NATIONAL ACTION PLAN
OF THE REPUBLIC OF TAJIKISTAN
ON PREVENTION AND MITIGATION OF THE IMPACT
CAUSED BY SAND AND DUST STORMS (SDS)
FOR 2022-2030

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Abbreviations:

ADB	Asian Development Bank
AF	Adaptation Fund
AAS	Academy of Agricultural Sciences
MIA	Melioration and Irrigation Agency
AoF	Forestry Agency on Forestry
CRT	Close to real time
GDP	Gross domestic product
WB	The World Bank
WMO	World Meteorological Organization
GAACC	Global Alliance Against Climate Change
GBAO	Gorno-Badakhshan Autonomous Oblast (Region)
SCLM&G	State Committee for Land Management and Geodesy
SUE KMK	State Unitary Enterprise "Khochagi Manzili Kommunali"
GEF	Global Environment Facility
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EU	European Union
GCF	Green Climate Fund
LUCLUF	Land use, changes in land use and forestry
IFAD	International Fund for Agricultural Finance
CDF	Collective *Dekhkan* farms
CIF	Climate Investment Fund
CEP	Environmental Protection Committee
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MEDT	Ministry of Economic Development and Trade
MEWR	Ministry of Energy and Water Resources
ICF	International Climate Fund
NAS	National Academy of Science
NMHS	National Meteorological and Hydrometeorological Service
NDS-2030	National Development Strategy of the Republic of Tajikistan for the period up to 2030
NSACC	National Strategy for Adaptation to Climate Change
NSAPCSUB	National strategy and Action Plan for the conservation and sustainable use of biodiversity
NCBB	National Center for Biodiversity and Biosafety
MTEF 2016-2020	Medium-Term Development Programme of the Republic of Tajikistan for 2016-2020
SDS	Sand& Dust Storms
NAP	National Action Plan
PPACC	Pilot Programme for Adaptation to Climate Change
GG	Greenhouse Gas
PFBGGIR	Preparation of the first biennial greenhouse gas inventory report
UNDP	United Nations Development Programme
UNCCD	United Nations Framework Convention on Climate Change
SFCCC	Special Fund to Combat Climate Change
SDS WAS	Sand and Dust Storm Warning and Assessment System
MMS	Mass Media System
SEA	Strategic Environmental Assessment
NWP	Numerical Weather Prediction
ES	Emergency situations
SDG	Sustainable Development Goals

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PROJECT INFORMATION

The Project "Regional Approaches to Combating Sand and Dust Storms and Drought" is financed by the Secretariat of the United Nations Convention to Combat Desertification (UNCCD) and is implemented by the Regional Environmental Center for Central Asia (CAREC).

Considering that the countries of Central Asia (CA) are significantly affected by drought and sand and dust storms (SDS), especially in areas outside the highlands, where the semi-arid and arid climate prevails, recognizing the increased risk of droughts and SDSs, the parties and the UNCCD have taken a decision on counteracting the negative impact of droughts and SDSs.

In order to assist the participating countries in improving their preparedness and resilience to droughts and SDSs, and creating conditions for the implementation of the coordinated actions and data exchange efforts at the national and regional levels, the UNCCD Secretariat has developed mechanisms to promote policies in the field of drought and SDS management, a support to the states in the development of national drought management plans has been provided, as well as methodologies and tools, including a set of drought management measures, and a comprehensive inventory and global overview map of SDS origins has been compiled.

This initiative of the UNCCD Secretariat for Central Asia is aimed at supporting the countries of the region in the development and implementation of the strategies to reduce the risks of SDSs and droughts at the national and regional levels, and facilitates coordination among the government agencies working in the climate and environmental profile, academic community, experts-practitioners and the local communities.

With the application of a comprehensive Droughts and SDS Risk Reduction Strategy, including monitoring and early warning systems, the CA countries will be able to strengthen regional integration and capacity to effectively improve preparedness and resilience to relevant environmental and natural disasters, focusing on pro-active management, in accordance with their national natural disasters risk reduction and mitigation plans; and the national plans for the management of land, water and other natural resources.

It should be also noted that the UNCCD Secretariat and CAREC recognize the importance of women during the implementation of the Convention and other environmental initiatives and, therefore, identify the following key important areas for their involvement into the processes: (i) raising awareness and participation in the development and implementation of the programmes; (ii) making decisions that both men and women equally implement at local level while dealing with the management, development, implementation and evaluation of the regional and national action programmes (RAP and NAP); and (iii) capacity building, training and public awareness efforts, especially at local levels, with the support from the local organizations.

Taking into account the above mentioned, and in order to reduce the existing risks and to prevent new risks of natural disasters associated with SDSs in the Republic of Tajikistan, this given "*National Action Plan for Prevention and Mitigation of Impact from Sand and Dust Storms in the Republic of Tajikistan for 2021-2030"* was developed, based on the consultations with the national Ministries and agencies responsible for planning, combating negative natural phenomena and for social protection of population.

INTRODUCTION

Taking into consideration the urgency of the global environmental issues and their close inter-dependency with the local context and environmental conditions, the Republic of Tajikistan has joined and ratified a number of important international Agreements. These include, first of all, the UN Convention to Combat Desertification (1997), the UN Framework Convention on Climate Change (1998), the Kyoto Protocol to the UN Framework Convention on Climate Change (2008) and the Paris Agreement on Climate Change (2017).

At present time, special attention of international organizations, experts and specialists in the field of climate change and environmental protection is dedicated to research the character of sand and dust storms (SDS), their sources and negative consequences of their impact in the arid and semi-arid regions of the world.

Such an interest has a reason behind: the need to combat SDSs was raised and the issue has been discussed during 5 years at 70-74 Sessions of the UN General Assembly and the accorded Resolutions have been adopted. In particular, the General Assembly, with the reference to its Resolutions №№ 70/195 of 22 December 2015; 71/219 of 21 December 2016; 72/225 of 20 December 2017; 73/237 of 20 December 2018 and 74/381 of 5 December 2019, had asked the UN Secretary General to include the issue of combating sand and dust storms on the Agenda of the Seventy-fifth Session of the General Assembly.

The Decision № 31 / COP.13 "Policy Advocacy Framework for Sand and Dust Storm Control" has mandated the Secretariat and relevant agencies and bodies of the United Nations Convention to Combat Desertification (UNCCD) to cooperate with other relevant United Nations entities and specialized organizations in assisting Parties to implement the Policy Advocacy Framework, in particular addressing anthropogenic sources of sand and dust storms and in strengthening resilience.

The Sendai Declaration and the Sendai Framework for Disaster Risk Reduction for 2015–2030 (hereinafter referred to as the "Sendai Framework") puts implementation of the same preventive measures as an obligation. The priority areas of these documents are countering natural disasters, including the threats posed by the SDSs, understanding their risk in order to prevent them, mitigate their impact, develop and take effective actions to ensure preparedness and response to them.

In this regard, the Republic of Tajikistan had to fulfill some obligations to develop a wide range of adaptation activities to respond to climate change in Tajikistan. These include formulation and approval of the National Action Plan to Combat Desertification in Tajikistan in 2001, the National Action Plan of the Republic of Tajikistan on Climate Change in 2003, the National Strategy on Adaptation to Climate Change of the Republic of Tajikistan until 2030, the National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030 and other important documents related to these challenges.

The most important challenge related to sand and dust storms is desertification, based on the reasons for its formation and further development of the process, it would be possible to address the issues and problems related to the SDSs. The fact is that all factors contributing to the process of desertification (land degradation, erosion processes, de-forestation, pasture degradation, land salinization, soil pollution, etc.), and its further development, are the primary reasons to trigger the formation and creeping of SDSs in most vulnerable regions of Tajikistan.

Therefore, at present time, along with the implementation of the National Programme of Action to Combat Desertification in Tajikistan, it is high time to develop a National Action Plan for the Prevention and Mitigation of impact caused by Sand and Dust Storms (hereinafter referred to as the NAP on SDS).

This is also prompted by the fact that the National Action Programme to Combat Desertification in Tajikistan does not pay an adequate attention to the analyses of the SDS issue. It can be confidently stated that these documents will complement each other and contribute to the effective implementation of the activities carried out within the framework of the implementation of each of them.

As a part of the process of the National Plan of Action for SDS elaboration, situation analysis on natural and anthropogenic sources of the SDSs and their impact on different sectors of the national economy was carried out, scientific and practical recommendations were proposed to reduce the influence of the factors contributing to their formation, as well as the main directions of actions to achieve the goals and to address problems related to SDS were identified.

During the preparation of the NAP on SDS, a number of consultative meetings were held with the representatives of the key Ministries and agencies, Scientific-research Centers and civil society organizations. On October 15, 2020, a Round Table was held at the Committee for Environmental Protection under the Government of the Republic of Tajikistan to discuss the Draft NAP on SDS with participation of the representatives from the key Ministries and agencies, Scientific-research Centers and civil society organizations. The Draft NAP and SDS was sent for consideration of the stakeholders: the key Ministries and institutions in order to get their feedback as recommendations and proposals.

There were some difficulties faced by the national Working Group during the development of the National Action Plan for the SDS which also should be noted, such as following:

- the absence of any research about the formation and development of the SDS processes in Tajikistan;
- the structural composition by components of SDS formed in Tajikistan has never been studied;
- the absence of information on the main places where the SDSs are tend to be born and developed;
- no mapping and zoning of the territory of the Republic of Tajikistan has been carried out in terms of capacity and degree of the impacts from the SDSs;
- the negative consequences of the SDSs and their impact on the status of health care system and other sectors of the economy of the Republic of Tajikistan have not been studied;
- the issues of the impact of the SDSs are not included in any strategic programmes, both at the national and sectoral levels;
- the absence of any coordination mechanism for the purpose of harmonizing efforts on combating SDSs among the key Ministries and institutions;
- no mechanism exists for assessing the damage caused by the SDSs.

1. NPA ON SDS: GOALS AND OBJECTIVES

1.1. The Goals and Objectives

The overall goal of the NAP is to reduce the existing and to prevent the new emerging disaster risks associated with the SDSs through building national capacities for their management. In order to achieve the set-up goal, the four key objectives below must be addressed:

To respond to the national challenges related to the sand and dust storms, the national Work Group has identified the following four key objectives that form the basis of the Action Plan:

- **Objective 1:** Identification of the SDS risks and mitigation measures to combat their impact on the population health and other sectors of the national economy;
- **Objective 2**: To ensure access for all stakeholders to the information on disaster risks related to SDSs;
- **Objective 3:** Integration of the SDS risk management measures into development process;
- **Objective 4:** To improve SDS Preparedness and Respond Mechanisms.

Timely and comprehensive interaction of all stakeholders and to combine joint efforts for combating negative natural phenomena and anthropogenic factors affecting the development of desertification processes, land degradation, de-stabilization of natural ecosystems and the spreading of the SDS sources, within the framework of the tasks and actions proposed in the given Action Plan, will contribute to the following:

- improvement of regulatory and legal documents to strengthen measures on the SDS risk reduction, prevention and mitigation of their impact for various sectors of the economy;
- creating a scientific base for research in the field of studying the nature of the development and creeping of the SDS, as well as mitigating their negative consequences;
- raising awareness of the population, representatives of communities, local executive authorities, local government bodies, relevant organizations and institutions on preventive, protective and restorative actions related to the SDSs;
- increasing the capacity of national and local authorities, civil society organizations, communities and volunteers in the field of monitoring the threats, risks, and social vulnerability associated with the SDSs;
- development of scientific and practical measures to mitigate the impact of SDS on the public health care status and other sectors of the national economy;
- to implement zoning and mapping of the country's territory according to the degree of the development and incidence of SDSs;
- establishment of an information system for registering gender and age-sensitive data, for analysis, prevention, forecasting and monitoring of the processes related to SDS, with a breakdown by individual sectors of the economy and social strata.

Some activities are already being carried out within the framework of the National Action Programme to Combat Desertification, as well as within other national and sectoral programmes, but in order to achieve the goal of the National Action Plan for SDS and to further address the above-mentioned issues, it is necessary to develop specific objectives, directions of actions and to assess the expected outcomes.

Therefore, to achieve the main goal of the National Plan of Action on SDS, the following activities are being implemented:

- elaboration and introduction of a gender-sensitive information software and trainings of the population in pro-active, protective and restorative actions related to SDSs;
- development of a system for integrating issues related to the SDS risks into the regional policy documents, strengthening local capacity to manage these risks;
- development of cooperation between government, civil society and private organizations in order to address the SDS risks, to raise awareness and capacity of the population in this sphere and to ensure the implementation of the adopted action plans;
- improving legal-normative framework with the purpose to enhance actions on SDS risk reduction and their inclusion into the development-related initiatives;
- improvement of the national mechanism for collecting, analyzing and disseminating information on the SDS, with the aim of adapting to desertification issues;
- application of existing and elaboration of new financial mechanisms to ensure safety of population, inhabited localities and economic sectors from the negative consequences resulted from the SDS phenomena;
- increasing capacity of national and local authorities, non-governmental organizations, communities and volunteers in the field of monitoring threats, risks, and social vulnerability associated with the SDS, taking into account gender\age\disability factors, as well as available resources for the risk management;
- carrying out scientific-research work in the sphere of SDS risk reduction, taking into account the financial potential of the scientific-research institutions and international organizations to support such an activity.

1.2. Expected Outcomes

- National legislation basis has been improved in terms of preventing and mitigating the negative consequences from the SDSs;
- a dialogue and cooperation among the state authorities, private sector and civil society has been established in the area of the SDS risk reduction;
- a scientific basis for research in the field of studying the SDSs nature, their development and spreading, as well as mitigating their negative consequences has been established;
- awareness on the SDS for the community representatives, local executive authorities, local self-government bodies, relevant organizations and institutions was enhanced;
- scientific and practical measures have been developed to mitigate the impact of the SDSs on the national health care sector and other sectors of the national economy;

- the territory of the country has been divided into zones and was mapped according to the degree of the development and impact of the SDSs;

- approach methodology to address main the factors contributing to the formation, development and SDS spreading is improved;

- a gender- and age-sensitive information system for registration, analysis and storage of the data on SDS is established;

- a database on losses as a result of SDSs, with a breakdown by individual sectors of the economy is created and regularly updated;

- regulatory legal documents were developed to strengthen measures to reduce the risks associated with SDS in various sectors of economy;

- assessments of the SDS risks, vulnerability of the population and infrastructure facilities for exposure to their possible consequences, as well as an assessment of the capacity of organizations and institutions to respond to them are carried out on a regular basis;

- Trainings for the population on preventive, protective and restorative actions related to the SDS are regularly conducted;

- a system for collecting and analyzing information, warning, forecasting and monitoring processes related to SDS was developed;

- a system for monitoring the implementation of the NAP on SDS was developed.

2. PORTFOLIO OF THE REPUBLIC OF TAJIKISTAN

2.1. Administrative situation

Tajikistan is located between 36^{0}40' and 41^{0}05' North latitude and 67^{0}31 'and 75^{0}14' East longitude (Figure 1), occupies an area of 141.4 thousand sq.km and is located in the inner part of the vast continental massif of Eurasia and without any outlet to a sea. The territory of the Republic of Tajikistan has a complicated outline of its borders, reflecting the historical and geographical characteristics of the population of the Tajik people in Central Asia.

In the North, Tajikistan borders with Kyrgyzstan (630 km), in the East - with China (430 km), in the South - with Afghanistan (1,030 km), and in the North and West - with Uzbekistan (910 km). In the south-east, Tajikistan is separated from India and Pakistan by a narrow strip of Afghan territory 15 to 65 km wide[1].

Figure 1: Administrative map of the Republic of Tajikistan [2]

The territory of Tajikistan is divided into the following administrative-territorial entities: GBAO: Gorno-Badakhshan Autonomous Oblast (region), Sughd region, Khatlon region, 65 districts, 18 cities, 47 urban-type settlements and 370 rural administrative units (*Jamoati Dekhot*). At the same time, 13 districts in the central part of Tajikistan belong to the group of Districts of Republican Subordination. The capital, Dushanbe, has a separate administrative status and is divided into four city districts.

2.2. Demographic characteristics

A very important indicator in determining the impact of SDSs, and especially on the health of the population, is the indicator of the growth rate and population density. With the increase in the number and, accordingly, the density of the population, the negative impact of the SDS on the population's access to food, drinking water and the health care system is increasing.

[1] Third Environmental Performance Review of the Republic of Tajikistan. UN 2017. https://www.unece.org/fileadmin/DAM/env/epr/epr_studies/Tajikistan%20r.pdf

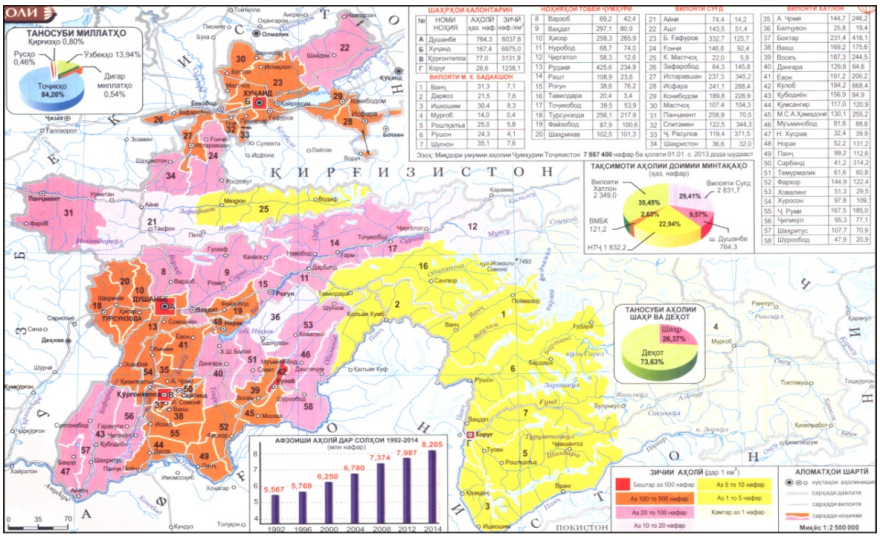
[2] Tajikistan - detailed political and administrative map. Detailed political and administrative map of Tajikistan. http://www.mapsfinder.ru/detailed_political_and_administrative_map_of_tajikistan/

Tajikistan is experiencing a very rapid population growth rate. During the period from 2000 to 2019, the country's population has grown by 49% from 6.13 million to 9.31 million people. The average annual population growth rate for this period was 2.1%. In the total population structure in 2019, the share of the rural population was 73.7% and of the urban - 26.3%.

	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total	6264,6	6842,2	7417,4	7807,2	7987,4	8161,1	8352,0	8551,2	8742,8	8931,2	9126,6	9313,8
Including:												
In rural areas	4594,0	5032,2	5443,9	5742,4	5880,9	5990,2	6136,5	6290,9	6431,3	6577,0	6729,8	6855
In cities	1670,6	1810,0	1973,5	2064,8	2106,5	2170,9	2215,5	2260,3	2311,5	2354,2	2396,8	2458,8

Figure 2: Dynamics of the population of the Republic of Tajikistan for 2000-2019 (thousand people [3])

A very important indicator in determining the impact of SDS, and especially on public health, is the population density indicator. The average population density over this period of time had increased from 42.8 per 1 sq.km in year 2000 to 64.5 people in 2019[4]. Although the average population density is not very high, it varies significantly due to the geographical features of the mountainous terrain, with the most densely populated areas of the country being the lowlands of northern and southwestern Tajikistan (Figure 3).



[3] Demographic Yearbook of the Republic of Tajikistan. Agency on Statistics under the President of the Republic of Tajikistan, 2018. https://www.stat.tj/ru

[4] The population of the Republic of Tajikistan as of January 1, 2019. Agency for Statistics under the President of the RT. https://www.stat.tj/ru

Figure 3: Map of population density of the Republic of Tajikistan in persons per 1 sq.km [5]

The population is distributed over four main regions and the city of Dushanbe as follows: Khatlon region - 35.9%; Sughd region-29.1%, region of GBAO - 2.5%, Districts of Republican Subordination (DRS) - 23.2% and Dushanbe city -9.3%. The lowest population density is observed in the mountainous areas, where the density value is less than 50 people per square kilometer of the territory. In the GBAO, the population density is 3.5 people per sq.km. The highest population density is observed in the capital - the city of Dushanbe - 8, 486 people per sq.km, and in other large cities of the country. The largest city in Tajikistan is its capital, Dushanbe, with a population of 846,4 thousand people. Other large cities include Khujand (180, 7 thousand people), Bokhtar (109,9 thousand people) and Kulyab (104,9 thousand people[6]) (Figure 4).

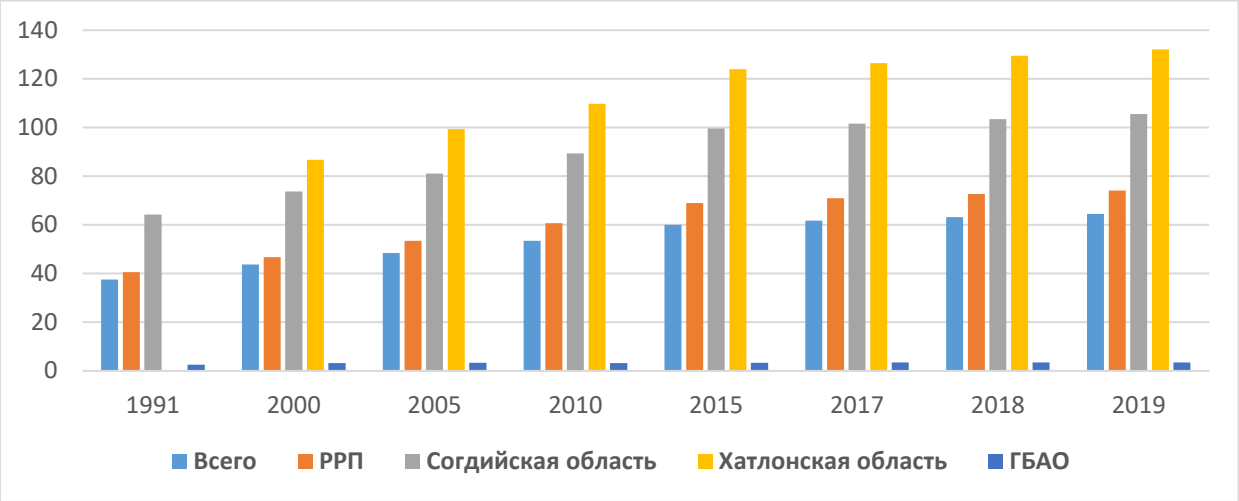


Figure 4: Dynamics of population density at the regional level in the Republic of Tajikistan in the period of 1991-2019 [7]

According to the forecasts, with a growth rate of 2.1%, the population of Tajikistan will reach the figure of 11,5 million by 2030, which is 88% higher than in 2000, and 55% higher than in 2010, and 26% - higher than in 2019[8].

2.3 Socio-economic characteristics

The socio-economic characteristics of Tajikistan are important, first of all, from the point of view of how much the country can withstand against the impact of the SDSs, what is the potential to respond and which sectors are the most vulnerable.

The economy of Tajikistan is agrarian-industrial, its basis is represented by agricultural sector: cotton growing, crop growing, animal husbandry, as well as by the industrial sector: mechanical engineering, production of aluminum, mineral fertilizers, textile and light industry, energy and production of consumer goods.

[5] The map was compiled on the basis of data from the statistical report - Demographic Yearbook of the Republic of Tajikistan. Agency on Statistics under the President of the RT, 2018. https://www.stat.tj/ru

[6] Population of the Republic of Tajikistan as of January 1, 2019. Agency on Statistics under the President of the RT. https://www.stat.tj/ru

[7] See ibid;

[8] Demographic Yearbook of the Republic of Tajikistan. Agency on Statistics under the President of the Republic of Tajikistan, 2018 https://www.stat.tj/ru

Relative remoteness and communication isolation from the existing global transport infrastructure, high-mountainous terrain, with no access to a sea, all of these factors determine an unfavorable economic and geographical position.

Tajikistan's total GDP in 2019 was USD 8.3 billion, including USD 903 per capita. In the structure of GDP, 20.9% are agricultural products, 21.2% - industry, 11.7% - construction, 28.6% - services, 7.9% - transport and 9.7% - taxes on net production[9]. (Figure 5)

Figure 5: Structure of Tajikistan's GDP in 2019 (%)[10]

Tajikistan's public external debt stood at USD 2.9 billion at the end of 2018 (40 percent of GDP), up from 24 percent of GDP in 2014. The real GDP growth slowed down from 7.3 percent in 2018 to 6.2 percent in 2019, according to the World Bank data, and will decline to 4.5-5.0 percent between 2020-21, reflecting the weaker economic growth in Russian Federation and the decline in the global commodity prices associated with COVID-19 pandemic. Remittance inflows will remain slow in the medium-term perspective. The mining, manufacturing and construction sectors will be supporting economic activity.[11]

It is important to highlight that Tajikistan was included in the list of 10 countries with the fastest rate of poverty reduction in the last 15 years. The poverty rate has reduced from 81% in 1999 to 27.4% in 2017. The extreme poverty rate, accordingly, has reduced from 73% to 14%. The analysis of data from 2003 to 2017 demonstrated that the factors that affected poverty reduction were the following: increased wages, remittances, timely pension payments, and etc.[12]

The analysis of the socio-economic situation in Tajikistan reveals that the country is one of the most vulnerable to the impacts of climate change, including the on from SDSs. Although at present, the economic damage from the SDS is not fully studied and the Government does not consider this phenomenon as a risk of climate changes, in future, the SDSs may become one of the factors negatively affecting the country's economy.

[9] Statistical Yearbook of the Republic of Tajikistan 2020. Statistics Agency under the President of the Republic of Tajikistan

[10] Agency on Statistics under the President of the Republic of Tajikistan, 2020.

[11] Medium-term Development Programme of the Republic of Tajikistan for 2021-2025.

[12] Increased vulnerability despite robust economic growth, Tajikistan. Economic Report, Fall 2017, World Bank Group.

2.4 Climate conditions

The climate of the Republic of Tajikistan is characterized by sharp seasonal and daily fluctuations of the meteorological elements. The relatively cold winter turns abruptly into a rainy spring, but the latter also quickly gives way to dry summers, with almost no precipitation for several months. There are also extreme dynamics in the average annual precipitation - from a minimum level of less than 100 mm in the Eastern Pamirs to 500-600 mm in the Vakhsh river valley in the south and a maximum value of over 2,000 mm on the Fedchenko glacier. The southern position of Tajikistan (36-42 ° north latitude) provides a high position of the sun. The average annual sunshine duration ranges from 2097 to 3166 hours.

The average annual air temperature varies over the territory of the Republic of Tajikistan within wide limits from 17.2 C in the south to -6.9 °C in the Pamirs. In the valleys of South-western Tajikistan, the average annual air temperature is 14-17 °C, the temperature of the coldest month (January) is plus 2 °C; 0 °C; and in July it is + 28 ° to +32 °C (See Figure 6). In the valleys of northern Tajikistan in January, the average monthly air temperature is negative and reaches -2 °C; and in July it is about + 30 °C, the average annual air temperature is +14 ° C to + 15 °C. According to thermal characteristics, all four seasons of the year are quite clearly distinguished in all the regions of the country: spring, summer, autumn and winter. A wide variety of physical and geographical conditions in Tajikistan determines the uneven distribution of the height of the snow cover and the duration of its lasting.

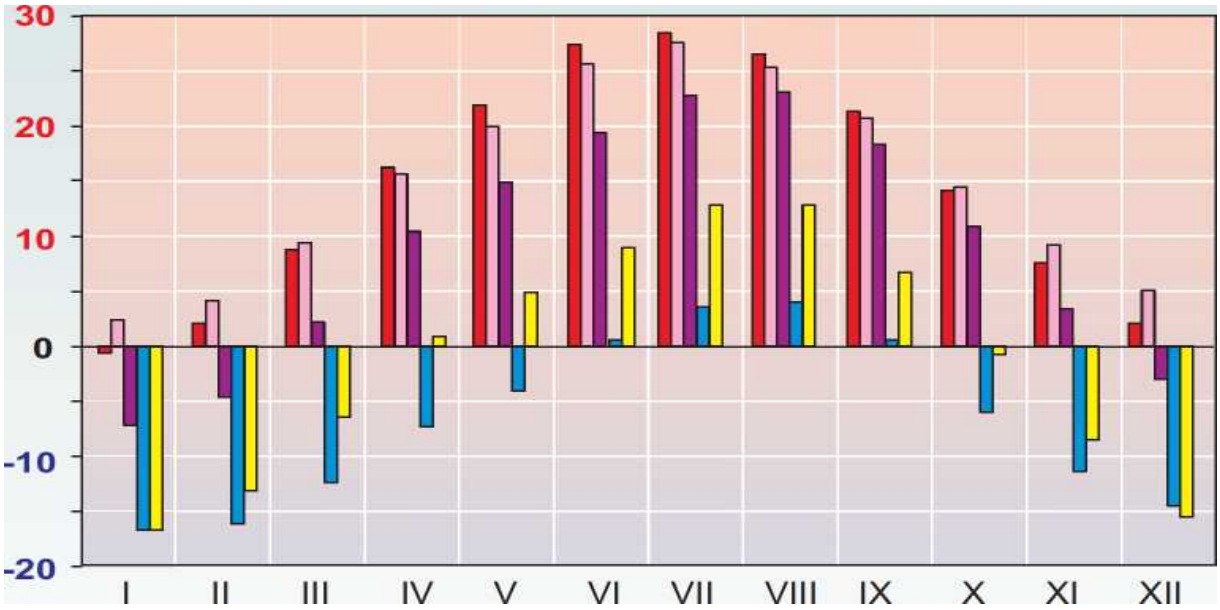


Figure 6: Annual variation of air temperature in Tajikistan (^{0}C)[13]

During the period between 1940 and 2010, Tajikistan had experienced an increase in temperature of 0.1º C to 0.2º C for each decade of this period. The number of days with a temperature of +40ºC and above is growing (Figure 7)[14]. The largest increase in temperature was observed in Dangara (1.2º C) and in Dushanbe (1.0º C). The mountain areas experienced an increase of 0.3ºC to 0.5ºC, while in the alpine areas, the increase was from 0.2º C to 0.4º C[15]. Recent warming trends recorded in the period 2001-2010 demonstrate that the average temperature for each decade was for 0.8º C higher than the average for the areas located at 1000-2500 m above the sea level. In the alpine

[13] Agency of Hydrometeorology under the Committee for Environmental Protection under the Government of the Republic of Tajikistan.

[14] Government of the Republic of Tajikistan, 2014, Third National Communication of the Republic of Tajikistan to the United Nations Framework Convention on Climate Change. Dushanbe, Tajikistan.

[15] The Government of the Republic of Tajikistan, 2014. Third National Communication of the Republic of Tajikistan to the United Nations Framework Convention on Climate Change, Dushanbe.

zone, the observed increase was of 0.2ºC above the normal. The temperatures were higher by an average of 0.1º C to 1.1º C in winter and for 0.1º C to 1.3º C in spring. Autumn temperatures in all mountainous regions exceeded the average by 0.6º C to 1.1º C.

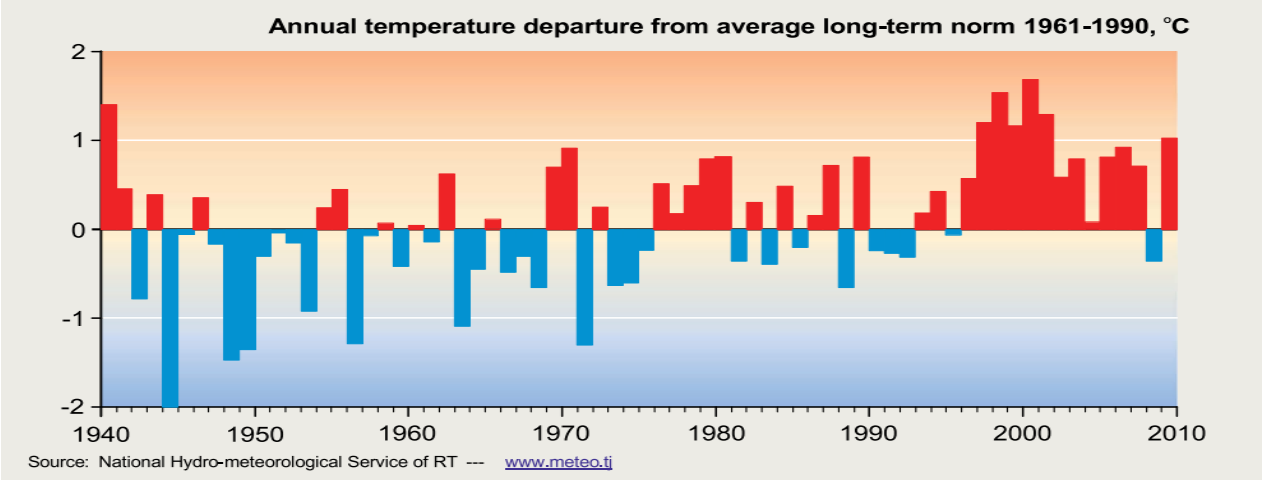


Figure 7: Changes in temperatures in Tajikistan

Annual precipitation volume had increased in the period between 1940 and 2012 by 5% -10%. The largest amount of precipitation was observed in 1969 (Figure 8). A relatively significant increase in precipitation was recorded during the summer periods in the period from 1976 to 2012. In most parts of the Republic of Tajikistan, the number of days with rainfall rates of 5 millimeters (mm) or more has increased, especially in the central highlands. The number of days with heavy precipitation (30 mm per day) has increased in the foothills of the country, such as in the Hissar valley. While the number of rainy days has increased, the number of snowy days has decreased. The rainiest years recorded were 1969, 1998 and 1999, with more frequent mudflows.

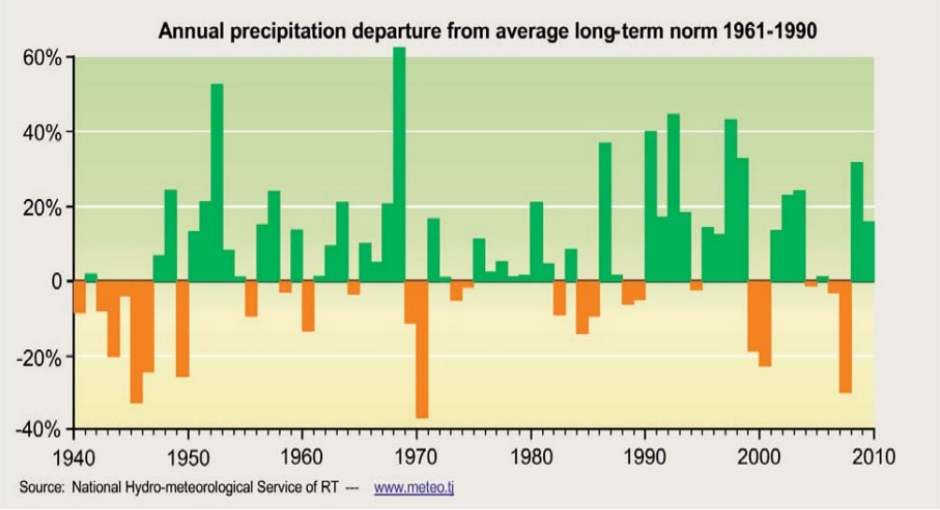


Figure 8: Changes in precipitation in Tajikistan

The continued melting and shrink of glaciers associated with climate changes raises a concern for Tajikistan, as Tajikistan's glaciers and snow reserves represent the main sources for irrigation

water[16]. About 30% of the ice cover has been lost since 1930; the current rate of de-glaciation is 0.5% to 0.8% loss in annual terms. The largest glacier in Tajikistan, the Fedchenko Glacier, had retreated to a distance of 1 km and had lost about 5 km of its ice cover from the beginning of the twentieth century. Small glaciers in the lower reaches are the most affected by climate changes and are melting at an unprecedented rate.

The persistent shrinking of glaciers is already adversely affecting the availability and utilization of irrigation water, as seen in the lower reaches of the Amu Darya basin in Karakalpak area, where access to irrigation water has almost halved. Farmers are increasingly relying on rainfalls to provide water and the changes in crop breeding are taken place due to the declining of access to the irrigation water.

[16] Government of the Republic of Tajikistan, 2014, *Third National Communication of the Republic of Tajikistan to the United Nations Framework Convention on Climate Change*. Dushanbe

3. BRIEF ANALYSIS OF NATURAL DISASTERS AND RISK MANAGEMENT SITUATION

3.1. Natural disasters: Threats and Opportunities

Tajikistan is one of the countries which is extremely exposed to natural and other types of disasters. Natural disasters have a negative impact on the population and areas of its habitat, taking away lives of people, destroying infrastructure and creating severe obstacles for further socio-economic development of the country. The main destabilizing processes in Tajikistan are the following: landslides, mudflows, floods, erosion processes, avalanches, earthquakes and SDSs.

(Figure 9).

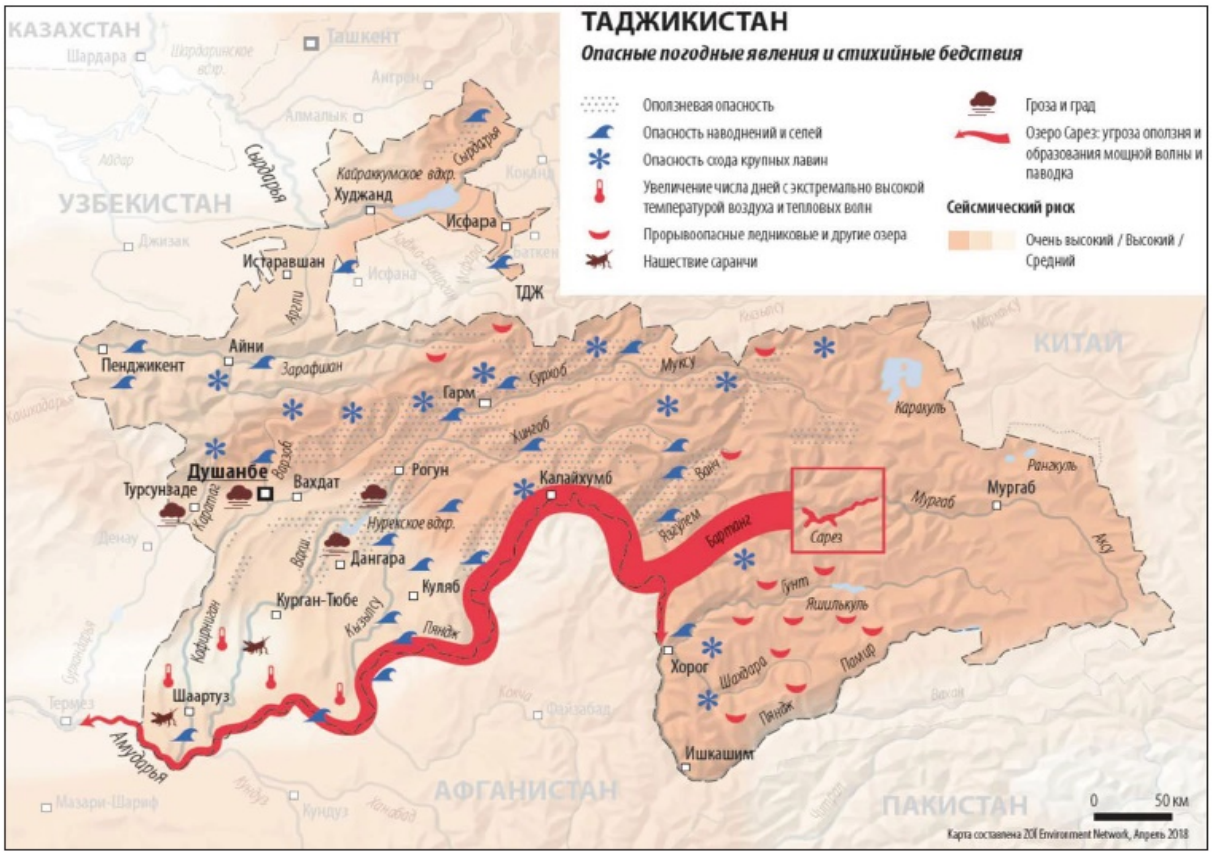


Figure 9: Dangerous weather events and natural disasters in the RT

In recent years, there has been an active melting of glaciers, an increase in average annual temperatures, desertification processes, a change in precipitation, more frequent periods with extreme weather conditions: droughts, SDSs and dust haze (DH). Experts believe that these phenomena are attributed to climate changes. But when speaking about the climate changes, generally, most often one means only the de-glaciation process and the decrease in the precipitation in the mountainous areas. **But an equally important issue associated with the climate changes, which is the occurrence of more frequent dust storms in the country, as well as dust hazes are moved into the end of the priority list of efforts while combating the climate changes**.

The overall negative impact of natural disasters on the national economy and communities is constantly growing. Meanwhile, there are indications that risks for the population and property grow faster in comparison to the rate of resilience growth for the population and infrastructure. The greatest physical danger caused by natural phenomena due to their massive capacity of spreading are mudflows, avalanches, rockfalls, earthquakes, floods and landslides. According to the data of the Committee for Emergency Situations and Civil Defense of the Republic of

Tajikistan, in the period of 1997-2018, there were approximately 4,194 natural disasters recorded, i.e., on average, one natural disaster every two days. Mudflows and floods are considered to be the most frequent (on average 70 cases per year) and the most devastating (on average 35 deaths per year) among the recorded natural disasters[17].

In the period of the past two decades, Tajikistan has experienced a significant increase in the number of natural disasters caused by natural hazards (Figure 10). The National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030 (approved by the Decree of the Government of the Republic of Tajikistan No. 602, dated December 29, 2018) highlights that, according to the official reports, the total damage from natural disasters caused by natural hazards that had occurred in the period from 1997 to 2018, at the average annual exchange rate (excluding inflation) equivalent, had exceeded the amount of USD 589 million. The largest financial damage (in all sectors of the economy combined) was caused by mudflows: on average, for about USD 15 million per year. Droughts (USD 5.4 million) are the second most important source of financial losses, mainly because of the processes of the 2000-2001 droughts. Earthquakes (USD 3.3 million) are ranked as third top destructive disasters in terms of financial losses.

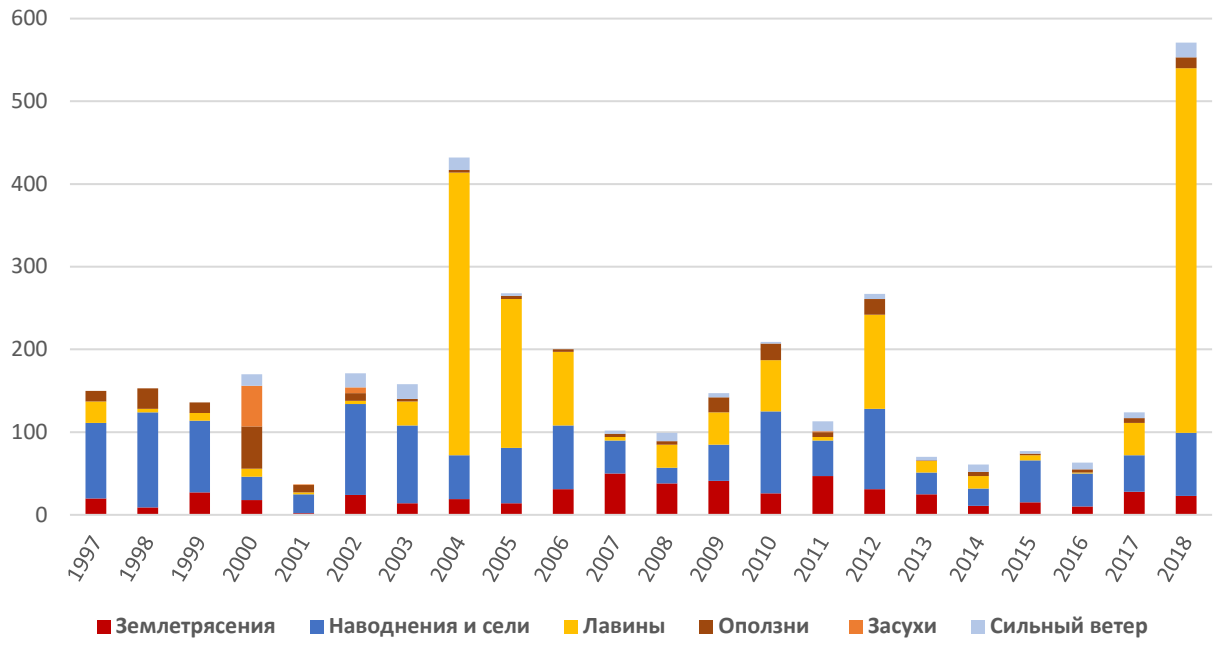


Figure 10: The number of major natural disasters that occurred in Tajikistan during the period of 1997-2018.[18]

Unfortunately, in Tajikistan, no methodology has been developed for recording of the SDSs processes, as a separate type of natural disasters. In the National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030, with the ranking scale for climatic risks (14 types) in descending order of priority, the SDSs are indicated in third place. According to the preliminary estimations, when determining the damage from SDS in the Strategy, it was estimated for equivalent of more than 450 thousand US dollars annually.

Droughts are another severe meteorological phenomenon that are associated with the processes of SDSs and in extreme situations can lead to significant property damage. Droughts most frequently occur in the southern regions of Tajikistan, where SDSs are most observed (Figure 11) and is

[17] National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030, Dushanbe, 2019.

[18] The information was obtained through consultations from Mr. Kamolov, D., the Head of the Department for Territorial Protection, Emergency & Civil Defense Committee.

mainly inter-related with the climatic characteristics of the area, which are manifested in a small amount of precipitation, presence of relatively high temperatures with a significant number of days with air temperatures above + 40 ° C, as well as the absence of a dense irrigation network, with no large reservoirs, forests and with the domination of a desert and semi-desert landscape, which contributes strongly to the occurrence of SDSs.

During the period of 1940-2010, there were eight cases recorded when droughts simultaneously had impacted the entire territory of the country (1940, 1947, 1956, 1971, 1980, 1988, 2000, 2001 and 2007). The droughts were particularly severe in 1971, 2000 and in 2001.

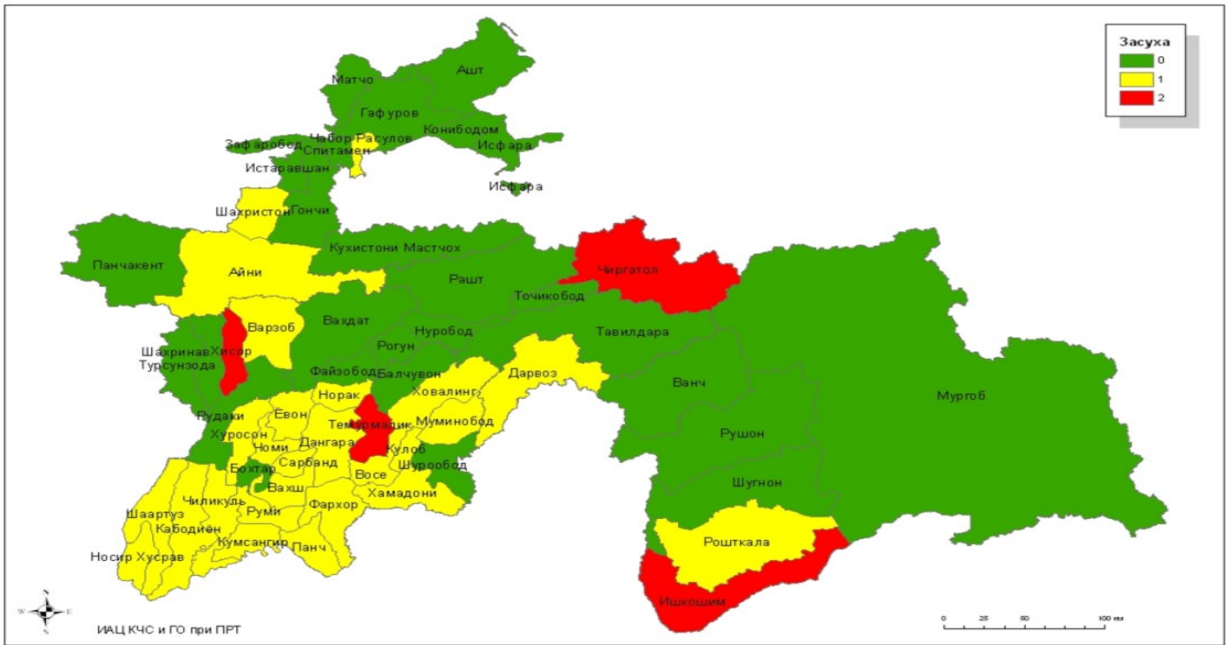


Figure 11: Territories of Tajikistan with the greatest risk of drought [19]

The map of the territories with the highest risk of droughts indicates that, on average, more than 40% of the territories of Tajikistan are exposed to this natural disaster.

3.2 Situation Analysis of Sand and Dust Storms (SDSs) in Tajikistan

At present time, an important issue for Tajikistan is that there is a very low understanding level of that problem, of what the risk caused by sand and dust storms (SDS) represents. Such a situation related to the absence, of significant direct human losses or causalities directly caused by that phenomena (SDS) in most of the cases, as well as by the fact that there is a very limited consolidated documentation on the long-term negative impact on the population's health and the economy.

People of Tajikistan, especially living in the most densely populated - the southern - part of the Republic are very well acquainted with this phenomenon: when the cold weather goes away, there is the turn for dust storms to become more frequent. Local people had given a name to it "An Afghan", as people used to believe that these storms are coming from the territory of Afghanistan.

But this perception is correct only partially. The storms coming to the territory of Tajikistan may be from various regions - even from African directions, but Afghanistan is, definitely, one of the main directions of their origin. Very strong winds, raising dust and sand from the deserts of Afghan

[19] The Digit "0" means the regions in which drought was not observed; the "1" - the regions with an average case of drought and the "2" - are the zones of high risk for frequent droughts.

Kandahar and Iranian Kerman, carry them for nearly 1,000 kilometers north. Residents of the southern regions of Tajikistan and the capital, Dushanbe, most often suffer from the "Afghan" wind. In recent years, one of the areas for SDS spreading remains the Aral lake. Dust storms in this direction began to reach the upper reaches of the Zarafshan river basin, which has never been observed before.

In the next 50 years, the climate changes like global warming may lead to the global climate related disasters and to more frequent dust and sand storms. The "Hot spots" of sand and dust storms, which are not even in terms of their frequency, scale and duration, are scattered throughout the entire territory of Central Asia. The main areas of their formation and spreading are located in the deserts of Kara-Kum, Kyzyl-Kum and Aral-kum.

Speaking about Tajikistan, over the past 30 years, the number of SDSs has increased more than 10 times. If in the early 90s, during a year, there were only 2-3 cases of SDSs, then in the recent years period, there have been more than 35 sand and dust storms recorded annually.

The SDSs are one of the causes which results in a formation of dust hazes (DH). The DHs can be transferred hundreds and even thousands of kilometers from the place of origin of the SDSs. In cases of a turbidity condition of the troposphere, the dust and sand particles can be transferred up to the heights of 3-4 km or higher.

In Tajikistan, dust storms are considered the most dangerous phenomena, and given the fact that there are significant physical obstacles for the large sand particles (high mountain ranges surrounding the country) on the way of SDS's creeping and spreading (the main routes and the sources of the SDS spreading were listed above and will be mentioned further below), they are mainly observed in the areas of the Nizhniy Kafirnigan and Vakhsh valleys. Dust haze (DH) is a phenomenon when there is a presence and preservation of the smallest dust particles in the air, which are remaining in a suspension condition and during which the horizontal visibility is worsened, up to 1-4 km at vicinity or less.

The thickness of the DH layer depends on the speed and vortex structure of the wind. Initially, the limited visibility of 1–2 km or less begins from the surface of the ground and to the height of 1,5–3 km up, but from the windward side of the ridges. The DH is thrown by ascending air currents to the heights of 5-7 km up.

It was discovered that the main reason for the more frequent dust storms formed in Tajikistan is associated with the problem of desertification and the main factors of their formation and development. The same picture is observed in all arid and semi-arid zones of Sughd, Khatlon regions and the Districts of Republican Subordination. Severe de-forestation around individual settlements in the Eastern Pamirs (Vakhan valley in Ishkashim district), became a trigger for the desertification processes, the formation of sandy massifs and transforming them into a movable condition. Thousands of hectares of gardens, agricultural cultivated lands, individual settlements and household plots appear to be under a thick layer of sand and dust. In Tajikistan, approximately 25 percent of global dust emissions, which are produced as a result of transformations in land use and management, as well as the result of the de-forestation and environmentally inappropriate agricultural practices, have anthropogenic reasons behind. In the rainfed areas where the agricultural soils are plowed too often and deeply and the stubble is removed, the soils remain exposed to the external impacts[20].

All this leads to various forms of land degradation and to the emerging of the sources of SDS formation. Overgrazing of pastures is another process leading to the loss of soil cover. There,

[20] Abdullayev, S.F.: Comprehensive studies of dust and gas impurities in arid zones and their impact on the regional climatic regime of the south-eastern part of Central Asia. Dissertation for the Degree of an Advanced Doctor of Physical and Mathematical Sciences, Dushanbe - 2014.

where the lands are not protected with proper soil cover, winds start blowing out small particles containing a significant portion of the soil's nutrients and humus.

The economic damage caused by the dust storms on the territories which are exposed to the SDS is significant. The SDS cause poor visibility which in its turn leads to drifts of vehicles on roads, which severely disrupt normal operation of all types of transport, household buildings as a result of SDSs are covered with thick sand and dust layer, and the SDS cause disruption of normal functioning of various measurement devices\equipment and instruments which require accuracy & precision for their operation. The upper layers of agricultural fertile soils are spoiled by infestation [21].

The dust storms, negatively affecting the agricultural potential of the region, cause serious damage to the economy of Tajikistan. Most significantly, the SDSs impact crops in remote places far from rivers, located in open and especially higher areas, where the winds are stronger than in valleys. In river valleys, the damage from dust storms is much less than in other places, since the soils there tend to be more turf-bounded[22].

Even when the direct reasons which trigger dust storms, disappear, the dust raised from the ground surface continue to remain in the air for several hours or even days. In such instances, intensive amount of the dust is carried by air currents for hundreds of kilometers into the area of eternal snow, this way continuing to cause irreversible damage to the environment. At present time, there is a reduction in glaciation in Tajikistan, i.e., a decrease in the area and volume of its glaciers, which is very likely due to an increase in the general temperature background and due to the transformations of the nature of precipitation carried by the dust storms. The degradation of glaciation is observed on the glaciers of Zeravshan, Hissar-Alay, Pamir and even the Hindu Kush mountains. (Figure 12)

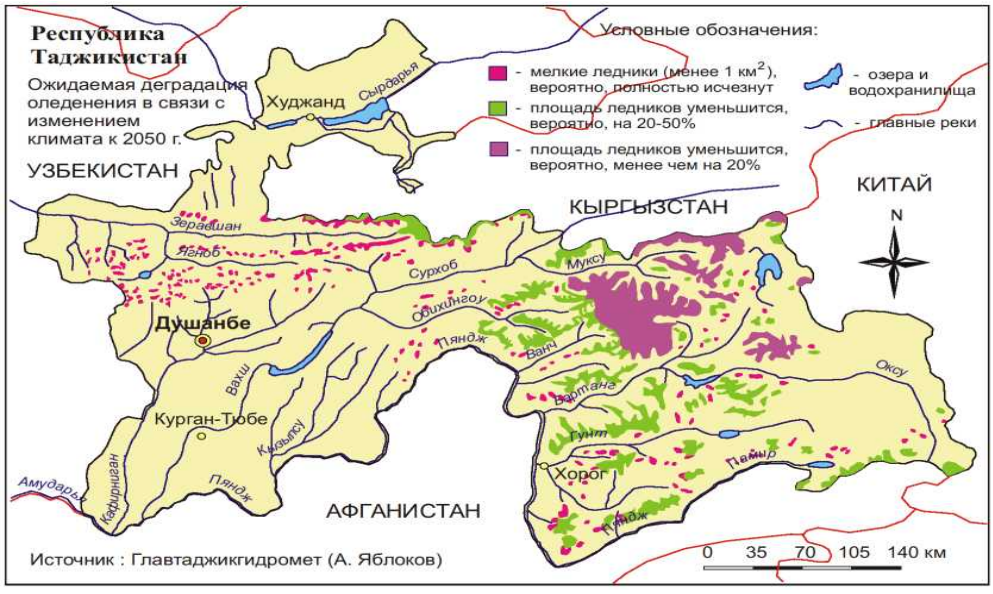


Figure 12: Expected degradation of glaciers caused by the climate changes by 2050.

In addition to the degradation of glaciation, the climate change, accompanied by the transfer of huge amounts of dust with salt content from the Aral Sea region, affects the movement of individual glaciers. Out of the 65 pulsating glaciers located in the mountains of Central Asia, 35 are located in Tajikistan, which indicates the proximity of the location to the sources of SDS formation and the vulnerability of this natural systems to climate change.

[21] Ibid.
[22] Ibid.

Therefore, at present time, highly important priority objective for the Republic of Tajikistan is to conduct scientific-research studies on the glaciers of Tajikistan, but what is more important is to carry out pro-active measures in order to prevent and mitigate the consequences of SDSs, taking into account the climate changes.

3.3. Key Directions for the Actions to be taken in the field of SDS Risk Management

The situational Review in the field of disaster risk management related to the SDS challenges in Tajikistan, carried out as a part of the development of the NAP for SDS, had demonstrated **that in Tajikistan, until present time, there have been no specific research studies on SDSs, on the nature of their formation, development, spreading and the negative consequences carried out**. With the exception of the National Action Plan to Combat Desertification in Tajikistan, there are no other specific fundamental documents (plans, programmes or strategies), within the framework of which it would be possible to take any actions in this direction. But in the above-mentioned Document, too, **no adequate attention is dedicated to the analyses of the SDS issue**, although the processes are very closely inter-connected. Taking as a basis the cause reasons for the formation and further development of the desertification process, it would be possible to address also the issues and problems concerning the SDSs in Tajikistan, such as:

- conducting research to study the characteristics of the nature and consequences of the SDSs;
- development of a system for collecting and analyzing information about the SDSs, monitoring of them, preventing and forecasting;
- development of methods & approaches in forecasting for the SDSs in order to improve the forecasting methodology;
- zoning of the country's territory according to the degree of development and incidence of the SDSs, mapping their sources of formation and impact;
- elaboration of practical measures and recommendations to reduce the impact caused by the SDSs on public health and other sectors of the national economy;
- carrying out activities to increase preparedness and awareness about the characteristics of the SDSs, their negative consequences and measures to mitigate them;
- conducting scientific-research studies on the issues of the SDS risk reduction, taking into account the financial capabilities of research and international organizations to support such a work with funding.

In addition, it is necessary to determine the impact of the SDSs on the health of the population and other spheres of the country's economy, such as transport, agriculture, energy, water management, etc., as well as to develop measures to mitigate their negative consequences. To achieve this, coordination of all efforts and actions among the interested Ministries and agencies is required.

It should be noted that Tajikistan does not have a lot of experience in the system of management and prevention of natural disasters related to the SDSs. Therefore, for Tajikistan, it would be of an effective use to cooperate and exchange experience in the sphere of management and prevention system of the SDSs with the countries of Central Asia and the UN World Meteorological Organization, which is capable to forecast and alert about the approach of sand and dust storms three days in advance.

The experience of the international coalition on combating sand and dust storms, and specifically the application of the sand and dust storm prevention and assessment system, would be useful for the SDS risk management system in Tajikistan. The introduction of this system in Central Asian countries would strengthen the capacity of the countries, including Tajikistan, to provide final users with timely and high-quality forecasts regarding sand and dust storms, relevant observations

results, the information and knowledge based on international interaction among communities dealing with scientific- research and operational activities.

In this direction, the priority objectives are the following:

- installation of automated stations, as well as portable equipment for measuring dust in local sources of the SDSs, especially in the southern part (Kabadian and Shaartuz districts) and the northern part of the country (Kanibadam, Asht districts);
- providing stations with the necessary equipment for the determination of particles and radioactive elements as part of the SDSs in different regions of the country;
- providing training for specialists in the field of monitoring, forecasting and alerting the spreading of the domestic, cross-border and transferrable SDSs.

3.4. Addressing natural disasters issues through implementation of programmes, plans and strategies of the Republic of Tajikistan, taking into consideration SDSs

By the Decree of the Government of the Republic of Tajikistan, dated December 29, 2018, No. 602, the National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for 2019-2030 was approved. The Strategy is a logical continuation of the National Strategy of the Republic of Tajikistan on Disaster Risk Management for 2010-2015. It also takes into account the goals of the National Development Strategy of the Republic of Tajikistan for the period up to 2030, in terms of the natural disasters risk reduction, such as:

- building national and institutional capacity for disaster prevention, preparedness and mitigation;
- integration of natural and climate disasters risk reduction, social vulnerability into the programmes and plans for the development of economic sectors;
- elaboration and implementation of a gender - and age - sensitive information support system, training the population in preventive, protective and restorative actions in response to natural disasters.

The main goal of the Strategy is to reduce existing and to prevent the new risks of natural disasters through building national capacity for disaster risk management. The Strategy [6] took into account the new approaches of the world community to the challenges of natural disaster risks, including the climate change challenge, set out in the Sendai Framework and the Sustainable Development Goals till 2030.

A separate Paragraph in Section 3 is devoted to the climatic and weather conditions, where disaster risk issues are described, and the contents of which are the results of the analysis of climatic parameters carried out during the preparation of the Third National Communication on Climate Change in Tajikistan (2014). The climatic natural disasters mentioned in the Document include mudflows, floods, avalanches, high temperatures and droughts. It is stated in the Strategy that droughts will occur more frequently because temperatures are raising, which will lead to the increased water losses as a result of evaporation and reducing snow cover.

In the future, drought will periodically affect rainfed crops, including fundamental food crops and other means for rural livelihoods. The Strategy does not mention the management and impact of SDSs as a type of a natural disaster when considering trends in the natural disasters. One of the reasons for the Strategy to abide mentioning the SDSs is the absence of information, a relatively low level of researches carried out, no coordination between stakeholders and the underestimation of the negative impact of this type of natural disaster on the health of the population and the economy in general.

At present time, the updated Medium-Term Development Programme of the Republic of Tajikistan for 2021-2025 is being approved in Tajikistan. One of the objectives of the Section “Environmental Protection, Climate Change and Disaster Risks” is to develop a National Action

Plan for Adaptation to Climate Change for 2021-2025 and a Medium-Term Programme for Natural Disaster Risks Reduction for 2021-2026.

In order to address the issues of management and response, to raise awareness and to identify damage from the SDSs, it is necessary to implement the following:

- In the National Action Plan for Adaptation to Climate Change for 2021-2025:

  - to include issues of risk identification, impacts and adaptation measures related to the SDSs;
  - to develop a system for assessing the damage associated with the risks of climate change including the SDSs;
  - to include awareness raising issues on countering the impact of SDSs at the national, regional and community levels;
  - to integrate the SDSs in the process of climatic risks forecasting.

-In the Med-Term Disaster Risk Reduction Programme for 2021-2026:

  - to include the impacts of SDSs as one of the types of natural disasters, taking into account the estimations of economic damage;
  - to integrate the occurrence of SDS into the Unified National System for Prevention and Response to Emergency Situations by coordinating bodies, which are the Commissions for Emergency Situations at the national, regional, city, district levels and at the level of *Jamoats* and organizations.

In the process of elaboration of the National Action Plan for Adaptation to Climate Change for 2021-2025 and of the Medium-Term Programme for Disaster Risk Reduction for 2021-2026, coordination of all actions with consideration of the measures planned in the National Action Plan for SDSs is required.

4. ECONOMIC IMPACT ANALYSIS FOR SDS

4. 1 SDS RISKS AND THREATS ASSOCIATED WITH CLIMATE CHANGE FOR THE NATIONAL KEY ECONOMIC SECTORS

When assessing economic impact by sector, region, gender and age group, a number of damage types need to be taken into consideration. These include the following: a) direct losses, i.e., the losses associated with the direct impact of the natural disaster; and (b) indirect\consequential damage, i.e., the damage to the economy due to business disruption or other similar consequences of the natural disaster. For the purposes of assessing the economic impact of SDSs, the damage to be considered includes the damage types in the region related to soil, organic matter and nutrients blown out, the infrastructural damage, the loss of livestock and forage fodder, the sand-blowing of crops and roadblocking.

The damage outside a given region depends on many factors, mainly the level of economic activity in the affected region. Specific areas of external damage include transport, health care, household works related to cleaning, trade and manufacturing, agriculture, including crop and animal losses, and deterioration in quality.

Until now, in Tajikistan, no specific research studies aimed at identification of the risks and threats of sand and dust storms associated with climate change have been carried out. Proceeding from the fact that there is no information on direct risks of the SDSs at the national level, it is necessary to consider the indirect indicators. The fundamental document in Tajikistan for identification of the climate risks and to some extent indirectly covering the SDSs is the National Strategy for Adaptation to Climate Change in the Republic of Tajikistan for the period up to 2030, where the following are identified as the main sectors sensitive to climate change: energy, water resources, agriculture, transport, health care and education system.

Agricultural sector. Agricultural economy in Tajikistan is the most vulnerable being exposed to the natural disaster risks, including the SDSs. Climate changes and associated with them SDSs are already having negative impact on the agricultural production. About 60% of Tajikistan's population depends on the agricultural sector as its main source of livelihood, income and employment. The basis of that sector is founded on crop production and animal husbandry, while the largest share of the agricultural crops constitutes for the most part of the gross agricultural output[23]. The Government of Tajikistan recognizes the need to reduce the vulnerability of the sector, in particular because agricultural sector accounts for 19.8% of GDP and plays an important role for population's employment[24]. Private sector acts as the main supplier for agricultural products (90%), what includes 90% of fruits and vegetables, and 95% - of bovine cattle.

In 2018, the production of agricultural crops in Tajikistan amounted to 69,1% of gross agricultural production, and the livestock – to 30, 9%. Of the total agricultural production, 6% was produced in the public sector, 56% - in households and 39% - in *Dekhkan* (peasant workers) farms. More than 93% of the livestock production and 39% of the crop production were produced in small-holding subsidiary farms.[25]

During the period from 2011 to 2018, there were no significant changes in the territorial amount of agricultural land. According to the Agency on Statistics under the President of the Republic of Tajikistan, the total area of agricultural land, as of 2018, was 3 mil. 669.4 thousand hectares. From the total area of agricultural land,[26] the share of arable land is 659.0 thousand hectares, the pastures

[23] UNECE 2017, Environmental Performance Review: Tajikistan;

[24] Agency on Statistics under the President of the Republic of Tajikistan, 2019. Agriculture of Tajikistan: Statistical Book

[25] Ibid.

[26] In Tajikistan, agricultural land refers to land regularly used for agricultural activities. Agricultural land includes arable land, fallow lands, perennial plantations, hayfields and pastures. The Statistical Agency and the Ministry of Agriculture use this definition to define the area of agricultural land.

– 2818 thousand hectares, the perennial plantations – 150.9 thousand hectares, the fallow lands – 25.7 thousand hectares and the hayfields – 15.8 thousand hectares. In the structure of the agricultural land, there is a significant increase in the area of the perennial plantations, which is a positive factor for the retention of the SDSs. In 2018, the area of the perennial plantations, in comparison with 2011, had increased from 121 to 150.9 thousand hectares, or by 25%. The increase in the area for the perennial plantations is largely related to the adoption in 2015 of the Programme for the Development of Horticulture and Viticulture in the Republic of Tajikistan for 2016-2020, which envisages specific incentives for creation of new agricultural land and for the conversion of fallow lands into agricultural lands through the creation of orchards and vineyards, and also in order to prevent erosion in hills and to reduce by this the impact of the SDSs.

Animal husbandry is an important direction of the agricultural development in Tajikistan. In 2018, the total livestock population amounted to 8,19 million heads, including about 5,6 million goats and sheep, 2.3 million head of cattle; the rest is accounted for by "other livestock" - horses, donkeys and yaks. If we look at the total volume of the agricultural production, then the share of the animal husbandry output products represents more than 30%. During the period between 2013 and 2018, the gross animal husbandry production increased by more than 40%.

In recent years, anthropogenic impacts associated with agricultural production have become a causal factor triggering appearance of the SDSs. Thus, a significant increase in the area of cultivated land occurred because of the intensive plowing of mountain slopes for the agricultural needs of annual crops (usually wheat), had led to erosion and other types of the land degradation, which in its turn is enhancing the chances for SDSs appearance. Despite the decrease in the area of pastures in recent years, the density of livestock per hectare of pastures has increased, which is also another reason causing SDSs associated with the degradation of the soil of the pastures. This is only an evidence that there has been no sufficient decrease in the livestock population. According to the information of the Agency on Statistics of the Republic of Tajikistan, in 2018 compared to 2011, the density of livestock per 1 ha of arable land had increased from 0,94 to 1,14 livestock heads, or more than 20%.[27]

The most vulnerable and exposed to SDSs are year-round and winter pastures, which are located near or around habitat localities and which experience the greatest anthropogenic pressure. They are located at an altitude of 500-1,200 m above the sea level. Animal husbandry farms utilize these pastures for 120-150 days in a year. These pastures feed not only sheep and goats, but also horses and other cattle. Therefore, in comparison with the summer pastures, the density of the livestock there is much higher, and, therefore, the degree of their degradation is also much higher.[28]

***Forestry sector*.** One of the factors in the evidence and spreading of SDSs is a decrease in the area of forest plantations. In 2019, the total land area of the State Forest Fund of Tajikistan was estimated at 1,85 million hectares. After the collapse of the Soviet Union, Tajikistan had been experiencing an extreme de-forestation process. Nowadays, Tajikistan is referred to be among the most sparsely forested countries (MSFC). The national forest area is about 410,000 hectares, or 3% of the total land territory. The forestry management is carried out by the Forestry Agency under the Government of the Republic of Tajikistan. The forests areas are concentrated in the north of the country at an altitude of 800-2,5 thousand meters.[29] (Figure 13)

[27] Umarov, 2019. Working Paper on the Livestock Sector in Tajikistan: Problems of Sustainable and Balanced Development. Discussion Paper No. 190. Provided in collaboration with: Leibniz Institute for Agricultural Development in Countries in Transition (IAMO), Halle (Saale).
[28] Ibid., page 34;
[29] Statistics Agency under the President of the RT. Statistical Book: Environmental protection in the Republic of Tajikistan, 2018. page 30;

Figure 13: Degree of Vulnerability of Tajikistan's Forests to Climate Change [30]

The total area of forests has declined sharply because of the expansion and the establishment of agricultural lands, as well as the process of de-forestation. The pressure on the forest resources remains high and the main factors are over-exploitation (mainly for fuelwood) and over-grazing. The villagers depend on collecting firewood for heating and cooking. Fuelwood remains the main source of energy for rural households, but the remaining forest resources cannot meet the growing demand.

In addition, livestock grazing on the pastures of the State Forest Fund plays in the process an important role. The over-grazing leads to significant pressure on open-access forests and rangelands. The community-owned or state-owned pasture management mechanisms are still too weak to address this problem because the benefits from collected fees for grazing livestock is often higher than benefits from the sale of forest products. The conflicts of interest between the objective goals of forest conservation and the over-grazing on forested and open access areas are widespread.

Forests in Tajikistan are an important basis and cradle for bio-diversity and play a key role in the provision of vital eco-system services, also in terms of adapting to climate changes and mitigating the impact from the SDSs (for example, to prevent erosion, to regulate sedimentation and water regime, to stabilize river banks, etc.). At the same time, forests are vulnerable to the effects of climate change, especially to droughts, during which the risk of forest fires increases dramatically. The existing tendencies also lead to a change in the regional distribution of forests (and a

[30] Second National Communication of the RT to the UNFCCC, 2008.

narrowing of the growing areas of alpine species), as well as to an increase in the number of pests and diseases. The Figure 4 demonstrates forest zoning based on the climate change vulnerability.

The intensive de-forestation process, since the time Tajikistan had gained its independence, has reduced the potential of forests to mitigate climate change and the impact from the SDSs[31]. The exact figures for the mitigation potential in the forestry sector are not identified. Forestry is the least explored sector in terms of climate change impacts and potential contributions to mitigation and adaptation. Assessing the potential of the forestry to mitigate and adapt to climate change and, therefore, for mobilizing funds for forest landscape restoration and sustainable forest management should be among the top priorities for the sector.

Transportation network: Transportation and delivery of goods, services and people is extremely significant for the Republic of Tajikistan. The development of transport industry is very critical for the country; breaking through the communication deadlock is definitely one of the key national strategic goals. The transport sector includes 680 km of railways: 13,968 km for the general use and 12,791 km for non-general use. More than 90% of cargo and passengers are transported in Tajikistan via automobile roads. In the southern regions of Tajikistan and in the city of Dushanbe, the SDS phenomena deteriorate visibility, especially in the mountainous passes, which leads, as a result, to an increase in traffic accidents. The SDSs negatively affect the road surface cover, the forest plantations along the highways, the vegetation, which should reduce the risks of rockfalls, avalanches and landslides. Although there are no precise data on the risks of SDSs specifically in the transport sector, their impact is extremely critical and sound. It should be highlighted that, unlike the dust storms, the sand storms also have negative economic effects, as sand particles act as an abrasive material that damages equipment and infrastructure, contaminates oil and fuel tanks, clogs filters and, in general, affect transport routes by blocking them.

In the period of independence, with the purpose of bringing the Republic of Tajikistan out of the communication deadlock, one of the objectives of this sector was the establishment of transport infrastructure. In order to achieve this objective, 45 national public investment projects have been implemented to date in the transport sector of the country, more than 2 thousand km of roads, 31 km of tunnels, 200 bridges and 173, 2 km of railways have been constructed and re-habilitated. At the present time, 16 investment projects are being implemented on the entire country level scale.

During the years of independence, 9 international terminals for the carriage of goods and 5 passenger flaw terminals were constructed and put into operations. The number of transport enterprises has also increased, currently, 220 transport institutions, 57 passenger terminals, 18 terminals for the transportation of goods, 836 passenger lines and 41 international transport companies operate in the Republic of Tajikistan. During the period of 2010-2019 in Tajikistan, the total number of road transport vehicles had increased by 8,6%, including cars and passenger transport by 33%[32]. With the increase in the number of road transport, the likelihood of traffic accidents associated with the SDSs is increasing, and first of all, with the decrease in visibility, it concerns especially the mountainous roads. On one hand, the improvement of the national transport infrastructure is benefiting the throughput capacity of the road network, but on the other hand, they become high-speed ways and during the process of SDSs associated with a decrease in visibility, it may result in increase of the road accidents rate. The SDSs events can also accelerate the deterioration of road infrastructure due to the consequential associated rains, heat and solar radiation, the asphalt cover can become feeble and cracked, leading to temporary or permanent road closures. After the SDSs and precipitation, the roads become slippery, which also becomes the reason of car accidents, especially in the foothill areas.

[31] Third National Communication of the Republic of Tajikistan on the UNFCCC, 2014.

[32] Statistical Yearbook of the Republic of Tajikistan 2020. Agency of Statistics under the President of the Republic of Tajikistan

Therefore, to reduce the impact of the SDSs on the transportation network, following measures are required:

- to include processes of the SDS in the category of the types of natural disasters and to develop an early warning system;
- to develop a system of warning road signs in places of frequent occurrence of the SDSs;
- to the Committee for Emergency Situations and Civil Defense, together with the Agency for Hydro-meteorology of the country, to develop a system of SMS-notifications of warning of SDSs on the main highway roads.

Energy and water resources. The climatic changes, including those associated with the SDS events, have a great impact on the water resources of Tajikistan. The water sector is a mainstreaming for other several key sectors such as agricultural, health care system, energy and infrastructure. The main consumers of water resources in Tajikistan are the following: hydro-power, agriculture, industry, water supply and sanitation, fisheries, re-creation sub-sector and the environment. In those zones where the SDS processes are more often observed, the SDSs first of all, negatively affect the water supply and sanitation systems.

In Tajikistan, of the total population, only 51,4% have access to drinking water, including 86,9% of the urban population, 61,5% of the settlement and 43,4% of the rural population.[33] In the rural areas, especially in the southern part of Tajikistan, which are most affected by SDSs, the main sources for drinking water are rivers, springs, wells, piped water, rainwater and imported water. The SDSs reduce the quality of drinking water, contributing to the spread of various water-born diseases. In addition, there has been an impact of climate change associated with the SDSs on hydrological vulnerability, which may have negative consequences for the management and utilization of water resources, especially in the area of agricultural irrigation. The efficiency of the irrigation systems in the Republic of Tajikistan often constitutes only 40-50%.

In Tajikistan, the areas of production and transmission of electricity are sensitive to climate change and to the extreme climatic conditions, including the SDSs. Since energy sector and water systems are inter-dependent, changes in the precipitation, a high risk of droughts, the reduced snow cover and different snowmelt times, including those associated with the SDSs, can negatively affect the production and supply of electricity. The vulnerability of these sectors raises concern because of the heavy reliance on the hydro-power sector for energy production: over 98% of Tajikistan's electricity is generated by hydro-power plants. The hydro-energetic power plants account for 93,9% of total installed capacity, generating 16,5 billion kilowatt-hours (kW) of the energy power.

Health care system. The consequences of the SDSs can negatively impact human health through adverse impacts on the social and environmental determinants of health, such as a clean air, safe drinking water, an adequate food supply, and safe & secure housing. Even if the entire population is affected by the impacts of climate change, some will feel the effects more than others. For example, children, the elderly, and people who have previously had health problems and are, therefore, less mobile will be more susceptible to health-related consequences and for more longer period of time. The sand and dust storms usually occur when high winds bring up large amounts of sand and dust from the exposed dry soils into the atmosphere. Various research studies have demonstrated that sand and dust storms cause diseases such as of the respiratory tract, cardio-vascular system, skin and eyes. Experts have also identified a significant economic impact that these phenomena have.[34]

Regarding the health care system of Tajikistan, the negative impact from the SDSs has not been fully studied, how they affect the health of the population, especially children, the elderly and

[33] National Report on the implementation of the country's strategic documents in the context of the Sustainable Development Goals. Dushanbe, 2018;

[34] UN: Sand and dust storms are health and welfare issue for people: https://news.un.org/ru/story/2018/07/1334462

women. From the increased risk point of view, the implications for cardio-vascular mortality and morbidity from respiratory diseases, including asthma among children, have been recorded. According to the WMO data, the particles lifted up as a result of the SDSs are known to cause or aggravate the following health problems, such as: coughing and wheezing, asthma and bronchitis, cardio-vascular diseases. Specific assessments of the impact and damage from the SDSs have yet to be fully carry out from a gender perspective due to the vulnerability of women and children to the SDS events. In 2018, according to the data of the Agency on Statistics under the President of the Republic of Tajikistan, 4,657 respiratory diseases were detected per 100 thousand inhabitants and 1,767 – cases of complications of pregnancy, childbirth of the post-partum period.

From the structure of morbidity in Tajikistan, it can be seen that more than 29% of the diseases are related with the respiratory system (Figure 14), and are associated with the negative impact from the SDSs, especially in the southern regions of the country and in the city of Dushanbe.

4. 2 Ensuring food security of the country taking into account the impact of the SDSs

The Government of Tajikistan recognizes the need to reduce the vulnerability of the agricultural sector to climate changes, especially taking into consideration that agriculture contributes significantly to the GDP (21,9%) and employment in the country (60%).

Although the national risks and threats of the SDSs associated with climate change in Tajikistan are not fully analyzed and researched, the impact of this phenomenon is already being soundly felt on the aspect of food security of the country.

The food security monitoring data in 2018 had proved that only 12% of the rural population of Tajikistan have no problem with the access to food; 54% - do experience certain difficulties; 28% of rural residents are exposed to moderate food security risks, while the remaining 5% have no access to food items in the volume required to satisfy their basic needs.

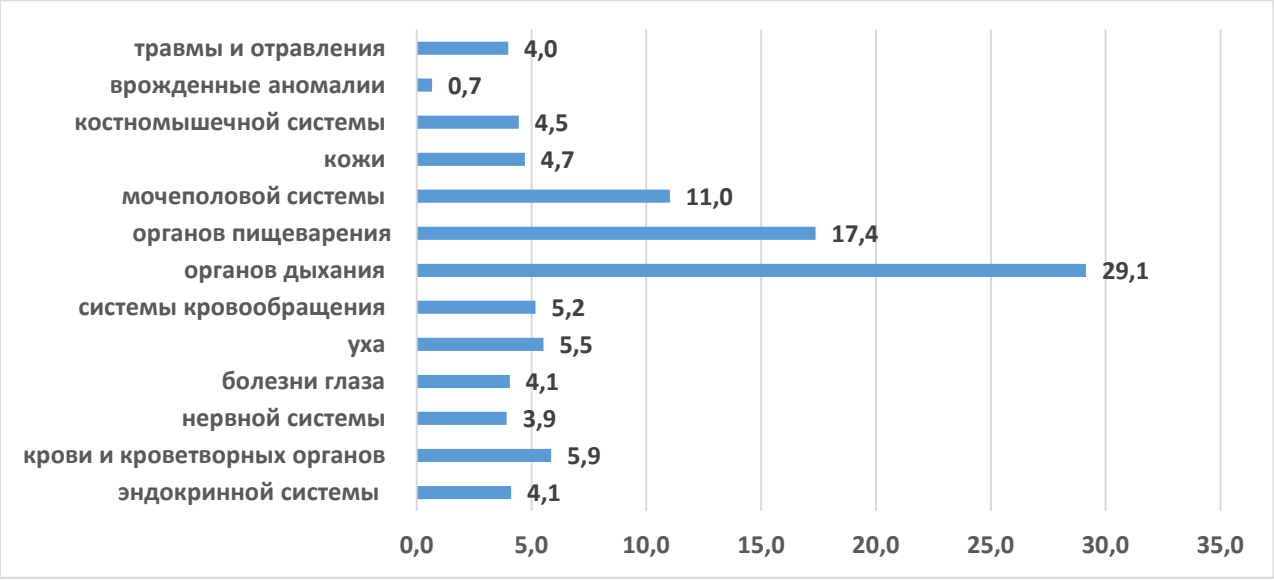


Figure 14: Structure of morbidity in the Republic of Tajikistan by main types of diseases [35]

[35] Statistical Yearbook of the Republic of Tajikistan 2020. Agency of Statistics under the President of the Republic of Tajikistan.

Assessing the level of food security in Tajikistan, it should be mentioned that national production fully satisfies domestic needs only for milk and dairy products. Self-sufficiency in wheat, eggs, meat and meat products is around 80%. For all other products, the contribution of public national production is relatively low. The most important positions in the import of food products are occupied by grain and flour.

In Tajikistan, the Food Security Programme (2016-2030) was adopted, which is aimed at stimulating domestic production and reducing the dependence of the national economy on imports of products from abroad. The main objective of this Programme is to support domestic production over the next 10 years and to meet domestic production needs of the country's population in bread and bakery products, potatoes, eggs and rice by 90%, in vegetables - by 80-90%, fruits and berries - 70-80%, vegetable oil - 80%, poultry meat - 40%, milk and dairy products (in terms of milk) - 50%.

Despite the fact that until now the negative impact of the SDSs on food security in Tajikistan has not been fully studied, soil degradation, droughts, relatively low access to quality drinking water, decreased productivity, agricultural diseases represent the first signs of such a negative impact.

By the end of this century, in some parts of Tajikistan, as a result of the impact by the SDSs, agricultural yields may drop by 30%. The decline of the agricultural performance capacity and productivity of pastures will negatively affect the supply and nutrition of the population. The changes in the bio-diversity and the eco-systems can cause infectious diseases and food- and water-born diseases outbreaks.

In preparing Tajikistan to deal with the dangerous climatic threats and impacts, including those associated with the SDSs, a deeper knowledge of the likely situations and adaptation options for reducing their harmful consequences is required. Successful adaptation to the impacts of the SDSs at the country level depends on several factors, such as the development of the SDSs adaptation projects that require joint efforts of both the national and the local governments, and the availability of funding and effective exchange of climate information between the sectors for planning of activities and investment decisions. The main measures to reduce the impact of the SDSs on the food security of the country include the following actions:

- introduction of crop diversity and plant breeding knowledge, combined method of plant cultivation, structure and planting, taking into account the impact of the SDSs;
- creation of seed banks in local communities, especially for crops resistant to droughts and diseases associated with the SDSs;
- planting trees to protect the community and economic facilities from wind and the SDSs;
- contributing to the improvement of soil conditions and protection from erosion, and the management of water resources and drainage systems, taking into account the impact of the SDSs;
- development of options for insurance of crops against droughts and the impact of the SDSs.

4.3 SDS Impact on the most vulnerable strata of the population

Vulnerability to the impacts of the SDSs and the climate-induced extreme weather phenomena are socially differentiated. For example, the poor, the elderly and children are disproportionately affected by the climate change and the extreme climate events because of their position in the society and their differential access to the benefits and rights. The need to reduce vulnerability also

proceeds from the fact that the current condition of vulnerability of these groups also affects their ability to respond effectively to the impacts of climate change, including the SDSs. Identifying gaps and needs that impede the ability of these groups to effectively cope with the growing climate risks and impacts of the SDSs, and promoting targeted actions to strengthen their resilience, are fundamental during the elaboration of the effective adaptation measures. It is important to highlight that Tajikistan was included in the list of 10 countries with the fastest rate of poverty reduction in the last 15 years. The poverty rate was reduced from 81% in 1999 to 27,4% in 2018 (Figure 15) . The extreme poverty rate, accordingly, was reduced from 73% to 14%. The analysis of data from 2003 to 2018 had demonstrated that the factors that contributed to poverty reduction included following: increase in salaries, remittances, timely pension payments, etc.[36]

In Tajikistan, the number of children under the age of 17 is more than 40% of the total population of the country. More than 180 thousand people (2,2% of the total population) have an official disability status. According to the Agency of Statistics of the Republic of Tajikistan, in 2019, the total number of elderly people in the country was 700 thousand people (8% of the total population). Therefore, more than 50% of the population of Tajikistan is included in the group as the most vulnerable population groups exposed to the impact of the SDSs.

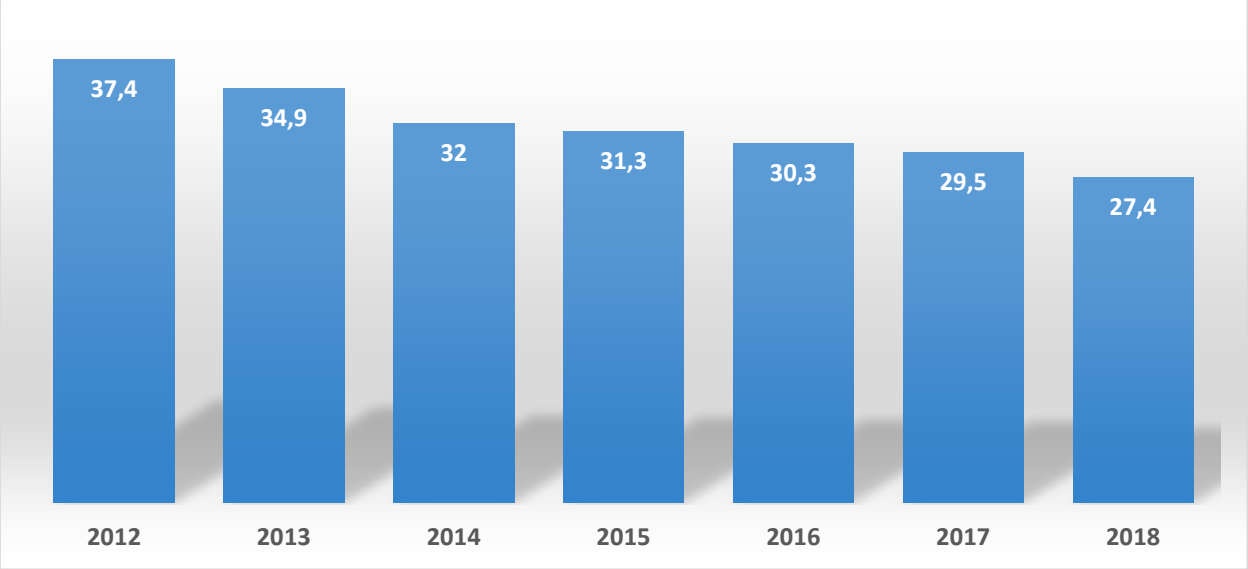


Figure 15: Dynamics of the poverty level in Tajikistan for the period of 2012-2018, (%)[37]

Identifying gaps and needs that hinder the ability of these groups to effectively deal with growing climate risks, including the SDSs, as well as promoting targeted actions to strengthen their resilience, are fundamental for developing the effective measures to implement the National Action Plan for Preventing and Mitigating the Consequences of SDSs in the Republic of Tajikistan for 2022-2030.

Based on the mentioned above, the Government of the country should take various measures that will significantly empower vulnerable groups and communities in order to effectively adapt to the growing impacts of the SDSs and other risks associated with the climate changes. For example, vulnerable groups need governmental support and assistance when it comes to introducing modern

[36] Increased vulnerability despite robust economic growth. Tajikistan Economic Report, Autumn, 2017, World Bank Group.
[37] Increased vulnerability despite robust economic growth. Tajikistan Economic Report, Autumn, 2017, World Bank Group.

approaches to adaptation. Therefore, the Government should address the existing gaps that hinder the effective integration of issues related to the prevention and mitigation of the impacts of the SDSs into the economic policies and action plans that respond to the needs of the vulnerable groups.

4.4 Gender perspectives of the SDSs.

The climate change risks, including of the SDSs, negatively affect everyone, but this does not mean that everyone is equally vulnerable to it. Some groups are more vulnerable than others. For example, the impacts of the SDSs and adaptability are not gender neutral. Understanding the risk associated with the SDS is a major step in managing the risk of potential disasters from the SDSs. The outcomes of the risk assessment of the SDSs should be based on a systematic gender-sensitive analysis, serve as the basis for their prevention and reduction, preparation and warning, response and rehabilitation activities.

Research experts identify women as a vulnerable group exposed to the effects of the climate change risks including the SDSs. Women are more likely to be vulnerable to the quality of nutrition: they suffer more often from anemia, the incidence of vascular diseases, obesity. The health and well-being of women has a significant impact on the health and development of their children, the households, the community and the society in general. Particularly vulnerable categories are pregnant women, with young children and those caring for sick and elderly family members. Women spend most of their time caring for household members and providing basic living conditions and food for their families at the expense of productive activities or participation in the social life of the society.

A number of legal and regulatory documents have been adopted in Tajikistan concerning gender issues. These include the following: the Law of the Republic of Tajikistan "On State guarantees of equality between men and women and equal opportunities for their implementation", adopted on December 15, 2004; the Family Code of the Republic of Tajikistan, dated November 13, 1998; the Decree of the President of the Republic of Tajikistan "On Measures to improve position of women in the society", from December 3, 1999; The National Programme "Main Directions of state policy on ensuring equal rights and opportunities for women and men in the Republic of Tajikistan for the period of 2001-2010"; the National Strategy for enhancing the role of women in the Republic of Tajikistan for the period of 2011-2020. Although the adopted normative-regulatory documents do not mention the gender aspects in connection with the climate change, they do touch upon the challenges of adaptation activities with the purpose to reduce the impact of the climate change.

In the ***National Strategy for Adaptation to Climate Change in the Republic of Tajikistan for the period up to 2030***, a special section is dedicated to the questions of the risks, impacts and adaptation measures related to the climate changes from a gender perspective. Although the Strategy does not specifically mention the gender aspects of the risks, impacts and adaptation measures associated with the SDSs, they indirectly mention this challenge in terms of the overall risks of the climate change.

In the ***National Development Strategy of the Republic of Tajikistan for the period up to 2030***, it is stipulated that the environmental pollution and the low level of eco-system management, the bio-diversity conservation, land degradation, vulnerability to the effects of the climate change, including the SDSs, access to clean water and sanitation have become the main challenges which the country is facing at present time. Speaking about the incentives to motivate protection of the environment, to reduce the impact of the climate change, with taking into consideration the gender aspects, it is proposed to elaborate and to promote the Code of Natural Environment Protection, as well as mechanisms for adaptation to the climate change with the expansion of international cooperation in this direction.

The National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for the period of 2019-2030 specifies that one of the problems in the disaster risk reduction is the poor gender mainstreaming, ignoring the fact that disasters have different impacts on men and women and, therefore, women and men have different specific needs and vulnerabilities.

In order for women to effectively resist the negative impacts of the SDSs, first of all, it is necessary to increase their capacity in terms of access to education and health care systems, the land resources, pasture and forest management, as well as to the financial resources. While the majority of agricultural workers are women (75%), and they are most exposed to the impacts of the SDSs, the number of female-headed *Dekhkan* farms is significantly lower in comparison with that of headed by males. According to the official statistic data, only 19, 2% of *Dehkan* farms were headed by women in 2017.

Taking into consideration the results of the Review, in order to improve the process of promoting the inter-relationship between gender aspects and the climate change, including reducing the impact of the SDSs into the implementation of the National Action Plan for the Prevention and Mitigation of the Consequences of Sand and Dust Storms (SDS) of the Republic of Tajikistan for the period of 2021-2030, it is required to implement the following actions:

Raising awareness and understanding of the inter-relationship between gender and the mitigation efforts for the sand and dust storms in the development context:

- to conduct researches that provide evidence-based information on the impact of the SDSs from a gender perspective;
- to adapt and apply women's knowledge of local peculiarities, their experiences and needs, to identify gender - sensitive implications to address the threats and disasters associated with the impact of the SDSs;
- to develop and disseminate advocacy, promotion and training materials (brochures, articles, videos, training programmes) and to conduct awareness raising activities (e.g., lectures, seminars, classes, campaigns) in collaboration with the mass media and NGOs in order to reduce the negative impact from the SDSs on the health and other aspects of women's life.

Improving the system of promoting the inter-relationship between gender and the mitigation efforts for the SDS in planning, budgeting and implementation of the development processes:

- to elaborate and to promote the application of gender-sensitive public and private financial funding schemes (e.g.: taxation, subsidies, tariffs, grants, bank loans and borrowings, micro-loans) with the purpose of reducing the impact of the SDSs;
- to improve funding for women's organizations and female entrepreneurs working in the areas of minimizing negative impacts and adaptation to the impacts of the SDSs and the climate change;
- to improve the integration of the relationship between gender and the impact of the SDSs in the planning and implementation of the international development assistance.

While strengthening capacity and providing opportunities for the active participation of women in sustainable socio-economic development programmes, taking into account climate change, including the SDS:

- to strengthen capacity of women to better respond to environmental and the climate risks and challenges (e.g.; trainings on climate risk management, early warning of natural disasters, including the SDSs);
- to promote the representation and active participation of women in the processes and institutions, to be among those who are responsible for work in the areas of climate change,

prevention of the SDSs, protection and management of eco-systems and natural resources (for example, involving women in the management of land, water and other resources, for instance, in the management of WUA and APU (Water and Pasture Users Association);

- to promote better representation of women in the development planning processes (for example, in the long- and medium-term development strategies, and in the sectoral strategies).

4.5 Policy, legislative and institutional barriers and constraints for the implementation of the NAP on SDSs

The political, legislative and institutional barriers and restrictions in the implementation of the National Action Plan of the Republic of Tajikistan on the prevention and mitigation of the consequences of sand and dust storms (PPB) for the period of 2021-2030 are based on the presently existing barriers for the implementation of the strategies and programmes adopted in the country related to climate change and desertification.

In the National Strategy for Adaptation to Climate Change in the Republic of Tajikistan for the period up to 2030, the main barriers, problems and gaps for the implementation of adaptation measures include the legal, institutional barriers and capacity gaps. The Strategy is stipulating that for the successful implementation of the adaptation measures, these obstacles need to be removed in the long, medium and short term with the help of the consistent technical assistance programmes from the international development partners, the Government and the community.

In the National Development Strategy of the Republic of Tajikistan for the period up to 2030, specific barriers, problems and gaps associated with the implementation of adaptation to climate change are presented at the sectoral level and at the national level. The Strategy outlines general problems related to adaptation measures to climate change. In particular, it is mentioned that environmental problems and vulnerabilities remain significant, especially in the context of climate change mitigation and adaptation.

These challenges have gained great importance in the framework of the new SDGs after 2015, which include efficient utilization of water resources, ensuring the resilience of habitat localities, taking urgent measures to adapt to climate change, protecting the terrestrial eco-systems from the land degradation, preventing and eliminating the consequences of natural disasters and increasing access to clean water and sanitation. The rural population of Tajikistan is more vulnerable to the environmental degradation. The high risk of natural disasters and vulnerability to the impacts of the climate change, including the SDSs, which represent threats to the sustainable development, were highlighted as some of the major challenges.

In the National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for the period of 2019-2030, the main obstacles for reducing the risk of the natural disasters associated with the climate change include the following: absence of precise data on the potential impact of climate change risks for Tajikistan; insufficient funding for the implementation of the planned objectives; slow processes of development and implementation of the sectoral strategies and instruments; a weak dialogue and the absence of effective models of interaction between the state, the private sector and the civil society in the sphere of disaster risk reduction.

In the Programme of Medium-Term Development of the Republic of Tajikistan for the period of 2021-2025, in the Section "Environment: Climate Change and Disaster Risk Management", the main challenges for reducing the impact of the climate change and the risks of the natural disasters are the following: inappropriate inclusion of issues on climate change and disaster risk management into existing sectoral and sub-sectoral strategies and programmes; underdevelopment, ineffective utilization and application of the potential of the national institutions to combat the climate risks and to ensure resilience to natural disasters.

In the National Action Programme to Combat Desertification in Tajikistan, a general analysis of the processes and consequences of desertification is provided. In the Section for Action Strategy to Combat Desertification specific activities on reduction of the impact of desertification are described. But this section practically does not stipulate any barriers or problems for the implementation of this Strategy.

In order to successfully implement the NAP on SDS and to achieve the desired level of adaptation to the climate change, through consistent national and international technical assistance programmes, it is necessary to eliminate the legal and institutional barriers, as well as capacity gaps in the long, medium and short terms.

The legal barriers represent fundamental challenges for the long-term sustainability and overall development, specifically the following:

- Existing current laws, regulations and Codes on environmental protection, energy, drinking water supply, construction and disaster risk management do not include the threats and consequences of the SDSs;
- The programmes, strategies and other legislative regulations do not stimulate government bodies to take measures in order to reduce vulnerability and to strengthen adaptation measures related to the SDSs.

The institutional barriers are caused by the fact that the capacity of Tajikistan's institutions to tackle climate risks, including the SDSs and to ensure equal resilience, have the following characteristics:

- imperfection of mechanisms for integrating the SDS problems into the national and sectoral development plans;
- absence of coordination and cooperation among the key ministries and agencies in the field of collecting information on the SDSs, developing and implementing the projects and the programmes aimed to reduce their risks;
- absence of the long-term development plans and effective allocation of resources to reduce the impact of the SDSs, both from the donors and from the state.

In order to overcome the above-mentioned barriers, the following actions should be accomplished:

- Incorporation of the SDS issues into the existing laws, regulations and codes on environmental protection, energy, drinking water supply, construction and disaster risk management;
- improvement of the programmes, strategies and other legislative documents in terms of stimulating government bodies to take measures in order to reduce vulnerability and to strengthen adaptation measures related to the SDSs;
- establishment of mechanisms for integrating the climate change problems, including the SDSs, into the national and sectoral development plans;
- ensuring coordination and cooperation among the key ministries and institutions in the field of collecting information on the SDSs, development and implementation of the projects and programmes aimed to reduce the risks of the SDSs;
- elaboration of the long-term development plans and effective allocation of resources to reduce the impact of the SDS, both from the donors' side and from the state;
- strengthening institutional capacity in order to improve coordination and cooperation among the organizations involved in collecting, analyzing, storing and disseminating information on the SDSs;

- improving methodologies to formulate long-term development plans in order to eliminate duplication in the activities among the organizations and institutions and to improve their interaction.

5. NATIONAL STRATEGIES, PLANS AND PRIORITIES FOR SDS MANAGEMENT

5.1 Systemic and institutional framework for the management and mitigation of the negative impact of SDS

The institutional mechanisms and commitments aimed at minimizing the risks of the climate change, including the SDSs, are popularly common among various government structures and institutions.

At present time, the Government of the Republic of Tajikistan has adopted more than 50 laws and by-laws in the field of climate change and environmental protection. More than 10 government programmes and action plans have been approved, and various national centers have been established to coordinate and resolve environmental problems of the national and of the global scale. Among them, the National Programme of Action on Desertification in Tajikistan is more connected with the SDS than others, since it considers in detail the main factors contributing to the formation and development of not only the process of desertification, but also of the SDSs, although this issue is not specifically stipulated.

In other documents, such as the National Strategy for Disaster Risk Reduction of the Republic of Tajikistan for the period of 2019-2030[38], the National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030, either a very brief description of the SDSs is provided, like description of a climatic natural disaster being included into the list of natural disasters as such, or only the measures are described on how to mitigate the influence of factors that can contribute to the formation, development and creeping of the SDSs, but this issue is not specifically elaborated as a separate challenge (some of these documents are discussed in the Paragraph 3.2, Part III). More attention is paid to the atmospheric air pollution by industrial, household, production or transport wastes, rather than to the SDS phenomena.

The Executive Office of the President of the Republic of Tajikistan is oversighting the implementation of the laws, the programmes and the plans related to the environment and climate change on the high national level.

The Majlisi Oli (Parliament) plays a key role in the formulation and improvement of legislation and bringing it in line with the international norms and agreements, including those related to the climate change.

The local executive authorities are empowered to exercise control in the field of environmental protection, the development and implementation of action plans in this area at the local levels.

With the initiation of the Pilot Programme for Climate Change Adaptation (PPCR) in 2009, a Secretariat and a permanent Working Group, headed by the Deputy Prime Minister, were established to be responsible for the day-to-day coordination of the PPCR activities.

The Committee for Environmental Protection under the Government of the Republic of Tajikistan is implementing national policy in the field of hydro-meteorology, efficient utilization of the natural resources, establishes and carries out environmental monitoring, comprehensive forecasting and is conducting research studies on the environmental conditions. The Committee implements, analyzes and forwards proposals for the improvements of the regulatory framework concerning environmental protection and the development of relevant by-laws, it determines the main directions for the activities in the field of environmental protection, for research studies, re-production and use of the natural resources, prevention of the negative consequences of climate change. Within this Committee there is a Department for State Control over the Use and Protection

[38]The National Strategy of the Republic of Tajikistan on Disaster Risk Reduction for the period of 2019-2030, Dushanbe, 2019.

of Atmospheric Air, a Service for monitoring, analytical control and environmental impact assessment, Inspections, Sections for processing and providing environmental information.

The State Institution "Agency for Hydro-meteorology" under the Committee for Environmental Protection is the national institution responsible for coordinating climate change issues in Tajikistan. The Agency for Hydro-meteorology provides the relevant ministries and institutions, local government authorities, as well as other agencies and organizations with the hydro-meteorological information and other relevant information on the condition of the environment. In the departments of the Agency for Hydro-meteorology, ***the level of atmospheric air pollution is measured every day, a separate component of which is an atmospheric pollution by the SDSs. Unfortunately, these measurements data are used only as an information and no further analysis is carried out on them.*** Within this Agency there is an operating Center on Climate Change.

The National Academy of Sciences of the Republic of Tajikistan participates in the development of strategies and tactics for environmental policy on the territory of the Republic of Tajikistan. The NAS consists of 15 Scientific-Research Institutes, including those for climatology, glaciology, hydrology, hydro-power, bio-diversity, conservation and rational utilization of water resources. For more than 30 years, within the framework of the Laboratory of Atmospheric Physics of the Physical-Technical Institute of the National Academy of Sciences, scientific-research studies on the issue of the elemental composition of the SDSs which are brought in from outside have been carried out. Together with NASA (USA), the German Institute for Tropospheric Research and the French University of Science and Technology, Lille, some joint projects dedicated to this issue were implemented.

The Ministry of Energy and Water Resources of the Republic of Tajikistan applies appropriate scientific and technological approaches to increase the flexibility of adaptation to climate change and resilience to the extreme conditions. The Ministry is involved in the implementation of the goals of the Clean Development Mechanism and the Kyoto Protocol of the RK of the UN EC.

The Ministry of Agriculture of the Republic of Tajikistan develops and coordinates the national policies, the plans and the national programmes in the field of agricultural economy.

The Tajik Academy of Agricultural Sciences is a national self-governing scientific institution that provides planning, coordination, development of fundamental and applied research studies in the field of agriculture and training of highly qualified scientific professionals. The Tajik Academy of Agricultural Sciences consists of 6 Scientific-Research Institutes, the "Biological Products" Scientific-Research and Production Enterprise, the National Republican Center for Genetic Resources and the Pamir Experimental Agricultural Station.

The Ministry of Education and Science of the Republic of Tajikistan is actively involved in the development and implementation of the environmental programmes in schools and universities of the country.

The Ministry of Health and Social Protection of the Population is contributing into the implementation of the activities for environmental and radiation safety, environmental protection, and is ensuring sanitary safeguarding of the national territory.

The State Committee for Land Management and Geodesy of the Republic of Tajikistan participates in the development and implementation of the national programmes related to the regulation of land relations, land reform, land use and protection, national topographic and geodetic, aerospace and cartographic activities. Various sorts of maps of natural resources of Tajikistan, which were developed during the Soviet times, at a scale of 1: 500000, and which can serve as a basis for the development of the maps of the zones of the sources and transfers of the SDSs are being preserved in the assets of the Scientific-Research Center under this Committee. They include the following maps: "Soils", "Soil erosion", "Soil salinization", "Land use", "Melioration", "Vegetation", "Forage lands "," Forests " and " Landscapes ".

The Forestry Agency under the Government of the Republic of Tajikistan develops and implements a unified national policy in the field of legal regulation and public administration in the sphere of forestry and forest resources, actively participates in the implementation of the programmes and projects on climate change. At present time, there is also the Forestry Research Institute of the Republic of Tajikistan operating in the forestry system of the Republic of Tajikistan, which conducts breeding activities in order to research forest planting materials, which are very effective for the efficient implementation of forest reclamation and re-forestation activities and are successfully used in order to prevent the SDSs events, for their introduction and application on agricultural lands, roads and populated areas. Because of the limited financial support and insufficient logistical supply resources, the Institute is not able to expand the scope of its scientific-research activities.

The Agency on Statistics under the President of the Republic of Tajikistan carries out activities on collection and dissemination of statistical information, guided by the principles of objective and comprehensive study of the socio-economic and environmental processes taking place in the Republic of Tajikistan.

The capacity of Tajikistan institutions to address the challenges of climate risks (including the SDSs) and to ensure equal resilience is complicated by the absence of the following:

- mechanisms for integrating climate change problems, including the SDSs, into the national and sectoral programmes, strategies and action plans;
- coordination and cooperation among the key ministries and institutions in the field of collection, analysis and storage of information, within the framework of the implementation process of the National Plan for SDS;
- coordination among the institutions which are responsible for managing of the projects and programmes for climate change-related disaster risk reduction and the SDSs;
- long-term development plans and effective allocation of the resources for adaptation to climate change and SDSs, both from the donors' side and from the Government.

Reforming of the institutional mandates with a clear distribution of roles, responsibilities, and communication for climate change adaptation and SDSs requires a medium to long term strategies. At the government level, there is a certain political interest in promoting adaptation mechanisms and resilience to climate change in the development policies, but at the institutional level, the understanding of the actual issue is very limited.

Therefore, one can conclude that in most of the above-mentioned organizations, the research studies of the challenges regarding the processes of SDS in Tajikistan, the areas of their sources, development and transfer, are not conducted at appropriate level.

Only at the level of Physical-Technical Institute of the National Academy of Sciences some in-depth research works on the elemental composition of the SDS, brought in from outside are carried out; and in the Agency for Hydro-meteorology of the Committee of Environment Protection, the degree of the pollution of atmospheric air by the SDSs is being measured and it would be very efficient to further develop this kind of research activities to more deeply study the SDS events, which are formed and spread in Tajikistan and beyond its borders. In order to achieve this, it is required to coordinate the actions of the Physical-Technical Institute of the National Academy of Sciences and the Agency for Hydro-meteorology with the other interested ministries and institutions in this specific direction.

5.2. Actions envisaged in the framework of the national development programmes for restoration of degraded land and natural pastures

In Tajikistan, there are practically no special programmes, strategies or plans dedicated to the management of the SDS processes.

On December 30, 2001, the Government of the Republic of Tajikistan had approved the "National Action Programme to Combat Desertification in the Republic of Tajikistan", in which the main factors of desertification and their consequences were considered. These factors are very effective when identifying the zones of the SDSs sources and spreading on the territory of the Republic of Tajikistan and their impact on the public health condition and other spheres of the national economy.

The National Development Strategy of the Republic of Tajikistan until 2030 provides for the integration of measures aimed at reducing the risk of natural disasters into the national, regional and sectoral strategies, programmes and development plans. The high risk of natural disasters and vulnerability due to the effects of climate change are identified as the main development challenges of the country.

The Agricultural Reform Programme of the Republic of Tajikistan for the period of 2012-2020 is the main Document which stipulates provisions for the development of the agricultural sector. The main issues for agricultural development, first of all, include the non-efficient utilization and management of the natural resources, imperfection in the sphere of land relations, an exhausted irrigation system, deterioration of fertility and an increase in the area of unutilized lands. Ineffective use of pastures, further development of desertification processes and the appearance of SDSs areas, salinization, waterlogging and land degradation contributed to the deterioration of the ecological condition of the agricultural sector.

The National Strategy for Adaptation to Climate Change in the Republic of Tajikistan for the period up to 2030 was adopted, in which agriculture was selected as one of the priority sectors exposed to the risk of climate change. Among other key risks identified were an increase in average annual air temperatures, more frequent precipitation, droughts, sand and dust storms, seasonal changes in river flow, degraded and disappearing of glaciers and a decrease in actual water flows.

Following the Programme for Improving the Condition and Efficient Use of Pastures for the period of 2009-2015, the Programme for the Development of Pastures for 2016-2020 was approved. These Programmes contain similar descriptions of the current situation of land degradation processes and pastures digression and the corresponding consequences impacting the agricultural sector. In the above-mentioned Documents, the National Programme of Action on Desertification in Tajikistan is more related to the problems of the SDS than others, since it stipulates in details the main factors that contribute to the formation and development of not only the desertification process, but also of the SDSs, although they are not elaborated specifically.

In other documents, a very brief description of the SDS is provided with reference to them as to a climatic natural disaster, and where they are listed along with other natural disasters as such, or they just consider only the measures to mitigate the influence of factors that can contribute to the formation, development and spreading of the SDSs. These factors include degradation, salinization and waterlogging of lands, digression of pastures, inefficient use and management of the natural resources, imperfection in the sphere of land use relations, an exhausted irrigation system, deterioration of fertility and an increase in the area of unused lands, etc., but they are not elaborated specifically. More attention is paid to the air pollution by industrial productions, household, technical or transport wastes.

Therefore, for an effective implementation of the formulated "National Action Plan for the Prevention and Mitigation of the Consequences of Sand and Dust Storms for the period of 2021-

2030", it is necessary to consider these phenomena as the factors contributing to the appearance of the sources of the SDSs, their development and creeping.

5.3. Development of a system for collecting information and monitoring the processes related to SDS

The conceptual basis for the creation of such a system is expressed in the UN Convention to Combat Desertification. At the end of 1994, while implementing Tajikistan's obligations under the UN Convention to Combat Desertification, such a system began to be developed by the Committee for Environmental Protection. Further, this system had to be improved and established during the implementation of the National Action Programme to Combat Desertification in Tajikistan (since 2002), and it could have been adapted to the processes associated with the SDSs. In theory, such a system has been developed, but it was not implemented in practice. This is evidenced by the National Report of the Republic of Tajikistan on the implementation of the UN Convention to Combat Desertification, in May 2006, and personal conversations with the implementors of this programme in the Committee for Environmental Protection and the Agency for Hydro-meteorology.

If such a system would have been established, it could have then been adapted for the aspect of the SDSs, further improving it by introduction of the data obtained about the SDSs, but so far there is no unified database on the SDS, and there is no coordination of actions within the framework of a single organizational management structure in this direction. Consequently, in order to carry out the basic principles of monitoring of desertification processes and the SDSs, it is necessary to observe all climatic elements and factors influencing the process of their formation. But first of all, it is required to establish a Monitoring Center under the Committee for Environmental Protection in order to coordinate all research in the field of registration, analysis, accumulation and storage of data related to desertification and the SDSs, it can be achieved with the assistance of the State Committee for Land Management and Geodesy, the Ministries of Agriculture and the Ministry of Health, the Forestry Agency and the Physical-Technical Institute of the National Academy of Sciences. Such a proposal was forwarded during the presentation of the outcomes of the work during the meeting held in September 2020, with participation of the representatives of the relevant ministries and institutions of the country.

To obtain a more detailed information about the nature of the SDS events, it is necessary, in the zones of their intensive manifestation, to establish new registration facilities. At present time, only few stations of the Physical-Technical Institute of the National Academy of Sciences and the Agency for Hydro-meteorology are operating in the country - in Dushanbe city and in Shaahrtuz district.[39]

The usage of the aero-space images of various resolution scales, colors and flight dates is of a very high importance. When interpreting satellite images, it is necessary to select reference areas of various degrees of the SDSs activity. This can be of significant help in identifying the sources of deflation, water erosion, natural disasters, and other processes contributing to the triggering of SDSs and will make it possible to more clearly and accurately determine their spreading from the different sources.

Such research studies can be carried out through the coordinated actions of the Agency for Hydro-meteorology or other relevant divisions of the Committee for Environmental Protection, the Tajik Scientific-Research Institute of Forestry, the Tajik Scientific-Research Institute of Soil Science and the State Committee for Land Management and Geodesy of the Republic of Tajikistan (in

[39] Shaahrituz district is located in the south of Tajikistan and borders with the Islamic Republic of Afghanistan. In this area, most of all SDSs are observed.

which, as it was mentioned above in the Para 3.1, general maps are stored, on the basis of which the maps of the sources zones for SDSs were developed).

5.4. Knowledge management: education, training and public awareness

At present time, compared to the previous years, there is a dramatic increase in the level of public awareness and in the activity of local media on climate change issues. The secondary and tertiary level of education initiatives have also achieved significant progress. About 10-15 years ago, only 10% of respondents in the country were aware of the problem of climate change. Now this figure has increased to 40-80%. Within the framework of the implementation of the National Action Plan on SDS, more attention is dedicated to raising awareness on the issues related to the SDSs.

Currently, almost all climate change awareness initiatives in Tajikistan are carried out within the framework of the projects and the programmes financed by the international organizations.

For instance, in the framework of the joint project on environmental education of UNDP, the Tajik Technical University and the Institute of Post-graduate Education, Resource Centers were opened that elaborate training modules on climate change for schools and universities.

In 2005, the Ministry of Education had approved a new textbook “Environment for Future Generations”, which was developed with the participation of the Regional Environmental Center in Central Asia, containing chapters on climate change and its consequences.

The Youth Environmental Center has elaborated and distributed books and manuals for schoolchildren and students: “An Interesting Ecology” (in 2007); “Adaptation to Climate Change” (in 2010) and “All about the Problem of Climate Change” (in 2011).

The Republican Educational and Methodological Center of the Committee for Emergency Situations and Civil Defense has developed Guidelines and Programmes for the education and training of civil defense leaders, students of secondary and higher vocational educational institutions of the Republic of Tajikistan and for the schoolchildren of the grades 2 and 6 of secondary schools with topics on emergencies and civil defense issues. But these programmes do not pay an appropriate attention to the climate change, ecological problems and issues of environmental protection.

In 2009, the Youth Environmental Center and the NGO "Little Earth" had elaborated a new Training Module on climate change for secondary school teachers and university lecturers and had conducted trainings with it for teachers from different regions.

The “Green Package” of educational materials for students, developed in 2011 by CAREC for the countries of Central Asia, was translated, adapted and approved by the Ministry of Education of the Republic of Tajikistan, and since 2011, has been introduced in several leading universities of the country.

Unfortunately, the awareness of the general population about the causes and consequences of glacier degradation and climate change, including the impact of the SDSs, is still at a low level. Therefore, further efforts are needed to popularize the scientific information and the results of glacier monitoring (the last monitoring was carried out in summer 2020) for the media, for decision-makers and the general public.

According to the experts, to the international and local humanitarian organizations working with communities, which are conducting public awareness activities, there is still a lack of traditional knowledge and experience in responding to extreme climate fluctuations and to the related natural disasters (including the SDSs). Local communities need more flexible and sustainable methodologies and knowledge, and the local bodies of executive power require actions in order to raise awareness and preparedness.

The Ministries and government agencies are interested in raising awareness of adaptation measures; however, they do not have a clear idea of specific actions and possible tendencies in the impact of climate change, including the SDSs on their scope of activity. Therefore, in the future, the main directions of adaptation activities in this direction are the following:

- Conducting short-term courses on climate change issues, on the impact of the SDSs and their consequences for decision-makers and representatives of the international organizations operating in cross-cutting sectors of the economy;
- organizing study tours for government officials not only to industrially developed countries, but also to the developing countries.

In order to address these gaps in the short-term period, it is necessary to continue the work started under the Pilot Programme for Adaptation to Climate Change, integrating the SDS issues into them. This can be achieved by providing technical assistance in raising awareness for the general population, for the specialists from relevant organizations and institutions.

It can be concluded that all of the above-mentioned activities were implemented only in the field of climate change, environmental protection and adaptation measures, but the SDS issues were not touched upon at all, since they were not raised. But during the process of implementation of these activities, such questions as how to mitigate the consequences, of the factors contributing to the initiation of desertification process, and of course, of the SDSs, were raised. These include land degradation, erosion processes, pasture digression, pollution, soil salinization and waterlogging, natural disasters, etc.

Raising individual awareness and preparedness of the population in matters of environmental protection, climate change and the SDSs plays an important role in mitigating their negative consequences. In view of this, the Government of the Republic of Tajikistan, in 1996, has adopted the National Programme of Ecological Education and Upbringing of Population of the Republic of Tajikistan until 2000, with the perspective for the future period until 2010.

In the course of implementation of this Programme, environmental subjects were introduced in institutions of general secondary and higher vocational education, gymnasiums, lyceums and colleges.

New faculties and departments for Environment and nature protection have been established in the institutions of higher level of education. The Tajik National University Specialists in Hydro-meteorology and Ecology are being educated. The Tajik State Pedagogical University educates future teachers of Geography and Ecology. The Tajik Technical University has a programme on life safety and environmental protection, and since 2003, it has been educating Environmental Engineers. Unfortunately, the poor logistical basis and technical equipment of the educational institutions, the absence of flexibility in teaching methodologies and of the information network, adversely affects the quality of the education.

Imperfections in the inter-institutional coordination system for the implementation of the activities under the above-mentioned Programme often led to ineffective outcomes, and the efforts of some enthusiasts to introduce the best practices while organizing the system of environmental education and upbringing of the population remained neglected.

Unfortunately, the existing system of environmental education of the population and professional training of specialists within this Programme does not provide sufficient capacity. As a result, there is a shortage of qualified specialists in almost all areas of natural sciences, forestry and agriculture, nature conservation and other sectors of the national economy.

The State Comprehensive Programme for the Development of Environmental Education and Upbringing of the Population of the Republic of Tajikistan for the period until 2020, adopted in 2015, emphasizes that the priority of environmental education should in establishing such an education system which would prepare students to resolve social, economic and environmental

problems at the local, national and global levels. This way it would be possible for the system of education to overcome its current alienation from the environmental questions.

Knowledge and skills must be supported by the practical actions, this way it would lead to the building of capacity and personal experience. It is not enough only to have one subject "Ecology" in the institutions of general secondary level of education. It is required to integrate the environmental issues not only in the educational process, but also in all spheres of human life, which is the main essence of the environmental education of the citizens of a nation.

As the analysis of indicators of the state environmental control demonstrates, most environmental offenses are committed due to insufficient environmental knowledge, poor ecological culture and weak training background of the managers and specialists, public and private enterprises and organizations of the country, which activities negatively affect the status of the environment. Therefore, nowadays, there is a need to increase the level of knowledge of citizens, leaders and specialists of institutions and agencies, and the degree of their involvement in the search for solutions to the challenges related to environmental preservation, climate change, including the SDSs.

Issues related to the SDSs are currently not included in the education curriculum, and there are very few qualified experts in this area, only a few specialists at the Physical-Technical Institute of the National Academy of Sciences and at the Agency for Hydro-meteorology. Consequently, for the training of such specialists, it is required to establish special departments at the Tajik National, Technical, Agrarian and Pedagogical Universities, with the involvement of the specialists from the above-mentioned entities.

This would give an opportunity to provide the relevant institutions and agencies with a capacity-qualified professionals, whose involvement will enable to successfully implement awareness-raising activities for the population, leaders of communities, institutions and agencies, and civil society organizations, not only regarding matters of environmental protection, climate change, but also about the SDSs, at all levels.

5.5. Involvement of non-governmental organizations and local communities in the implementation of national projects, programmes and plans on SDS

At present time, there are more than 30 NGOs with ecological profile working in Tajikistan, 25 of which are members of the Civil Environmental Council. The members of this Council have played a significant role in promoting the essence of the UN Conventions on Adaptation to Climate Change and the UN Convention on Combating Desertification.

Nowadays, in Central Asia and Tajikistan, there are a large number of active environmental organizations that are involved in addressing various environmental issues.

The mission of the Regional Environmental Center for Central Asia (CAREC) is to contribute into tackling the national and regional challenges in the field of environmental protection and climate change, including the SDSs. The activities of this entity have already been recognized and appreciated by the national, regional and international partners.

A significant role for the accelerating democratic transformations in the Republic of Tajikistan is played by the movement of women, since the course towards democratization of our society allows to empower and promote women to ensure execution of their rights and their full participation in the social, economic, political and scientific life of the society at all levels.

Among women's NGOs, not the least role is played by the Association "Women of Science of Tajikistan", the priority direction in the activities of which is focused on ecological education and environmental protection. The Association has developed a new, understandable and interesting curricula in the field of education, awareness raising and for informing civil society about

combating desertification in Tajikistan. Such education programmes with specific adjustments could be successfully used also to raise awareness on the SDSs issues.

The civil society organization "Zan va Zamin" (Woman and Earth) was founded in 1999 and is supporting modern agricultural practices and is contributing into the preservation of agro-bio-diversity, paying particular attention to the rights and participation of women in all activities and at all levels.

The Youth Environmental Center, since 1995, has been working with local communities, civil society and government organizations and is actively involved in the development and implementation of the programmes related to the environmental protection, natural resource management and adaptation to climate change.

The Youth Group for Environmental Protection is the avant-garde of the environmental movement in Sughd region and focuses mainly on general comprehensive schools, conducting awareness-raising campaigns on environmental protection, disaster risk reduction and climate change.

The NGO CAMP "Kuhiston" is conducting trainings on the topics such as: adaptation of land resources to climate risks; on use of drought-resistant crops and crop varieties; on improvement of pasture management practices; on sustainable management of water resources and natural disaster risks. This organization provides technical assistance and information materials to local communities on the above-mentioned issues, which, after some integrated adjustments, could be used also for the SDS awareness raising activities.

The civil society organization “Civil Initiatives Support Fund” is collecting and analyzing the practices of traditional land and water usage, is raising awareness of the local communities and is assisting them to adapt to the climate change.

Such NGOs, as the "Mekhrangez", the "Hamkori bahri Tarakkiyot", the "Climate Change and Disaster Risk Reduction Center", the "Bakht and Saodat" are closely collaborating with Dekhkan farms, women's groups and poor communities, and produce brochures and booklets on aspects of bio - and agro-diversity in the light of climate change.

Since 2001, thanks to the efforts of UNDP, “Jamoat Support Centers” have been established in Tajikistan. Such Centers are actively involved in the management of small grants and in project activities on the natural disaster risks reduction, improvement of agricultural practices, agro-forestry and on raising the quality of health care services.

Among international organizations, the main partners and service providers in the sphere of climate change issues in Tajikistan are UNDP, OSCE, EU, GIZ, Acted, Oxfam and others. While these organizations do not directly implement activities on climate change and the SDSs, they do recognize the importance of adaptation in these areas.

The international organization Oxfam GB (UK) dedicates its attention to the awareness raising activities for the government officials and specialists of international organizations involved in the climate projects and in the implementation of the Pilot Programme for Adaptation to Climate Change.

In order to facilitate the implementation of the UNECE Aarhus Convention on Access to Environmental Information in the Republic of Tajikistan, the OSCE Programme Office in Dushanbe had organized a network of Aarhus Centers in the cities of Khujand (2005), Bokhtar (2009), Khorog (2011), Tursun-zade (2013), as well as in Rasht and Kumsangir (2014).

Based on the results of the analysis of the implementation of Phase 1 of the Pilot Programme on Adaptation to Climate Change in Tajikistan, which reflected the issues of the training and raising awareness about the environment and climate change, as well as taking into account the activities of partners and service providers (NGOs and civil society organizations) in this sphere, the following gaps were identified:

- Absence of policy for integration of the climate change issues and the impact of the SDSs into the curricula of general comprehensive schools, universities and specialized institutions for adult education;
- insufficient role of government bodies in awareness raising and education on climate change issues and the impact of the SDSs;
- the irregularity and ad-hoc nature of the initiatives undertaken to raise awareness of climate change and the impact of the SDSs;
- limited coverage of climate change issues in the media, a rare appearance of articles on these issues in press, radio and TV;
- insufficient number of publications and media resources in the national language.

In addition, the activities of all local and regional governmental and non-governmental organizations have been implemented only in the field of climate change, environmental protection and accorded adaptation measures. The SDS issues are not touched upon at all, since they were not raised. If such questions would have been raised, then, of course, an appropriate response would be provided to them accordingly.

On the other hand, the main factors contributing to the formation and development of desertification, which were in the action agenda for the above-mentioned organizations, are also the same reason to trigger the formation, development and spreading of the SDS events, which impact the environment, public health and other sectors of the national economy.

Consequently, for the abovementioned NGOs and civil society organizations, raising awareness about the SDS issues, measures to combat their negative consequences, obtaining appropriate skills and models of action during the SDSs is a clear and achievable objective.

Therefore, the experience gained by the local, national, regional and international NGOs and civil society organizations in the process of raising awareness of the communities and other segments of the society could be also used for the implementation of the similar activities regarding the SDS events. With the same success, after introduction of appropriate adjustments, the textbooks, booklets, brochures and other visual aids and materials developed by these entities on adaptation to climate change and combating desertification could be used.

6. SCIENTIFIC AND PRACTICAL RECOMMENDATIONS TO REDUCE INFLUENCE OF FACTORS CONTRIBUTING TO THE DEVELOPMENT OF SDSs

6.1 Sources of the SDSs in Tajikistanы

The main sources of SDSs development in Tajikistan include separate, point areas in Shaartuz (I) and Kabadian (II) districts of the Khatlon region; the arid and semi-arid zones in the Sughd region (Kanibadam, Asht districts) (Figure 16). On the territory of Shaartuz and Kanibadam districts, with their further spreading into the Afghanistan territory, there are vast massifs of hilly and hilly-ridge sands of semi-fixed sand masses (the Kurdzhalakum sands, on the left bank of the Kafirnigan River at the confluence of the river into the Pyanj River; the Karadum sands in the Dusti district (III) between the Vakhsh and Pyanj rivers). The height of the sandy hillocks is about 5-15 m, the sandy ridges are from 10 to 40 m height, with the length of 0,1-1 km; the steepness of the slopes is from 5 to 250 m. All that masses are represented with dry sands, poorly fixed by vegetation.

Even if there is some vegetation cover on the surface of the sands, it is hardly visible in some rare places, and is very scarce, of a steppe and semi-steppe type, represented mainly by dwarf shrubs and rarely by shrubs (tamarisk, saxaul, etc.) (Figure 11). The main places of SDS sources in the Sughd region of Tajikistan include separate territories in the Kanibadam (IV) and Asht districts (V). These are the sands of the isolated terrain features of the Kairakkum desert in the Kanibadam, Dasht, Shait, and Khojayagon-Asht districts (Figure 16).

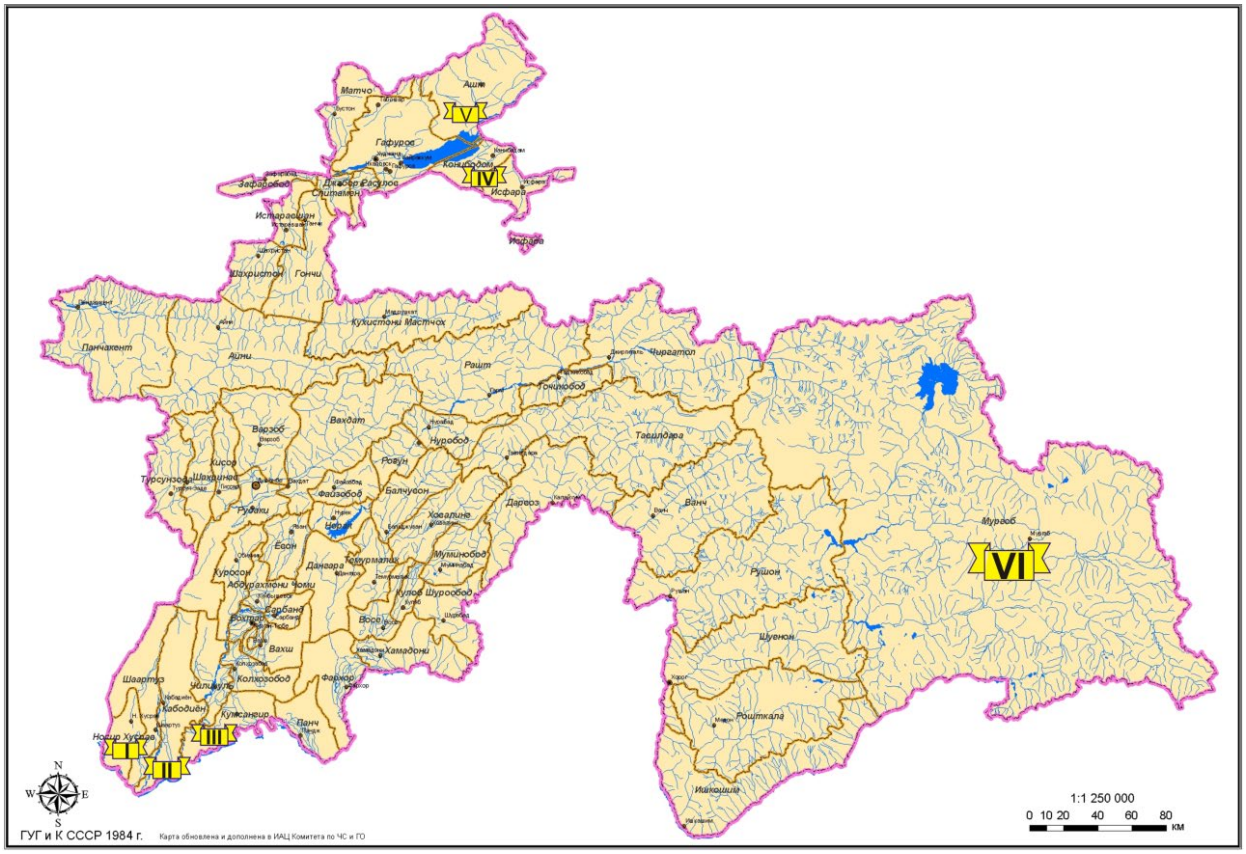


Figure 16: Centers of SDSs spreading on the territory of Tajikistan

The places where sandy deserts appear in Tajikistan have a clear pattern, all of them are formed in the deltas of large rivers, such as Pyanj, Vakhsh, Kafirnigan and Syrdarya and are mainly related to erosion processes (Figure 17). But there are also territories where the sources for SDSs are possible, these are the semi-deserts of the Eastern (VI) and Western Pamir mountains, Lower Pyanj

area, Hissar Valley, Northern Tajikistan with displaced soil types - sandy-pebble, loamy and sandy loam, crushed-loamy and crushed sandy loamy territories.

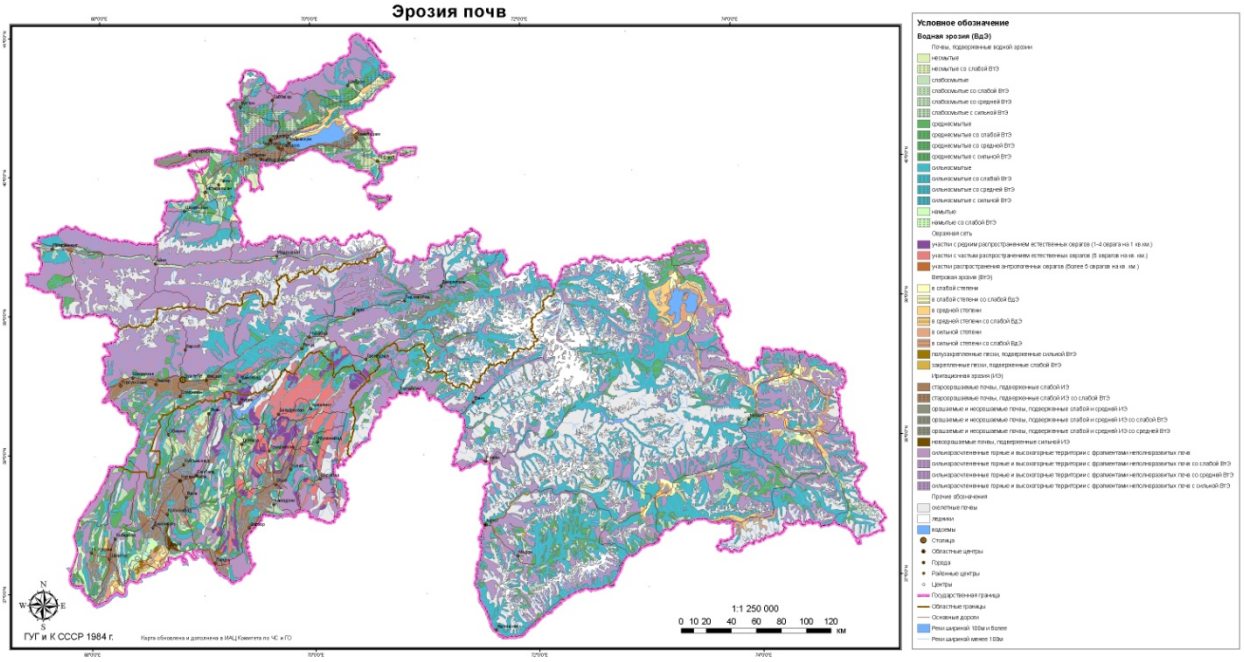


Figure 17: Map of the soil's erosion spreading in Tajikistan

These above are the potential areas on which, in the future, the climate change could have a severe impact and turn them into real places of origins for sandy deserts.

6.2. National actions in relation to SDS.

Combating desertification and the SDSs issue is one of the important challenges of modern times, and to address which, it is necessary to apply protective and preventive measures, including forest reclamation and re-forestation activities. Such measures include the re-vitalization of old and the creation of new forest belts where the winds are especially strong. This methodology experience was applied in China, where almost a quarter of the country's territory has already turned into a desert. The problem of dust storms was resolved there through planting a forest belt for 4,5 thousand kilometers long, which was named the "Green Wall of China". This process of planting was initiated in 1970, and now the forest covers an area comparable to the entire territory of the Great Britain.

Protective afforestation process in Tajikistan, including for the prevention of the SDSs, has begun to develop in 1969, but since 1988, the installation of field-protective forest belts is no longer carried out. Until 1992, the re-forestation process was carried out on an annual basis on an area of 4,500 hectares, but since 1993, these areas have been decreased to 3,000-3,500 hectares per year. The shortage of fuel, problems with of electricity supply in 1992-1997 forced the population to tackle their survival life problems at the expense of the wildlife, which had led to the formation of the new and to the expansion of the old desertification zones. The floodplain forest formations which are protecting the coastal zones of the mountain rivers Vakhsh, Kafirnigan in the lower reaches, up to the areas of the wildlife reservation territory "Tigrovaya Balka", Zeravshan, Syrdarya, have been almost completely eliminated[40].

Nowadays, the situation in the field of the forestry management in Tajikistan is gradually returning to the normal. At present, the total area of land of the national forestry fund is 1,8 million hectares,

[40] The National Strategy and Action Plan for Bio-diversity Conservation Until 2020. Dushanbe, 2016.

of which only 25% is occupied by forest plantations. The forested area is 410 thousand hectares, of which 38 thousand hectares are forest crops planted during recent years. Over the past period of 10-15 years, the forest reclamation activities have been carried out on the area of 12 thousand hectares, more than 15 million pieces of propagules and seedlings of various tree species have been planted[41].

The main core in the system of forest reclamation measures to protect the agricultural lands from dust storms, strong winds (garm-mudflows) are the forest shelter belts, which should be laid in the form of a system covering the entire territory of the forestry and linked to the crop rotation fields, the irrigation networks and the roads. The main stripes are established, as a rule, with three and four-row, auxiliary - two-row, and in some cases - of a single-row types.

In various natural geo-morphological zones, the strategy of actions for the implementation of anti-erosion measures, especially forest reclamation, is different. Almost all of the valley territories are irrigated and used for growing cotton. The fight against soil degradation should be carried out in two directions:

- reconstruction process for forest plantations with the implementation of a number of hydraulic and agrotechnical measures in the area of collection of irrigation water, in order to reduce and stop erosion and landslide processes;
- an appropriate usage of forest shelter plantations, which are contributing to the reduction of the impact of the climatic factor.

On the de-graded land areas, it is required to carry out a complete or partial filling of the ravines with local or imported soil and to implement planting of forest cultures on the covered part of the ravines. Several options for filling ravines are proposed in this regard. In the deflation spreading zone, it is necessary to introduce forest soil protection belts of various structures and of various forest species.

In the foothill-low-mountain zone, of the forest-forming species, the most effective are considered to be forest plantations of pistachio, almond and other small-leaved forest-forming species with the implementation of number of hydro-technical anti-erosion measures.

At present time, scientific institutions are testing and improving a set of methods for combating erosion processes, where the main components are forest plantations. In order to combat deflation on the targeted territory, it is necessary to apply a system of forest reclamation measures together with the agro-phyto-melioration actions.

The targeted territories have been used for the rainfed type agriculture for a long time, therefore, all forest reclamation anti-erosion measures in the rainfed zone should be aimed at further suspension and weakening of erosion processes. Here it is necessary to apply a set of measures to combat soil degradation - a buffer zone, with natural re-generation of small-leaved soil-protective forests and herbaceous vegetation.

The middle mountains represent the main zone for the formation of the surface runoff, and the main purpose of anti-erosion measures is aimed at reducing and stopping erosion processes. The key role in this direction is dedicated to the forest reclamation and amelioration activities through planting walnut, juniper, maple, birch and other forest-forming species together with implementation of agro-hydraulic measures to combat soil degradation.

For natural re-generation of forestry, it is necessary to regulate livestock pastures and to implement agro-technical measures. In addition, special attention in this regard should be dedicated to the afforestation on slopes with a steepness of more than 12 degrees and to prohibit de-forestation on slope lands for the cultivation of row crops.

[41] Ibid

Since the upper border of the forests is located at an altitude of 3,500 m above sea level, i.e., to the upper part of the Alpine zone, then forest reclamation and anti-erosion measures should be concentrated at these heights. Depending on the geographical location, it is necessary to propose various forest-forming species with the obligatory implementation hydraulic engineering measures. In the high-mountainous zone, the same reclamation measures are applied as in the middle-mountain zone.

Taking into consideration the nature conservation and environment-forming role of forests, and that there is insufficient area for them, the implementation of forest reclamation activities and their integration into production processes is a priority objective for the Republic of Tajikistan. The main implementation principle for forest reclamation environmental actions and their further improvement remains the restoration of economically valuable species, both in the cut-down areas and on the unforested lands, in order to increase the forest coverage of the territory of Tajikistan.

It is envisaged to re-construct the system of organization of the re-forestation activities, while ensuring the maximum usage of the forest's self-production capacity, which provide its restoration at the lowest cost. The introduction of a programme of genetic resources of the main forest-forming species, on which scientists from scientific-research institutions in Tajikistan are working is also planned.

In the zone of ecologically unfavorable areas, re-forestation is of great importance, including in the zone of spreading of wind erosion in the South and North of the Republic, because it is preventing the movement of sand masses to the agricultural lands.

To ensure an appropriate implementation of the above activities following is required:

- strengthening and establishment of new nursery farms for the cultivation of the main forest-forming species;
- continuation of scientific-research studies to improve forest reclamation anti-erosion measures;
- organization of permanently operating teams or working groups in each forestry enterprise or other farms which possess forest plantations to conduct planting activities and for maintaining of the forest reclamation plantations;
- elaboration of the land maps for afforestation and the timing of their implementation;
- introduction of the best practices in the sphere of forest development in combination with anti-erosion activities.
-

6.3. Population Health and Public Healthcare System Measures

The health care system in Tajikistan has not fully researched the negative impact from the SDSs on the health of the population, especially children, the elderly and women. In terms of increased risk, only the implications for cardio-vascular mortality and morbidity from respiratory diseases, including asthma among children, have been recorded. Specific research assessments of the impact and damage from the SDS have yet to be fully established from a gender perspective due to the vulnerability of women and children to the SDS. According to the Agency on Statistics under the President of the RT in 2018, for 100 thousand of inhabitants there have been 4,657 respiratory diseases, 1,767 - complications of pregnancy, childbirth in the post-partum period identified[42].

[42] Statistical Yearbook of the Republic of Tajikistan. 2020. Agency of Statistics under the President of the RT.

The arid land territories of Tajikistan are constantly exposed to the presence of sub-micron dust particles formed as a result of the SDSs. An increase in dust emissions can cause a significant deterioration of the health of humans and other living organisms.

The global climate change and the expansion of desert zones create conducive conditions for the formation of sources, development and frequent spreading of SDSs. Despite its relevance, this problem has not been comprehensively researched, although it is one of the extremely important factors affecting the environmental, social and economic spheres of the country's development, especially healthcare system.

Dust particles of the size larger than 10 microns are not inhaled and, therefore, can only damage external organs, causing mainly skin and eye irritation, conjunctivitis and represent an increased risk of ocular infection.

Inhaled particles less than 10 microns in size often enter the nasal cavity, mouth and upper respiratory tract, causing respiratory distress such as asthma, tracheitis, pneumonia, allergic rhinitis, and silicosis. Smaller particles can even enter the lower respiratory tract and, entering the bloodstream, affecting all internal organs, causing a severe cardio-vascular disease.

In 2014, the Global Model estimated that dust exposure was responsible for about 400,000 premature deaths cases from cardio-pulmonary disease among people over 30 years old.

Depending on the weather and climate, dust can remain suspended in the air for several days, leading to allergy outbreaks at a considerable distance from the original source. Some infectious diseases can be transmitted through the dust. Meningo-coccal meningitis (a bacterial infection of the thin tissue layer that surrounds the brain and spinal cord) can damage human brain and, if left untreated, can be fatal in 50% of cases.

Researchers believe that inhaling dust particles in hot, dry weather can damage the lining of the nose and throat, creating an environment conducive to the spread of bacterial infection, and iron oxides in the dust particles may increase this risk.

Chronical exposure to fine dust particles is contributing to premature death from respiratory and cardio-vascular diseases, lung cancer and acute lower respiratory infections.

In the Laboratory of Atmospheric Physics of the Physical-Technical Institute of the National Academy of Sciences, the nature and elemental composition of the dust storms brought in from outside are under the process of in-depth analyses. As a result of the research carried out by the scientists of this institute, there were traces of radioactive technogenic isotopes identified in the sand and dust particles collected in the arid zone of Tajikistan. This became the basis for further in-depth analyses of the elemental composition of the dusty haze spreading from the south to the central part of the country.

These analyses' results had demonstrated that in all of the taken samples of the dusty haze, there was a 5-10 times increase in the content of isotopes compared to the soil samples from the areas located along the path of the dusty haze, indicating that the dusty haze was enriched with radio-active isotopes brought from the neighboring countries (China, Pakistan, India). The extreme danger of such a situation in this case is that the radio-active isotopes, through the lush grass of the foothills, are able to enter the body of humans and animals, causing serious diseases.

The study on the dynamics of the changes in the concentration of some heavy metals and radio-active isotopes in the soil and in the dust aerosol samples in the south of Tajikistan showed that an increase in their concentration is observed closer to the north. Perhaps this is because of the influence of the migration of the radio-nuclides from the area of tailing impoundments in Northern Tajikistan (waste of uranium ore processing). Wind-carried contaminated dust and hazardous substances can enter the soil and, during heavy rainfalls, absorbed into the surface and even groundwater, and further negatively affecting the health of the population.

In the transfer of heavy metals and radio-active contamination, atmospheric processes play an important role, in particular, the dust storms and dust haze, which are transferring solid particles over long distances from the original places of the dust release.

During the invasion of a dust haze (natural) from the south-western border of the country, an increased concentration of elements in the aerosol of the dust haze was found relative to their concentration in the soils of the dust haze spreading zones: Sc, Zn, Ni, Cu, Ca, Sr, and Ge. A heavy migration in the atmosphere is observed for the elements of Co, Zn, Rb, As and Sr, which is an evidence of the accumulation of very toxic elements in the atmosphere [1].

What is an alarming signal – that is the high content of such toxic elements as Zn, As and Sb, which is up to ten times higher than the Clarke (the average content of the element in the Earth's crust).

Currently, there are no reliable data on the impact of heavy metals on the health of the population of Tajikistan, but it is known that heavy metals such as lead and mercury can significantly and dangerously affect the development of the nervous system of children even at low levels of pollution.

The process of the influence of hazardous radio-active elements on the health of the population and animals, as well as the development of plants, proceeds very slowly and the consequences cannot be detected immediately, therefore, regular monitoring of this process is strongly required.

There are other organizations involved in determining the quality of atmospheric air, surface and groundwater. For example, the Agency for Hydro-meteorology is monitoring the quality of atmospheric air and surface waters, the Institute of Geology, Earthquake Resilient Constructions and Seismology of the National Academy of Sciences carries out researches to determine the content of Radon in groundwaters, the Agency for Nuclear and Radiation Safety of the National Academy of Sciences conducts radiation monitoring. The Main Department of Geology under the Government of the Republic of Tajikistan is engaged in monitoring of the quality of groundwaters.

To ensure the protection of the population from infection with contagious diseases and various kinds of diseases of humans, plants and animals associated with the influence of the SDSs and the effective implementation of the National Action Plan on the SDSs in this direction, the following actions are required:

- to implement regular checking of the elemental composition of the SDSs (for the presence of dust particles of the sub-micron fractions, radio-active isotopes and heavy elements in the air, soil and groundwaters) in the habitat localities, in the mountainous and foothill areas and in the most vulnerable exposed zones;
- to carry out regular reviews of the sanitary and hygienic conditions of the most important facilities, primarily schools and medical institutions, to develop projects for their modernization;
- raising awareness of the population and students of general education schools in matters of the SDSs, and the impact of their negative consequences on the health of the population;
- to raise awareness among and through the media (newspapers, magazines, TV and radio) on the topic of preparedness to the SDS phenomena, mitigating their negative consequences and behavior models for adaptation to them.

The Ministry of Health and Social Protection of the Population and the Committee for Environmental Protection need to improve cooperation with the above and other environmental organizations in the exchange and analysis of the data on the impact of the SDSs on environmental pollution, of the condition of health care system and other sectors of the national economy, to conduct joint research and to coordinate efforts and activities in this direction.

In order to study the impact of the SDSs on the health of the population, agricultural and other sectors, meetings and interviews have been conducted with the activists of the most vulnerable

communities living in Shaartuz, Kabadian and Jilikul (now, Dusti) districts of Khatlon region, Asht and Zafarabad districts of Sughd region and Ishkashim district of the GBAO region. The results of the survey had demonstrated that in most cases, the population and communities have only a superficial understanding of the SDSs and their negative consequences. Most of the respondents mentioned only the impact of the SDSs on the health of the population and the difficulty of transport movement due to very poor visibility conditions. Questions regarding the impact of the SDSs on the status of growth and productivity of agricultural production and their impact on other sectors of the national economy were somewhat difficult for them to realize, the answers were not clear and were obtained through the leading questions.

To address the problems associated with the SDSs, it was proposed to carry out some preventive measures, which may include the following:

- to identify quantitative and qualitative indicators for the impact of the SDSs on health conditions of the population (women, men, children of different ages, the elderly people);
- Carrying out works on re-forestation, protection of pastures and farmlands, gardens, household plots, roads of settlements from the negative consequences of the locally originated and the brought from outside SDSs;
- raising awareness of the population (men, women), including students of secondary schools, on the reasons for the formation of the SDSs, their negative impact on the health of population, measures to prevent them and the rules of behavior for adaptation during their process;
- ensuring a high-quality forecast of air pollution by the locally originated and the brought from outside SDSs and other pollutants in order to take appropriate measures to protect the population and the territory.

These recommended activities are directly or indirectly presented in separate Sections of the National Action Plan for the SDS and in the Plan for its implementation.

7. GIS MAPPING OF SDSs SOURCES, DEVELOPMENT AND SPREADING

Presently, for Tajikistan, the absence of scientifically grounded cartographic basis for the SDS makes impossible to conduct an effective risk assessments and planning for measures to mitigate their negative consequences. By to-day, for Tajikistan, a compilation of thematic maps "Natural resources of Tajikistan" is the only available resource which is applicable to fill this gap - to conduct an assessment research, to characterize and to prepare a contemporary, scientifically grounded cartographic basis at a scale of 1: 500,000, reflecting the development of the main hazardous natural processes associated with the SDSs.

The compilation of thematic maps "Natural resources of Tajikistan" of the 1: 500,000 scale, was developed during the period of 1985-1990s[43] as the first large-scale regional implementation of the concept of an integrated study and mapping of natural resources based on the information from space. The research and cartographic works are based on the principles of a new scientific direction for the study of natural resources and the environmental - cosmic nature study. Surveys from space were carried out from automatic spacecraft of the Cosmos series, manned spacecraft of the Soyuz type and long-term orbital stations Salyut.

The space information used in the course of the work was presented in the form of integrated black-and-white, multi-spectral, multi-zonal and synthesized images, as well as the results of their optical-electronic processing. During the process of elaboration of these thematic maps, the previously issued topographic and thematic maps of various scales, statistical and literary reference materials developed as a result of long-term researches of the natural resources in Tajikistan by traditional research methods were also applied.

The use of space photographs made it possible to clarify, to compliment and to bring into a unified system cartographic, statistical and other materials of different times, diverse and scattered in the content, that is, to create a series of thematic maps that make up a unified package of interrelated studies. The closest in the content to the SDS maps can be considered the following maps located in the collection of the thematic maps: "Natural Resources of Tajikistan": Soils (Figure 13), soil erosion, soil salinization, vegetation, land use, forests, landscapes, etc.

In order to address the problem of GIS - mapping of the SDS sources of development and distribution, it is necessary to compile in a digital version the following types of maps:

- The Map of the sources of development and distribution of the transfer of sand and dust on a scale of 1: 500000;
- The Map of the creeping degree and intensity of the SDSs on a scale of 1: 500 000;
- The Exposure Degree Map.

But, unfortunately, till present time, the GIS mapping of the sources of SDSs in the country has not been carried out. Probably, it will be feasible to fulfill this during the implementation of the National Action Plan for the SDSs. The figure below demonstrates a map of soils of Tajikistan, showing the sources of formation of sand and dust storms of a local nature.

The source of SDSs can be defined as a relatively dry, unprotected topsoil surface, free of vegetation, snow / ice or water, and unfrozen, with soil particles blown away by the wind. The destructibility or dynamics of a source is influenced by the climate, the weather conditions (for example, wind speed or drought), the nature and characteristics of the soil surface, and the nature of human activity.

The dynamics of the SDS sources is associated with seasonal changes in vegetation and snow cover, the presence of changes in the area of water bodies, and soil freezing. These changes are causing significant changes in the geographic distribution of the SDS sources. Soil surface is more susceptible to wind erosion when it contains smaller soil particles, typically clay and silt particles

[43] Atlas "Natural Resources of the Tajik SSR". The Soils. M., GUGK, 1984.

up to about 50-60 μm in diameter. Dust emissions increase with the disturbed and loose soil structure.

The knowledge about the sources of the SDS is required to assess the risks and their impact, for planning of measures to reduce their consequences, to forecast them and to establish early warning systems. Mapping of the spatial and temporal distribution of the SDS sources requires an understanding of the causes, the formation and activation of their sources. Two methodologies for the mapping of the SDS sources can be distinguished:[44]

The first method relies on the data from the past SDS events, with the better the maps, the longer the time frames covered by these datasets. This method provides a good coverage of the main and often active sources of the SDS, including the global and regional sources that dominate in the formation of the SDSs.

The disadvantages of this method are as follows:

- the spatial and temporal discontinuity of the observations;
- the relatively lower mapping resolution than using soil-related parameters;
- the possibility of neglecting or underestimating local and short-term events and sources of the SDS.

Another method is the surface condition mapping with an emphasis on assessing the potential for wind erosion of the soil surface. Important soil parameters required for the mapping of the sources of the SDS and they include the soil characteristics such as soil texture and structure, soil particle size distribution, soil moisture and temperature, soil coverage and soil permafrost.

The advantages of this method include the following:

- Involving information on soil surface conditions such as soil characteristics and land use;
- identification and differentiation of the localized sources;
- identification of inactive or minor seasonal sources.

However, this method above requires a complex combination of the information from different data sources and must somehow address the issue of the information shortage about the soil characteristics and analysis.

[44] Convention to Combat Desertification. Conference of the Parties. Fourteenth session. Follow-up to policy frameworks and thematic issues: sand and dust storms. New Delhi, India, September 2-13, 2019.

8. MONITORING AND EVALUATION OF THE IMPLEMENTATION OF THE NATIONAL ACTION PLAN FOR SDS

Monitoring and evaluation of the implementation of the National Action Plan for SDS (SDS NAP) will be carried out by the Committee for Environmental Protection under the Government of the Republic of Tajikistan, on the basis of regular monitoring of approved gender-sensitive indicators that meet the criteria of measurability, adequacy, cost efficiency for the information collection, direct reflection of the mid-term results and the final outcomes.

The M&E system of the SDS NAP will be structured in such a way as to ensure the achievement of the established goals by coordinating the activities of the national public institutions, mobilizing internal and external financial resources, their efficient and effective use based on the involvement of all stakeholders, including development partners into the implementation of the Programme.

The M&E system of the SDS NAP is designed to track the progress in achieving the goals, to identify the accumulated positive experience and existing issues for the implementation of the National Development Strategy of Tajikistan for the period up to 2030 (NDS-2030), the Medium-Term Development Programme of Tajikistan for the period of 2021-2025 (MTDF for 2021-2025), The National Strategy for Climate Change Adaptation of Tajikistan for the period up to 2030, the National Strategy for Disaster Reduction for 2018-2030, to conduct an analysis of development processes within the framework of the Programme itself and the development of substantiated proposals for adjusting the policy in the field of implementation of the SDGs, the Sendai Framework for Action in Disaster Risk Reduction and the United Nations Convention to Combat Desertification (UNCCD).

In order to measure the country's progress towards the set-up objectives, ***a system of indicators*** will be applied to track the effectiveness and efficiency of the policy measures laid down in the SDS NAP for 2021-2030.

The following indicators are used for the monitoring and evaluation system of the NAP for SDS, which are the tools of the M&E system: The system of M&E indicators for the SDS NAP will be elaborated by the Committee for Environmental Protection under the Government of the Republic which is responsible together with the direct participation of the key ministries and agencies for the implementation of the SDS NAP in accordance with the Action Matrix (Ministry of Agriculture, Ministry of Energy and Water Resources, Ministry of Transport, Ministry of Health and social protection of population, Agency for Land Reclamation and Irrigation, Forestry Agency, National Academy of Sciences).

The indicators will be developed in line with the recommended indicators of the Sendai Framework for Action on Disaster Risk Reduction and the SDGs.

The monitoring and evaluation system of the MTDF for 2021-2025 applies the following indicators, which are the instruments for the M&E system:

- ***Indicators for the measures / actions.*** *They show what actions, measures are taken in order to achieve the set-up objectives, and to whom these actions / measures were referred to. They also reflect the implementation of the actions / measures to achieve the assigned tasks;*
- ***Indicators for the spent resources.*** *They show how much and what resources are required in order to achieve the setup objectives;*
- ***Impact indicators.*** *They reflect on what the final effects would be, as well as the changes in the direction of achieving the strategic goals at the national level and improving the well-being of people;*
- ***Indicators (signs) of output.*** *They show what goods / products were created after the implementation of actions and measures;*
- ***Indicators (signs) of expected (final) outcomes.***

Information collection system. The key sub-system of the M&E is formed by the system for collecting data on the values of monitoring indicators and other quantitative and qualitative information characterizing the SDS influencing the socio-economic development of Tajikistan.

In order to expand the sources of information and involvement of the communities, civil society associations into the monitoring process of the National Plan of Action on SDS, it is envisaged to assist in joint and civil monitoring of its implementation at the national and local levels.

In the data collection system, the central role belongs to the Committee for Environmental Protection under the Government of the Republic of Tajikistan, which will ensure the timely collection, processing and provision of the main data set for all indicators.

For the completeness and integrity of the information provided, the collection of data on the relevant indicators / signs (measurement of the values / target values (benchmarks) of the indicators) for the SDS NAP should be carried on annual basis after the closure of the reporting year.

Financial support monitoring system. Various sources, both internal and external, both public and private, must be identified for financing the SDS NAP, and the ability to control these financial flows directed towards achieving the set-up objectives plays an important role in understanding the potential of each source.

The appropriate sectoral and territorial administrations, civil society organizations and business structures, as well as development partners should be involved in the process of monitoring and evaluation of the National Plan of Action on SDS. The results of the monitoring and evaluation on the progress of the implementation of the National Action Plan for the SDS, in accordance with the agreed protocol, will be submitted to the Government of the Republic of Tajikistan and to the UNCCD Secretariat.

CONCLUSIONS AND RECOMMENDATIONS

Legislation and Policy

There are various current laws and norms available which stipulate regulations in the field of disaster management in the Republic of Tajikistan, as well as the National Strategy for Disaster Risk Reduction for the period of 2019-2030, the National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030, the National Action Programme on Combating Desertification in the Republic of Tajikistan 2021. However, the inclusion of impact issues and the adoption of necessary measures for the SDS in these documents is quite limited. The situation is similar with the sectoral legislation, policies, plans and strategies, which rarely mention the aspect of the SDSs and the potential impacts of climate change. The existing regulations do not contain a clear list or definitions of the different types of disasters associated with the SDSs that may have an impact on the country.

The recommendations for improvement of the current existing regulations can be summarized in the following way:

- to incorporate aspects related to the SDSs and climate change into the legislation, the programmes and the strategies for disaster risk and into the sectoral legislation;
- To improve the legal and regulatory framework of the institutional arrangements associated with the SDSs in relation to disaster risk assessment for the key sectors of the economy;
- to improve the legal and regulatory framework in the field of dissemination of information on damage and losses from natural disasters associated with the SDSs.

Institutional framework

In Tajikistan there is an institutional State System for Natural Disaster Risk Reduction and Management – it is a unified state system for prevention and liquidation of emergency situations. The Emergency Situations Commissions of various levels (national, regional, city, districts, etc.) are acting as the main coordinating bodies of that unified State System. Tajikistan also has a National Platform for DRR, which serves as an advisory mechanism. Among the priority objectives of the key ministries and agencies there are risk reduction and assessment of the damage from natural disasters, cooperation with other ministries and agencies within the framework of the unified State System. However, the assessment of the risk and damage from the SDS phenomena in the objectives of the institutional structure is not specifically defined, there is no scientific assessment of the damage to the economy as a whole.

The recommendations for improving of the institutional framework and coordination mechanisms include the following:

- To strengthen the role of the National Platform for Disaster Risk Reduction, in particular, in the field of coordination of measures to reduce the risk of the SDSs, implemented by the government agencies in collaboration with the international community, including the Rapid Assessment and Coordination Group on emergency situations;
- To improve further the mechanisms for allocating the funds and resources to mitigate risks and establishment of monitoring procedures in order to improve the efficiency of risk management related to the SDSs.

Early Warning System

There is a functioning Emergency Early Warning System in Tajikistan. The Agency for Hydro-meteorology is responsible for preparation of weather forecasts, for notifying the government agencies about high potential natural disasters. The information is provided to the CoES, which then is disseminated further among its territorial brunches. However, at present moment, there is no early warning system which could be applied for the phenomena of the SDS. In the context of market economy, such issues as accessing, analyzing and disseminating of the valuable information in Tajikistan remain unresolved. Other gaps related to the national SDS early warning system include the following problems: poor coordination among the decision-makers; absence of a clear structure of responsibility distribution and management, as well as the planning procedures; insufficient information on the list of appropriate services related to the SDS, absence of an adequate national and local database on disasters related to the SDSs (which would have included the data from the early warning systems).

In order to strengthen the existing early warning system from the SDS perspective, the following recommendations could be proposed:

- To establish an integrated early warning system for the SDS for the government agencies responsible for disaster risk prevention, with the application of the latest technology and by increasing its capacity.
- The CoES and the Agency for Hydro-meteorology should develop a list of services available for final users dealing with the aspects of weather and natural disasters specifically related to the SDSs;
- To establish a database for the information exchange about SDSs at the national and local levels, which would include the data on the SDSs recorded during the previous years;
- In future, it is recommended to consider development of such a notification system that would be sending SMS alerts and SDS related messages so the final users would be able take appropriate actions based on the weather forecasts.

Reducing the impact of SDS on the main sectors of the economy, on public health care and education systems

In Tajikistan, there is practically no information on the impact of the SDSs on crop production, food security, transport sector, water and energy resources and, above all, on public health. There is also no awareness raising activities among the stakeholders regarding the negative consequences from the SDSs.

The recommendations for raising awareness efforts and improving of the understanding of this phenomena and as well as related to mitigation of sand and dust storms impacts in the development context are the following:

- Introduction of crop diversity and plant breeding knowledge, combined plant cultivation, structure and planting methodologies, taking into account the impact of the SDSs;
- Establishment of seed banks in communities, especially for crops resistant to droughts and diseases associated with the SDSs;
- Re-forestation through planting trees in order to protect the communities and economic infrastructures from wind and SDSs;

- To increase efforts of improving restorative measures for soil condition and on protection against erosion, and in the sphere of water and drainage systems management, taking into account the impact of the SDSs;
- Development of practical measures and recommendations to reduce the impact of the SDSs on the health of population and other sectors of the national economy;
- Carrying out activities to increase preparedness and awareness about the characteristics of the SDS nature, their negative consequences and measures of mitigation and adaptation;
- to carry out regular assessment analyses for identification of the elemental composition of the SDSs (the presence of dust particles of the sub-micron fraction, radio-active isotopes and heavy elements in the air, soil and groundwater) in the habitat localities, in the mountainous and foothill areas and in the most vulnerable zones exposed to the SDSs;
- to conduct regular reviews of the sanitary and hygienic conditions of the most important facilities, primarily in schools and medical institutions, to develop projects for their modernization;
- Awareness raising activities for the population and students of general education schools regarding the issues related to the SDSs, and the impact of their negative consequences on the health of the population;
- Awareness raising efforts for and through mass media (newspapers, magazines, TV and radio) in the field of preparation for the SDS, mitigation and adaptation measures in order to stay resilient to SDSs.

The SDS phenomena through the Prism of Gender Aspects.

In the Republic of Tajikistan, women are among the most vulnerable groups of the population which are exposed to the effects of climate change risks including the SDSs. Women are more likely to be vulnerable to the quality of nutrition: they more often suffer from anemia, the incidences of vascular diseases, obesity. The health and well-being of women has a significant impact on the health and the development of their children, family, community and the society in general. Particularly vulnerable categories are pregnant women, with young children, those who are taking caring for sick and elderly family members. Women spend most of their time taking caring for household members and providing basic living conditions and food for their households at the expense of other productive activities or participation in the social life.

The recommendations to raise awareness and improve understanding regarding gender aspects of sand and dust storm mitigation in a development context are the following:

- to strengthen capacities, to empower and provide opportunities for more active participation of women in the sustainable socio-economic development programmes, which are taking into consideration aspects of climate change, including the SDSs;
- Efforts on raising awareness and understanding of the inter-relations between a gender and mitigation of sand and dust storms impact in the development context;
- Improvement of the system of promotion and advocacy efforts related to gender and mitigating the negative consequences from the SDSs during the process of planning, budgeting and implementation of development activities;
- To strengthen capacities, to empower and to provide more opportunities for the active participation of women in sustainable socio-economic development programmes, taking into account climate change, including the SDSs.

You can find the Implementation Plan for the "National Action Plan for the Prevention and Mitigation of the Consequences of SDSs for the period of 2022-2030" in the below presented Appendix 1.

The given Implementation Plan for the SDS NAP for the period of 2022-2030 includes the following items:

1. Integration of the issues of the negative impact of SDS into the sectoral programmes and strategies;
2. Further improvement of the legal-normative documentation;
3. Further Improvement of the system of coordination, cooperation and capacity building with regard to the SDSs, climate changes and disaster risks issues.

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APPENDIXES

Appendix 1: Implementation Plan

for the "National Action Plan for the Prevention and Mitigation of the Consequences of SDSs for 2022-2030":

№	Measures	Activities	Responsible Body	Co-implementors	Timeframe	Financial sources	Expected outcomes
1	2	3	4	5	6	7	8
1. Integration of the issues of SDS negative impact into the sectoral programmes and strategies							
1.1	Development of the Medium-Term Development Programme for the Republic of Tajikistan for the period 2021-2025;	Integration of the issues of reduction of the negative impact of SDSs into the section of the Implementation Matrix of measures "Environmental protection, climate change and the risks of natural disasters"	CEP, COES and CD	UNDP	2021-2025	UNDP	Adoption of specific measures to reduce the impact of SDSs, fund raising and mobilization of financial resources, further improvement of the legal-regulatory aspects, awareness raising and strengthening of the capacity
1.2	Development of the National Action Plan for Adaptation to Climate Change;	Inclusion of the issues of integration of the adaptation measures to reduce the impact of SDSs for the main sectors of the economy, specifically on public health, taking into account gender aspects	CEP	UNDP	2021 -2025 г	UNDP 3 mln USD	Development of adaptation and mitigation measures to reduce the negative impact of SDSs
1.3	Development of the Medium-Term Programme to prevent the degradation of water, land and pasture resources until 2025. Development of a medium-term programme to prevent agricultural and rangeland	Integration of the issues related to the reasons triggering the SDSs, the development of a methodology for determining the damage from human economic activity in the agricultural sector	MOA, SCLM&G	MIA, AoF, MoF, MEDT	2022	Public Budget, International organisations	Taking measures to reduce the formation of SDSs as a result of economic activities in agricultural sector (drip irrigation, rotation of pastures, planting protective forest belts)

	degradation (Ta{iayi barnomai miyona mu{lati kishovarz va charogo{o)						
1.4	Development of the "National Programme for Environmental Education of the Population of the Republic of Tajikistan for the period 2021-2030".	To integrate the issues of increasing the level of environmental education for the population regarding the SDSs	CEP	UNDP, UNEP	2022	0,4 mln USD UNDP, UNEP	Raising the awareness of the population about the causes of the appearance, ways to reduce the impact, the negative influence for health from SDSs
1.5	Development of the "National Environmental Programme of the Republic of Tajikistan for the period 2021-2030."	To integrate the challenges of the negative consequences from the SDSs on the ecological status of the country, the measures to prevent them and to reduce their negative impact	CEP	COES and CD, UNDP	2021	0,4 mln USD UNDP, UNEP	Integration of the adaptation and mitigation measures to reduce the impact from the SDSs
1.6	Implementation of the Principles of Environmental Standard Assessment (ESA) and Disaster Risk Management (DRM) issues during the development of strategic sectoral and regional programmes.	To include Risk Assessment Standards for the SDSs	CEP, COES & CD	UNDP, UNEP	2022г	0,4 mln USD UNDP, UNEP	Taking into account the risks of SDS in the process of assessing the risks of natural disasters
1.7	Development of the National Action Plan for Disaster Risk Reduction for the period of 2022 - 2026.	To integrate SDSs related problems, determination of the SDS impact, development of the appropriate measures and identification of financial resources	COES & CD		2021	0,1- 0,4 mln USD UNDP	Elaboration of activities in order to reduce the impact of SDSs, as they are one of the types of natural disasters
2. Further improvement of the legal-normative documentation:							
2.1	To introduce amendments into the following legislation: The Law "On State Regulation of Ensuring the	The amendments to be introduced with special consideration of the impact of SDS on soil fertility	MOA	AAS	2022	Public Budget	The amendments to be introduced with special consideration of the impact of the SDSs on soil fertility

	Fertility of Agricultural Lands ", from 2004;						
2.2	The Law "On Soil Protection", from 2009;	To introduce amendments regarding soil conservation	CEP	AAS	2022	Public Budget	The amendments to be introduced with special consideration to the impact of SDS on soil fertility
2.3	The Law "On Pastures", from 2013;	The amendments to be introduced with special consideration to the efficient use of pastures, degradation, rotation use	MOA	AOA	2022	Public Budget	The amendments to be introduced with special consideration to the impact of SDS on soil fertility
2.4	The Law "On Protection of Atmospheric Air", from 2012;	To introduce amendments regarding the measurement and monitoring of SDS	CEP	Agency on Hydro-meteorology	2022	Public Budget	To introduce amendments regarding the measurement and monitoring of SDS
2.5	The Law "On Hydro-meteorological Activities", from 2002;	To introduce amendments regarding the measurement and monitoring of SDS	Agency on Hydro-meteorology	CEP	2022	Public Budget	To introduce amendments regarding the measurement and monitoring of SDS
3.	**Further Improvement of the system of coordination, cooperation and capacity building with regard to the SDS, climate changes and disaster risks issues**						
3.1	Development of a system for monitoring and assessing of the impact of the SDSs	Improvement in the area of risk management of SDSs and their negative impact	COES и CD	CEP, Agency on Hydro-meteorology	2023	Public Budget	Monitoring and Evaluating the Impact of SDSs
3.2	Development and improvement of the early warning system for the SDS risks based on the application of the GIS technologies	The GIS mapping of SDSs of different focal zones of Tajikistan; To elaborate an early warning system for SDSs.	CEP, SCLM&G, COES& CD	CEP, Agency on Hydro-meteorology	2023	Public Budget	Establishment of an early warning system for the spread of SDSs
3.3	Development of normative-legislative basis to strengthen the role of the National Platform for Disaster Risk Reduction	To integrate the issues of coordination of measures aimed at SDS risks reduction into the National Platform	COES & CD	CEP, Agency on Hydro-meteorology	2023г.	Public Budget	Control, monitoring and combating measures for SDSs