increase in air temperatures as a result of climate change will increase heat loads in summer and increase their duration, which will cause a decrease in weight gain, and from a certain level even weight loss in animals.

Currently, the efforts of the Government are aimed to further development of agricultural sector through further deepening of reforms and transformations to address problems associated with mitigating degradation, drought, improving the reclamation state of irrigated lands, reconstructing irrigation and drainage infrastructure, with particular attention to the diversification of agricultural production (with the transition to drought-resistant and less

moisture-intensive crops, creation of value chains), restoration of pastures, forests. In this regard, the question arises of updating the vulnerability assessment of agricultural production, taking into account recent developments in the sector, using new methodologies and approaches, experience and analysis of the impacts of the 2018 drought, involving all stakeholders and the local community, and identifying targeted mitigation and preparedness measures to droughts.

Moving from a reactive approach for drought management to proactive approach opens up opportunities to invest in measures such as drought monitoring and the establishment of drought early warning systems (DEWS). A proactive approach based on the DEWS helps to protect ecosystems and communities from drought, so that temporary shortages of available water resources do not escalate into humanitarian or environmental disasters. However, most of the current DEWS need to be more effectively linked to the goal of drought elimination and monitoring.

If the UNCCD invests in the improvement of the DEWS systems, then the corresponding consequences are manifested at the local level and felt by individual affected resource users. Unfortunately, system-level impacts and processes are in many cases not tracked and this information is not communicated effectively to decision makers. Therefore, improved use of monitoring systems to diagnose needs and opportunities for preventive investment in drought prevention under the UNCCD is essential. These systems should underpin all other aspects of integrated drought management activities.

In this case, the goal is to improve national risk and vulnerability assessments, inform the mitigation policy and financial response process, and enable decision makers to track the performance of their investments over time.

Therefore, it is quite possible that an effectively coordinated collective effort by the international community could significantly improve the existing natural resource and drought monitoring systems in the very near future. Seizing this opportunity must be an integral part of a broader effort to ensure inclusive green economic growth and recovery, and to leave no one behind when achieving the SDGs.

Each country needs to develop and use its own monitoring systems, drought indicators and indices. In accordance with IDMP recommendations, the monitoring system will include the following three levels of general indicators and indices:

Level 1: A simple indicator of drought hazard – focused on climate/meteorology;
Level 2: A simple indicator of drought exposure, such as the number of people exposed to drought;
Level 3: Comprehensive indicator of vulnerability to drought - in all likelihood, the totality of physical, social, economic and environmental factors that contribute negatively to increasing the vulnerability of communities and ecosystems to drought.

Based on the above, the weaknesses and gaps in national drought monitoring are:

There is an urgent need to strengthen and expand the system hydrometeorological monitoring and improving the quality of long-term hydrological and meteorological forecasts, which in turn are the main prerequisites for flexible management and mitigation of the effects of drought.

Providing early information and increasing the awareness and access of stakeholders and especially vulnerable local communities to land resources observations technologies and practices will prepare and minimize the impacts of future droughts and implement concrete

measures and actions. This will reduce possible damage to the population, agriculture and the economy as a whole.

Section 2: Materials of National Drought Management Legislation

2.1. Umbrella Papers on Drought Management.
2.2. National IWRM Plans, National Action Plans (UNCCD) - are there a drought issues?

In the Republic of Uzbekistan, a separate law, a national integrated drought management plan is not available.

The national plan for Integrated Water Resources Management in the Republic of Uzbekistan (2020) provides for a governance and management system based on: taking into account all possible water sources in the country; coordination of intersectoral interests of all levels in the hierarchy of water use; hydrographic water management; broad involvement of all stakeholders and water users in the process of governance and rational use of water; ensuring the stability of water supply to key water consumers (economic sectors), as well as key areas of biodiversity and nature-protected areas.

The CCD Convention for Uzbekistan (1999) contains a comprehensive analysis of the causes of desertification and identifies priority areas of action to combat it and land degradation under anthropogenic pressure, and also proposes scientifically based measures to improve the condition of pastures and hayfields, reduce the socio-economic consequences of desertification, the impact of drought with a shortage of water resources.

However, Uzbekistan is vulnerable to climate change, exacerbating an already difficult situation characterized by low rainfall, aridity, dramatic fluctuations in weather conditions and uneven distribution of resources. Measures to adapt to climate change are part of a set of preventive / preparatory / response measures to combat the negative consequences of climate change. Such measures are aimed not only at mitigating negative impacts, but also at maximizing existing opportunities. All Central Asian countries, including Uzbekistan, have adopted programs and developed laws in the field of environmental protection, which more or less cover the issues of combating drought.

Uzbekistan belongs to the group of developing countries, its demand for such resources as energy, water, as well as early warning of possible droughts is constantly growing. Strategic development and economic growth plans for the country should be developed taking into account environmental issues and plans for adaptation to climate change.

Drought issues are addressed in several different papers dealing with other environmental topics.

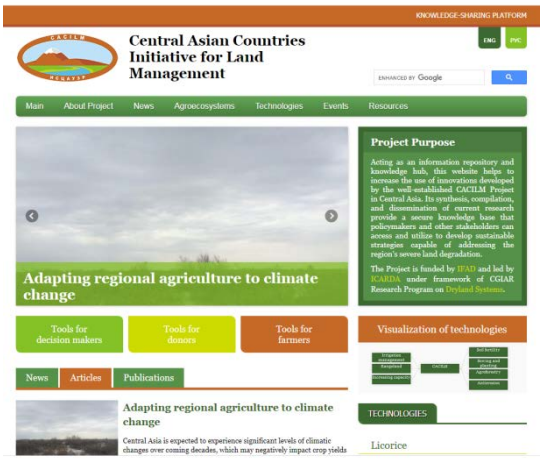
2.3. Drought plan preparation phase.

A national drought management plan in Uzbekistan should be developed in accordance with the theoretical model of an integrated drought management plan developed by the IDMP , which is based on a 10-step approach [33] and recommendations of the Program documents adopted at the High-level Meeting on National Drought Policy (HMNDP), which was held in Geneva from 11 to 15 March 2013 and serves as a methodological framework, tools and approaches for the development of refineries:

- Policy documents - Declaration, Policy Document "National Policy on Drought Management", and "Scientific Paper: Best Practices for a National Drought Management Program, which were prepared and proposed in 2013 by the World Meteorological Organization (WMO), the United Nations Convention to Combat desertification (UNCCD), the Food and Agriculture Organization of the United Nations (FAO) to assist countries in

developing practical and scientific actions for preparedness, adaptation and mitigation of the effects of drought. These policy documents serve as guidance for policy development and the National Drought Plan (NDP).

- UNCCD has identified drought management as one of the objectives of the new 10-year strategy and has prepared a set of guidelines for developing an action plan (10-step approach).
- Implementation of the CACILM regional program as a platform for the exchange of knowledge, experience and lessons learned by the CAR partner countries and international program participants (FAO, ICARDA, IWMI, ICBA, etc.).



The plan for integrated drought management in Uzbekistan should be developed in accordance with national legislation, policies and strategies of the country, as well as with international protocols, agreements and guidelines of the WMO and UNCCD [9,10], providing for the transition of society from the traditional approach to the adoption of urgent emergency responses to drought to more proactive (proactive) risk-based approaches. It should be aligned with sectoral and environmental programs, strategies and plans that support disaster risk management and mitigation.

2.4. Drought laws, Regulations and work programs.

The National Drought Plan is closely linked to a number of international environmental and sustainable development instruments, including:

- Sustainable Development Goals;
- Paris Agreement;
- United Nations Framework Convention on Climate Change (UNFCCC);
- United Nations Convention to Combat Desertification (UNCCD);
- Convention on the Conservation of Migratory Species of Wild Animals (01.05.1998);
- Ramsar Convention on Wetlands of International Importance Mainly for Waterfowl Habitat (30.08.2001).
- Vienna Convention for the Protection of the Ozone Layer (18.05.1993);
- Montreal Protocol on Substances that Deplete the Ozone Layer (18.05.1993) and its London (1998) and Copenhagen (1998) amendments, etc.

Since gaining independence, the Republic of Uzbekistan, like other Central Asian countries experiencing the consequences of the Aral Sea disaster, has been a party to bilateral and multilateral agreements and regional initiatives in the field of joint management of water and energy resources and combating desertification, land degradation and drought in Central Asia [21].

In 1993, in order to overcome the environmental crisis and improve the socio-economic situation in the Aral Sea basin, the heads of states of Central Asia established the International Fund for

Saving the Aral Sea (IFAS), which operates on the basis of the adopted intergovernmental agreements:

During the existence of IFAS, the heads of states of Central Asia and the governments of the countries adopted the Nukus (1995), Almaty (1997), Ashgabat (1999) and other declarations on the problems of the Aral Sea, as well as a number of strategic decisions aimed at stabilizing the state of the environment, improving methods management of water and land resources and mobilization of financial resources for the implementation of the Programs of specific actions ASBP-3-7 to improve the ecological and socio-economic situation in the Aral Sea basin. In 2018, at the meeting of the heads of the founding states of the IFAS (August 2018), President of Uzbekistan Shavkat Mirziyoyev put forward five proposals for the interaction of Central Asian countries in overcoming the consequences of the Aral Sea disaster and it was proposed to consider the issue of declaring the Aral region a zone of environmental innovations and technologies. Selected international and regional agreements, plans and specific results / targets directly related to the National Drought Plan are summarized in Table 1.

Table 1. International, regional programs, instruments related to drought

№	Agreements/ Programs	Objectives	Specific goals / tasks associated with the National Drought plans
1	Goals Sustainable development (SDGs)	The UN General Assembly in September 2015 adopted the 2030 Agenda for Sustainable Development, including 17 SDGs and 169 SDGs that call on countries, inter alia, to protect, restore and promote the sustainable use of terrestrial ecosystems, sustainable forest management, combating desertification, halting and reversing land degradation and loss of biodiversity	SDG Target 15.3 aims to “combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve land degradation - a neutral world” by 2030. The development of a National Drought Action Plan is required in accordance with SDG 15.3. It will also align with other SDGs on food security, environment, poverty alleviation and climate change.
2	Framework Convention The organization United Nations about change climate (UNFCCC)	The goal of the UNFCCC is "to stabilize the concentration of greenhouse gases in the atmosphere at the level in order to prevent dangerous anthropogenic interference with the climate system"	The UNFCCC framework sets non-binding caps on greenhouse gas emissions for individual countries and does not contain enforcement mechanisms. Some interventions are aimed at mitigating the effects of climate change, as well as addressing land degradation, desertification and drought. The UNFCCC is directly linked to the needs and target priorities of the National Drought plans.
3	UN convention to combat desertification (UNCCD)	The UNCCD is one of the three global environmental Rio Conventions adopted in 1992. The UNCCD is designed to address land degradation and the problem of desertification and drought in countries experiencing severe droughts in the arid and semi-arid regions of the world, especially in Africa.	At the national level, UNCCD obligations implemented through the National Action Program (NAP, 1999), which includes long-term strategies supported by international cooperation and partnerships to combat desertification and mitigate the effects of drought through effective action at all levels to promote sustainable development.
4	UN convention on biological diversity (CBD)	Like the other two Rio Conventions, the CBD has three main objectives in relation to biological diversity: the conservation of biological diversity; sustainable use of its components; fair and equitable sharing of the benefits arising from the use of genetic resources.	The main priorities for capacity building of the CBD are common to the three Rio Conventions and include targeted activities to overcoming desertification in the lower reaches of the Amu Darya River, disappearance and degradation of aquatic and semi-aquatic communities, combating environmental degradation, preserving and maintaining agro-biodiversity and ecosystem services in affected desertification and drought landscapes.

5	Subregional program action on fight against desertification and drought (SDAP) for Central Asian countries	The SDAP was developed and approved by the Conference of the Parties UNCCD in Havana in 2003. to strengthen development subregional cooperation of Central Asian countries in the field of combating desertification, land degradation and drought (DLDD)	The priority areas of subregional cooperation in DLDD are: (i) monitoring and assessment of desertification processes, creation of an SRR and mitigation of the effects of droughts, improving water use in agriculture, combating erosion, salinization and waterlogging; (ii) agroforestry, forestry and catchment management; (iii) pasture management; (iv) conservation of biodiversity and nature protection, development of eco-and ethno-tourism; and (v) increasing the economic potential of local communities
6	Central Asian Countries Initiative on land resources management (CACILM)	CACILM is a multi-country and multi-donor partnership within the UNCCD, created with the aim of implementing a long-term program to restore, maintain and improve the productive functions of lands in the countries of Central Asia, while preserving their ecological functions, which should subsequently lead to an increase in the economic and social well-being of people, dependent on these resources	CACILM is a long-term program of projects and activities to strengthen and promote IDM approaches and practices and adaptation to drought in five CA countries. Key software the document is the National Programming Framework (NPF) for IDM CACILM. Within the framework of Phase 1, national and multicountry projects were implemented in Uzbekistan, financed by grant funds of donors (GEF, ADB, UNDP, GM, GIC) - members of the CACILM Strategic Partnership Agreement, CACILM is directly related to and supports the priorities and expected results of the National Drought plans
7	Regional project "Complex natural resource management in subject to drought and saline agricultural production landscapes Central Asia and Turkey "	The second phase of the CACILM-2 Program started in 2018. The overall goal of CACILM-2 is to scale up integrated natural resource management in drought-prone and saline agricultural landscapes. One of the project components focuses on measures to combat drought, introduction and dissemination of SMART practices in drought-prone areas	CACILM-2 component directly addresses drought management by: (i) improving drought forecasts for river basins. (ii) assessing risk and vulnerability to droughts, (iii) developing an Integrated Watershed Management (ICM) plan, and providing technical support to agrometeorological services, developing an agrometeorological advisory service system (supported by WMO) and expanding National Drought plans practices and demonstrating drought-tolerant and water-saving technologies.
8	Central Asian Multi-country UNDP program for management climatic	The program aims to assist the Central Asian countries in adapting to the risks of droughts caused by existing and projected climate changes (2011-2015)	This Program supports and develops potential of the Ministry of Emergency Situations of the Republic Uzbekistan and other relevant stakeholders. The main objective of the project is to stimulate the reduction of the risks of natural disasters associated with climate change, as well as to ensure the integration of management climate risks into the development of key strategies and plans in the Republic of Uzbekistan

	risks in Central Asia		
9	Regional Strategy for Drought Risk Management and Mitigation in Central Asia 2021-2030	The Regional Strategy for Drought Risk Management and Mitigation in Central Asia for 2021-2030 proposes measures to increase the resilience of ecosystems and societies to droughts and periods of water scarcity by moving from a reactive to a proactive approach and regional integration. The regional strategy is designed to help the countries of the region achieve the long-term goals of socio-economic, technical and institutional development for the effective and sustainable management of drought and other adverse natural phenomena, especially in relation to anthropogenic factors contributing to desertification, land degradation and drought.	The main priorities of the Strategy are the following: 1. Capacity building for monitoring risk assessment and drought prevention; 2. Drought mitigation, development of plans to address water scarcity and dissemination of data; 3. Capacity building and awareness raising; and 4. Regional cooperation
10	“Green Central Asia” Program supported by Germany	The Program covers six countries. Central Asia and Afghanistan. The goal is to create greater access to information and promote academic collaboration among the six participating countries over the next four years.	"Green Central Asia" will contribute to the implementation of the new EU strategy for Central Asia. The program provides • Conflict prevention and strengthening of cross-border cooperation on climate change impacts in Central Asia; • Establishment of a regional political dialogue on environmental and climate security threats; • Development of capacity in the field of environmental management

2.5. Liaison with national programs and instruments

2.5.1. Environmental policy

The priority of the Republic of Uzbekistan during the period of ongoing economic reforms is to ensure reliable social guarantees and measures for social security and environmental protection. The strategic framework for the harmonious development of reforms and transformations in all sectors of the economy is provided by Decrees of the President and Resolutions of the Cabinet of Ministers of the Republic of Uzbekistan, as well as special laws, regulations and norms regulating their implementation. Main approaches and priorities on environmental protection and nature management and implementation of international agreements are integrated into strategies, national programs and sectoral action plans.

The fundamental legislative act that establishes the legal, economic and organizational foundations for the preservation of the natural environment and the rational use of its resources is the Law "On Nature Protection" (1992). In parallel, a package of laws was adopted regulating the protection, conservation and use of natural resources, with special attention to the most vulnerable components of the environment.

To ensure the vital interests of the individual, society and the state, the laws of the Republic of Uzbekistan "On protection of the population and territories from natural and man-made emergencies" and "On civil protection", as well as a number of Resolutions of the Cabinet of Ministers of the Republic of Uzbekistan were adopted. The Constitution and environmental legislation of the Republic of Uzbekistan defines the legislative, state and executive authorities, as well as enterprises and organizations that are responsible for environmental protection and use of natural resources. The list of national responsible organizations, their status and responsibilities is presented in Table 3.

High-level state structures of legislative and executive power - the Oliy Majlis and the Cabinet of Ministers, within the framework of their powers, determine the mechanism and carry out coordination and control over the implementation of the actions of the relevant executive agencies in the field of environmental protection, improvement and maintenance, and the implementation of international obligations under the Rio Conventions; claim government programs and action plans; develop and adopt

legislative acts of republican significance, establish the procedure for action in the event of an emergency, etc.

In 2007, a Drought Management Center was established under Uzhydromet. The Center serves as an advisory and advisory body on monitoring, drought forecasting, early warning systems and drought preparedness in the face of climate change. The main tasks of the Center are: (i) implementation of the provisions of the UNCCD; (ii) monitoring and evaluation; (iii) early warning and mitigation of the consequences of drought; (iv) cooperation.

2.5.2. Drought management policies and activities

The government of the country has implemented and is implementing measures to reform the economy associated with the development of market relations and private ownership in the countryside. Over the past decades, a number of legislative acts have been adopted to support the development of reforms and transformations in agriculture and water management and improve the use of water and land resources. In 2007, by the Decree of the President of the Republic of Uzbekistan, the Republican Fund for Land Reclamation Improvement of Irrigated Lands in the

regions of Uzbekistan was established, Programs of measures and measures for water conservation were launched and are being implemented. Significant results have been achieved in improving the efficiency of land use, reclamation of irrigated lands, reconstruction / modernization of irrigation and drainage infrastructure, etc.

Of particular importance are Decrees of the President of the Republic of Uzbekistan and Decrees of the Government aimed at overcoming the impact of low water and stimulating sustainable land management, such as the Decree of the President of the Republic of Uzbekistan No. x products for state needs on low-yielding lands ", the Decree of the President of the Republic of Uzbekistan dated October 20, 2008" On measures to optimize sown areas and increase the production of food crops ", etc.

Since 2017, a new stage in the country's development began on the transition to the path of innovative development aimed at radically improving all spheres of life of the state and society. The country has adopted a number of fundamental decrees and resolutions of the President of the Republic of Uzbekistan and the Cabinet of Ministers of the Republic of Uzbekistan, adopted the Law on Pastures (2018), initiated national programs, institutional reforms and transformations aimed at ensuring food security and sustainable development in the long term.

In support of the economic and institutional reforms carried out in the country, by the Decree of the President of the Republic of Uzbekistan, the Strategy of Actions for the Further Development of the Republic of Uzbekistan in 2017-2021 was adopted, "which became the most important program document for the medium term for all sectors of the economy, including the policy of combating desertification. , land degradation and drought

Under the auspices of the UN, the UN Multi-Partner Trust Fund for Human Security was established (November 27, 2018) for the Aral Sea region in Uzbekistan. A special charitable foundation "Muynak-2019" and other mechanisms have been created to stimulate urgent actions to overcome the consequences of desertification, dust storms, drought in the zone of ecological disaster.

Recently, the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan “On measures to accelerate the creation of “green cover” - protective forest plantations on the drying up territories of the bottom of the Aral Sea” (No. 132 of 15.02.2019) was adopted, which provided for the allocation of 100 billion soums. for which in the period 2019-2021. protective forest plantations have been created on an area of over 1,500 thousand hectares of dried seabed.

The main approaches and measures to combat desertification, land degradation and drought are integrated into a number of national programs, strategies and projects:

- Strategy of actions in five priority areas of development of the Republic of Uzbekistan for 2017-2021 (2017);
- Uzbekistan on the way to 2030: transition to a resource-efficient growth model (2015);
- Environmental Action Program (NEAP);
- State program for the development of irrigation, improvement of the reclamation state of irrigated lands and the rational use of water resources for the periods 2013–2017, 2018–2019;
- Concept for the development of agriculture in the Republic of Uzbekistan until 2030;
- National Strategy and Action Plan of the Republic of Uzbekistan on biodiversity conservation for the period 2016-2025;
- Comprehensive program to mitigate the consequences of the Aral Sea disaster, recovery and socio-economic development of the Aral Sea region for 2015-2018;

- State program for the development of the Aral Sea region for 2017-2021;
- Program for the integrated development and modernization of drinking water systems water supply and sewerage for 2017-2021;

Selected national programs, strategies and specific goals / objectives directly related to the National Drought Plan are shown in Table 2.

In general, drought management policies have become part of an integrated development policy in the country, policy instruments and regulatory frameworks reflect issues of regulation of activities to combat desertification, land degradation and drought; regional agreements were adopted to improve water availability, a set of measures and actions to mitigate the effects of drought, etc.

Table 2. Laws, regulations, national programs, strategies and other documents related to drought

№	Agreements/Programs	Objectives	Specific goals / tasks associated with the National Drought plans
1	Action strategy for 5 priority directions of development Republic Uzbekistan on 2017-2021 years.	The Action Strategy has laid a comprehensive framework and measures, including a set of regulatory, technical, agrotechnical, institutional and adaptation measures and solutions, and their integration into agriculture and water economy to mitigate drought risks and expand National Drought plans in various agricultural landscapes of the country	An important priority of the Action Strategy is "Modernization and intensive development of agriculture", including: (i) introduction of modern resource-saving agricultural technologies, (ii) new varieties of crops, (iii) adoption of systemic measures to mitigate the negative impact of global climate change, etc. This is a priority the direction of the Strategy is directly related to the target objectives of the National Drought plans.
2	Uzbekistan on paths to 2030: moving to resource efficient growth model	In line with the resource-saving growth model by 2030 in the water and agricultural sector, Uzbekistan intends to: (i) strengthen its adaptive capacity by at least 40% in the most vulnerable areas; (ii) increase water use efficiency and save water up to 25%; (iii) establish National Drought plan and risk management at all levels; (iv) expand the areas of reforestation and agroforestry, etc.	Moving to a resource efficient growth model by 2030 is a key approach and action to achieve the National Drought plan targets and expected results and is closely linked to mitigation of climate change and drought.
3	Concept development agriculture complex Republics Uzbekistan up to 2030	The main objectives are: (i) stimulating an increase in the share of production of highly profitable crops / breeds; (ii) providing access to large foreign sales markets; (iii) assistance inflow of foreign and domestic investment; (iv) modernization and innovative development; (v) creating modern infrastructure, including water management, transport, science and education; (vi) providing access to financial and insurance instruments, etc.	The concept for the development of the agricultural sector has identified the key priorities of the Republic of Uzbekistan for innovative development and investment for the period up to 2030. The development of the National Drought Plan will correspond to the targets of the Concept in the context of ensuring food security, preservation of the environment, livelihoods of the population and climate change, including mitigating drought risks in the long term.
4	State program development irrigation and improvements reclamation fortunes irrigated land for the period 2018-2019 "	The program includes a wide range of measures: (i) reduction of the area of moderately and highly saline lands by 50.7 thousand hectares; (ii) reduction of the area with the occurrence of the groundwater level up to 2 m for 137.2 thousand hectares; (iii) maintaining the land reclamation state for 411.8 thousand hectares; (iv) technology adoption water saving: drip irrigation (12,500 ha), mobile flexible irrigation pipes (46650 ha), screened irrigation furrows (26 600 hectares), (v) prevention of wind erosion of irrigated lands and sanding of water facilities on an area of 2 995 hectares.	Irrigation Development and Improvement Program activities The reclamation state of irrigated lands contributes to mitigating salinization and land degradation and reducing the impact of desertification and drought in the regions of Uzbekistan for the period 2018-2019. The expected results and activities of the Program as a whole across the country contribute to the achievement of the overall target objectives of the National Drought plan.

5	Program action on protection the surrounding environment of RUz. (NEAP) at 2013-2017	NEAP is aimed at implementing measures to the following directions: (i) creation of guaranteed and decent living conditions and ecological safety, (ii) greening the sectors of the economy; (iii) prevention of environmental pollution by waste; (iv) development of legislation and regulatory framework; and (v) development of regional and international cooperation.	The program covers general and cross-cutting measures and actions closely related to the target objectives of the National Drought plan., aimed at improving the ecological state of the environment, including reducing environmental pollution, incl. the zone of ecological disaster - the Aral Sea region. In addition, measures to improvement of soil fertility, afforestation, introduction low-waste resource-saving technologies, and prevention of transboundary pollution of the natural environment.
6	Complex program for mitigating consequences disaster, recovery and socially economic development region Priaralye on period 2015-2018 years	The program includes: Mitigation measures aimed at (i) to create favorable conditions for reproduction and preservation of the gene pool and health of the population living in areas of environmental risk; (ii) expanding employment and the formation of sources of income to increase the level and the quality of life of the population of the Aral Sea region, and (iii) restoration of the ecosystem and biodiversity, conservation and protection of flora and fauna.	With the support of the Executive Committee of IFAS and the Charitable Foundation for the Protection of the Aral Sea Gene Pool for the implementation of the activities of the Program to prevent desertification, reproduction and preservation of the gene pool for the period 2015-2018, 4.3 billion dollars were directed to the Aral Sea region.This Program made a significant contribution to the achievement of the expected results of the National Drought plan.
7	State program development of the region Priaralye on 2017-2021 years	The Aral Sea development program is aimed at implementing a set of technical and institutional interventions, with the attraction of internal and external investments and loans from IFIs, including deposits for combating desertification and managing water and land resources. For implementation provided for 8.4 trillion. soums.	Activities include the following interventions: (i) afforestation of 20 thousand hectares on the drained bottom of the Aral seas - 31.6 billion soums; (ii) implementation of the climate change adaptation program - 64.2 billion soums; (iii) improvement of water resources management in South Karakalpakstan on an area of 100 thousand hectares.
8	Program an integrated development and modernization drinking systems water supply and sanitation on 2017-2021	Integrated systems development and modernization program drinking water supply and sewerage for 2017-2021, with the creation of the Clean Water Fund.	The program consists of 36 investment projects implemented with the involvement of loans from international financial institutions, which are aimed at the comprehensive development and modernization of drinking water supply and sewerage systems in the medium term.
9	Framework	The program provides for assistance in raising awareness and	The UNDAF program aims to (i) proactively mitigate the risks of

	UN program to provide assistance in development goals (UNDAF) at period from 2016 to 2020 years	strengthening national capacity to support rural communities in disaster prone areas, etc.	increased droughts associated with climate change and (ii) implement additional vulnerability assessments; and (iii) promoting development patterns that are more resilient to climate change, and (iv) implementing climate change adaptation and mitigation measures.

2.5.3. Mobilizing financial resources

Government policy aims to expand innovation, investment and replication / diffusion of IDM technologies in order to create an enabling environment; promoting the development of institutional change; introduction of resource and water conservation, advanced technologies of IDM; drought mitigation and adaptation; expanding climate-resilient agriculture management, improving water supply, etc. Innovation and financial mechanisms (IFM), being an unconventional form of financing, are based on the sustainable generation of funds and incomes by the beneficiaries of projects and programs. The main tools in the field of IFM in republics are the use of fiscal incentives in the form of payments for emissions or discharges of pollutants into water, air or soil, payments from users to utilities, payments for the use of natural resources, etc. Numerous international funds, created mainly with the aim of confronting new challenges such as climate change, food security, natural risks and threats, can play a key role in financing IDM in the country. In recent years, there has been an increase in the role of corporate finance and sponsorship in supporting environmental projects. In this regard, coordination, initiatives and joint efforts, prioritization and economic assessment of mitigation measures and impacts at the subregional and local level, and the selection of the most effective and urgent measures, is one of the major challenges for the development and implementation of a drought plan.

In general, despite the increase in financial flows in the field of IDM and the improvement of the land reclamation state, the need for financial resources remains high. There is a growing awareness of the importance and willingness of rural communities, their awareness of the benefits and benefits of innovative financing mechanisms allocated by Funds and Development Agencies to support joint activities in the field of IDM and combating DLDD. At the same time, planning and incentive approaches and mechanisms are not flexible enough and are not fully implemented, insufficient attention is paid to the issues of resource mobilization to restore and maintain productivity of rainfed, pastures and forests, especially in rural areas affected by drought and desertification. The adoption and implementation of the drought management plan will allow coordinating the efforts of all stakeholders to mobilize financial and human resources for climate-resilient management, based on innovative approaches and technologies, in order to increase agricultural productivity, food security and maintain ecosystem service flows in the face of climate challenges**.**

2.6. Importance of the National Drought Plan

The occurrence of drought creates serious problems and impacts on agriculture, water resources and other sectors of the economy, livelihoods, food security and the human environment. Therefore, the importance of this National Drought Management Plan cannot be overemphasized as it has the potential to increase preparedness and also helps to mitigate its impacts across all groups and sectors of the economy at various levels.

Improving agricultural productivity and food security

Agriculture is the most vulnerable sector of Uzbekistan's economy to drought. The agricultural sector accounts for about 17.6% of the gross national product (GNP), about 27% of employment and up to 22% of export income. Cyclical fluctuations in river flow and long periods of low water complicate the economic use of water sources for irrigated lands, with a total area of 4.277 million hectares, especially in the lower reaches of the Amu Darya River. Over 21.6 million hectares (85% of the total area of agricultural land) is occupied by low-productive pastures, concentrated in desert and semi-desert zones and very sensitive to water shortages. Therefore, agricultural productivity and food security are highly sensitive and depend on moisture availability, rainfall and available water resources. This means that the National Drought Plan

will make a significant contribution to the development of modern methods for forecasting drought / low water, building capacity for the introduction of planning tools and adaptation of innovative approaches and technologies for water conservation and water conservation to mitigate the effects of drought and improve the productivity of agricultural systems and, therefore, food security.

Enhancing sustainable development of irrigated and rainfed agriculture

Irrigated arable land, the most valuable and multifunctional category of land and the main means of agricultural production, accounts for 3.5 million hectares, and only 0.745 million hectares are accounted for by dry land. Irrigated agriculture is concentrated mainly in desert and semi-desert zones on naturally non-drained lands prone to salinization and suffering from a lack of water for irrigation and soil leaching. More than 80% of the rainfed area is located in semi- and unsecured natural moisture zones, with a rainfall of 250-350 mm. Under these conditions, an increase in the frequency and severity of drought poses a serious threat and risks to the development of irrigated and rainfed agroecosystems. National Drought Plan will provide consistent assessment vulnerabilities and risks for irrigated and rainfed areas, population groups and local communities and strengthening the adaptive capacity of stakeholders, using international approaches, tools and methods of EBM / GIS mapping. Technical interventions to prevent drought include interrelated measures and actions, namely crop protection and adaptation, special crop cultivation technologies, rainwater harvesting, water reservoirs, etc. The refinery will rely on accurate and timely assessments, accounting and dissemination of meteorological data to initiate options for mitigation and emergency response.

Strengthening cooperation and coordination and monitoring mechanisms

Effective water management for drought-affected areas depends on the institutional and legal framework established to address the interrelated issues of water use and drought planning. Water resources management and allocation requires strengthening intersectoral collaboration and coordination mechanisms for planning and reaching trade-offs between different stakeholders. The refinery will ensure the establishment of an ad hoc Drought Preparedness Working Group, preparation and implementation of an information communication Program / Strategy for the Analysis and Sharing of Data for Rapid Assessment and Decision Making in Drought Management, and strengthening intersectoral cooperation and institutional capacity for the implementation of the Plan.

Risk-Based Mitigation Planning

Management of water resources in conditions of climate variability will inevitably entail adjusting water limits based on predicted scenarios of climate change and socio-economic development, updating / improving the data transmission and exchange system, consumption patterns with varying degrees of drought risks and hazard levels.

The aim of mitigation planning is to reduce risk based on risk factors. The planning process seeks to identify activities and institutions that can help provide the necessary resources to reduce vulnerability to those sectors / regions / groups most at risk. Currently, the country is implementing a number of Programs and projects aimed at mitigating the impact of droughts, and the main goal of the Plan should be to analyze the implemented measures and recommendations for their effectiveness.

The proposed mitigation measures include the development, selection and implementation of the most effective measures and approaches for the rational use of water resources, water

conservation, as well as the introduction of drought-resistant crops and diversification of agricultural production in drought-prone areas. Special attention will also be paid to measures and actions to promote sustainable management and conservation of forest resources and pastures. Scaling up innovation and mobilizing resources is essential.

Ensuring a timely and effective response to drought should it occur.

This activity brings together the refinery's activities to ensure a timely and effective response to drought should it occur. This includes: setting up a Working Group and developing a mock Drought Action Plan in order to make the most efficient use of limited water resources and minimize negative impacts on those regions / groups / sectors that will experience the greatest water scarcity. A key element of activities in this direction is the development of drought response plans at the subregional level, for individual regions and territories, taking into account their vulnerability and availability of mitigation measures.

The overriding task is to analyze the impact of this year's drought with a damage assessment. This event can be supported by FAO (CACILM project), UNDP and other international organizations.

2.7. Weaknesses and gaps in national legislation / drought management. Suggestions for improvement.

In the Republic of Uzbekistan, there is no separately adopted law or national plan, integrated drought management and measures to combat them. Drought issues are addressed in several different papers dealing with other environmental topics.

In this regard, the project proposes, based on an analysis of the current state, to check which country programs and institutions already exist related to drought management in Uzbekistan in order to determine who needs to be involved and / or disseminated a survey in order to organize a workshop on integrated management planning. drought and the development of a draft Concept for the National Program of Action for Combating Drought

Section 3: Responsibility for Drought - National Institutions Involved

National development priorities include agricultural and water policy, with sustainable mechanisms for coordination and interaction of responsible structures, and priority measures to combat drought and ensure preparedness and coherence of stakeholders. Regular government development plans include activities to prevent and mitigate the negative effects of drought, to ensure stable water demand for society and the economy.

3.1. Role of institutions involved in drought monitoring and control

Currently, Uzbekistan has a sufficiently developed institutional structure that allows monitoring dangerous phenomena, taking measures to prevent or mitigate their consequences.

The authority and commitment of the risk management process is essential to ensure its continued effectiveness. This process requires a strong and sustained commitment from the responsible ministries and departments, as well as careful and strategic planning to achieve commitment at all levels.

The country has created (PKM RUz No. 242 of 24.08.2011) and is functioning the State System for Prevention and Action in Emergency Situations (Ministry of Emergency), which unites governing bodies, forces and means of republican and local authorities, enterprises and organizations, whose powers include organization of emergency response measures, including those related to meteorological conditions.

The system includes the following departments and ministries: the Ministry of Emergency Situations (MES), the Center for the Hydrometeorological Service (Uzhydromet), the Ministry of Health (the Ministry of Health), the Ministry of Agriculture, the Ministry of Water Resources, the State Committee on Ecology, etc., whose functions and actions are clearly identified. The basis for the activities of the State Emergencies Service is the estimates and forecasts of Uzhydromet, which are promptly received by the Ministry of Emergencies. The powers and responsibilities of the main organizational structures are presented in Table 3. The State Emergency Service consists of territorial and functional subsystems and has three levels: republican, local and object.

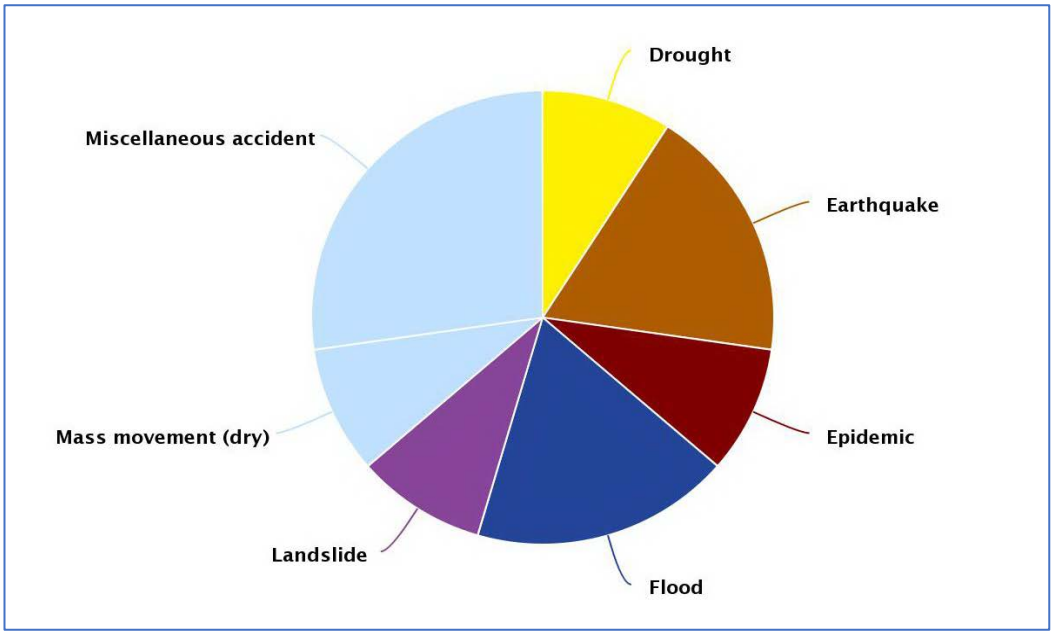


Figure 2. Uzbekistan on the Way to Disaster Risk Reduction

Emergencies in Uzbekistan include:

- Threat of the establishment of an agrometeorological drought, causing a moisture deficit in the atmosphere and leading to disruption of the water balance of plants, their oppression and death with possible significant material damage.
- The threat of a dry wind (persistence for 5 days or more at an air temperature of + 45 ° C and above strong winds and an air humidity of 30% or less) leading to significant material damage when agricultural crops are suppressed and killed and posing a threat to human health.
- Threat of the establishment of low water and a shortage of water resources, which can lead to disruption of the life of the population and significant economic damage in the agricultural and individual sectors of the economy.
- Threat of the establishment of intense heat (air temperature exceeding + 40 ° C and above for several days), leading to significant economic damage when agricultural crops are

damaged and posing a threat to human health. In some cases, it poses a threat to the normal functioning of certain sectors of the economy.

The State System for Emergency mandate includes the following main tasks:

- implementation of state policy, development and implementation
- normative legal acts in the field of protection of the population and territories from emergencies in peacetime and wartime;
- forecasting possible emergencies on the territory of the republic, assessing their socio-economic consequences;
- development and implementation of targeted and comprehensive scientific and technical programs aimed at preventing emergencies, ensuring the safety of people, reducing risks, hazardous technologies and industries, increasing organizations;
- ensuring the sustainability of the functioning of sectors of the economy, other constant readiness of management bodies, forces and means intended for the prevention and elimination of emergencies;
- collection, processing, exchange and issuance of information in the field of protection of the population and territories from emergencies;
- preparation of the population, officials of management bodies, forces and means of the State Emergency Service for actions in emergency situations.

3.2. Response and action

The response to combat drought and desertification in Uzbekistan is a response to and mitigation of climate change in the context of crisis management and includes:
(i) operational measures to reduce water limits during the growing season, adherence to water use discipline, ban the cultivation of rice as the most water-intensive crop, use water from drainage collectors for irrigation, and (ii) mitigation measures and actions to overcome risks and protect the population and territory in the Aral Sea zone.

In crisis situations, special committees for drought management are additionally created. Thus, in order to mitigate the consequences of the severe drought of 2000-2001, a special Committee on drought problems in the lower reaches of the Amu Darya was created under the chairmanship of the First Deputy Prime Minister of the Republic of Uzbekistan. The Ministry acted as a coordinator for the implementation of proactive measures proposed by the Committee.

3.3. Parties concerned

Stakeholders can be divided into two large groups:

(i) state institutions that participate in planning, management and monitoring of the environment and nature-use within the framework of their state responsibility, and which have influence and / or authority to make decisions on activities related to the management and monitoring of drought at the local level, subregional and national levels;

(ii) primary stakeholders who are directly or indirectly affected by desertification, land degradation and drought, and who may be beneficiaries of the activities carried out by the relevant Agreements, programs and projects (or will participate in them in various ways).

The main beneficiaries at the national level are low-income and wealthy agricultural producers, women, local communities and households, agricultural workers, suppliers of agricultural inputs, procurement organizations, organizations financing agricultural production, construction organizations, central and local authorities, and drinking water supply management organizations. water, land and biological resources; and the environment.

At the local level, water resources provide livelihoods for the majority of the population, whose security as well as their livelihoods are threatened without adequate and reliable irrigation and water supply during and after drought. In fact, there are no local organizations that do not have any responsibility to ensure a reliable supply of acceptable water quality for consumption and production.

The country has accumulated positive experience in using FAO approaches to mitigate the risk of drought. In particular, to raise awareness of local farmers in Syrdarya and Kashkadarya regions (2002-2004) and South Karakalpakstan (2005-2009), within the framework of FAO and WB projects [21], farmer field schools were established.

The Council of Farmers, Dekhkan Farms and Owners of Homestead Farms conducts explanatory work among farmers on an ongoing basis. It promotes the dissemination of best land use practices, including in drought conditions, the introduction of alternative energy sources, and innovation and information and communication technologies. Self-government bodies of citizens assist in the implementation of control over the sanitary and ecological state of the corresponding territory, water supply sources, dwellings, educational institutions.

3.4. Stakeholder Participation Mechanisms

Droughts and other climate challenges and disasters cause widespread socio-economic and environmental impacts and threats / degradation of ecosystem services. In this regard, a large number of stakeholders will be involved in the implementation of the Action Plan - from target beneficiaries, local communities to government agencies and non-governmental organizations, and the private sector, as well as the GEF implementing agencies and other donors and international partners.

The active participation of all stakeholders will lead to:

- Effective partnerships between the implementing agency of the responsible institutions and other stakeholders;
- Effective use of the knowledge, experience and skills of all parties involved (NGOs, local authorities, academia and the private sector) in the design, implementation, monitoring and evaluation of projects and National Integrated Drought plan activities;
- Capacity building at local and national level;
- Raising the status and powers of vulnerable groups such as women and the poor in the rural population.

Broad participation of non-governmental organizations (WUAs, rural gatherings of citizens, public organizations, Councils of farmers, dekhkan farms) in the implementation of the National Integrated Drought plan, monitoring and public oversight, will provide feedback between the government and the public, and will increase the transparency and accessibility of the results of the implementation of the Plan especially at the local level.

The contribution of civil society will consist mainly of the following aspects: popularization among the population of the main goals, objectives and expected benefits from fulfilling the

obligations under the Convention and, in particular, on the National Integrated Drought plan; running campaigns to engage and improve public understanding of government action to meet Convention obligations and National Integrated Drought plan implementation; attracting intellectual and material resources, including the resources of the GEF Small Grants Programs; implementation of specific activities of the National Integrated Drought plan and pilot projects to combat drought at the local level and desertification in the Aral Sea region; study of public opinion in order to adjust / improve the measures and actions of the National Integrated Drought plan in the process of its implementation; preparation of alternative national reports, reviews and reports on the implementation of the National Drought Management Plan.

Table 3. Key organizations involved in drought monitoring and drought management

	Name Ministries / organizations	Role of institutions involved in drought prevention / mitigation coordination and drought monitoring	Responsibilities for drought management
1.	Oliy Majlis (Parliament)	The Law "On Nature Protection" (1992) provides for the responsibility of the Oliy Majilis for declaring the territory as a zone of environmental emergency, natural disasters and environmental disasters, demarcating the legal regime of these zones and the state of susceptibility to an environmental emergency.	The Oliy Majlis (Parliament) of the Republic of Uzbekistan is the highest state body representing the legislative power in the Republic of Uzbekistan. Parliament determines the main directions of state policy related to the protection, improvement and maintenance of the state of the environment; approves state environmental programs; develops and adopts legislation.
2.	Ministry of Agriculture	Coordinates the development and implementation of measures to prevent, mitigate and eliminate the consequences of drought. In drought conditions, organizes, develops and implements a set of urgent measures to prevent and reduce the catastrophic consequences of drought. Accountable to the Cabinet of Ministers	Manages the country's agriculture policy, develops sectoral and regional programs for the development of agriculture. Develops programs for land reclamation and development. Develops forecasts of the likelihood of hazardous natural phenomena. Within the structure of the Ministry there are scientific subdivisions: Scientific and Production Center of Agriculture, Tashkent State Agrarian University, etc.
3	Cadaster agency under the State Tax Committee of the Republic of Uzbekistan	Monitors the state of land resources to identify changes, prevent and eliminate consequences of negative processes of desertification and drought. Assesses changes in the qualitative state of soils and natural pastures for agricultural purposes. It is part of the State System for Emergency Service.	The Cadaster Agency performs the following functions: develops and implements a set of measures aimed at improving the organization of land management, land use and protection, accounting and assessment of land resources; monitors the condition and use of land resources; carries out geodetic and cartographic work. At the cadaster agency there is a scientific unit - the Institute of Soil Science and Agrochemistry, which conducts research aimed at protecting and increasing the fertility of agricultural soils.
4.	Ministry of Water Resources	Establishment of a special operating mode for water management objects. In drought conditions provide change of operating mode or further operation of water facilities, monitors the hydrological regime of reservoirs. Develops and implements measures to prevent and mitigate the impacts of drought. It is part of the State System for Emergency Service.	Manages the country's water policy, develops strategies and a mechanism for their implementation; develops sectoral and regional programs for the development of water management; develops the balance of water resources, sets the limits for water withdrawals by sources, basin irrigation systems, sectors of the economy, territories; organizes accounting and control of the use of water resources, monitors the reclamation state of irrigated lands, determines the main directions of research in the field of water management, organizes and

			coordinates their implementation. Scientific subdivisions: Tashkent Institute of Irrigation, Institute of UzGIP, etc.
5	Ministry of Emergency Situations	Monitoring, prevention and elimination of the consequences of natural and man-made emergencies. Under the Ministry of Emergency Situations, the Inspection Service of the State System for Warning and Action in Emergency Situations and the Republican Multidisciplinary Rapid Response Center (RMCR) were organized	The main operational and coordinating body for drought prevention / elimination within the framework of the State System for Emergency Service. Provision of management bodies of the State Emergencies Service and the population information on actions during a drought. Empowered carry out a preliminary assessment of damage and possible economic losses. Ministry of Emergency Situations connects to activities to eliminate the consequences only in case of severe droughts, accompanied by human casualties.
6	Centre of Hydrometeorological Service under the Cabinet of Ministers of the Republic of Uzbekistan	Monitoring, forecasting, and control of hazardous hydrometeorological events (including droughts). Providing hydrometeorological information to the Ministry of Emergency Situations, interested ministries and departments, to the Chairman of the Council of Ministers of the Republic of Karakalpakstan, khokims of regions, cities and districts, including through the use of the Drought Early Warning System. Management of the creation and operation of the State System for Emergency Service and its functional sub-systems: the state service for monitoring and control over natural hydrometeorological phenomena and the state of the environment.	The main activities of Uzhydromet "are: - Conducting and improving regular hydrometeorological observations, as well as monitoring of environmental pollution; - development of methods for obtaining, collecting and disseminating hydrometeorological and environmental information; - specialized online service for agriculture and water management, aviation and economic sectors; - provision of hydrometeorological information, forecasts and warnings to the government, ministries, agencies, population; - management of the state water cadastre and the State data fund on the state of the environment; - maintenance of the national hydrometeorological and climatic database; - monitoring of the state of environmental objects, water resources, glaciers, snow cover; - assessment of the current state and future climate changes; - monitoring of the state of agricultural crops and vegetation on pastures; - management of the State Fund for Hydrometeorological Information; - fulfillment of international obligations under the World Meteorological Organization (WMO), the Framework Convention on Climate Change, the Convention to Combat Desertification and the UNESCO Hydrological Program; support for the operation of the WMO Regional Hydrometeorological Training Center. The scientific department of Uzhydromet is NIGMI, whose functions include

			conducting scientific research (fundamental and applied) in the field of hydrometeorology, climate change and ecology.
7	Ministry of Finance	Financing by order of the Cabinet of Ministers activities to create material resources for liquidation and overcoming the consequences of emergency situations.	Develops and implements financial national policy, ensures the growth of national income.
8	Ministry economics and poverty reduction in Uzbekistan	Conducts a review of targeted protection programs population and territories from emergencies together with the Ministry of Emergency Situations, the Ministry of Finance. Prepares proposals on them for submission to the Cabinet of Ministers of the Republic of Uzbekistan. Prepares proposals to the Cabinet of Ministers on the accumulation of material resources in the state reserve for the implementation of measures to prevent and eliminate emergency situations (including droughts).	The Ministry of Economy develops and implements the country's economic policy, develops programs, plans and strategies for the country's development. He is engaged in the development of forecasts of socio-economic development, coordinates investment projects in the sectors of the economy.
9	State Committee for ecology and protection of environment	It is part of the State System for Emergency Service. Management of the creation and operation of the State System for Emergency Service and its functional sub-system: the control and inspection service for environmental protection and ecological safety.	he main tasks of the State Committee for Ecology of the Republic of Uzbekistan are the implementation of state control and coordination of interdepartmental activities in the field of environmental protection.
10	State committee of the Republic of Uzbekistan on Forestry	Monitors the state of forest vegetation. Calculates damage to forestry from drought. Provides information about the state of forests in dry season to higher authorities. Implements timely warning of a fire hazard. Conducts restoration of drought-affected forest areas.	The Committee carries out state management in the field of expanding forest areas through their creation, restoration, protection, development and increasing the efficiency of activities for their use.
11	Ministry of higher and secondary education	Organization of training of specialists in the field prevention and elimination of emergencies.	Organization of courses at specialized universities for the preparation and retraining of agricultural specialists and farmers in preparedness for action in drought conditions.
12	Ministry of innovative development Republics Uzbekistan	Making proposals for the implementation of modern forms agricultural production, use available land, water and other natural resources aimed at providing food security in the country.	The main directions of the Ministry's activities are the organization of processes for the development of innovative ideas, technologies, scientific research aimed at developing the system of state and public administration; formation of mechanisms promotion and practical use of domestic innovative ideas, developments and technologies; developing principles and promoting the introduction of green economy

			technologies.
13	Ministry of development of information technologies and communications of the Republic of Uzbekistan	Providing communication infrastructure areas affected by an emergency (drought)	The main tasks and activities of the Ministry for the Development of Information Technologies and Communications of the Republic of Uzbekistan are: ensuring the implementation of a unified state policy in the field of information technologies and communications; development and implementation of comprehensive programs for the implementation and development of the national information and communication system; creation of interdepartmental information systems; introduction modern technologies for the protection of communication and information networks, software products and resources.

3.5 Public awareness in case of drought; Drought reporting before, during and after a drought

Until now, drought management in Uzbekistan has been limited to the use of costly crisis management measures, that is, the elimination of the consequences of drought, rather than the introduction of economic measures to mitigate the risks of drought, which are increasingly being voiced today.

There is a hypothesis that climatic changes will lead to more frequent occurrence and intensification of droughts in Uzbekistan (Sorg, A., Bolch, T., Stoffel, M., Solomina, O., & Beniston, M. (2012). Climate change impacts on glaciers and runoff in Tien Shan (Central Asia) NatureClimateChange, 2 (10), 725) and hence the cost of crisis management will only increase.

If we proceed from the fact that drought risk management, from a social point of view, is a more optimal course of action than eliminating its consequences, then the question arises: what are the problems, as well as what are the opportunities for transition from management (resolving crisis situations that have already occurred) crisis situations to drought risk management in Uzbekistan?

Drought preparedness means that risk mitigation and institutional actions are taken prior to the onset of a drought to effectively address its effects and minimize the negative impacts of drought on people, the economy and the environment.

3.6. Weaknesses and gaps in drought communication

Under Uzhydromet, there is a National Drought Monitoring Center. This center is tasked with providing early warning and proposing measures to mitigate the effects of drought in a changing climate. The Ministry of Agriculture and Water Resources (now divided into two departments) is also a relevant body, but the respondents to the above study noted that the Ministry does not take drought forecasting into account when planning agricultural activities and does not inform the relevant organizations about the need to take mitigation measures drought.

It should be noted that it is the Ministry of Agriculture that should develop a set of measures to mitigate drought risks together with local authorities and farmers. Uzhydromet is ineffective in monitoring, forecasting and providing timely information on drought to local administrations and farmers through the media. Currently, such communication is ineffective, as it is carried out through a complex system of administrative channels.

Based on the foregoing, the following conclusions follow. Weak coordination and communication between responsible organizations. It has place of fragmentation of measures and actions aimed at preventing drought, due to lack of coordination and interaction between local communities and responsible organizations; lack of a coordinated integrated plan for agriculture adaptation to drought and mitigation measures. Lack of guidance documents, clear procedures and instructions for early warning and communication of information, and weak decision support system tools, together with insufficient institutional capacity for planning and participatory management, limit the scope for implementing concrete measures, innovations and practices to adapt and mitigate drought risks.

Section 4: Drought Assessment Process

4.1. Drought indices.

For the assessment and monitoring of all types of drought (meteorological, agricultural and hydrological, etc.), various drought indices have been developed and are widely used throughout the world.

The most representative drought indices are: Palmer Drought Index (PDI), Soil Moisture Index (SMI), Standardized Precipitation Index (SPI), Surface Water Supply Index (SWSI) and indexes of the three-pillar approach: https://www.droughtmanagement.info/pillars/. Each of these indices has its own strengths and weaknesses, and therefore each the country selects the appropriate index or combination of indices based on their suitability for the specific hydrological characteristics of the country in terms of weather and water resources.

Drought is one of the natural phenomena, it is associated with more serious problem of water scarcity, in which human actions can identify factors such as drought exposure and vulnerability. Through improved decision-making and implementation, these aspects of drought risk can be easily prevented and eliminated. Some aspects of drought risk reduction may be more affected change than other broader climate change risks. Human Societies and decision makers are empowered to reduce, eliminate and mitigate the growing risks and impacts of drought through effective implementation of drought policy; and development of partnerships.

For example, planning actions to address land degradation neutrality (LDN) in drought-affected regions can increase drought resilience. With effective strategies, implementation processes and partnership systems in place, reducing drought exposure and vulnerability will not take decades

Decision 29/COP.13 about initiation of the Drought Mitigation Initiative and its follow-up work on drought policy development promotes the use of a three-pillar approach for integrated drought management. This framework guides the transition from reactive approaches to drought (with a focus on crisis response) to a proactive approach that focuses on reducing (or eliminating) the risk of drought, for example through use of sustainable land and water management practices. In particular, decision 29/COP.13 requested Parties to take a proactive approach to the issue of integrated drought resilience when developing national drought policies, based on three key elements of national drought resilience policies:

a) establishment of comprehensive drought monitoring and early warnings;

b) completion of vulnerability and impact assessments for drought-prone sectors, populations and regions; and

c) drought taking measures to ensure drought preparedness and risk mitigation

The national team of Uzbekistan will study the process of integrated drought management through this prism.

4. 2. Monitoring and how to collect data on drought impacts

Systematic observations of the characteristics and various parameters of the climate system serve as an information basis for assessing vulnerability, impact and development of measures to prevent, mitigate and adapt to drought risks, etc.

In Uzbekistan, climatic monitoring is carried out by Uzhydromet, which has a developed network of meteorological, hydrological, agrometeorological observations, as well as observations of the state and quality of atmospheric air, surface water and soil.

4.3 Forecasting

The effectiveness of preventive and mitigation measures during a drought period directly depends on a long-term forecast of temperature and precipitation. Despite the efforts made in the world, the effectiveness and justification of long-term and ultra-long-term forecasts of droughts (a year or more) is low. The validity of monthly and seasonal forecasts of temperature and precipitation anomalies is slightly higher, but also insufficient for making effective and timely decisions. Particular difficulties in long-term forecasting arise in the continental regions of temperate latitudes, where the natural variability of temperature and precipitation is high, which is also typical for the Central Asian region. In arid regions, there is an increased frequency of precipitation anomalies below normal, that is, the problem of forecasting rare events arises.

At present, in the practice of Uzhydromet, the official method of long-term forecasting is synoptic (selection of analogous years). Statistical methods of forecasting for the season are used as advisory methods, which make it possible to find general patterns in the formation of weather conditions for long periods of time. The analysis shows that the best tool for forecasting water flow are mathematical models of the flow formation process. The original mathematical models of the formation of the flow of mountain rivers developed at the NIGMI Uzhydromet served as the basis for the creation of an automated information system of hydrological forecasts (AISHF) in Uzhydromet. AISGF allows making long-term forecasts for the main components of the Syr Darya and Amu Darya basins and tributaries to large reservoirs. This system implements a mathematical model of runoff formation in a mountain river basin by calculating runoff components (snow reserves, water inflow due to rainfall) and their transformation.

The realism of the simulation results makes it possible to use this system to assess the response of water resources to possible climate change, based on climate scenarios [1, 7, 30]. Hydrometeorological information is stored in electronic and paper (tables, books and magazines) carriers. Data is regularly sent to government officials and heads of large agricultural enterprises, individuals in the form of forecasts and generalized information.

In general, the current system for the transmission of information and forecasts of drought and

early warning to end users is not well developed. Farmers and households receive information from local authorities and the media (television, radio) mainly during critical periods. Local authorities do not always have the necessary manuals and recommendations to prevent and mitigate the effects of drought.

It should be noted that there is a lack of technical resources, management tools and qualified specialists, especially at the regional and local levels, and a lack of awareness and awareness by the population of the dangers and threats of drought, methods and measures to mitigate the effects of drought.

4.4. Drought Early Warning System (DEWS)

Uzhydromet has developed a pilot DEWS, which is a tool for assessing, monitoring, warning, warning and decision-making in the event of low water and drought in the Amu Darya and Syrdarya river basins. Early warning includes regional history of droughts, monitoring of present weather, the use of climate predictions, and the possible determination of drought development, spread and severity. The purpose of the DEWS is to provide early information to decision-makers and the public about a possible drought. DEWS contains four components:

- "Monitoring and data analysis" - development of the existing monitoring system of hydrometeorological parameters, prevention of dangerous phenomena.
- "Risk Knowledge" - determination of the nature and degree of risk through analysis potential threats and vulnerability assessments. Risk assessment includes technical characteristics of the threat, probability, its territorial distribution, intensity, as well as an assessment of social, economic and environmental consequences.
- “Dissemination of information and communication” - preparation and provision of information on potential impacts to all interested parties.
- “Responsiveness” - facilitating the development and testing of programs to ensure preparedness for safe community behavior and the implementation of possible options for measures aimed at reducing harm.

The basis of the DEWS is the Automated Information System of Hydrological Forecasts, developed at the NIGMI Uzhydromet for assessing water resources on the basis of a regional mathematical model of the formation of mountain river runoff.

Within the framework of the UNDP / Uzhydromet project “Climate Risk Management in Uzbekistan”, the DEWS was tested on the territory of the Kashkadarya region of Uzbekistan.

Based on the results of the studies, gaps, the following needs were identified:

- increasing the lead time of seasonal hydrological forecasts from the development of DEWS using satellite information and forecasts of temperature and precipitation for a month and a season, issued by Regional Climate Centers for NMHSs;
- study of the potential consequences of drought across the territory, depending on its depth (using models such as WEAP, etc.) and the development of criteria for assigning a hazard level to the expected drought;
- development and approval of plans for response to the expected reduction in water availability, depending on the depth of drought in each region;
- development and dissemination of output products (special surveys and hydrometeorological forecasts by basin / area, adapted for farmers, including assessment of water availability, meteorological conditions and recommendations for irrigation regime);
- organization of a training system for water users at various levels, including local authorities and farmers.

The degree of expected low water and drought is a criterion for the adoption of certain action plans to mitigate the consequences of the expected drought. The reliability of predictive information should be sufficiently high, since in the event of large-scale droughts, large areas of the country may be at risk, and in addition, on the basis of this information, the authorities will be able to adjust the strategy for managing the available water resources, which will require significant costs.

4.5. Drought Risk Assessment and Vulnerability Socio-Economic Assessment of Drought Impact (GDP); Drought Costing Process

Risk identification methods, risk analysis and risk assessment are an integral part of the risk management process. In this regard, some attention is paid to the development of approaches and methods to risk assessments, along with predictive estimates of the impact of droughts and low water in conditions of climate change on socio-economic sectors, but there is still insufficient experience in this.

Certain work on assessing the risk of drought in Uzbekistan as one of the climate risks was done within the framework of the UNDP project "Climate Risk Management in Uzbekistan" for selected regions ("Climate Risk Profile of Uzbekistan", UNDP, 2015)

To analyze the risks associated with an increase in areas prone to atmospheric drought, field studies can be carried out, in particular on three categories of land use - arable land, meadows and pastures located in different agro-climatic zones of the country, and on the basis of this, it is possible to construct comparative maps of the distribution of atmospheric droughts in Uzbekistan for the corresponding years (for example, for 2005 and 2015), and will highlight the zones most susceptible to atmospheric drought.

An assessment of the dynamics of hydrological drought in mountain river basins showed that extreme low water occurs when there is a deficit of precipitation in January-March and high air temperatures, which leads to insufficient snow accumulation and causes a deficit in runoff during the growing season (hydrological drought) for irrigation of land at the oblast level.

According to estimates by CACILM (2006) and other sources [19,22], a significant part of the country's agricultural land is subject to a number of destructive phenomena and processes that have a negative impact on livelihoods, welfare and health of the population, and the environment. The most vulnerable are the regions of ecological risk, where there is an overlap of mutually reinforcing natural and anthropogenic factors. All parties involved are severely affected by desertification, land degradation and drought.

The performed assessments confirm that the negative impacts of drought, aggravated by the processes of desertification and land degradation, are manifested everywhere, but agroecosystems and rural residents in the middle and lower reaches of the Syr Darya and Amu Darya rivers (the Republic of Karakalpakstan, Khorezm, Bukhara, Syrdarya, etc.) are most vulnerable and vulnerable.) and in areas with the highest population concentration (Fergana Valley)

The economic impact of the safety data sheets produced in Aralkum seems to be under-researched in publications. INTAS and RFBR (2001) Provide an interesting overview of the actual economic impact with preliminary cost estimates. The assessment is based on a multi-sectoral approach that considers both land and water resources and can serve as an example and a baseline. Aggregating the identified impacts showed that the cost of some of these direct losses has been estimated for the entire Aral Sea region at nearly US $ 100 million per year (US $ 59 million for agriculture and US $ 41 million for industries).

Several other documents address the concurrent use of water resources in the region and associated scenarios and impacts (eg availability of drinking and irrigation water, crop yields, fisheries, etc.). Orlovsky and Orlovsky (2001) report cotton losses of 5-15% and rice yield 3-6% due to dust. The salt content of rain is also reported to have increased to 100–150 mg / l, up from

30–100 mg / l in 1975. In spring, these rains form salty crusts that interfere with seed germination and shorten the life of the support. construction of high-voltage power lines. Additional costs for the repair of power lines on the Raushan-Beruniy section of the Kungrad railway section for the period 1981-1990 increased to US $ 15 million, and property damage due to power outages increased to US $ 9 million, resulting in total capital expenditures increased budgeted investments by 2.8 times over the same period.

In addition to direct costs, INTAS and RFBR (2001) report USD 17 million in indirect losses and USD 29 million in social losses. Thus, the total direct and indirect losses from the environmental disaster in the Aral Sea region amounted to USD 145 million per year. It is worth noting that this was quantified in 2001 when the level of impact on land and water resources was much lower than it is now.

4.6. Drought recovery; Actions after a drought (technology measures, subsidies, briefings, etc.)

In Uzbekistan, a financial mechanism has been developed and is operating to mitigate the consequences of droughts and other natural hazards - insurance. Currently, the only company specializing in insurance of risks in agriculture provides agricultural producers with affordable insurance services that meet their needs (about 40 types).

The main types of agricultural insurance include:

voluntary insurance of agricultural crops against over seeding; voluntary insurance against crop shortages; voluntary insurance of orchards and vineyards against crop shortages; voluntary insurance of farm animals, etc. The insured risks are damage or death of crops, animals and machinery as a result of drought, harmssel (dry wind), mudflow, flooding, lack of water or lack of water, hail, rainfall, storm, hurricane, frost, snow, frost, lodging of crops as a result of prolonged rains, lightning, fire, collapse, rising groundwater levels, etc.

Based on the experience of agricultural insurance in foreign countries, a number of innovations are being introduced into the insurance practice. In particular, significant benefits were provided to farms on crop shortage insurance: due to the simplification of the terms of the insurance contract, the number of insurance risks increased, for some insurance rates were established, which were differentiated by region, the system for considering insurance claims was simplified, in the absence of insured events, the insurance rate was reduced.

4.7. Weaknesses of the current drought impact assessment. Suggestions for improvement.

Insufficient technical equipment and capacity of responsible institutions and specialized services in monitoring and assessing drought risks, modeling climate scenarios, communicating and disseminating information on early warning and mitigating drought risks for agricultural consumers and local communities. As indicated above, in Uzbekistan, due to climate change, an increase in the frequency of drought is expected. Since drought is, first of all, a shortage of water resources, therefore, a reliable and timely forecast of river water availability and ensuring access to information for stakeholders and beneficiaries is of vital importance. All target groups of stakeholders - ministries and departments, associations, local communities are interested in early forecast of drought and information on the risks and problems they may face during a drought. The government, state, professional and commercial organizations must be fully informed in order to make appropriate adequate decisions. Advance awareness of the population will reduce their vulnerability and drought risks through timely and effective action.

Section 5: Looking Ahead – Concept for revision National Drought Plan

In the future, the organization of drought management activities will be carried out in accordance with the "three-pillar" approach. This clarifies the relationship between the various strands of successful drought management as a common goal supported by the three main components of the policy and implementation process, including mitigation, preparedness and response (component 3). The development of these measures should be based on impact, vulnerability and risk assessment (component 2). These assessments should, in turn, be based on information obtained from monitoring systems for relevant effects in affected communities and ecosystems (component 1). This allows work to be carried out in the context of a holistic and integrated approach to drought management and disaster risk reduction.

5.1. Ongoing research / scientific programs that may contribute to a better understanding of drought.

Research should include information on its implications for agriculture and the economic impact on income, poverty and food security. There are significant gaps in knowledge of drought impacts and cost-benefit analysis and mitigation measures versus preventive measures to mitigate drought risks.

In this regard, it is proposed:

5.1.1. Development of research on the methodological and prognostic basis for forecasting drought and low water levels, including:

- Development of forecasts of water flow in the formation zone in order to assess the degree of low water based on the introduction of regional models describing the process of flow formation and the participation of international experts;
- Implementation of agrometeorological assessments of drought based on crop models to predict the possible impact of drought on selected crops;

5.1.2. Support scientific research aimed at assessing risks, vulnerabilities and developing mitigation measures for drought impacts on various sectors of the economy, including:

- Identification of research, institutional and legal needs for risk assessment and development of mitigation measures for drought / low water;
- Implementation and use of global climate models to predict temperature and precipitation changes in the long term;
- Development / adaptation of methods for remote monitoring and forecasting of the yield of major agricultural crops and pasture vegetation;
- Studies to adapt and expand the implementation of auxiliary indices and indicators for drought assessment in order to increase the efficiency and reliability of the results obtained;
- Assessment of the impact of climate change on the processes of desertification and drought.

5.2. Educational programs that can contribute to a better understanding of drought.

5.2.1. A better understanding of drought requires the development and implementation of an educational program on basic drought / dry season concepts and best practices for building local capacity to ensuring sustainable implementation of drought management.
5.2.2. Enhanced participation of civil society and academia in the implementation of the National Plan, Integrated Drought Management and Drought Management Measures.
5.2.3. Creation / development of a system for the exchange of knowledge, skills and experience on best practices on integrated drought management and drought mitigation measures.
5.2.4. Develop approaches and methods to demonstrate and implement best practices, technologies, environmentally sound preparedness, mitigation and response to drought, etc.

5.3. Weaknesses in the drought management program design

The National Action Program to Combat Desertification in Uzbekistan, developed in 1999, does not take into account integrated drought management plans and measures to combat drought.

Low incomes of local communities in drought prone areas.

The local population has a low level of profit from the main activity and, as a rule, does not have alternative sources of income, therefore, the lack of water during extreme droughts and financial difficulties force farmers to look for ways of survival, which often lead to a deterioration in the quality of surface and groundwater, overgrazing livestock, deforestation and other negative impacts.

Low level of knowledge among local communities and lack of advisory support and services for dissemination of best practices. Lack of knowledge and awareness of the population of drylands on the practices and measures for adaptation and mitigation of climate change, complicates their wide participation in the implementation of programs to prevent and minimize the risks of drought. The lack of adequate advisory and information support and services for the dissemination of best practices and technology transfer limits the adoption of cost-effective and safe technologies in land use practices and their replication in a sustainable manner.

5.4. National and regional initiatives proposed for the IDM (Integrated Drought Management) program.

To meet the requirements of the UNCCD, institutional reform is required, as well as active cooperation of Uzbekistan at the regional level, which must be carried out by the authorized body.

In addition, in the area of eliminating the causes of desertification and drought, it is necessary to apply priority measures:

• diversification of agricultural crops;
• breeding and seed production of drought tolerant varieties, including the production of seed crops for diversification;
• increasing the efficiency of water resources use in agriculture;
• improvement of extension services and advisory services;
• expanding the range of drought risk insurance products, in particular, types of insurance based on weather derivatives indices;
• improvement of the system for monitoring and forecasting droughts (data collection, modeling of hydrological and economic conditions, open access to data);
• Strengthening coordination of measures to address the causes and consequences of drought and measures to mitigate drought risks.

National Dialogue

The Global Water Partnership (GWP) expressed its readiness to provide technical and methodological support for the preparation of the concept of a national plan to combat drought in Uzbekistan. This support is funded by the US National Oceanic and Atmospheric Administration.

From December 2021 to March 2022, with the involvement of national experts, an Overview of the current state of drought management in Uzbekistan, as well as the concept of the National Drought Management Plan, was prepared. The goal of the national plan is to address drought-related issues through monitoring and early warning, vulnerability and risk assessment, and drought mitigation and adaptation measures.

On April 5, 2022, a workshop was held in Tashkent to discuss the necessary steps to develop a National Drought Management Plan 2023-2030.

The workshop was attended by representatives of all ministries, departments, research institutes, non-governmental organizations involved in the problem of droughts.

As a result, recommendations were given on the content of the national plan, namely:

The first priority area is capacity development for monitoring, risk assessment and drought prevention: strengthening the technical base of the Hydrometeorological Service and introducing innovative solutions for drought monitoring and forecasting; development of a drought monitoring and early warning system that will improve the decision-making process for planning and managing risks regarding the impact of drought on food and water security.

The second priority is drought mitigation. This includes the development of measures to address water scarcity issues based on monitoring and early warning data: the degree of expected low water and drought (a set of indicators) is a criterion for the adoption of certain action plans to mitigate the effects of the expected drought.

The third priority area is capacity building and awareness raising: it is important to raise the awareness of the rural population (including women) about climate change adaptation and effective agricultural practices.

The fourth priority area is to actively develop regional cooperation: given the transboundary nature of the effects of drought, cooperation between the countries of the region is extremely important. In this regard, participants turned to the Global Water Partnership to provide all possible assistance in activating regional and international cooperation on drought risk reduction.

REFERENCES

1. Third National Communication of the Republic of Uzbekistan on the Framework Convention on Climate Change, Tashkent, 2016, 220 p.
2. State cadastre of zones of increased natural hazard part: zones
increased risk of hydrometeorological phenomena (Annual edition) part-I (2005-2015), Uzhydromet, Tashkent
3. WB (2005). Drought. Assessment of management and mitigation of effects for the countries of Central Asia and the Caucasus. Report # 31998-ECA, World Bank, 2005.
4. ADB (2009). TA 6479-REG: Addressing Climate Change in the Asia and Pacific Region-Building Climate Resilience in the Agriculture Sector- IFPRI Report. Manila, 2009
5. WMO (2011) Agricultural Drought Indices Proceedings of an Expert Meeting 2-4 June 2010, Murcia, Spain
6. Agaltseva N.A., Rakhmatova N.I. Drought in Uzbekistan: problems, early
prevention and mitigation. Ecological Bulletin Magazine -
Tashkent 2012.S. 23-28.
7. Journal Ecological Bulletin, No. 9, 2012 8.
8. Strategy of actions in five priority directions of development of the Republic
Uzbekistan in 2017-2021 (UP 4947 dated 02/07/2017 and Appendix No. 1 to it)
9. CACILM (2006). National Framework Program of the Republic of Uzbekistan, Tashkent, 2006, 148 p.
10. CACILM (2009). Supplement to the National Framework Program of the Republic of Uzbekistan, Tashkent, 2009, 148 pp.
11.V.E. Chub (2007). Climate change and its impact on hydrometeorological
processes, agriculture and water resources of the Republic of Uzbekistan.
Uzhydromet, NIGMI, Tashkent, 2007, p. 132
12. V.E. Chub, A.S. Merkushkin. Role of climate services in mitigation
the consequences of drought in Uzbekistan. Ecological Bulletin Magazine - Tashkent
2012.S. 6-9.
13.V.E Chub (2001). Climate change and its impact on the potential of natural resources of the Republic of Uzbekistan. Uzhydromet, NIGMI, Tashkent, 2001, 252 p.
14. Multi-country project GEF / UNDP / GM / GIC on capacity building for SLM, CACILM, UNDP, Tashkent, 2012.
15. UNDP (2003) Impact Assessment of the 2000-2001 Drought. in Karakalpakstan and
Khorezm.
16. UNDP (2007) Water is a vital resource for the future of Uzbekistan, Tashkent, 121 p.
17. Project GEF / UNDP / GM / GIC “Achieving stability of ecosystems on
degraded lands in Karakalpakstan and the Kyzylkum desert "CACILM,
(2009)
18. ADB (2007) Strategy for improving the well-being of the population of the Republic of Uzbekistan for 2008-2010, Tashkent, 141 p.
19. SRID, MB, 2001 Uzbekistan - Strategic Study of the Irrigation and Drainage Sector. Part 1, Final Report. The strategy is based on
Government Resolutions (398 and 357) and the National Irrigation Development Program for 2000-2005.
20. UNDP (2006). Traditional knowledge of land use and
water use. Community Mobilization in Central Asia: Implementation
sustainable land management at the community level and building
potential of the local population "with the support of the UNDP Regional Center in
Bratislava and the CCD Global Mechanism Program. Dushanbe, 2006.
21. UNDP (2010) Food Security in Uzbekistan, Tashkent. 76

22. National Action Program to Combat Desertification in the Republic of Uzbekistan - Tashkent, 2000

23. Muminov F.A., Abdullaev Kh.I. Agroclimatic resources of the Republic Uzbekistan. - Tashkent: SANIGMI, 1997, 178 p.

24. NSOP, 2005 GEF / UNDP Project National Assessment of the Capacity to Implement Environmental Conventions.

25. Law of the Republic of Uzbekistan "On environmental control", 12.11.2013, No. ЗРУ-363 // SZ RUz, 2013, No. 52, art. 688

26. Guidelines for Developing National Drought Management Policies: A Guide for Action / World Meteorological Organization and Global Water Partnership, 2014.

27. ICCD/cric (19) /4 Interim report of the intergovernmental working group on the effectiveness of policies and implementation measures in the context of efforts to address drought under the UNCCD. Committee for the Review of the Implementation of the Convention Nineteenth session. Bonn, 15-19 March 2021.

28. Report “Regional Strategy for Drought Risk Management and Mitigation in Central Asia for 2021-2030”. UNCCD, CAREC. Almaty, 2021