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Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia for 2021-2030

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IMPORTANT:

The data used to develop the national context of SDS processes in the CA countries were provided in 'The National Action Plans to Mitigate and Prevent SDS' developed by appointed national institutions and national working groups in each CA country as part of the implementation of the national part of the second component of the UNCCD pilot project in CA 'Regional Approaches for Combating Sand and Dust Storms and Drought'.

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COVER PHOTOS:

- ***The Long Quest for the Pollen*** (taken from Upshare);
- ***Dust Storm in the New City of Bukhara*** (taken from C-1);
- ***A ship in the sands of the departed Aral Sea*** (taken from Living Asia);
- ***Turtle and the Sand*** (*Taken from UNDP Kazakhstan);*
- ***Thorns and Rusted Ships*** (*Photo by Mikhail Davlatov (CAMP4ASB));*
- ***Aral Sea Dust Storm*** (*Photo by Jeff Schmaltz);*
- ***Partially buried oil pipeline*** (*Photo by Ussen Kapar*);
- ***Home farms on the sandy ground*** (*Photo by Zhanat Aitkhozhin (CAMP4ASB)*);
- ***Lands of the Kurta district of Kazakhstan*** (*Photo by Ussen Kapar*);
- ***Rusted Ships*** (*Photo by Tichonina (CAMP4ASB)*);
- ***Dust Storm in the Block of Flats in Kyzylorda*** (*Taken from Platon.asia*);
- ***SDS in one of the villages of Central Asia*** (*Photo by Konstantin Kikvidze (CAMP4ASB)*);
- ***Samarkand is covered by Sand Storm*** (*Taken from Repost.uz*).

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ABBREVIATIONS

ACL	Admissible concentration limit
APDIM	Asian and Pacific Centre for the Development of Disaster Information Management
ASBP	Action Program to Assist the Aral Sea Basin Countries
BTD	Brightness Temperature Difference
CA	Central Asia
CAREC	Regional Environmental Centre for Central Asia
CBD	Convention on Biological Diversity
CESDRR	Center for Emergency Situations and Disaster Risk Reduction
CIS	Commonwealth of Independent States
COVID-19	Coronavirus disease 2019
DLDD	Desertification, land degradation and drought
ED IFAS	Executive Directorate of the International Fund for Saving the Aral Sea in the Republic of Kazakhstan
FAO	Food and Agriculture Organization
GA	General Assembly
GDP	Gross domestic product
GIS	Geographic Information Systems
GIZ	German Development Cooperation Agency
ICSD	Interstate Commission on Sustainable Development
ICWC	Interstate Commission for Water Coordination
IFAS	International Fund for Saving the Aral Sea
IPCC	Intergovernmental Panel on Climate Change
LDN	Land Degradation Neutrality
MES	Ministry of Emergency Situations
NAP	National Action Program
NCEP	National Centers for Environmental Prediction
NDDI	Normalized Difference Dust Index
PANCT	Public Association for Nature Conservation of Turkmenistan
REP4SD-CA	Regional Environmental Programme for Sustainable Development in Central Asia
SDG	Sustainable Development Goals
SDS	Sand and dust storms
SDS-WAS	Sand and Dust Storm Warning and Assessment System
SRAP-CD	Subregional Action Program to Combat Desertification
SSEPR	State System for Emergency Prevention and Response
UN	United Nations
UNCCD	UN Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WMO	World Meteorological Organization
WOCAT	World Overview of Conservation Approaches and Technologies

SUMMARY

Recognizing the increased risk of droughts and sand and dust storms (SDS), the UNCCD country Parties adopted decisions to combat the negative impacts of droughts and SDS.[i] The UNCCD Secretariat in collaboration with key partners has provided the affected countries with methodological and technical assistance in implementing these decisions to strengthen preparedness and resilience to drought and SDS. The UNCCD Secretariat has initiated a pilot project on '***Regional Approaches for Combating Sand and Dust Storms and Drought'*** in 2020, which was implemented by the Regional Environmental Centre for Central Asia (CAREC) between 2020 and 2021.

More than 80% of about 400 mln ha of the territory of Central Asia is covered by deserts and steppes, which coupled with climate change and lasting droughts, represent a natural source of SDS. Unsustainable practices of irrigation farming and livestock grazing, mining and other construction activities create conditions for the formation of anthropogenic SDS sources. Desiccation of the Aral Sea led to the development of 5.5. mln ha of salty desert which is a source of 100 mln tones of dust and poisonous salt.

The SDS impact is multifaceted, intersectoral and often transnational. It is suggested that salts from the Aral Sea region are being detected along the coast of the Antarctic, on glaciers of Greenland, in Norwegian woods and other regions around the globe. (O'Hara *et al.*, 2000). Despite the increasing frequency of SDS in the region and its growing economic impact, the CA countries do not have fully operational national SDS forecast, early warning and monitoring systems. This hinders data exchange between SDS source and destination countries and undermines coordinated preparedness and mitigation efforts.

Although to a different extent, the Central Asian countries are prone and vulnerable to a risk of SDS with nearly 6.5 million people or 9% of the total CA population living in the areas with the highest risk of SDS. Total area prone to medium and high risk of SDS occurrence in Central Asia totals to 85 mln ha. The SDS, as well as salt and toxic substances, cause respiratory diseases and eye disorders and are especially harmful to pregnant women, young children and people over 65. Dust transfer also affects glaciers causing to increase in ice melt in Central Asia especially Tian-Shan and Pamir mountains experience very high levels of exposure of glaciers to dust deposition (APDIM, 2021).

The CA countries have ratified the key international environmental conventions and framework agreements, which are the universal instruments to address environmental and socio-economic risks and threads. National action plans have been developed and implemented to fulfil the commitments under international agreement agreements, however with minimal regional cooperation.

A long-term vision of the Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia for 2021-2030 (hereafter the Regional Strategy) is to reduce the vulnerability of the countries and communities to the effects of SDS by mitigating the active sources and planning for proactive measures at the destination areas.

The Regional Strategy addresses challenges faced by the countries of the region (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan), which are associated with climate change and human activities aggravating the SDS negative impact. Experts in all the CA countries also note with concern an impact that the Aral Sea disaster and the formation of the Aralkum desert on the increased frequency of SDS and droughts in the region.

[i] Decisions 29/KC.13 and 23/KC.14

The objective and priorities of the Regional Strategy have been drawn from the analytical research organized in each of the countries as well as the national and regional consultations with the participation of key stakeholders.

A mid-term goal of the Regional Strategy is to build a systematic and institutional capacity for effective and sustainable management of sand and dust storms sources and natural resources in the CA countries.

The key priorities are:

- **Area 1: Strengthening knowledge about SDS** will help reduce the risks associated with them. Awareness of potential harms, risks, and related mitigation measures will be increased and better communicated. In addition, it will inform integrated and synergistic interventions and stimulate knowledge and technology transfer.
- **Area 2: Mitigation of the impact of anthropogenic sources of SDS** is aimed at elimination of environmental and socio-economic causes of DLDD as well as at understanding the impact of sand and dust storms on various sectors of the economy both at the source and at the destination.
- **Area 3: Regional cooperation and joint action.** This would provide the necessary basis for solving environmental problems in Central Asia through coordinated and joint actions, especially in the Aral Sea basin.

The Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia will be integrated into Regional Environmental Programme for Sustainable Development in Central Asia (REP4SD-CA) 2021-2030 which was developed by the Interstate Commission on Sustainable Development (ICSD).

ICSD, as a custodian of the Regional Strategy, will be responsible for implementation, monitoring and reporting, within the framework of its mandates and REP4SD-CA.

INTRODUCTION

Sand and dust storms are atmospheric phenomena where large amounts of dust (soil particles, grains of sand) are carried by the wind from the earth's surface to a height of several meters with significant deterioration of lateral visibility (WMO, 2021). At the same time, dust (sand) can rise into the air, move over thousands of kilometres, and settle on a large territory. Although this phenomenon is meteorological, it is, however, associated with the state of the soil structure, moisture, cover and terrain. About 40% of solid or liquid particles that are suspended in the troposphere are dust particles resulting from wind erosion. Results of the simulation modelling give grounds to assume that emissions of dust into the atmosphere caused by a combined impact of land use and climate change have increased by 25-50 per cent since 1900 globally (UNEP, 2017).

The UN General Assembly (UN GA) resolutions 'Combatting Sand and Dust Storms' adopted in 2015 (A/RES/70/195) and 2016 (A/RES/71/219) recognize that SDS pose serious challenges to the sustainable development of affected developing countries and the wellbeing of their people.

In preparation for the UN Conference on Sustainable Development (Rio+20), the UNCCD Secretariate issued a report for a UN General Assembly high-level meeting, which takes a broad perspective on issues of land degradation, desertification and linkages between the Sustainable Development Goals (SDG) and socio-economic development of the countries.

As a result of unsustainable agricultural practices, which is the most significant factor in the increase in dust storms, large areas of arid and semi-arid regions of America, Africa, Australia, the Middle East and Central Asia continue to degrade. As a consequence, this has led to land degradation, or desertification, over a large area, reducing the ability of ecosystems to withstand even short periods of drought, which reduces trowel cover. Under favourable conditions, these dry and bare lands become an active anthropogenic source of sand and dust storms, and given the increase in mean annual temperature and occasional peaks of extreme temperatures, manifestations of SDS in CA are becoming more frequent and significant. It is worth noting that in the Aral Sea basin this has led to the formation of a new active hotspot of sand and dust storms, and previously stable ecosystems have been destroyed (Sivakumar, 2005).

As was noted earlier, a new salt desert occupying 5.5 million ha emerged on the dried section of the Aral Sea. Dust storms rage over it for over 90 days a year scattering over 100 million tons of dust and poisonous salts many thousand kilometres into the atmosphere every year (Babayev, 2008). Tails of dust raised from the bottom of the Aral Sea get up to 400 km in length and 40 km in width. Poisonous salts from the Ara region are detected along the coast of the Antarctic, on glaciers of Greenland, in Norwegian woods and many other parts of the globe. Addressing the devastating impact of the Aral Sea crisis on the environment and the livelihoods of millions of people living in the Aral Sea region is the most important task of the present (O'Hara *et al*., 2000).

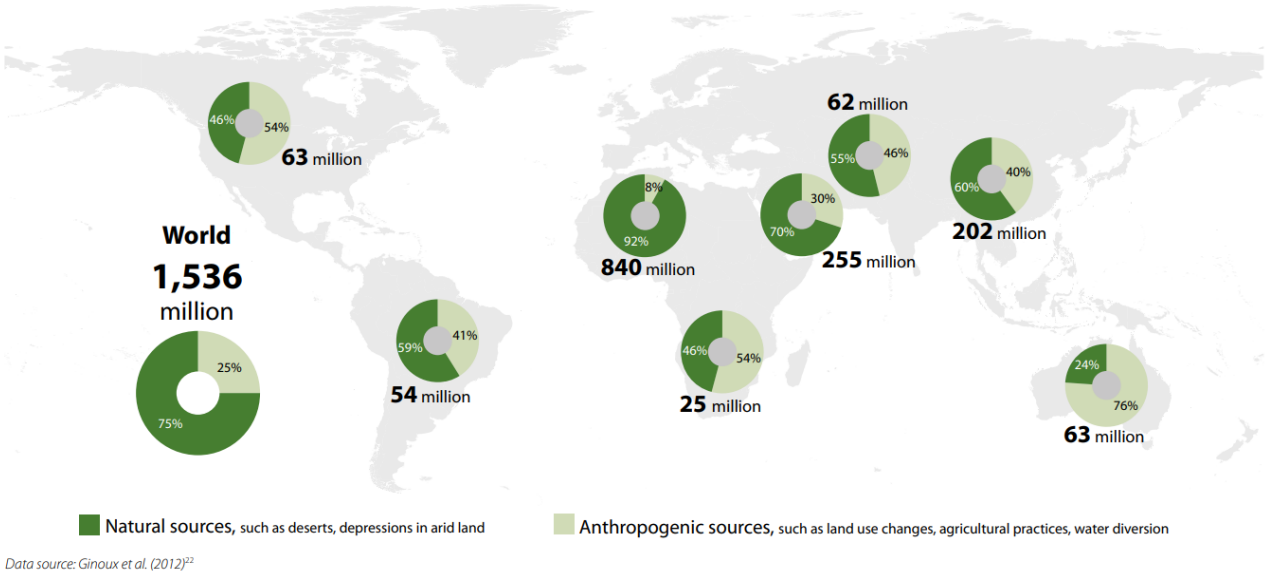
CA water sector reforms should not be limited to new strategies and initiatives, revision of the legal framework and creation of new institutes. The main objective is to achieve a regular, strong high-level interaction between all the countries of the basin, with inclusive stakeholder engagement, as well as technical and financial support. Many water-related issues in the Aral Sea basin should be addressed jointly by all the countries of the basin as part of this Regional Strategy, and address water-energy and food security. The main interests of geopolitical and economic development unite the CA countries toward closer regional cooperation to effectively overcome pressing challenges of environmental protection, which meets their common interests (Xenarios *et. al.*, 2019).

REGIONAL CONTEXT

1.1. Natural and Anthropogenic Factors of SDS Occurrence and Sources

When discussing sand and dust storms mitigation measures, one needs to consider their spatial and temporal distribution, frequency of occurrence, severity and other contributing factors. For example, according to *Ginoux, P. et al.* who compared results of the satellite imagery analysis for 2003-2009 with similar research conducted in previous periods, a conclusion was drawn that Australia, Central Asia and the US plains are prone to frequent high-intensity sand and dust storms, both of natural and anthropogenic origin. At the same time, the situation in Northern Africa, Middle East and South America has changed insignificantly (Ginoux *et. al.*, 2012).

Figure1: Sources of dust emissions into the atmosphere (tons/year)[ii]



Data source: Ginoux et al. (2012)[22]

The main reason for dust storm occurrence is turbulence over a loose and unstable surface, conditioned by the wind structure, which contributes to the rise of dust and sand particles from the soil surface. Dust storms in most regions start when the wind speed reaches 10-12 m/s. According to the observations of the Institute of Deserts, Flora and Fauna of Turkmenistan, dust storms in the Central Asian region are usually observed in the summer, when the wind is particularly active and its direction contributes to active dust and sand transport from active SDS sources. However, in southern regions, they can develop in the winter as well, because the snow cover here is very unstable and the soil surface dries quickly in the absence of precipitation (Rodin *et. al.*, 2014).

Natural factors of SDS occurrence in Central Asia include high temperatures, long-lasting droughts, a small amount of precipitation, the presence of vast territories of sand and clay deserts with thinned out and degraded vegetation cover, frequent and strong winds throughout the whole year. More than 80% of the region's territory is occupied by deserts and steppes, namely the Karakum, Kyzylkum, Muyunkum and other deserts, where sands were deposited by ancient rivers, and from where sand and dust materials are blown, while mountainous territories are zones of their accumulation. Desert plains, in turn, are characterized by deflation processes, which result in the generation of large masses of blown sands and strong salt and dust flow. The Karakum and Kyzylkum deserts, where dust storms occur from 40 to 110 days a year, are the largest source of dust storms (Fedorovich, 1954).

[ii] Source: https://wedocs.unep.org/bitstream/handle/20.500.11822/22267/Frontiers_2017_CH4_RU.pdf?sequence=5&isAllowed=y

Anthropogenic factors affecting or contributing to the occurrence of sand and dust storms, which account for about 25 per cent of global dust emissions, can include unsustainable methods of land use, and excessive water uptake, secondary use of water and soil salinization, deforestation and unsustainable farming practices that contribute to the soil erosion (UNEP, 2017).

Changing climate and more frequent and intensive drought exacerbate the risk of sand and dust storms. The Intergovernmental Panel on Climate Change (IPCC) forecasts that **the hydrological behaviour of rivers in Central Asia will change, while the shallowest rivers will dry out completely. River flow anomalies will progress year on year and will be characterized by periods of drought and flooding in the following several decades** (World Bank, 2016). This will lead to even stronger interlinkages between factors of sand and dust storm occurrence and droughts.

According to the 2018 report "Sand and Dust Storms in Asia and the Pacific: Opportunities for Regional Cooperation and Action" prepared by UNESCAP, there are two main factors of sand and dust storm occurrence associated with climate change (Srivastava, 2018):

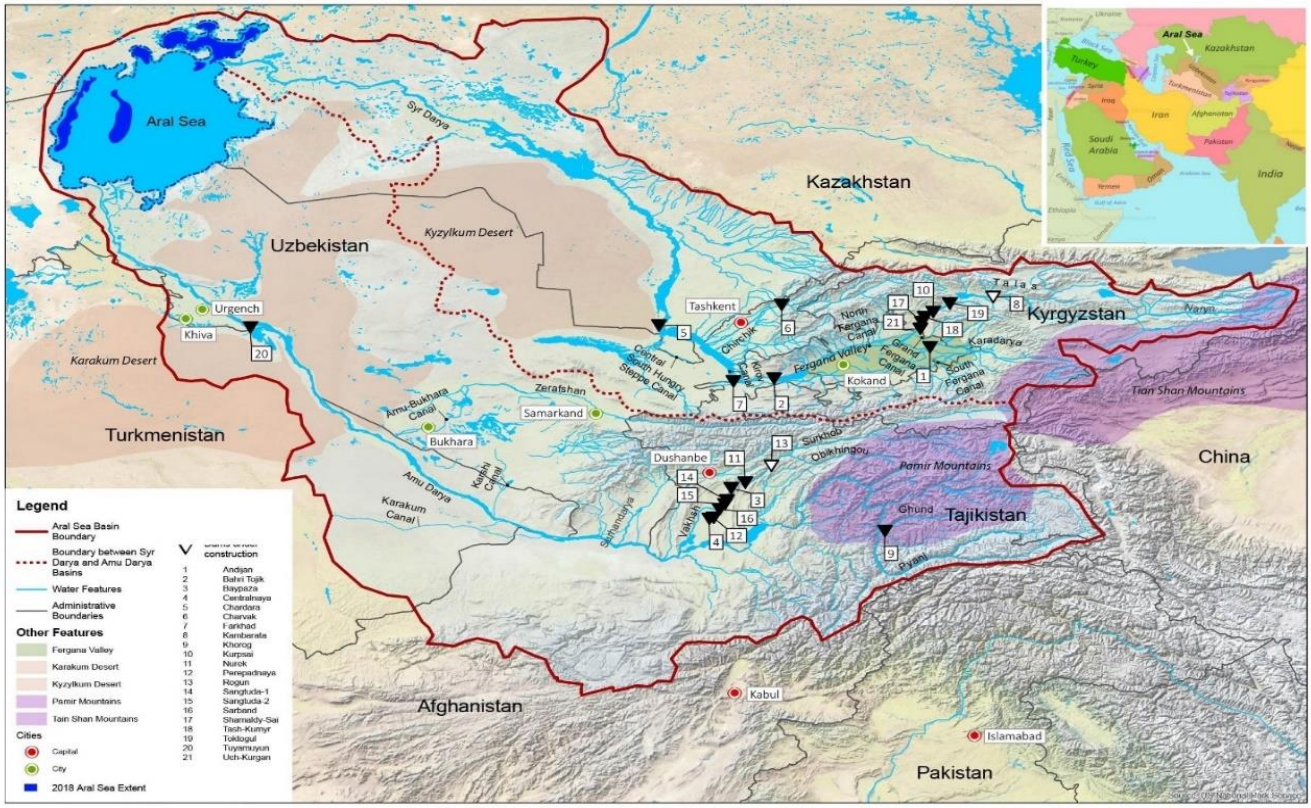
- **Wind behaviour change:** 1) a share of surface winds that increase an erosion threshold determined by terrain characteristics; 2) a more frequent manifestation of extreme weather events; and 3) a change in wind direction.
- **Expansion of zones of sand and dust sources:** 1) an increased frequency of droughts and hot winds in arid basins; 2) limited vegetation; 3) unsustainable land use and land degradation; and 4) erosion of the upper soil structure.

The impact of sand and dust storms on the climate is emphasized by the WMO, noting that aerosols, particularly mineral dust, affect the weather and both the global and local climate (WMO, 2021). Dust particles, especially if they are covered with pollutants, act both as condensation nucleus to form warm clouds and as effective agents of icy nucleus for cold cloud formation. Dust particles influence the growth of cloud droplets and ice crystals, thus affecting the quantity and location of precipitation. This suggests that sand and dust storms occurring in Central Asian countries are extremely dangerous processes caused by natural and anthropogenic factors, which also trigger a chain reaction of processes affecting the climate as well.

Agricultural practices and the development of vast steppe areas have gradually led to the depletion of natural resources and a decrease in the regenerative capacity of ecosystems. The traditional tillage practice leads to a massive deflation of soil in the steppes, where the sand previously accumulated. Overgrazing around small settlements has led to the emergence of sporadic anthropogenic sources of dust storms.

Intensive irrigation development in the Ara Sea Basin in the early 1960s and irrational use of water resources led to the emergence of significant areas of secondary saline soils and secondary solonchak, which are a source of salt transport. The Aral Sea crisis area includes territories of Turkmenistan, Kazakhstan and Uzbekistan and indirectly affects Tajikistan and Kyrgyzstan. The Aral Sea tragedy is one of the largest in the modern history of global ecological disasters, which formed an anthropogenic SDS source on CA by emitting over 100 million tons of dust and poisonous salts every year. Today, it affects 73 million Central Asian residents posing a threat to the sustainable development of the region, the health, the gene pool and the future of the people living there. Dramatic climate change that can be felt not only in Central Asia but in other regions as well, has become a direct consequence of the drying up of the Aral Sea (Cawater-info.net, 2012).

Figure 2: Competition over Resources in the Aral Sea Basin (Source: UNU-INWEH)



As noted in the assessment prepared by O'Hara and his team, the results show that the rate of dust deposition in Karakalpakstan is quite high, especially in the northern part of the Aral Sea estuary. The Amudarya delta is a significant local source of dust and the drying up of the delta has resulted in active dust transfer in recent years. The dust deposition rate in the Karakalpakstan section of the Aral Sea Basin is one of the highest in the world and although systematic pesticide application is no longer carried out due to economic constraints, there is significant airborne dust contamination with the organophosphorus substance phosalon (O'Hara et al., 2001).

Intensive industrial development of Central Asia's arid plains, including the construction of transportation and water management infrastructure, as well as oil and gas extraction, are among the key drivers behind the formation of anthropogenic SDS sources intensifying desertification and drought processes**.**

About 600 ha drift sands are formed around just one natural gas deposit, which must be fixed since sand deposits and leakage processes reduce the effectiveness of the work of these facilities significantly.

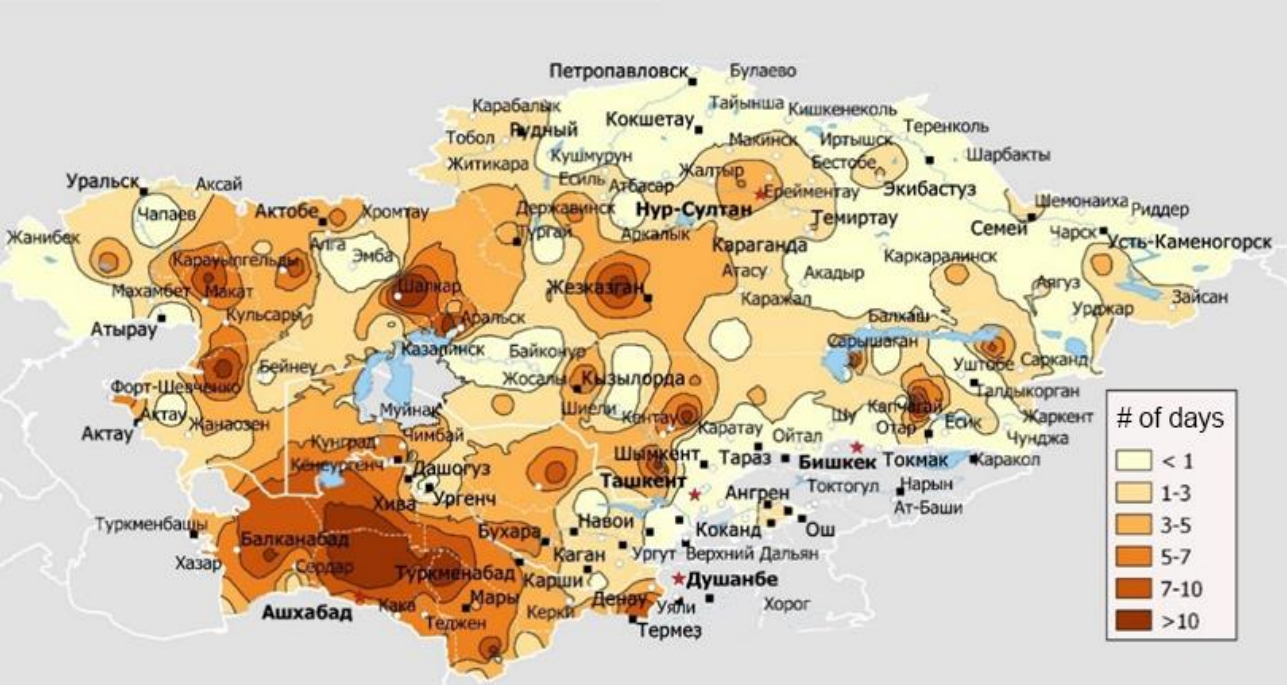
According to the average monthly data of the National Centers for Environmental Prediction (NCEP) Reanalysis for 1981 – 2010[iii] and based on the hypsometric terrain of the region, the following seasonal wind indicators were determined that contribute to SDS formation and accumulation in CA (Table 1).

[iii] NOAA/OAR/ESRL PSL, Boulder, Colorado, USA. https://psl.noaa.gov/

Table1: Wind Speed and Direction by Country in the Winter and Summer Periods

Country	Winter	Summer
Kazakhstan	South: SE & S - 3-58-3,8 м/с; South-East: E - 3,58-5,06 м/с; Center: E - 5,06-6,54 м/с; North: NE - 5,06-6,4 м/с.	W - 3,64-5,05 м/с; *Exception:* South-east: N & W - 2,24-4,35 м/с; North: SW - 2,94-4,35 м/с.
Kyrgyzstan	E & SE - 3,58-5,8 м/с	W & SW - 2,24-3,64 м/с
Tajikistan	NE - 5,06-5,8 м/с	W - 2,24-3,64 м/с
Turkmenistan	E & SE - 2,84-5,06 м/с.	North and East.: SW & W - 3,64-5,05 м/с; Center: S - 4,35-5,05 м/с;
Uzbekistan	SE & S - 3,58-5,8 м/с	W - 3,64-5,05 м/с
Note: Wind direction South: (S), Southeast: (SE), Southwest: (SW), East: (E), West: (W), North: (N), Northeast: (NE), Northwest: (NW).		

Figure 3: Spatial distribution of soil textures prone to dust storms on the territory of Central Asia



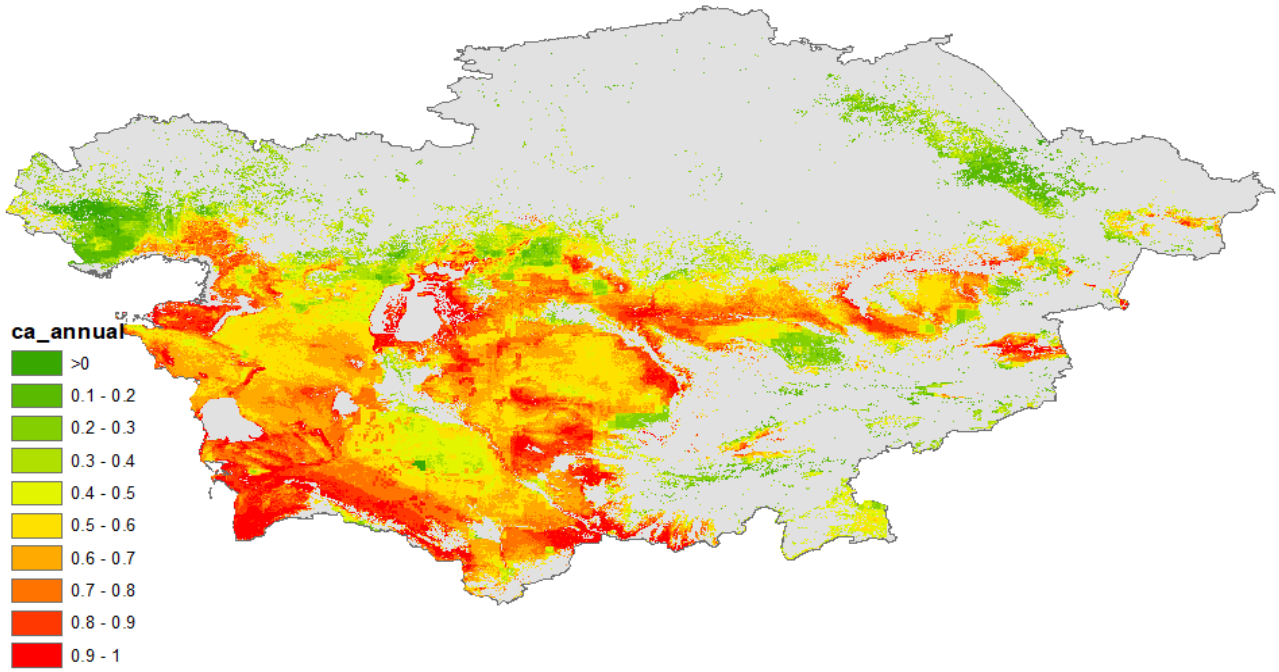
The data from the tables of daily meteorological observations from 144 meteorological stations in Kazakhstan and 29 meteorological stations in Uzbekistan and Turkmenistan were sampled to study the spatial and temporal distribution of dust storms on the territory of CA. Based on these data and according to the characteristics defined by O.E. Semenov, the number of days of dangerous and especially dangerous dust storms on the CA territory was determined (Semnov & Tulina, 1978). Across a large area of the Ili River valley, the Karakum sands and central Kyzylkum, dangerous and extremely dangerous dust storms are often observed.

In Central Asia, the number of days with dust storms is increasing from the northwest to the southeast. In the southern part of the region, the number of days with dust storms is high in sandy deserts and river valleys. The overall number of dust storm days a year is 20-38 in a steppe zone and 55-60 in a desert zone (near the Aral Sea and the Balkhash Lake regions) (WB, 2005). Territories with more

frequent dust storms (20 days a year) are located in areas with a high wind speed, in areas, where soils have light texture or which are used extensively, or in sandy areas with rare vegetation.

One of the main objectives of reducing the vulnerability to SDS is to provide access to timely and reliable information to all stakeholders to take measures to prevent and eliminate SDS consequences. To tackle this problem, the UNCCD Secretariate developed the Sand and Dust Storms Source Base-map, which was based on the use of publicly available global data about the surface of the earth to identify potential SDS sources on a global scale (UNCCD, n.d. (a)). Data over five years, 2014 – 2018, were used for the global map development (Fig. 4).

Figure 4: Annual Index of Potential Territories of SDS in CA. Global Overview Map of Sand and Dust Storm Sources, UNCCB, 2019

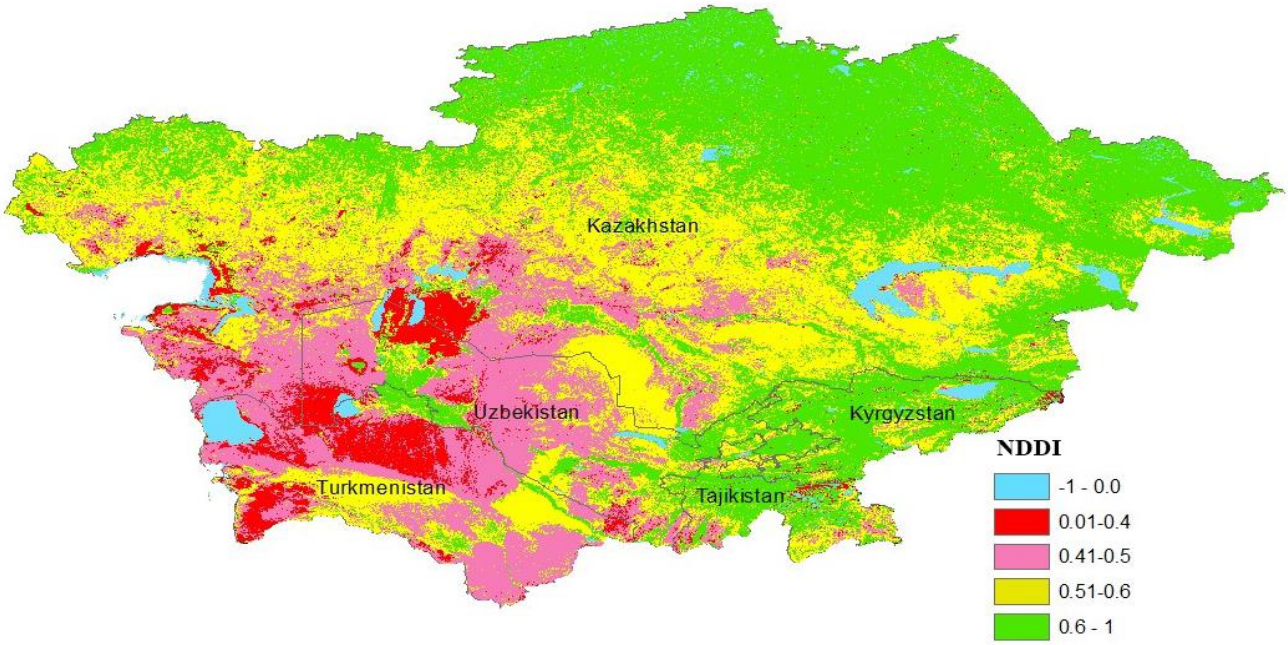


Along with the approach described above, the NDDI[iv] and BTD[v] indices are currently widely used in the Asian region (Northern China, Mongolia and Kazakhstan) and the Arab countries to decipher dust storms. The use of these indices allows obtaining information that characterized an area of the spread of a storm and their frequency (Albugami *et. al.*, 2018). To determine SDS sources and sand and dust accumulation areas in Central Asia, Kazhydromet's ground measurements for Kazakhstan were used and later extrapolated to the whole territory of CA. Data has been calibrated only for the territory of Kazakhstan, thus there may be a certain error level for other countries in the region given large climatic and geographical differences.

For the analysis of SDS occurrence in the region, the data obtained from NOAA AVHRR and MODIS have been utilized to determine: 1) an SDS direction; 2) a dust tail length; 3) a storm distribution area, and 4) a number and area of SDS sources.

[iv] NDDI - Normalized Difference Dust Index
[v] BTD - Brightness Temperature Difference

Figure 5: Possibilities of SDS Occurrence in CA (July 2018) based on AVHRR and MODIS



The analysis of the obtained data presented both on the global overview map of sand and dust storm sources (Fig. 4) and the results of the NDDI dust index for CA (Fig. 5) confirm that the territories highly prone to sand and dust storm formation are located on the Southeast of the region, which also coincides with the 'dust belt' determined by the WMO based on many years of empirical data (WMO, 2020).

1.2. SDS Monitoring, Early Warning and Preparedness

Detection of sand and dust storms at source along with their formation monitoring and forecasting contribute to a reduction of a negative socio-economic impact through active actions aimed at elimination of DLDD anthropogenic factors both in source areas and destination areas.

The SDS early warning system is at the early development stage in the region. Only regulatory acts have been adopted at this point that regulates their organization and operation in some countries, and a foundation has been formed for regional collaboration via global initiatives and conventions. Current and emerging SDS research and monitoring systems are available as follows:

- Kazakhstan and Uzbekistan work on the creation of a monitoring system to analyse air quality and identify sand and dust storms based on GIS technology;
- Work is conducted in Kyrgyzstan (Bishkek) to monitor air concentrations of particulate matter (PM);
- The National Institute of Deserts, Flora and Fauna in Turkmenistan and the Institute of Geography and Water Security in Kazakhstan are engaged in research activities to study sand and dust storms.

To date, the available scientific database of SDS processes is based largely on the research conducted during the Soviet times.

The CA region experiences certain challenges in accessing raw data required for monitoring and calibration of an SDS detection system. Information on soil moisture and river flows is particularly difficult to obtain. The process of SDS registration itself is non-systematic and sporadic, even in metropolitan areas, which makes it impossible to calculate an economic loss from a given natural phenomenon.

The countries in the region are active parties to global agreements on the exchange of meteorological data and environment and climate monitoring initiatives. These agreements can become a foundation for further regional actions and the creation of a regional database of hydrometeorological and climate data. For example:

- The WMO project on sand and dust storms was initiated in 2004, while the associated Sand and Dust Storm Warning and Assessment System (SDS-WAS) was launched by the Fifteenth World Meteorological Congress in 2007. The SDS-WAS expands the capabilities of the countries to provide to stakeholders timely and high-quality forecasts of sand and dust storms per results of observations, information and knowledge based on the international partnership of communities engaged in scientific research and operational activities. It is administered by the SDS-WAS Global Steering Committee and three regional hubs. Currently, Kazakhstan is the only country in the region that is a participant of the WMO's Regional SDS-WAS Center for Asia;[vi]
- According to the joint action plan on implementation of the Hydrometeorological Safety Committee of the CIS member-states, all countries of the region support collaboration in the field of information exchange on relatively dangerous and disastrous hydrometeorological events. This plan states that dust storms along with the list of other natural phenomena are dangerous hydrometeorological and heliogeophysical events (CIS Council of Heads of States, 2004).
- Moreover, as members of the World Meteorological Organization (WMO), national hydrometeorological services of the countries in the region provide the international meteorological community with access to national networks of meteorological condition observation of the territories of the countries.

1.3. Vulnerability of the Region to SDS Manifestations

SDS vulnerability and risk assessment allow decision-makers and local communities to plan measures that reduce and prevent a negative impact of SDS. This type of analytical assessment should become part of a decision-making process and be integrated into budget planning and climate change adaptation initiatives, implemented in each country.

Social Risks

An estimated 1500 million tons of dust are released into the atmosphere annually worldwide. The majority of sand and dust are formed as a result of natural processes, however human activities related to unsustainable natural resources use contribute significantly to SDS formation processes.

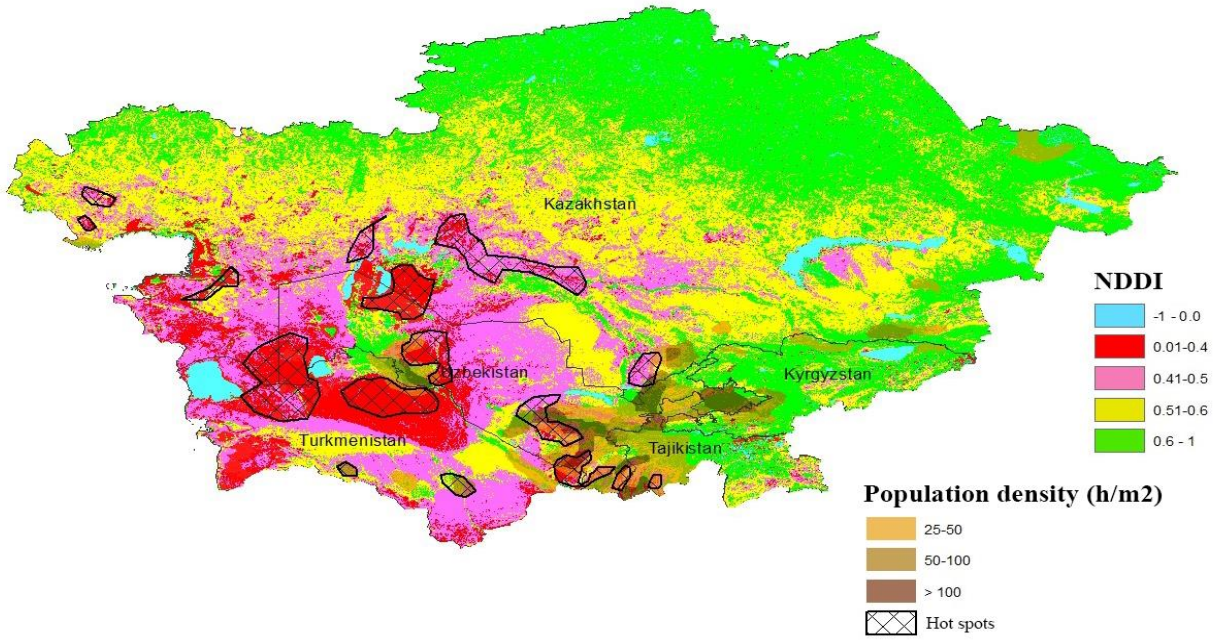
Sand and dust storms negatively affect road and rail transport, industrial plants, power and communication lines, pipelines, irrigated land, settlements, and other infrastructure.

As part of the Situational Analysis developed within the scope of the Project[vii], an SDS occurrence probability map was created to identify territories in CA that are socially vulnerable to SDS. Mapping of population exposure to SDS in the region provides governments, local communities, practitioners and donor agencies with spatial information on where potential development interventions should consider SDS mitigation measures. In case of frequent and extended SDS occurrence, the population is subjected to high risks of morbidity and mortality, while part of the population may choose to migrate, which might negatively impact the socio-economic stability of these territories.

[vi] For more information, please refer to: https://public.wmo.int/en/our-mandate/focus-areas/environment/SDS/warnings

[vii] For more information, please refer to: https://carececo.org/main/activity/projects/droughtSDS/

Figure 6: SDS High Vulnerability Hotspots



Analysis of the map of satellite monitoring of the potential occurrence of dust storms in CA allowed us to determine areas prone to SDS by country (Table 2).

Table 2: Areas Prone to SDS by country

No.	Countries	SDS – high grade, %.	SDS – high grade, ha.	SDS – medium grade, %.	SDS – medium grade, ha.
1	Kazakhstan	3,1	8381605	15,0	40076474
2	Kyrgyzstan	0,3	51561	3,4	649042
3	Tajikistan	4,1	560409	11,6	1588088
4	Turkmenistan	30,9	3218485	42,9	4465587
5	Uzbekistan	15,7	6615802	44,2	18633897
	Total for CA		**18827862**		**65413088**

Table 3: CA Population Prone to SDS

No.	State	Share of employment in agriculture, %*	Rural population, %*	Gini coeff. *	Hotspot area, %	Hotspot area, ml ha.	Av. population density, ppl/km^2 residing in hotspots	The average number of people residing in hotspots
1	Kazakhstan	14,8	42,5	27,5	2,8	7,3	40	2 935 586
2	Kyrgyzstan	26,3	63,6	27,7	0,7	0,1	39	51 733
3	Tajikistan	44,9	72,8	34	1,8	0,2	47	113 855
4	Turkmenistan	22,6	48,4	40,7	14,7	1,5	20	308 314
5	Uzbekistan	33,2	49,5	35,1	14,8	6,2	50	3 149 665
	Total					**15,30**		**6 559 153**

The hotspot analysis (Table 3) demonstrates that each country is prone and vulnerable to a risk of SDS. Hotspots include sand masses of the Mangyshlak peninsular (Bostamkum, Tuyusuv, Karanzharyk,

Aralkum, Moyunkum) on the territory of Kazakhstan; most of the Kyzylkum and the Aral region in Uzbekistan, and Zaunguz Karakum, Western and Northwestern Karakum in Turkmenistan.

Kazakhstan, Uzbekistan and Turkmenistan are at the highest risk of SDS occurrence, while Tajikistan and Kyrgyzstan are less at risk. Based on the mapping of SDS high vulnerability hotspots, around 6.5 million people in the region reside in the areas with the highest risk of SDS, which is approximately 9% of the total CA population. This is a conservative estimate, as SDS can cover significant areas and cross the national borders. Therefore, the number of people that are indirectly affected by SDS processes is much higher.

SDS have a significant impact on agriculture and rural population dependent on land resources through subsistence farming or engagement in agricultural production. As the climate change process aggravates, the intensity and frequency of SDS will increase, which will affect agriculture and have an impact not only on the economy but also on human development.

Impact of Sand and Dust Storms on Health

The environmental disaster of the Aral region has led to the displacement of more than 100 000 people and affected the health of over 5 million people throughout the whole region of Central Asia. There was a sharp increase in the incidence of anaemia, brucellosis, bronchial asthma and typhoid, which exceeded a country average by about 8 folds, as well as the incidence of tuberculosis. Today, infant mortality is the highest in the country, while acute respiratory infections account for almost half of all pediatric deaths in the region. Such diseases as ischemic heart disease, respiratory, renal and nervous system diseases will continue to increase. A temperature increase will cause additional concerns because the hotter the weather, the more infectious diseases will emerge due to deterioration of the quarter quality and its stress in the desert or due to a high level of salt in some regions. An average life expectancy in Kazakhstan's Kyzyl-Orda oblast has decreased from 64 to 51 years (Conant, 2006).

Women and children are the most vulnerable part of the population subjected to the impact of hazardous environmental substances. Maternal and infant morbidity and mortality in Karakalpakstan and the Kyzyl-Orda oblast, the two regions near the sources of dust and toxic salt transfer from the dried bottom of the Aral Sea, are significantly higher than in other regions of Uzbekistan and Kazakhstan. Currently, anaemia is the largest problem for the healthcare systems of the countries in the Aral region. If in the 1980s only 17-20% of pregnant women had anaemia, currently, around 70% of all pregnant women in Karakalpakstan have a severe form of anaemia by the third trimester, blood plasma of pregnant women contains significantly high levels of organochlorine pesticides such as HCB, -HCH, pp-DDE and pp-DDT, which are also much higher than those in European countries. This is associated both with the leakage of salts into water supply systems and wells and with the presence of salts in the air that the population breathes (Conant, 2006, APDIM, 2021).

Socially Vulnerable Populations and Gender Policy

Effective implementation of SDGs in the interests of women and girls is required for the creation and strengthening of an enabling environment for achieving gender equality. Although the region overall is characterized by an officially high level of equality between men and women and all CA countries ratified the Convention on Elimination of *All Forms of Discrimination Against Women*, the persistence of discriminatory laws, social norms, practices and inequalities faced by the most marginalized groups of women and girls are the causes of gender inequality.

Women, particularly in rural regions, are particularly vulnerable to all socio-economic variabilities. As can be seen from the analysis by UNDP experts, the COVID-19 impact on household revenues is expressed in three aspects: (i) a loss of income from salaries and revenues from informal activities; (ii) a loss of money transfer; and (iii) inflation of prices, particularly an increase of food prices (Bouma & Marnie, 2020).

In Central Asia, the loss of income has a significant impact on households and causes a series of concomitant negative consequences, including an increase of household debt, inability to pay medical bills from own funds, and reduced access to health and education services. Such aggravating factors as children's malnutrition due to a loss of access to school meals for children and an increased risk of home violence play an important role. Surveys show that a disproportionate impact on households will lead to an inequality growth and poverty increase.

Figure 7: Human Development Index[viii]

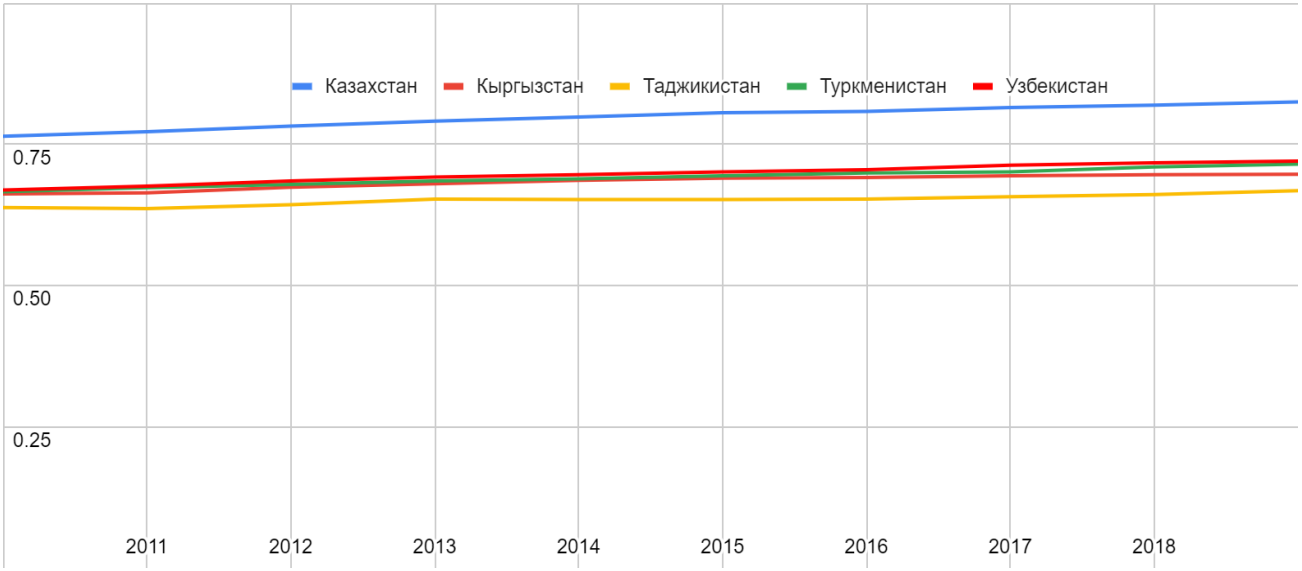
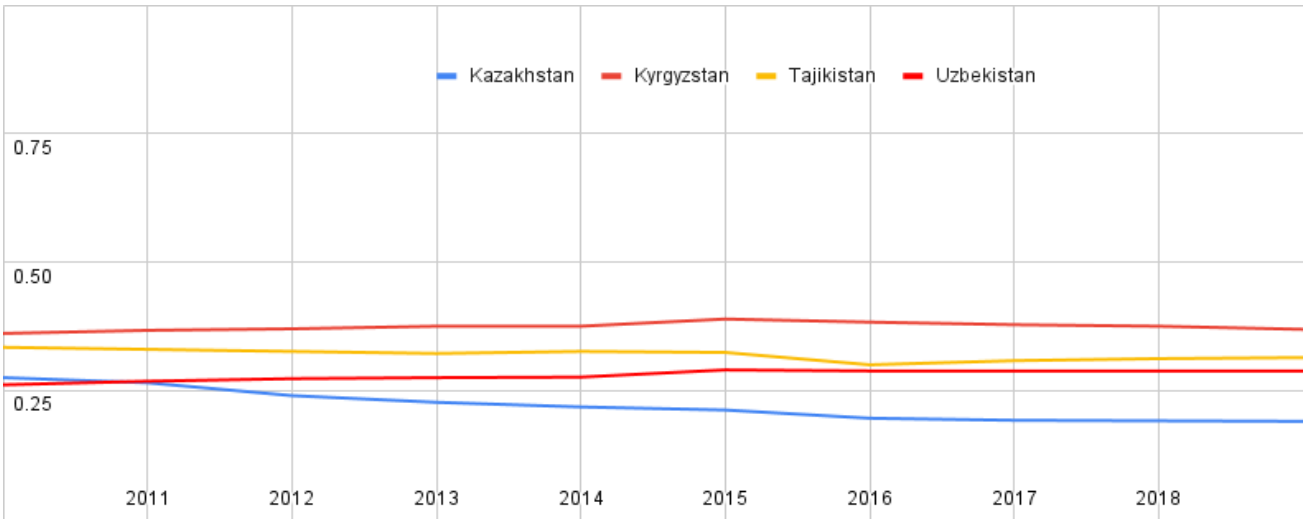


Figure 8: Gender Inequality Index[ix]



All of the stated above is also supported by the data published on the website of the UN Multi-Partner Trust Fund for Human Security for the Aral Sea Region in Uzbekistan: Water pollution and a large volume of dust and salt blown off from the bottom of the dried Aral Sea play a defining role in an increase of morbidity among people overall and pediatric mortality specifically. These resulted in high incidence rates of some somatic diseases – anaemia, renal and digestive tract diseases, an increased level of respiratory, blood, gallstone, cardiovascular and oncological diseases. In the Republic of

[viii] Human Development Report, UNDP 2020

[ix] Human Development Report, UNDP 2020

Karakalpakstan, average pediatric mortality in the last decade exceeded similar rates for the Republic of Uzbekistan by 13%, with maternal mortality in Karakalpakstan being 17% higher. TB related mortality in the Republic of Karakalpakstan remains the highest in the country (18.4 per 100 000 people) and is almost 3 times higher than the average mortality rate in Uzbekistan. Acute gastrointestinal infection incidence in Karakalpakstan reached 188 per 100 000 people in the last decade, which is 1.4 times higher than the average for the Republic of Uzbekistan. Of respiratory tract diseases, the chronic bronchitis incidence rate is 2.5-3 times higher than the average rate for the country. Children are subject to particularly strong and quick negative impact, which presents a particular threat to the genetic pool of the population of the Aral region and, thus, the consequences will be irreversible (Aral Sea Trust Fund, n.d.).

CA countries take measures to offset negative consequences of SDS processes and the Aral crisis – respective legislations have been amended; wide-scale afforestation of territories is conducted, and protective forest belts are created. Based on the conducted research, drought-resistant plants are introduced, novel agricultural technologies are developed, which, when used appropriately, will allow land users of CA to minimize risks of agricultural crop losses. Freshwater supply conditions are improving, particularly in the Aral region, and medical preventive activities are conducted to prevent SDS-related diseases. Yet more active and comprehensive regional measures are needed to ensure that SDS frequency and severity is reduced and their negative impacts are mitigated in the CA region.

Economic Risks

Due to the low recognition of SDS as disaster risk, no country in the region calculates direct economic losses from SDS. In many cases, no significant direct human losses or financial costs could be attributed directly to SDS. There is no compensation scheme associated with SDS impact. Limited documented information is available on the long-term consequences of this phenomenon on health, economy and agriculture. A common methodology for Economic assessment of SDS negative impact, both direct and indirect as well as the long-term cost of inaction, on infrastructure, transportation, population, agriculture and other sectors should be developed and applied in the region.

Economies of Central Asia continue to significantly depend on agriculture (including animal husbandry), which accounts for **10-38% of GDP and provides 18-65% of jobs**, making the economies of these countries vulnerable to droughts due to a reduction of agricultural production, adversely impacting food prices, trade and access to markets and leading to a decrease of farmers' revenues and unemployment (FAO, 2019). At the same time, there is a direct impact of SDS on agriculture leading to a decrease in crop productivity caused by the reduction of biomass photosynthetic activities and soil erosion. Approximately 60% of the population of Central Asia live in rural areas and its majority depends on agricultural revenues. The nominal personal income of rural residents accounts for about half of the overall revenues of urban residents. The majority of rural residents rely not only on cash revenues from agricultural products but also on in-kind revenues from their land and the use of such natural resources as fish, game and firewood.

The spectrum of indirect SDS impact in Central Asia is large. Specifically:

- Excessive sedimentation of irrigation canals and watercourse caused SDS and drifting sands;
- Disruption of transportation (road, railways, air);
- Deterioration of quality of surface water;
- Reduction of visibility and associated incidents;
- Reduction of energy supply from solar panels.

Activities aimed at an increase of productivity of agricultural lands and the introduction of economic mechanisms to combat land degradation and drought could help effectively avoid the development of the new SDS sources and reduce existing sources.

1.4. SDS Mitigation at Source

To date, appropriate measures on sustainable land resource management along with comprehensive approaches to land and water use at the scale of the terrain have been developed and are being implemented at the national and regional levels. Many methods are based on research and technical developments as well as traditional local knowledge of the CA countries, such as:

- Stabilization of drift sands and protection of engineering structures from sand drifts and blowing;
- Phytomelioration, afforestation and creation of windbreaks;
- Increase productivity of desert pasture;
- Desert crop development using local runoff;
- Creation of underground freshwater reservoirs by collecting and accumulating precipitation;
- Solar energy use for small consumers in the desert.

Studies conducted by the Central Asian Forestry Research Institute show that protective forest belts reduce wind speed by 60-65% at 15 times tree height, by 50-55% at 20 times height, and by 30-40% at 25 times height. Relative humidity of air under the influence of protective forest strips increases by 10-15%.

Works to rehabilitate the dried bottom of the Aral Sea are currently conducted both on Kazakhstan's and Uzbekistan's parts of the Aral Sea basin. According to the State Forestry Committee of the Republic of Uzbekistan, over 1.5 million ha of the plantation was created over three years as part of the 'State Program on Development of the Aral Sea Region for 2017 – 2021 (Novitsky, 2021). As of today, Kazakhstan has planted about 1.8 million haloxylon nurslings on Kazakhstan's part of the Aral territory occupying one thousand hectares. According to the program to plant haloxylon on the dried bottom of the Aral Sea, two billion trees will be planted on 213 thousand ha by 2025 (KazInform, 2021). As part of the implementation of the Green Belt Project along the eastern coast of the Aral Sea and settlements, multi-cluster and multi-level phytomelioration works will be carried out along the eastern coast of the Aral Sea with the introduction of local and introduced psammophyte flora species considered as a potential source of wind-salt-dust transport, as well as the creation of "green belts" around settlements. All this should contribute to the preservation of the natural resource capacity of the ecosystem in Kazakhstan's part of the Aral region and foster the local population's wellbeing (ED IFAS, 2021). According to the IFAS Executive Directorate in the Republic of Kazakhstan, forest reclamation on the area of 1 million 757 thousand hectares is required only on Kazakhstan's part of the drained bottom of the Aral Sea.

Three countries (Kazakhstan, Kyrgyzstan and Uzbekistan) have set voluntary Land Degradation Neutrality targets and is expected that Tajikistan and Turkmenistan will formulate LDN targets in 2022. The following commitments contribute to SDS source mitigations (UNCCD, n.d. (b)):

- **Kazakhstan:** increase land use effectiveness; increase irrigated lands by 40% resulting in the total area reaching 2 million hectares.
- **Kyrgyzstan:** improve the ecological condition of pastures by introducing a pasture rotation system; Improve access to 10 000 ha of pastures by improving pasture infrastructure (bridges/roads, watering points); The practice of sustainable land resource management is introduced on 100 000 ha of lands (including pastures and forests); Reclamation works have been conducted on 10 000 ha of agricultural lands.
- **Uzbekistan:** by 2030 will have carried out activities to combat desertification; restore degraded lands and soils including lands affected by desertification, drought and floods.

1.5. Country Situation Analysis

Kazakhstan

Sources and Monitoring

The East Coast of the Aral Sea and the Amu Darya estuary are a source of strong salt and dust emission. Satellite data analysis shows that in August 2011 the dried bottom of the Aral Sea occupied the area of 57 529 sq. km., which is one of the largest sources of SDS in Central Asia. Dust and sand storms have also been registered in the Balkhash and Balkhash-Alakol districts of the country.

The volume of salts blown from the bare bottom of the Aral Sea amounted to 15-75 tons/year and caused serious concern about human health (Saiko and Zonn, 2000). Other estimates show that the total number of blown matters from the bare bottom of the sea ranges from 40 to 150 million tons (Miclin, 2010). Deflation processes in the form of sand and dust storms prevail on a large territory of desert pasters located mainly in Southern Kazakhstan (Medeu, 2010).

Risk and Vulnerability Assessment

According to the National Action Plan to combat sand and dust storms in Kazakhstan, the total volume of economic losses resulting from desertification is estimated at 93 billion tenges in Kazakhstan. Land degradation particularly affects poor farms. According to preliminary estimates, the loss of pasture degradation in Kazakhstan is 963.2 million US dollars a year. Foregone income from cropland erosion is estimated at 779 million US dollars a year. Secondary salinization, swamping and other causes lead to a loss of 375 million US dollars in revenues. Annual losses caused by a loss of humus are estimated at 2.5 billion US dollars.

Strategic Framework and Impact Mitigation Work

In 2008, the country adopted a state mid-term environmental program. A new strategy and action plan included coordination and financial support of programs aimed at the protection of the environment. The President adopted the Kazakhstan-2050 strategy to tackle issues of sustainable development and environmental projects, among others.

It is worth noting that forests were planted on 61 thousand ha. of the dried bottom of the Aral Sea for 2007 and 2015.

According to UNDP Kazakhstan: 61% of SDG goals are already covered by national strategic documents, so issues of environmental protection, improvement of social well-being of the population and restoration of ecosystems are already considered, to a greater or lesser extent. (https://www.kz.undp.org/content/kazakhstan/ru/home/sustainable-development-goals.html).

Kyrgyzstan

Sources and Monitoring

The territory of Kyrgyzstan is vulnerable to droughts and sand and dust storms because it is surrounded by countries with prevailing arid and semiarid terrains. The main constant sources of dust are located in a large ‘dust belt’. An increased frequency of storms transports 43 million tons of dust and sand from the dried bottom of the Aral Sea every year.

Risk and Vulnerability Assessment

SDS processes harm Kyrgyzstan, particularly its socio-economic conditions and population health. However, the loss resulting from this natural phenomenon is not accounted for. The dust and other particle concentration are measured in the city of Bishkek only.

Strategic Framework and Impact Mitigation Work

In the Kyrgyz Republic, issues of environmental protection and adaptation to climate change are reflected in the key national and sector-specific strategic documents. Already now, the country experiences consequences of climate change, which harm ecosystems, population health, areas of economic activities, increases vulnerability to emergencies. However, there is no program to prevent and combat dust and sand storms. **Moreover, attention to SDS phenomena has weakened with underestimation of SDS risks and increasing vulnerability is seen at all levels of society nationwide.**

The State Agency for Land Resources is responsible for the development and implementation of a coordinated policy of rational land planning and use. Forest belts are a part of internal farmland tenure. The State Agency for Land Resources is responsible for water supply services for farmers' fields and protective forest belt irrigation.

The Ministry of Emergencies together with the interdepartmental Agency of Hydrometeorology prevent forecast and eliminate consequences of natural disasters, including droughts, water scarcity, hurricane winds, emergency monitoring and assessment. However, specialized regulations on SDS are not available in the database of the country. SDS related issues are considered in conjunction with issues of combatting land degradation and emergencies.

In 2011, a unified information management system in emergency and crises was put into operation, which purpose is to automate activities of the governing bodies of the State System of Civil Protection, increase efficiency, reliability and quality of management decision making, including decisions on early emergency warning and implementation of protective measures. 2018-2030 Concept of Comprehensive Protection of Population and the Territory of the Kyrgyz Republic from Emergencies was adopted in 2018 along with the Action Plan Implementation Concept and the Emergency Response Plan (MES KR, 2018).

Tajikistan

Sources and Monitoring

The main sources of sand and dust storms in Tajikistan include estuaries of the Vakhsh and Kafirnigan Rivers in the Southwest of Tajikistan as well as an intermediate estuary of the Syrdariya river, where it flows into the Kayrakum water reservoir. The danger of SDS for Tajikistan is primarily reflected in the health of people, agricultural efficiency and safety of air and land transport. In the geological past, the SDS in Tajikistan played a role in soil formation. For example, loess species of Southwestern Tajikistan are of aeolian origin.

The number of SDS in Tajikistan has increased more than 10 folds in the last thirty years. While only 2-3 SDS cases were registered in the early '90s, more than 35 sand and dust storms were registered every year in the last several years**.** Strong winds raise dust and sand from deserts in Afghanistan and transport them over almost 1000 kilometres to the north.[x] Experts explain an increase in the frequency of SDS by climate change and stronger droughts and dust and salt leakages from the dried bottom of the Aral Sea.

There are local sources of SDS in Tajikistan. Significant deforestation around some settlements in the Eastern Pamir has triggered desertification, formation of sand massifs and led to their mobility.

[x] NAP on SDS prevention and mitigation (Tajikistan)

A thousand hectares of gardens, farmlands, individual settlements and home grounds ended up under a heavy layer of sand and dust.

Risk and Vulnerability Assessment

Active melting of glaciers, an increase of average annual temperatures, desertification processes, climate change and the nature of precipitation, more frequent periods of extreme weather conditions – droughts have been observed in recent years. An equally important problem related to climate change is an increase in dust storms in the country. At the same time, dust haze is becoming a less important priority in the list of the high-priority tasks in combatting climate change.

Drought is one of the factors that deteriorate all socio-economic and environmental factors of the country and population development. When water supplies are insufficient, the population resorts to irrational water use and agricultural practices, around 3 million people suffered during the drought of 2000-2001 in Tajikistan, while the damages were estimated at 100 million US dollars (GDP of 4.8%). It also led to a loss of income and an increase in unemployment in southern regions of the county affected by drought. The 2011 drought affected about 2 million people and damages to the agricultural sector were estimated at around the US $63 million US dollars. The drought has a significant negative impact on the level of water in the Nurek water reservoir, which affected the energy security of the country, while insufficient precipitation led to decreased production of wheat, barley, and rice by at least 75% relative to previous years.

Strategic Framework and Impact Mitigation Work

The Committee of Emergency Situations and Civil Defense and its local branches are directly responsible for the development of activities to prevent, reduce and eliminate disaster consequences and provide assistance to emergency committees at all levels.

The National Disaster Mitigation Strategy of the Republic of Tajikistan for 2019 – 2030 has a disaster risk management system. It is worth noting that SDS is not included in the list of natural disasters in the Republic of Tajikistan.

Turkmenistan

Sources and Monitoring

The extreme continental climate of Turkmenistan increases the risk of SDS occurrence and subsequently increases the number of dust particles in the air. Studies show that each cubic meter of air contains more than 300-400 mg of dust particles.

Risk and Vulnerability Assessment

As the negative impact of climate change increases, the number and the scale of SDS events will increase in the country. Heavy drought, which was observed in Turkmenistan in 2000-2001, 2005 – 2006 and 2008 led to a significant reduction of crop yield of pasture grass and eventually resulted in a reduction of livestock numbers. Livestock owner has to sell about 20-40% of ship, 17-34% of goat and 10-13% of the camel during arid years. In 2001, a direct economic loss from growing crops on degraded and salinized lands amounted to approximately 140 million US dollars. [xi]

Strategic Framework and Impact Mitigation Work

The Law on Protection of Nature (1991), amended in 2014, has become a core document that regulates socio-economic and environmental regulatory norms in Turkmenistan. It is now aimed at climate change risk reduction and to a certain degree at issues of SDS management in Turkmenistan.

[xi] Determined as a sum of lost products.

As noted in the statement of the President to the UN General Assembly, "air masses formed in the area of the environmental disaster caused by the drying of the Aral play a particularly dangerous role, and have a significantly negative impact on nature, climate and health of people residing in the Aral region and far beyond. Sand and dust storms that transport hazardous substances from the bottom of the dried Aral Sea are spread for thousands of kilometres and pose a real threat for people's lives (NT, 2020)."

A significant part of adaptation measures has already been integrated into sectoral plans of ministries and agencies. Currently, the country is working on the Fourth National Communication of Turkmenistan on climate change to UNFCCC. The National Climate Change Strategy of Turkmenistan has been adopted in 2012. Intersectoral Committee on environmental issues has been created in 2019, which considers relationships between climate change, sand and dust storms and other climatic negative natural phenomena.

Uzbekistan

Sources and Monitoring

Strong desertification processes are observed on the dried bottom of the Aral Sea. One of the factors of the ecological tension of the territory is wind and water soil erosion, soil salinization and subsequent development of desertification processes (Kurbanov, 2019).

Risk and Vulnerability Assessment

Experts of the Republic of Uzbekistan noted that the ecological situation deterioration is linked to climate change, has a direct and indirect negative impact on the quality of life of the Aral Sea basin residents. [xii] The morbidity of the population is 72.3% in the Khorezm oblast and 70% in the Republic of Karakalpakstan. Incidence of TB, oesophagal cancer, blood and hematopoietic system diseases and diseases of the digestive system are several times higher and the average incidence rate for the republic.

Uzbekistan has experienced several extreme hydrological droughts in the last decade, which destroyed 50 to 75% of crops in drought-affected regions. Damages caused by 2000-2001 droughts are estimated at approximately 130 million US dollars. The share of the population residing in territories at risk of drought is 76.3%. According to surveys, an absolute number of farmers (94%) experienced a shock related to drought (WB, 2005).

According to scientists of the Republic of Uzbekistan, the fallout of salts from the atmosphere reduces bio productivity of farmland by 5-10%, pastures by 20-30%.[xiii] For the Republic of Uzbekistan, 70% of the territory of which is currently represented by arid and semi-arid areas, prone to natural salinization, the spread of drift sand, dust storms and dry hot winds, the issues of combatting drought and SDS are a priority in ensuring sustainable development of the country. About 10 million ha of pastures need to be drastically improved. Overgrazing, deforestation for fuel and other purposes have led to a significant reduction of tree and shrubbery vegetation in the desert zone. The total forest area decreased by half in comparison with 1965. Forestry authorities of the Republic restored a total of 1560 thousand ha of forests between 2011 and 2020.

According to the data on the UN Multi-Partner Trust Fund for Human Security for the Aral Sea Region in Uzbekistan website, more than 75% of the total graze land area in the Republic of

[xii] National Plan for Sand and Dust Storm Management in Uzbekistan

[xiii] National Action Program to Combat Desertification in the Republic of Uzbekistan, Tashkent, 1999. https://knowledge.unccd.int/sites/default/files/naps/uzbekistan-rus1999.pdf

Uzbekistan is located in the Karakalpakstan, Navoi and Bukhara oblasts. Areas of degraded graze lands account for more than 83% in Karakalpakstan, more than 59% in the Bukhara oblast, and more than 90% in the Navoi oblast. Salts falling out during dust storms, an increase of irrigation water mineralization and raising levels of underground waters – all have resulted in a decrease in crop yields (yields of corn decreased by 3 folds, rice – by 2 folds, cotton - by 1.6 folds, potatoes and vegetables – by 1.5 – 2.5 folds). High evaporability and low level of precipitation (90-120 mm/year) on initially salinized soils resulted in the need to increase irrigation frequencies (6-10 times) and wash works (2-4 times). The highest water use rates for irrigation are registered in the Khoresm oblast, the Republic of Karakalpakstan and the Bukhara oblast, which are almost 1.5-2 times higher than similar levels in the Samarkand, Dzhizak and Syrdariya oblasts (Aral Sea Trust Fund, n.d.).

Strategic Framework and Impact Mitigation Work

The Law on Nature Protection (1992) is the fundamental legislative measure that establishes a legal, economic and organizational basis for the preservation of the natural environment and rational use of its resources. To ensure the vital interests of the individual, society and the state, the Republic of Uzbekistan adopted the following laws: 'On Protection of the Population and Territories from Natural and Man-Made Emergencies' and 'On Civil Protection' along with a series of Resolutions of the Cabinet of Ministers of the Republic of Uzbekistan. The Constitution and environmental regulations define legislative, state and executive authorities, as well as businesses and organizations that are responsible for environmental protection and the use of natural resources.

To offset the negative consequences of the Aral Sea crisis, the Republic is working on improving socio-economic conditions and the ecological state of the region; respective legislative acts have been amended. The Government of Uzbekistan has allocated 100 billion sums for afforestation of the bare sea bottom, which should be conducted within 10-12 years.

The country created and operates the State Emergency Prevention and Response System (SEPRS), which unites management bodies, forces and means of republican and local authorities, companies and organizations, whose mandate include the organization of emergency response measures, including those related to meteorological conditions. The main SEPRS activities include assessments and forecasts of Uzhydromet received by the Ministry of Emergency Situations in real-time. Currently, Uzbekistan has prerequisites for forecasting, warning the population about SDS and taking active mitigation measures.

1.6. Existing Regional Mechanisms

The countries in the region are committed to sustainable development policy. Since independence in 1991, the countries have adopted fundamental regulations, national strategies and programs that comprise the legal framework for sustainable development and environmental protection. Over this time, the countries have signed more than 29 international environmental conventions and more than 20 treaties, which have laid a foundation of the mechanism of regional cooperation. Among the most relevant for SDS are The United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD); UN Framework Convention on Climate Change (UNFCCC); Sendai Framework for Disaster Risk Reduction 2015-2030; Convention on Biological Diversity; Center for Emergency Situations and Disaster Risk Reduction (CESDRR); and International Fund for Saving the Aral Sea (IFAS) (ICSD, n.d.).

The conventions and treaties provide an international legal framework for partnership between the countries on environmental protection and the use of natural resources of the region including open-air protection, conservation of biodiversity, water quality, combatting desertification and man-made impact of natural resources. However, the synergism between international partners and conventions

is largely manifested only at the national level and is practically non-existent at the regional level. This creates certain barriers for regional cooperation, however represent untapped opportunities for joint research, experience and data sharing as well as formulating a common regional position in international and inter-governmental processes.

Regional Organizations and Agreements related to SDS

There are few regional organizations and in Central Asia which act as a collaboration platform within their scopes and mandates and could be considered as a mechanism to leverage the SDS agenda at the regional policy level.

The International Fund for Saving the Aral Sea (IFAS) and its working bodies, the Interstate Commission for Water Coordination (ICWC) and the Interstate Commission on Sustainable Development (ICSD) act as a basis for regional cooperation on the issues of environment and transboundary natural resources use in Central Asia. IFSA is a high-level regional organization authorized to foster regional cooperation and the development of an intersectoral dialogue around environmental protection and sustainable development.

Regional Environmental Programme for Sustainable Development in Central Asia (REP4SD-CA) 2021-2030 is one of the most recent regional documents developed under the auspices of ICSD. This document is the basis for regional cooperation and achievement of regional sustainable development using the implementation of national tasks within the framework of environmental SDGs. REP4SD-CA combines the main environmental conventions and treaties from the regional perspective to achieve synergy and form proactive and coordinated actions.

In 2014, the CA countries signed the **Agreement on Cooperation in the Field of Environmental Protection among the Member-States of the Commonwealth of Independent States** to strengthen regional cooperation to protect and use lands, soils, forests, waters, air, flora and fauna of the CA countries, which is one of the mechanisms of creation of effective institutional and legal prerequisites for the improvement of the ecological situation in the region. The Agreement regulates a set of measures, including issues of transboundary nature, such as restoration and conservation of lands, exchange of data on unfavourable natural phenomena, and the neighbouring state emergency notification procedures (Adilet, n.d.).

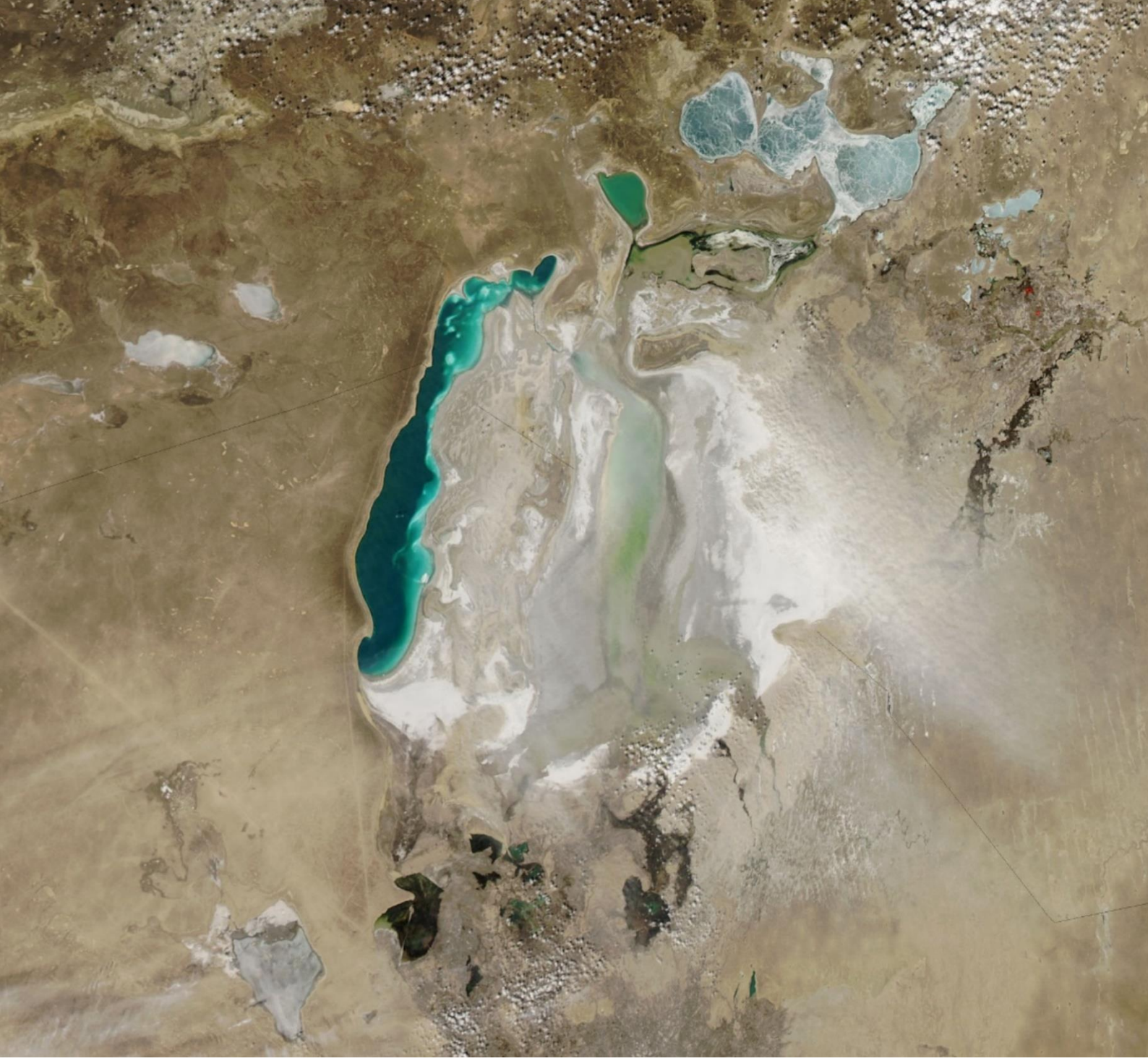
Center for Emergency Situations and Disaster Risk Reduction (CESDRR) – In 2018, a regional forum in the form of Meetings of Heads of Emergency Agencies of the Central Asian Countries was created and the Center for Emergencies and Disaster Risk Reduction received a status of the Regional Forum Secretariate. Although the Central Asian countries are prone to destructive natural disasters, such as earthquakes, floods, drought, dust and sand storms, which cause multiple casualties and lead to large economic losses, the countries register emergencies and resulting losses independently, which makes it impossible to conduct an adequate comparison and assess situations in the countries and consequences of previous disasters (CESDRR, 2021). Currently, the Center for Emergencies is developing a Regional Disaster Risk Mitigation Strategy 2022-2030.

Given the mandate and the political level of ICSD, it is recommended to consider the integration of tasks and priorities of the Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia for 2021-2030 under the umbrella of REP4SD-CA This integration will contribute to the improvement of socio-economic and ecological conditions in the region of the Aral Sea basin and sustainable use of its natural resources to achieve the Sustainable Development Goals.

The South-South partnership is an important factor of regional development in the Asian-Pacific region. The volume of direct investments and technology transfer has increased in recent years and their applicability to the realities of Central Asia has increased. Japan, South Korea and China have accumulated significant knowledge, experience, technologies and capabilities, which can be shared

with the countries in the region using various programs and projects related to the environment, policy development, sustainable production and consumption practices and development of nature-based solutions.

Collaboration with UNESCAP Asian and Pacific Center for the Development of Disaster Information Management (APDIM) offers opportunities for capacity building, technical assistance and a platform for connecting to a network of experts in the Asian region and foster regional cooperation and action for disaster risk reduction.



REGIONAL MID-TERM STRATEGY FOR SAND AND DUST STORM MANAGEMENT IN CENTRAL ASIA 2021-2030

Vision: A long-term vision of the Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia for 2021-2030 is a reduction of social vulnerabilities of the countries and communities to SDS manifestations using mitigation at source and destination areas. Socio-economic aspects of land degradation and SDS occurrence require special attention with the focus being made not only on desertification, land degradation and drought but particularly on the people that reside on the territories at high risks of SDS and land degradation, whose wellbeing depends on the natural resources.

Strategic Goals: **The mid-term goal of the Regional Strategy is to increase system and institutional capacities for effective and sustainable management of sand and dust storms and natural resources in the Central Asian countries.** This will help to improve interactions and cooperation between organizations and communities in mitigating a negative impact of SDS and DLDD processes and serve as a basis for joint work at the subregional level.

Key Priority Areas

Area 1: Strengthening knowledge about SDS

Understanding the multi-dimensional impact of sand and dust storms on various economic sectors in the country and the region will help to effectively address the environmental and socio-economic causes of SDS and DLDD both locally and regionally. If properly approached, this will lead to a global change in sand and dust emissions, contribute to biodiversity conservation, and reduction of anthropogenic impacts contributing to climate change.

This could be achieved through the facilitated SDS data and knowledge generation at national and regional levels, the inclusion of SDS in natural disaster registry, organization of training courses for diverse stakeholder groups.

Improved coordination between the government, the private sector, and the local communities to reduce the risks associated with sand and dust storms, raise awareness of their potential impacts and risks, and increase the capacity of decision-makers to take integrated and synergistic action across sectors will strengthen inter-sectoral and transnational cooperation.

Capacity building for women and other socially vulnerable groups in the most relevant areas, such as early warning and information dissemination, could help the population to prepare for and cope with the effects of SDS. Awareness-raising is an important aspect of informing people about the risks that exist, how they can affect them, and what proactive measures an individual can undertake to mitigate the impact and reduce the negative consequences of SDS. Overall, this will help reduce the vulnerability of people who are most at risk.

Area 2: Mitigation of the impact of anthropogenic sources of SDS

Reduction of anthropogenic factors causing sand and dust storms and mitigation of their negative impact on human wellbeing and the environment is an important premise of the Regional Strategy. Desertification, land degradation and drought, combined with climate change, exponentially increase the consequences of sand and dust storms and stimulate an increase of their sources.

Mitigation measures must be designed at the community and farm level, which are quite often at the greatest risk. For this purpose, active participation of the leading agrarian and natural resources management universities is important, as they hold a plethora of knowledge and historic statistical information that could play a crucial role.

SDS source mitigation should be considered during the development of the national and regional action programs to combat desertification, national and regional climate change adaptation and mitigation plans, as well as ecosystem restoration programs and initiatives in the region.

Area 3: Regional cooperation and joint actions

The countries of Central Asia are committed to regional cooperation, especially in the field of environmental protection. They have established solid platforms for regional cooperation over the years. The countries are part of the international community working together to solve environmental problems both globally and regionally, especially in the Aral Sea basin.

Joint SDS advocacy and programming will strengthen partnership building, resource mobilization and technology transfer showcasing the Central Asian experience and connecting the region to the global SDS scientific and technical communities.

The regional cooperation process for the elimination of negative consequences of sand and dust storms and DLDD causes will stimulate the socio-economic growth and lead to the strengthening of the market economy, thus creating a new foundation for joint work on transboundary environmental

problems. The success of such actions will depend on the ability and readiness of government institutions and regional and international organizations to act together and to finance activities aimed at resolving ecological problems.

Strategy Implementation Monitoring

According to its mandate, the Interstate Committee on Sustainable Development (ICSD) created in 1994coordinates the regional cooperation in the field of environmental protection and sustainable development of the CA countries. The main objectives of ICSD include the development of a strategy for sustainable development, management of regional programs, action plans and environmental and sustainable development projects, coordination of actions in the fulfilment of the commitments of CA countries to implement environmental conventions that have a transboundary nature.

Integration of the Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia for 2021-2030 into the Regional Environmental Programme for Sustainable Development in Central Asia (REP4SD-CA) and its implementation will benefit the countries in the region in the future because it will be aimed at improvement of socio-economic and environmental conditions in the region of the Aral Sea basin and sustainable use of its natural resources to achieve Sustainable Development Goals. Given coordinated actions within the framework of the ICSD mandate and REP4SD-CA, objectives will be achieved transparently and sustainably. ICSD will be responsible for implementation, monitoring and reporting, within the framework of its mandate and capacity to report to CA countries at no additional financial costs.

Implementation Mechanisms

The implementation of the Regional Strategy will be carried out primarily from the national budgets within the framework of national programs and strategies for socio-economic development and environmental protection within the priority areas and tasks already financed or to be financed by the countries in the next 5 years.

It is expected that the majority of the activities of the Regional Strategy will be implemented through partnership programs and initiatives of regional and international development partners. The UNCCD Secretariat and CAREC will engage actively in attracting grant and other external funds, as well as projects contributing to the achievement of the objectives, set out in the action plan below, and the priority areas of the REAP4SD in CA.

ACTION PLAN

No.	Activity	Action	Expected Outcome	SDGs
Priority area 1: Strengthening knowledge about SDS				
1	Establishment of a regional platform and data centre for regular exchange of information between the hydrometeorological services of Central Asia on monitoring drought and sand and dust storms	Create a regional platform and data centre for regional information exchange on drought and SDS	Raise awareness and expand cooperation between the CA countries about information exchange on combatting drought and SDS development processes	SDG 9, SDG11, SDG13, SDG14, SDG15, SDG17
2	Contribute to the inclusion of the CA countries into the SDS-WAS to build the capacity of the countries in the field of SDS monitoring and forecasting, research and exchange of experience and technologies within the regional and global network	National hydrometeorological services have joined the WMO within the framework of the SDS-WAS	Capacity building of the CA countries in the field of forecasting and monitoring of SDS process development.	SDG 9, SDG 11, SDG 13, SDG 14, SDG 15, SDG 17
3	Develop basic principles of inclusion of SDS development processes into the natural disaster registry.	The national hydrometeorological service and MES representatives have developed a plan to include SDS development processes into the natural disaster registry.	The natural disaster registry contains SDS development processes.	SDG 3, SDG 5, SDG 6, SDG 10
4	Develop methodology and conduct SDS impact assessment including direct and indirect, short- and long-term impact cost	Establish and maintain effective partnerships with the key agencies (ESCAP-APDIM, UNCCD, WMO, UNDRR, WOCAT and others) to customize global or regional methodologies	SDS impact assessment report for Central Asia	SDG 8, SDG 9, SDG 11
5	Develop an SDS atlas (source and deposition areas)	National research institutes: the NIDFF and the Institute of Geography of the Ministry of Education and Science of RK, and Uzhydromet determined methods to identify and mapping SDS leakage and accumulation zones	SDS atlas has been created.	SDG 13, SDG 14, SDG 15
6	Disseminate information on SDS among wide circles of stakeholders (decision-makers, the public, local communities, etc.)	Develop an information campaign to raise awareness at all levels.	The population of the CA countries at all levels has been informed and is aware of SDS.	SDG 13, SDG 14, SDG 15, SDG 17
7	Conduct training courses for leading universities in the CA countries on the development of curriculum to train SDS experts.	Identify the best international and regional practices to combat SDS and develop a training course to form a foundation of regional activities based on local knowledge.	Experts can apply measures to combat SDS	SDG 9
Priority area 2: Mitigation of the impact of SDS anthropogenic sources				
8	Programs and projects for economic support of agricultural producers affected by negative processes of drought and SDS to improve socio-economic conditions of agricultural producers, who were affected by negative processes of drought and SDS	Develop innovation-based programs to assist the agro-industrial complex in partnership with the leading ministries and agencies in the CA countries that work in the field of environmental protection.	Farmers use innovative approaches to reduce the negative impact of SDS.	SDG 2, SDG 3, SDG 6, SDG 9

9	Consider SDS source mitigation in the development of new national and regional projects to restore ecosystems, in updated commitments within the framework of achieving LDN and within the framework of the Paris Agreement.	Find synergy between UNCCD and UNFCCC for joint actions to restore ecosystems and mitigate SDS impact on them.	Multisectoral and multilateral planning as a basis of balanced and sustainable actions.	SDG 17
10	Strengthen the engagement of NGOs and local communities in national and regional programs on drought and SDS process management.	With the support of international development partners, prepare plans to engage NGOs and local communities in the work to reduce the negative impact of drought and SDS processes.	Enhanced participation of NGOs in the dissemination of information about the danger of the spread of drought and SDS processes.	SDG 11 и SDG 17
Priority area 3: Regional cooperation and joint actions				
11	Integrate the Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia for 2021-2030 into appropriate national and regional programs of CA	With the support of the UNCCD National Focal Points in the countries, find entry points for the introduction of the Regional Mid-term Strategy for Sand and Dust Storm Management in Central Asia for 2021-2030 into national and regional programs, where appropriate.	The actual implementation of the Regional Strategy on SDS Process Management in the countries of Central Asia.	SDG 9, SDG 11, SDG 13, SDG 14, SDG 15, SDG 17
12	Develop a single regional action plan to address gender issues in the Central Asian countries in the field of drought and SDS development	With the support of international development partners, contribute to the development of an integrated gender plan.	Equal access and participation in addressing the issues of combatting SDS processes in CA.	SDG 5
13	Improve cooperation on SDS processes at the regional and international level	Build institutional capacity by establishing a training centre to train staff, organize scientific conferences, inform the public and develop recommendations for CA governments as part of strengthening efforts to combat SDS.	National experts have been trained and national policies have been supported for regional integration actions	SDG 17
14	Determine priority areas to combat SDS processes for each CA country	Develop a comprehensive priority action plan in each CA country to combat SDS development processes	A gradual reduction of a negative impact of SDS processes in each CA country	SDG 9, SDG 11, SDG 13, SDG 14, SDG 15, SDG 17

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