CLIMATE CHANGE AND SECURITY
IN CENTRAL ASIA

THE REPUBLIC OF KAZAKHSTAN, THE KYRGYZ REPUBLIC, THE REPUBLIC OF TAJIKISTAN, TURKMENISTAN AND THE REPUBLIC OF UZBEKISTAN

Regional Assessment

ENVSEC
Environment & Security

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The European Union (EU) through its Instrument for Stability has provided support to the Environment and Security (ENVSEC) Initiative for contributing to regional stability through transboundary co-operation on adaptation to the consequences of climate change. Within the framework of the project Climate Change and Security in Eastern Europe, Central Asia and the Southern Caucasus under the Environmental and Security Initiative (ENVSEC), one of the four main activities attempted to identify and map climate change and security risks in Eastern Europe, Central Asia and the South Caucasus in a participatory way. The conclusions of that effort are presented in the respective regional reports.

The Austrian Development Agency (ADA) has co-funded the project by providing financial resources for the project activities in the pilot region in the Dniester River Basin. Moreover, the ENVSEC initiative partners the Organization for Security and Co-operation in Europe (OSCE), the United Nations Development Programme (UNDP), UN Environment, the United Nations Economic Commission for Europe (UNECE) and the Regional Environmental Centre for Central and Eastern Europe (REC) contributed their own resources to the implementation of this project.

The Environment and Security Initiative (ENVSEC)

The Environment and Security Initiative (ENVSEC) is a partnership of five international organizations – the Organization for Security and Co-operation in Europe (OSCE), UN Environment (UNEP), United Nations Development Programme (UNDP), United Nations Economic Commission for Europe (UNECE) and the Regional Environmental Centre for Central and Eastern Europe (REC) – with specialized, but complementary mandates and expertise, that provides an integrated response to environment and security challenges. The tf ENVSEC is to contribute to the reduction of environment and security risks through strengthened co-operation among and within countries in four regions: Central Asia, Eastern Europe, Southern Caucasus, and South-Eastern Europe.

The Environment and Security Initiative (ENVSEC) as a platform for co-operation provides multi-stakeholder environment and security assessments and facilitates joint action to reduce tensions and increase co-operation between groups and countries. Detailed information on ENVSEC is available at www.envsec.org

The assessments herein rely on the most recent statistical data available, while the recommendations take into account the latest developments and trends.

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ABBREVIATIONS AND ACRONYMS

AR-5	IPCC Fifth Assessment Report
CAIAG	Central Asia Institute of Applied Geosciences
CAMP4ASB	Climate Adaptation and Mitigation Program for the Aral Sea Basin
CAREC	Regional Environmental Centre of Central Asia
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CIS	Commonwealth of Independent States
COP21	Twenty-first session of the Conference of the Parties to the UNFCCC
CSTO	Collective Security Treaty Organization
ECO	Economic Co-operation Organization
EEU	Eurasian Economic Union
ENVSEC	Environment and Security Initiative
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GLOF	Glacial Lake Outburst Flood
ICSD	Interstate Commission for Sustainable Development
ICWC	Interstate Commission on Water Co-ordination
IFAS	International Fund for Saving the Aral Sea
IPCC	Intergovernmental Panel on Climate Change
MODIS	Moderate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NEACC	North Eurasia Climate Centre
NGO	Non-Governmental Organization
OSCE	Organization for Security and Co-operation in Europe
PPCR	Pilot Program for Climate Resilience
REC	Regional Environmental Centre for Central and Eastern Europe
RMCCA	Regional Mountain Centre of Central Asia
TAPI	Turkmenistan, Afghanistan, Pakistan, India pipeline
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	UN Environment
UNFCCC	United Nations Framework Convention on Climate Change
WGI	Worldwide Governance Indicators
WMO	World Meteorological Organization

GLOSSARY OF TERMS

Source: Except where noted, definitions come from IPCC, 2014: Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (eds.)]. In: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, pp. 117-130.

Adaptation The process of adjustment to actual or expected climate and its effects.

Adaptive capacity The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Afforestation Planting of new forests on lands that historically have not contained forests.

Biodiversity The variability among living organisms from terrestrial, marine and other ecosystems.

Deforestation Conversion of forest to non-forest.

Drought A period of abnormally dry weather long enough to cause a serious hydrological imbalance.

Ecosystem An ecosystem is a functional unit consisting of living organisms, their non-living environment and the interactions within and between them.

Ecosystem approach The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. [CBD]

Energy intensity The ratio of energy use to economic or physical output.

Energy security The goal of a given country, or the global community as a whole, to maintain an adequate, stable and predictable energy supply.

Extreme weather event An extreme weather event is an event that is rare at a particular place and time of year.

Food security A state that prevails when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development and an active and healthy life.

Hazard The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Heatwave A period of abnormally and uncomfortably hot weather.

Permafrost Ground (soil or rock and included ice and organic material) that remains at or below 0°C for at least two consecutive years.

Reforestation Planting of forests on lands that have previously contained forests but that have been converted to some other use.

Resilience The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.

Risk The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values.

Sensitivity In IPCC reports, equilibrium climate sensitivity (units: °C) refers to the equilibrium (steady state) change in the annual global mean surface temperature following a doubling of the atmospheric equivalent carbon dioxide (CO2) concentration.

Vulnerability The propensity or predisposition to be adversely affected.

Water security The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. [UN-Water]

SUMMARY

At present, nowhere in Central Asia does the concern about climate change as a multiplier of insecurity rise to the level of alarm, but the situations in the mountains and densely populated areas, as well as in the southern borders of Central Asia, warrant ongoing attention.

The Pamir and Tien Shan Mountains – with the Ferghana Valley in between – are geopolitically volatile areas where socio-economic insecurity has been an inherent part of life for many years. The mountains are particularly vulnerable to climate change: melting glaciers and permafrost disrupt water regimes and threaten ecosystems. Natural disasters are more prevalent and more damaging in the mountains. And mountain dwellers endure greater poverty and isolation than lowlanders.

Retreating glaciers, melting permafrost and disruptions in precipitation and snow melt patterns change the hydrology of mountain rivers. Water deficits and changes in river regimes are likely to increase the energy insecurity in the mountain areas dependent on hydropower and the food insecurity in the lowlands dependent on water for irrigation. In dry and low-water years, competition for pastures and local water resources increases, and water diversions that disadvantage others may lead to high tensions.

The near-term projected climate change impacts in densely populated areas are no more than a moderate concern, but many people are at risk of food insecurity and the effects of heatwaves, especially in places with competition for natural resources. Large-scale labor migration, predominantly male and working-age youth, increases the stress on the women, children and elderly who stay behind and are exposed to crop failures, extreme weather and natural disasters.

The region's abundant natural resources are unequally distributed: Kyrgyzstan and Tajikistan have large quantities of water, stored in mountain glaciers, Turkmenistan and Uzbekistan have huge oil and gas deposits and Kazakhstan is rich in coal, metals and minerals. Wealth in these countries is also unevenly distributed, and poverty remains widespread in Kyrgyzstan and Tajikistan.

The analysis of trends and projections regarding the relationship between climate change and security in Central Asia reveals the following environmental and socioeconomic conditions:

- Growth in oil, gas and coal production and use, as well as an increase in industrial and municipal waste is adding to greenhouse gas emissions and stress for ecosystems
- The overall energy efficiency of the economies of all countries is growing
- The population of the region continues to grow, including in the densely populated areas, and the proportion of young people remains high with high levels of unemployment
- In Kyrgyzstan and Tajikistan, labour migration has been one of the key sources of improving family well-being
- Episodes of instability and civil unrest have undermined socioeconomic development in mountain countries and in isolated enclaves, border areas, and distant or densely populated multi-ethnic provinces
- The situation in Afghanistan raises concerns about threats to security for all the countries of Central Asia, and climate change further destabilizes the situation
- The insurance, health and social support systems neglect the problems caused by climate, and children, pregnant women and the elderly are the most vulnerable
- Decision-making related to water management, energy production and food supplies does not yet sufficiently consider climate change
- Prediction tools for weather, farming and meteorological conditions and river flows lag behind the growing needs of the population

Food and energy security is largely determined by weather and climate factors. And in Central Asia, water is a key natural resource and water security is a priority, especially in cases of transboundary water resources.

The climate change implications for human security are likely to become more prevalent over time.

Heatwaves, droughts and forest and grassland fires in Kazakhstan have inflicted significant economic losses over the last years, especially in the northern parts of the country, a grain supplier for many countries. Kazakhstan has ambitious environmental and climate plans, and has devoted substantial budget resources to modernization, introduction of a green economy and development of an emissions trading system. One of the economic driving forces is the oil and gas sector, which operates mainly near the Caspian Sea, where fluctuations in sea levels and adverse weather and climate can negatively influence production and environmental security.

Most of Kyrgyzstan is mountainous and the regional climate projections call for higher temperatures, melting of glaciers and permafrost, and significant changes in ecosystems. Against this background, the country is addressing climate change in a serious and responsible manner, and taking measures to adapt to climate change as a leader in mountain ecosystem research and conservation. In the recent past, the country was shaken by revolutions and unrest, which were also linked to problems associated with the availability and use of natural resources and energy.

Tajikistan's situation is a composite of the main regional themes – the impacts of climate change and extreme weather in mountainous and densely populated areas, and cross-border tensions related to water resources and energy development, complicated by poverty. The southern areas of the country are particularly susceptible to climate change and extreme weather conditions, and proximity to unstable Afghanistan is an ongoing national security concern. Nevertheless, Tajikistan has become a pioneer in incorporating climate change considerations into economic planning, in linking investments to long-term climate effects and in recognizing the connections between climate resiliency and economic security.

Most of Turkmenistan's water comes from upstream states, and any reduction in water will make the country more vulnerable. But the country takes climate change seriously at the highest political levels, and has recently demonstrated leadership in the region by offering to host a regional centre on climate change adaptation.

Uzbekistan's areas with significant climate change and extreme weather concerns include the populous Ferghana Valley, Kashkadarya Province, the Amu Darya delta and the ancient oasis in the Zarafshan River basin. The country has worked with donors and invested budget resources in reforms in the agriculture and water sectors. These investments improve climate resilience, and Uzbekistan has been a leader in developing solar energy in the Central Asia region as well.

All of the hotspots identified in this study are regional/transboundary hotspots:

- Densely populated areas
- Remote areas on the Afghan border
- High mountain areas
- Central Asia breadbasket
- The Amu Darya River
- The Syr Darya River
- The Zarafshan River
- The Ili River and Balkhash Lake
- The Chu and Talas Rivers
- The Caspian Sea and coastline
- The Aral Sea and coastline

This study recommends that the Governments of the Central Asian countries take swift actions from the local to the regional level to tackle the impacts of climate change and the implications for security. Some of the proposed areas of intervention, including those matching the priorities of the Environment and Security Initiative, will need strengthened regional co-operation as well as more consistent and targeted international support.

1. METHODOLOGY

The overall goals of the climate change and security assessment are to identify and explain how climate change may exacerbate threats to security, and to propose effective measures in response. Achieving these goals requires a clear understanding of the current political, socioeconomic, and environmental conditions, trends and driving forces. These are likely to vary across the countries in a region, and may vary significantly within countries or transboundary ecosystems. The comprehensive survey of these underlying factors is therefore an important element of the climate change and security assessment, and is based on an examination of the publications and routine reporting of national, regional and international organizations, and on academic studies and journal articles.

An understanding of how climate change may affect political, socioeconomic, and environmental conditions depends in part on an understanding of current and projected climate change, and entails the identification and analysis of the effects of rising and extreme temperatures, changing precipitation patterns and extreme weather on resources and livelihoods, and on security. The most recent Intergovernmental Panel on Climate Change (IPCC) reports, the countries' national communications to the United Nations Framework Convention on Climate Change (UNFCCC), other country or river basin studies and inputs from multi-stakeholder consultations all inform this analysis.

The assessment of the effects of climate change on vulnerability focuses on security implications, and identifies how the hazards related to climate change, in combination with other cumulative pressures, may affect the environmental, socioeconomic and political conditions, and how these changed conditions may affect security and stability within and across borders. This assessment necessarily includes a consideration of the climate change adaptation capacity and resilience of governments, institutions and key sectors. It also examines how climate change and the other pressures play out in socioeconomic and environmental terms at the local, national and regional levels.

The definition of "security" in the context of climate change keeps evolving over time much like the Intergovernmental Panel on Climate Change definition of "vulnerability". These modifications of the meanings of the terms do not indicate loose usage but rather the refinements of understanding of the complex relationships among the many contributing factors, and the respective points of view of the agencies and institutions conducting assessments. A sampling of definitions demonstrates how different organizations have grappled with the security terms relevant in the context of climate change and security assessment.

The Food and Agriculture Organization of the United Nations (FAO) noted in a 2002 report that "food security" is a flexible concept, and that some 200 definitions have appeared in the literature. In 1996, the World Food Summit determined that food security existed, "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". The IPCC defines the term as, "A state that prevails when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development and an active and healthy life."

In a 2009 statement, the World Economic Forum defined "water security" as, "the gossamer that links together the web of food, energy, climate, economic growth and human security challenges that the world economy faces over the next two decades". UN-Water provides a comprehensive definition of water security: "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."

A 2011 Brookings Institution paper notes that, "Although there is a vast literature and much discussion about what constitutes 'energy security', there is no consensus on a definition," but asserts that, "At the most basic level, energy security means having access to the requisite volumes of energy at affordable prices." The International Energy Agency expands on this definition to include the concept of uninterrupted availability of energy sources, and distinguishes between long-term and short-term security. The former "mainly deals with timely investments to supply energy in line with economic developments and environmental needs", while the latter "focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance." In the IPCC definition, energy security is, "The goal of a given country, or the global community as a whole, to maintain an adequate, stable and predictable energy supply."

Other categories of security include personal, physical, human, national and others, each with their own range of definitions and applications. In the consideration of potential climate threats to security, the assessments strive to be as explicit as possible about the nature of the security at risk.

The approach used during the climate change and security assessments follows the Environment and Security Initiative general approach for developing integrated climate vulnerability assessments and consists of three phases:

1. Desk studies: Conducting desk studies and developing a preliminary assessment of the main climate-security implications and sites in the project countries of a region

2. National and regional consultations: Holding national and regional multi-stakeholder consultations based on the desk studies and preliminary assessment reports

3. Joint analysis: Preparing regional a joint analysis, a final assessment report and a visual synthesis of climate change-security issues and hotspots, and communicating climate change and security implications and areas of concern, priorities and recommendations to policymakers, state institutions and the public

The vulnerability assessment also considers the adaptive capacity of the countries and the region as a whole, and may include an evalution of financial and institutional capacities and of regional co-operation processes. The IPCC applies five criteria for assessing vulnerability which are listed below:

1. Exposure of a society, community, or social-ecological system to climatic stressors. If a system is not at present nor in the future exposed to hazardous climatic trends or events, its vulnerability to such hazards is not relevant in the current context.

2. Importance of the vulnerable system(s). Views on the importance of different aspects of societies or ecosystems can vary across regions and cultures. However, the identification of key vulnerabilities is less subjective when it involves characteristics that are crucial for the survival of societies or communities or social-ecological systems exposed to climatic hazards. Defining key vulnerabilities in the context of particular societal groups or ecosystem services also takes into account the conditions that make these population groups or ecosystems highly vulnerable, such as processes of social marginalization or the degradation of ecosystems.

3. Limited ability of societies, communities or social-ecological systems to cope with and to build adaptive capacities to reduce or limit the adverse consequences of climate-related hazards. Coping and adaptive capacities are part of the formula that determines vulnerability. While coping describes actions taken within existing constraints to protect the current system and institutional settings, adaptation is a continuous process which encompasses learning and change of the system exposed – including changes of rule systems or modes of governance. Severe limits of coping and adaptation provide criteria for defining a vulnerability as key, since they are core factors that increase vulnerability.

4. Persistence of vulnerable conditions and degree of irreversibility of consequences. Vulnerabilities are considered key when they are persistent and difficult to alter. This is particularly the case when the susceptibility is high and coping and adaptive capacities are very low due to conditions that are hard to change. Irreversible degradation of ecosystems, chronic poverty and marginalization, and insecure land tenure arrangements are drivers of vulnerability that in combination with climatic hazards determine risks which often persist over decades. In this way, communities or social-ecological systems (e.g. coastal communities dependent on fishing or mountain communities dependent on specific soil conditions) may reach a tipping point that would cause a partial or full collapse of the system. Inability to replace such a system or compensate for potential and actual losses and damages is a critical criterion for determining what is "key".

5. Presence of conditions that make societies highly susceptible to cumulative stressors in complex and multiple-interacting systems. Conditions that make communities or social-ecological systems highly susceptible to the imposition of additional climatic hazards or that impinge upon their ability to cope and adapt, such as violent conflicts are considered under this criteria. Also, the critical dependence of societies on highly interdependent infrastructures (e.g. power supply [or] transport) leads to key vulnerabilities [in] systems where capacity to adapt is low.

These IPCC criteria provide guidance on how to evaluate the relative importance of various areas of vulnerability. The ENVSEC climate change and security assessment considers these criteria in defining the corresponding vulnerable areas (climate change and security hotspots) and the context-specific implications for security.

1.1. Phase 1: Desk studies

The desk studies consider the underlying political, socioeconomic and environmental conditions; the current and projected climate change; the climate hazards and stressors; and the impact of climate change in the context of the vulnerability of specific places in the region. The desk studies culminate in the identification of climate change and security hotspots.

1.1.1. Survey of underlying political, socioeconomic and environmental conditions

A comprehensive survey of the underlying socioeconomic, political and environmental conditions in the countries and the region as a whole entails the examination and description of the range of factors that may influence the interplay of climate and security. These factors include the following:

- The geopolitical situation and broad security influences
- Climate change politics and mainstreaming
- Governance
- Social dynamics
- The economic situation
- The availability and condition of natural resources
- Agriculture and food security
- Energy production and security
- The water-agriculture-energy nexus
- Critical infrastructure

1.1.2. Current and projected climate change

The relationships between rising global temperatures and a host of secondary effects are increasingly well understood. Climate trends and projections are available at the global, regional, national and sometimes local levels. Such trends and projections usually consider the following:

- Average annual and seasonal temperature
- Number of hot days and nights
- Frequency of heatwaves
- Average annual and seasonal precipitation
- Number of days above and below precipitation thresholds
- Number of extreme weather events

Among the reliable sources of climate information are the following:

- Intergovernmental Panel on Climate Change publications, including special reports and the parts of the Fifth Assessment Report published in 2013-2014, and international online resources with climate data and climate change models
- National communications to the United Nations Framework Convention on Climate Change
- Country statements, positions and presentations
- National policies, programmes and plans related to environmental issues, natural resources and adaptation to climate change
- Official data from international organizations
- Peer-reviewed international research

An understanding of the climate trends and projections for a country and a region provided the basis for the analysis of climate change hazards and risks in this study, and for the analysis of likely regional consequences on security.

1.1.3. Climate hazards and stressors

The identification and analysis of hazards resulting from climate change is an essential step in the climate change and security assessment. Some of these hazards come in the form of sudden events, and some arise slowly over time. The long-term effects of rising temperatures and disrupted precipitation patterns may diminish pastures, interfere with irrigated and rain-fed agriculture and energy production, change sea levels and compromise human health. For either sudden or slow onset effects, the hazard analysis considers the potential environmental, socioeconomic and political consequences of these hazards. The array of hazards under consideration included the following:

- Melting glaciers and the formation of potentially dangerous glacial lakes
- Floods, flash floods and other climate-related disasters
- Sea-level rise and enhanced coastal flooding
- Desertification and loss of usable land
- Hailstorms, cold waves, dust storms
- Droughts and heatwaves
- Wildfires
- Changes in the hydrologic cycle; too much and too little water; major seasonal shifts
- More frequent and severe extreme weather events

1.1.4. Impact and vulnerability assessment

The analysis of the role of climate change as an additional stressor examines how natural hazards caused or intensified by climate change may affect the existing environmental, socioeconomic and political conditions. It considers the likelihood of the climate risk and the potential exposure to hazards, and explores the implications for security.

Some of the relationships are fairly straightforward, and some are highly complex. Floods or extreme cold waves, for example, may cause immediate human and economic losses, may trigger an energy or food crisis and may threaten livelihoods. Changes in the hydrologic cycle, in contrast, may cause environmental degradation over time with repercussions for the economy and food and power production for a growing population in the coming years. The security implications may be far-reaching and complicated by other factors.

The levels of identified risks are likely to rise over time, especially in the absence of adaptation, and therefore the timeframe for the analysis is an important factor in the vulnerability assessment. The IPCC Fifth Assessment Report uses three distinct time frames – the present, near term (2030-2040) and long term (2080-2100) – in its evaluation of climate risks. By taking a similar approach, this assessment aims to help alert policymakers to the prospect that a low-level present risk has the potential of becoming a high-level long-term risk, even when long-term projections of the underlying security conditions may not be feasible.

The IPCC describes risk as "The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values." In its enumeration of key climate-related risks, the IPCC offers descriptions, including the following:

- Systemic risks due to extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services
- Risk of mortality and morbidity during periods of extreme heat, particularly for vulnerable populations and those working outdoors in urban or rural areas
- Risk of food insecurity and the breakdown of food systems linked to warming, drought, flooding, and precipitation variability and extremes, particularly for poorer populations
- Risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity.

This assessment considers the structural, socioeconomic and environmental consequences of climate change, and covers a broad range of perceived risks and context-specific security concerns:

- Livelihood insecurity (urban and rural)
- Human and economic losses
- Additional pressure and competition over scarce natural resources
- Seasonal or persistent water shortages and possible energy and water insecurity
- Damage to infrastructure; industrial safety concerns, including stability of tailings
- Diminished ecosystem services
- Biodiversity disruptions and possible loss of fish stocks, pastures and genetic resources
- Increased social tension and conflict
- Changes in trade patterns and economic impacts
- Increased rates and wider geographic spread of diseases, and declines in human health
- Loss of sources of income and increased poverty or diminished well-being
- Decreased physical security and possible growth in crime
- Displacement and increased migration
- Loss of land and cultural and natural heritage

According to the IPCC definitions, a hazard is "the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources" and vulnerability is "the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected." In ranking risks, the IPCC considers the hazard and the vulnerability of the exposed society or systems, and applies the following criteria:

- Magnitude
- Probability that significant risks will materialize and their timing
- Irreversibility and persistence of conditions that determine risks
- Limited ability to reduce the magnitude and frequency or other characteristics of hazardous climatic events and trends and the vulnerability of societies and social-ecological systems exposed

The examination of climate change as an additional stressor also considers the adaptation capacity of the countries and the region as a whole, and includes evaluations of financial and institutional capacities, regional co-operation processes, resilience and national climate change policies and plans.

1.1.5. Climate change and security hotspots

In this report, climate change and security hotspots are areas with ongoing tensions or environmental concerns where climate change is expected to undermine social or economic stability, threaten infrastructure or livelihoods, or compromise security by exacerbating political or social tensions, conflicts or instability.

Defining climate change and security hotspots

This project identifies and assesses climate change and security hotspots across Eastern Europe, Central Asia and the Southern Caucasus. These hotspots are identifiable in geographic terms, and are characterized by ongoing tensions, environmental concerns or both. In each of these hotspots, climate change through one or more pathways is expected to undermine social or economic patterns, threaten infrastructure or livelihoods, or compromise security by exacerbating political or social tensions, conflicts or instability. Areas with weak institutions or lacking the effective mechanisms for transboundary environmental and security co-operation are especially vulnerable.

The analysis of hotspots, which has been discussed with stakeholders in the countries during several consultations, recognizes the value of natural resources both economically and in terms of security, and considers the tensions associated with the value of resources. Such tensions may arise from criminal activity conflicting with legitimate uses or from questions of who can use a resource, and how. How climate change may affect these situations is of particular interest.

The identification of hotspots started with a review and analysis of existing information on environmentally sensitive areas. The sources included the Environment and Security Initiative assessments in the region, national communications, international studies on climate change and security and interviews with national and regional experts. Stakeholders at national and regional consultations reviewed the initial designations, and refined the assessments.

The hotspots included here reflect the judgement of the project analysts and the stakeholders, informed by the following considerations:

- Existing or prospective vulnerability to climate change
- Existing instability or security risks
- Analytical conclusions regarding the connections between climate change and security
- Other existing political, socioeconomic and environmental factors

1.2. Phase 2: National and regional consultations

A series of multi-stakeholder national meetings in each of the five Central Asian countries to discuss and complement the preliminary findings of the assessment followed a participatory approach that ensured that the voices of key-stakeholders including CSO representatives were heard. The participants in the meeting comprised experts from various ministries or other national institutions, academia, non-governmental, regional or international organizations.

Work sessions in the meetings focused on country-specific issues raised by background papers and expert presentations. Discussions concentrated on the relationship between climate change and security, and on how that relationship is playing out in the country.

Participatory mapping exercises supported the identification of vulnerable areas. The perception of risk from the country perspective is an integral part of this determination, as are national political sensitivities. The participatory mapping process accounts for these national views in a way that a vulnerability assessment based on a desk study alone cannot.

The regional consultations brought together experts from the region as well as policymakers and representatives of the ENVSEC organizations. These consultations attempted to reconcile national perceptions of climate change across the region, and to identify regional commonalities and differences. The goals were to try to reach agreement on what the problems are, to combine the national assessments into a regional synthesis assessment and to identify the issues that require a regional approach.

An ENVSEC regional co-ordination meeting for Central Asia took place on October 6, 2015, in Bishkek, Kyrgyzstan, and was hosted by the Government of Kyrgyzstan and UNDP. Participants, representing Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, including Governments, representatives of civil society, academia and ENVSEC partner agencies (UNDP, UN Environment, OSCE, and UNECE) attended and actively participated in the meeting.

During this meeting priorities for future regional co-operation and partnerships within and beyond the ENVSEC platform to enhance work in the area of environment and security, disaster risk reduction as well as climate change and related areas were discussed. The outcomes of this meeting are partly reflected in this assessment as well.

1.3. Phase 3: Joint analysis

In developing the regional synthesis report based on the preliminary assessment and the multi-stakeholder consultations, ENVSEC takes account of international knowledge, practitioner expertise and available technologies; incorporates the national concerns expressed by the countries; and seeks a regional consensus on hotspots.

1.4. A note on the limitations of the methodology

The assessments here rely heavily on the available data and on the findings of assessments or studies conducted by other organizations and institutions. Where possible, national stakeholders verified the data during the consultation process. Climate change and security risks are based in part on perceptions and on climate change scenarios, both of which tend to be uncertain. The analyses may be limited by weaknesses in the data and uncertainty in the projections.

In addition, identifying geographic hotspots in some areas and presenting the security implications in a neutral manner can sometimes be a challenge for the international community. In this regard the climate change and security assessment may not report fully on the details of those regions that are experiencing protracted conflicts or that are very sensitive about certain areas, issues or resources.

2. EXISTING POLITICAL, SOCIOECONOMIC AND ENVIRONMENTAL CONDITIONS

This chapter surveys the underlying socioeconomic, political and environmental conditions in the countries and the region as a whole, and examines the range of factors that may influence the interplay of climate change and security.

2.1. The geopolitical situation and broad security influences

The decline of the Soviet era and the beginning of independence in Central Asia featured significant socioeconomic changes, social protests and sporadic outbreaks of local riots and violence throughout the region, including the well-known disturbances in the Ferghana Valley in 1989, 1990, 2005 and 2010. Episodic tensions and clashes have continued in some near-border locations, especially in enclaves. Among the countries of Central Asia, Turkmenistan has alone avoided episodes of domestic and regional insecurity both recently and over the years since independence. All of the other countries have experienced violence ignited by various factors, extremist attacks and other unrest.

Most of the instability has occurred in the mountainous countries, including civil war in Tajikistan and successive revolutions in Kyrgyzstan accompanied by violence and unrest. These regions are the sources of most of the water available downstream in the Syr Darya, Amu Darya, Zaraf-shan and Chu-Talas Rivers. To some extent, instability in these countries could affect the management of water resources. Some social disturbances have occurred in relation to the energy and mining sectors near the Caspian Sea area of Kazakhstan and in Kyrgyzstan.

With independence came rising sensitivities related to national boundaries and the development of more border restrictions – customs, immigration and security checkpoints. The installation of border fortifications and physical borders constrained the movement of goods and people, and resulted in an increase in border incidents. In some areas, barbed wire or border trenches separate friendly states. Figure 1 shows the locations of valuable natural resources and conflicts.

Valuable natural resources and conflicts

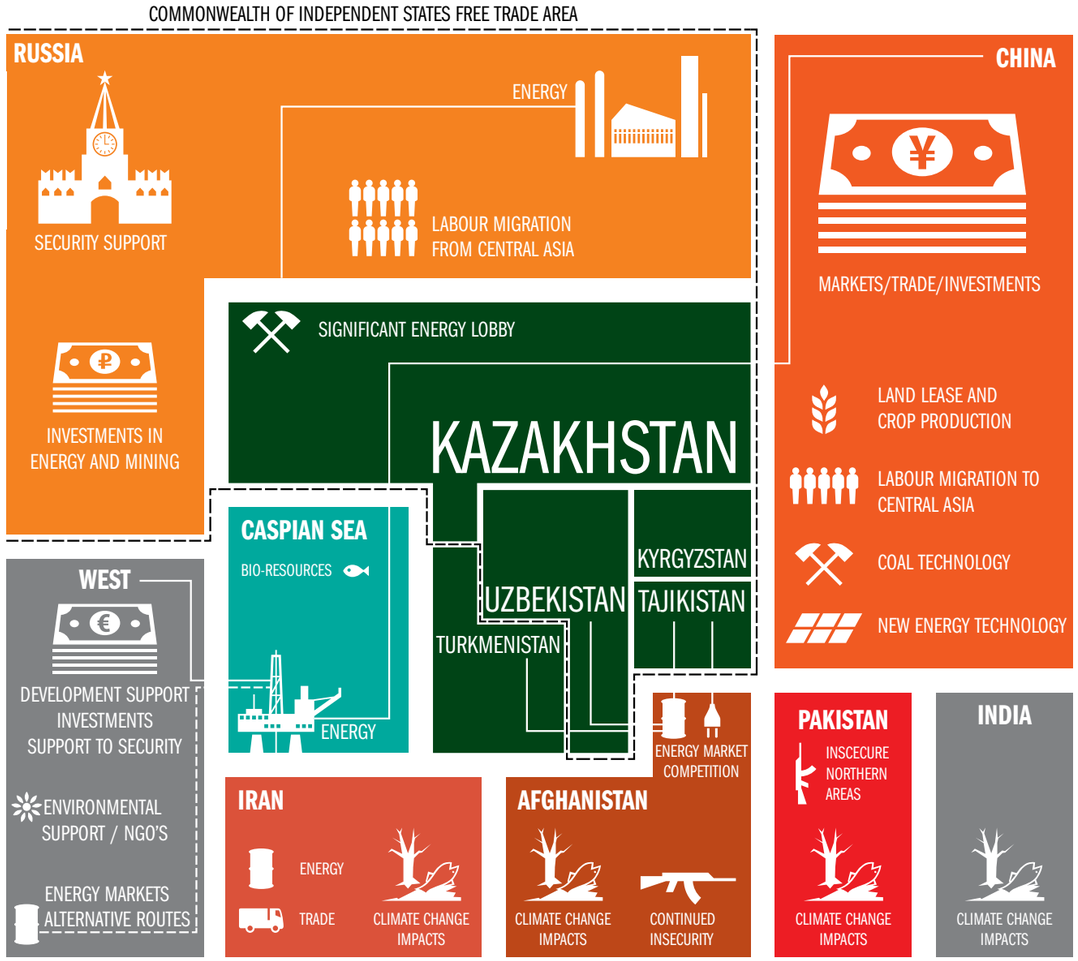
- Social conflicts, acts of violence and skirmishes
- Major energy producing areas
- Disputes over industrial pollution
- Concentration of high-value commodities (gold)
- Syr Darya — Cross-border water resources tensions
- Kyrgyzstan — Nature resource disputes
- Rogun* — Contested hydropower projects
- Disputes with transboundary component
- Suspected routes of drug smuggling
- International borders
- Disputed borders
- Geopolitically unstable areas
- Kyrgyzstan: local resistance to mining across the country

0 200 km

Map produced by ZOÏ Environment Network, August 2016.
Source: Compilation of experts' opinion and analysis

Figure 1: Valuable natural resources and conflicts

Central Asia's neighbours – Russia, China, Afghanistan and Iran – all potentially affect the political, economic, environmental and security conditions in the region. Each of the countries has its own security agenda, and border control and terrorism are prominent concerns. Russia and the countries of Central Asia have common military security interests, but after the fall of the Soviet Union, Russia gradually reduced its presence and military assistance along the Afghan border. Recently, the role of the Russian military forces increased in relative importance. Figure 2 provides a graphical depiction of the regional influences at work in Central Asia.



Geopolitical influences on Central Asia in the context of climate change and security

Cartogram produced by Zoï Environment Network, August 2016.

Figure 2: Geopolitical influences on Central Asia in the context of climate change and security

In the southern region, three countries of Central Asia – Tajikistan, Uzbekistan and Turkmenistan – border on Afghanistan. The Afghan side of the 740-kilometer Turkmen-Afghan border lies predominantly in sparsely populated deserts, and has recently experienced a growth of radicalized and extremist groups. Authorities in both countries intend to enhance security in this area. The presence of rebellious groups (the Islamic Movement of Uzbekistan) in this area of Afghanistan, where shared ecosystems support local livelihoods, raises the importance of the connection between environment and security. In addition, this area may figure in Turkmenistan's plans to develop gas pipelines for destinations via Afghanistan to Pakistan and India (TAPI). Border insecurity could jeopardize or delay these economic developments. In November 2015, the President of Turkmenistan launched the construction of TAPI with departure point at the country's largest natural gas field, Galkynysh. The length of TAPI is estimated at 1 800 km with an annual capacity of 33 billion m^3 of natural gas. Also in 2015, the leaders of the countries visited each other's states and discussed the topics of socioeconomic co-operation and security enhancement.

Uzbekistan maintains high security standards along its 137-kilometre border with Afghanistan on the Amu Darya River, and is capable of preventing the intrusion of militants and illegal migrants from Afghanistan. The countries maintain good co-operation on transport, trade, economic and energy issues, but only limited co-operation on environmental protection, shared water ecosystems and resources, and climate change and extreme events.

The 1 340-kilometre Tajik-Afghan border area, in contrast, is located in the mountains with many villages scattered on both sides of the upper Amu Darya/Panj River, and is a security concern of Central Asia (Zarifi, 2011; CSTO, 2013). Mountain border areas are difficult to control, and over many years some mountains have harboured illegally armed groups. The geographic isolation, high poverty and unemployment rates, high prices, and energy and food insecurity in the mountains create room for social dissatisfaction (University of Central Asia et al., 2012).

In Tajikistan, achieving peace and stability after a period of internal conflicts in the first years after independence eased social problems and assisted in the reduction of tensions. Inadequate energy and food security remains a priority of the government.

In multi-ethnic piedmont regions of the Ferghana Valley, especially in border areas and enclaves, the general tolerance sometimes unravels in the face of the perceived or actual inequitable distribution or use of scarce resources. Grievances related to the use of local land and water resources give rise to tensions and other hostilities. Fortunately, arguments and incidents that have arisen have remained local and not escalated into interstate disputes (ENVSEC, 2005; Eurasianet, 2014).

Inadequate security measures along the Afghan border led to increased risks – drug trafficking and the intrusion of militants – but joint efforts by the Afghan International Security Assistance Force and the Collective Security Treaty Organization in Tajikistan have improved border security. Drug trafficking and instability in Afghanistan remain problems in the area (CSTO, 2013).

According to a recent IPCC assessment, Afghanistan, Iran and other countries of South Asia are likely to experience dry climate, higher temperatures and poor harvest years, which in the worst-case scenario may lead to large-scale displacements (IPCC, 2014). In addition, El Niño effects may cause extreme climate and weather conditions such as severe drought.

Military withdrawals from Afghanistan are likely to create security and stability challenges in the region, especially in the countries of southern Central Asia. In addition, some densely populated areas of India and Pakistan are expected to experience higher temperatures and drier conditions. This added stress could also affect security and stability, especially in areas where tensions already exist, and any resulting economic or political instability could echo in the southern areas of Central Asia, or even in the entire region.

In 2010, Afghanistan and Tajikistan signed a bilateral agreement and, with the assistance of UNECE, OSCE, the Russian Federation and Finland, are taking part in environment protection and hydrological monitoring in the upstream basin of the Amu Darya River. They are improving data sharing and discussing common environmental issues and priorities. Development of similar co-operation between Afghanistan and other Central Asia states could facilitate dialogue and reduce risks.

CASA 1000, a major project intended to export surplus electricity from Kyrgyzstan and Tajikistan to Afghanistan and Pakistan, is expected to generate significant revenues for the Central Asia countries. This income may enable the countries to increase their economic capacity and meet their domestic energy needs, and thus to improve energy security. A few transmission lines currently run from Tajikistan to northern Afghanistan, but a full-scale connection to Pakistan needs to cross not only high mountains but also insecure areas of Afghanistan and western Pakistan.

Iran's only common border with Central Asia is with Turkmenistan, but Iran participates in Caspian Sea resource sharing and protection and in trade and energy activities in the region. With the lifting of sanctions in 2015-2016, Iran is likely to become a more active player in Central Asia. Iran is the host country for the Secretariat of the Economic

Co-operation Organization (ECO) – an intergovernmental regional organization of 10 countries extending from Iran and Turkey to Pakistan, and including all Central Asia countries. The purpose of ECO is to promote economic, socio-economic, technical and cultural co-operation and activities in the core business areas of energy, transport and trade and the organization is increasingly incorporating climate change as a priority in its plans. The organization is taking steps to develop environmental and climate change action plans to mitigate climate change and in March 2015 issued the Safranbolu Declaration on climate change.

China and Russia are both trading and political partners of the countries of Central Asia. Wide-scale calamities related to extreme climate events – heatwaves, droughts and exceptional flooding – along with frequent weather abnormalities and warming in the Arctic region, have defined the public attitude towards climate change. In 2010, severe heatwaves and droughts hit both Russia and Kazakhstan, and in 2012, drought hit Siberia. In the summer of 2013 there was a record flood in the Amur River. Russia is now acknowledging that it needs to consider climate change in planning and preparation for extreme weather, and that it needs to strengthen its capacity to respond (ROSHYDROMET 2005, 2008). The climate change doctrine issued in 2009 by the President of the Russian Federation articulates the importance of considering climate change at all levels of decision-making and economic activities.

The Russian interest in the Central Asia energy sector runs in both directions – as a buyer of the region's fossil fuel resources and as a bulk seller and a retailer of refined petroleum products. Russia adds natural gas from Central Asia to its distribution network of pipelines, and assists the region with gas and oil exploration. But high dependency of Russia's economy and budget on energy exports in the light of significant fall of global oil and gas prices has led to major economic crises in 2015-2016, with a deterioration of the ruble exchange rate and job losses. These developments had different effects on the economies of the Central Asia countries, with those who rely most heavily on economic and working ties with Russia the most affected.

China has recently completed construction of two important pipelines to the Caspian region. One supplies oil from Kazakhstan, and the other supplies gas from Turkmenistan. The pipelines lead to western China where episodic riots have occurred, and both the energy security and the economic boom associated with the new pipelines may improve stability in the area by opening an alternative energy supply and by creating jobs. Similarly, the new markets opened by the pipelines may help the Central Asia countries buffer the economic shocks common in the oil and gas industries, improving economic and social security and providing more stability. Diversity in markets generally plays a positive role in economic stability, as more sources and trade relationships provide alternatives when one market experiences a temporary shock or failure. Diversity in food sources, for example, offers protection against crop failures and increases food security. The overall slowdown of the Chinese economy has had an impact on trading and Chinese economic ties and business projects with Central Asia. After creation of the Eurasian Economic Union (EEU) in 2015, and Kazakhstan's and, later, Kyrgyzstan's entering the EEU Customs Union, trading and economic patterns with China and across the Central Asia region were starting to change.

China is increasingly present in the renewable and conventional energy market of Central Asia, and many small and medium scale hydropower stations, wind energy and solar power installations are being built with Chinese investment and technology. The region is also interested in Chinese investments in coal mining and in building coal-fired power plant capacity. There is an interest, particularly in Kyrgyzstan, in China's investments in coal-based cement production. Construction and repair of roads in Central Asia are mainly being done by China.

While not a direct geographic neighbour of Central Asia, the European Union (EU) is an important energy, transport and trade partner with wide policy influence and a strong commitment to responding to climate change. The findings of this EU-funded report will inform the policy direction for subsequent EU involvement in helping Central Asia respond to climate change and security risks, and may provide the basis for future development projects in the region. Recently, the EU decided to allocate 20 per cent of all development project funds to climate-relevant activities, and is interested in low-carbon development and projects to improve resilience. The European Union has played a decisive role in the adoption of the Paris Agreement, and is currently considering plans for climate change co-operation with Central Asia.

2.2 Climate change politics and mainstreaming

None of the Central Asia countries incorporates climate change into its national security strategy or considers it as a multiplier of threats to security.

In the fall of 2015, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan submitted their Intended Nationally Determined Contributions to the United Nations Framework Convention on Climate Change, and through this process elevated climate change discussions to the highest policy levels, culminating in speeches of the heads of states and governments at the COP21 in Paris, France in December 2015.

In the wake of the Paris Agreement, the countries need to specify further climate change actions. Since the estimated cumulative greenhouse gas emissions in 2025 and 2030, as defined by national contributions on a global scale, do not fit into the estimated emissions reduction needed to limit global warming less than 2°C, the countries will gradually revise their contributions, making them more substantial and effective. According to the main provisions of the Paris Agreement, the countries are to improve their systems of monitoring, reporting and verification on greenhouse gas emissions and climate resilience, to develop strategies for low emissions and adaptation, to foster adaptation measures and capacities and to facilitate co-operation at the regional level.

To prevent, mitigate and solve the issues of losses and damage related to adverse climate change impacts, including extreme weather conditions and slow onset events, UNFCCC has developed and adopted the Warsaw International Mechanism on Losses and Damage. This mechanism provides for co-operation on a range of matters – early warning systems, emergency preparedness, slow onset events, insurance tools – and on improving the resilience of communities, livelihoods and ecosystems.

At the regional level, the Climate Adaptation and Mitigation Program for the Aral Sea basin (CAMP4ASB), designed with support of the World Bank, funded by the international climate funds, and executed through the International Fund for Saving the Aral Sea (IFAS) with the Regional Environmental Centre, is expected to become the main regional climate co-operation and policy co-ordination platform in Central Asia, starting from 2016.

As Parties to the United Nations Framework Convention on Climate Change, all Central Asia countries regularly prepare and submit their National Communications, which contain the official information on climate change, pursuant to the requirements of the Convention. So far, all the countries of the region have finished and submitted their Second National Communications to the UNFCCC. Tajikistan and Turkmenistan have completed their Third National Communications, and at the end of 2013, Kazakhstan published its combined Third, Fourth, Fifth and Sixth National Communication to make it possible to synchronize its reporting with other UNFCCC Annex I countries. Before that, Kazakhstan's reporting and convention requirements were similar to those of other Central Asian states, but since receiving a special status in UNFCCC to the Kyoto Protocol the reporting requirements have changed.

Kazakhstan has adopted an environmental code and a concept for a transition to a green economy in addition to pioneering emissions trading in the region. The country also provides subsidies for renewable energy and tax rebates for energy efficiency and special tariffs for renewables. Since changing its UNFCCC status, Kazakhstan has stood out among other Central Asia countries in relation to policy and climate-related activities and international attention.

Kyrgyzstan's climate-related activities include a national strategy for sustainable development 2013-2017 and national strategies, programmes and laws for improving energy efficiency and renewable energy and climate adaptation. The country has established a high-level inter-agency Climate Change Co-ordination Commission on climate change, with a climate-related network of non-government organizations.

Tajikistan has adopted a national climate change mitigation action plan and a national climate change and health strategy. In 2015, the country developed a national adaptation strategy and a national sustainable development strategy, approval and implementation of which are expected in 2016. Other climate-related national initiatives include national programmes on glaciers, energy efficiency, small-scale hydropower, disaster risk reduction and forests. Recently Tajikistan has developed, but not yet adopted, an environmental code. The current draft version does not consider climate-related issues.

In Turkmenistan, the National Climate Change Strategy lays out the policy framework for building climate resilience and a low-emission economy. Turkmenistan has initiated policy documents and projects that aim to improve its agricultural and forest management practices, advance socioeconomic reforms and modernize industry and the energy sector.

Uzbekistan is the region's leader in Clean Development Mechanism (CDM) projects, and foreign investments in emission reductions and solar energy development. The governmental authority for natural resources protection and the national hydrometeorological service are well versed on climate change issues, and collaborate on climate policy initiatives and projects, including with the Ministry of the Economy and other agencies in the development of a low-carbon development strategy. Major investments are planned to solar energy development and improving energy efficiency in the residential sector.

2.3. Governance

Most countries of Central Asia are members of intergovernmental organizations dealing with climate-relevant, environment and security issues, including OSCE, the Collective Security Treaty Organization (CSTO), the Hydrometeorological Council of the Commonwealth of Independent States, The World Meteorological Organization (WMO), the International Fund for Saving the Aral Sea and the Economic Co-operation Organization. These organizations provide co-operation opportunities on climate change and a broad range of security issues, and establish common governance principles. Each country has specific governance models and practices.

A country's planning and governance is a critical factor in its capacity to respond effectively to climate change. The Worldwide Governance Indicators (WGI) project compares the countries of the world against each other, and reports the rankings. The World Bank applies these indicators, among other factors, in the development of its adaptive capacity index – an attempt to quantify and summarize a country's potential to respond to climate change. The IPCC (2007) reports that, "The specific determinants of adaptive capacity at the national level…represent an area of contested knowledge," but says that, "Some studies relate adaptive capacity to levels of national development, including political stability, economic well-being, human and social capital and institutions."

The 2014 WGI rankings for Central Asia vary by selected indicators and by countries. Also, there may be significant differences in the same indicator for one country from year to year. Turkmenistan and Kazakhstan rank the highest in the region (48th percentile) in political stability, while the lowest stability is attributed to Kyrgyzstan and Tajikistan. Kyrgyzstan leads in voice and accountability (30th percentile). In all other indicators, Kazakhstan ranks highest in the region, including government effectiveness (54th percentile), rule of law (34th percentile) and control of corruption (26th percentile). The higher the ranking, the better the performance and quality.

The centralized decision-making and leading role of the governments and their leaders generally favoured by the Central Asia countries sometimes is a pillar for their stability and government. This approach, however, does not always take into account the local potential and capacities to conduct climate-related and environment activities. In the capital cities the central authorities and experts may have a better understanding than local officials of the countrywide picture and the threats associated with climate change, but the laws, strategies and plans they develop may overlook local specificities due to the size of the territories and the differences in physical and economic geography, among other reasons. Civil society players, especially environmental non-governmental organizations (NGOs) in Kazakhstan, Kyrgyzstan and Tajikistan are currently helping to bridge this gap in knowledge and skills at the local level, and are mobilizing resources to take local climate or environmental actions.

In Kyrgyzstan, the Central Asia country with the most decentralized government, Parliament plays an important role in governance, and the ministries routinely consult with public advisory councils to listen to the ideas and concerns of citizens and NGOs. In Kazakhstan, the introduction of e-governance and public services has provided the citizens with a greater access to climate information and decision-making, and has opened the opportunities for members of the public to express their opinions. In all Central Asia countries, the hydrometeorological services play the major role of forecasting and providing information on extreme weather and climate events.

2.4. Social dynamics

The examination of social dynamics in the region facilitates an understanding of the human capacity for dealing with climate change impacts, and for the insecurities and challenges these impacts may cause. Knowledge of education levels, the percentage of employed and unemployed, the distribution of wealth and income, and vulnerable groups based on age or gender can guide policy makers in identifying the scope of adaptation measures that may be necessary and that are feasible. Future projections compared to the current situation will also help estimate what contribution could be expected for adaptation.

Central Asia is home to more than 65 million people (UN DESA, 2012; national population estimates, 2015). Most are young and living along the main rivers or oases. The population has been growing at a rate of 1.3 per cent to 2.4 per cent per year, with Tajikistan exhibiting the highest growth rates. By 2050 the population in the region may approach 85 million (UN DESA, 2012).[1]

The Ferghana Valley has the highest rural population density in Central Asia ranging from 300 to 660 people per km^2. The piedmont areas in the south-eastern parts of Central Asia are also densely populated. Deserts in the interior of Central Asia and along the eastern Caspian are among the least populated. With the demise of the Aral Sea and the diminished capacity of the Caspian Sea to support fisheries, the coastal populations declined, but the booming oil and gas industry is reinvigorating communities in the Caspian area (ENVSEC, 2008, 2011).

1 See also: http://www.census.gov/population/international/data/idb/informationGateway.php

The agricultural areas include fertile mountain valleys and mountain areas in Tajikistan and Kyrgyzstan, and lowland oases, river valleys and deltas in Kazakhstan, Uzbekistan and Turkmenistan, and vast steppes of northern Kazakhstan. Nomads work in the high mountains of Kyrgyzstan, the deserts of Turkmenistan and the deserts and steppes of Kazakhstan pursuing a centuries-old lifestyle reshaped by modern conditions in the Soviet era and reflecting present-day realities. The Ferghana and Zarafshan Valleys are a mix of urban and rural population and lifestyles. Figure 3 depicts the migration patterns in the region in recent years by type of migration.

Migration and displacement

Migration

- Osh — Migration into cities
- Local and international migration to oil and gas production areas (workers, engineers)
- Environmental migration
- Complex ethnic interaction in the Ferghana valley
- Labour migration: mainly 2001 - 2014
- Other migration: mainly 1991 - 2000

Languages

- Russian
- Kazakh
- Uzbek
- Tajik
- Kyrgyz
- Uighur
- Ukrainian
- Karakalpak
- Other
- German
- Korean
- Chinese
- (1) Minorities in the Pamirs: Yaghnobi, Bartangi, Shugni, Ishkashimi
- Sparsely populated areas
- International borders
- Disputed borders

0 200 km

Map produced by ZOÏ Environment Network, August 2016.
Source: Compilation of experts' opinion and analysis

Figure 3: Migration and displacement

2.4.1. Socioeconomic migration

In the 1990s, the ethnic migration saw the regular outflow of the population from the region. In the early 2000s, the economic boom in Russia and Kazakhstan was accompanied by huge labour migration from poorer countries of Central Asia and increase in inner urbanization. These types of migration are likely to continue in near future, and some portion of labour migrants can settle permanently and relocate their families.

Remittances from labour migrants account for a significant proportion of national incomes and external investments in the isolated mountain countries, especially in Kyrgyzstan and Tajikistan, and improve economic security in the short run (ILO, 2010). Tajikistan is often in the top ten countries relying on remittances from abroad – more than US $3.0-3.5 billion per year in 2012 and 2014. In 2013, remittances amounted to 50 per cent of the country's gross domestic product (GDP), making Tajikistan the country most dependent on remittances in the world (World Development Indicators, 2015; World Bank, 2015). The share and overall amount of remittances in Kyrgyzstan is lower, but still significant – almost 30 per cent of GDP.

As a result of economic stagnation, inflation and currency depreciation in Russia since August 2014, remittances from Russia to both Tajikistan and Kyrgyzstan have declined by as much as 40 per cent. Job opportunities declined, and a number of labour migrants could not find employment. Such reductions in remittances to both countries and the limited job opportunities may be reflected in the socioeconomic conditions in the home countries.

Statistics for 2016 have not been published yet, but overall monitoring, price indication and media coverage suggest worsening conditions. In 2015, reduction in labour migration amounted to 18-25 per cent (national reports and WB estimates) resulting in return of many unemployed migrants, labour market stress and, finally social pressure.

In theory, labour migration may reduce the reliance on natural resources in the home countries of the migrants, and may therefore make the countries less vulnerable to climate change, but the system is less than ideal. Reliance on remittances comes with the social instability associated with separated families – particularly the added pressure on women left behind – and the opportunities to work in another country depend on that country's economic and labour conditions and on its immigration policy (OSCE ODIHR, 2012). The loss of skilled workers is another cost of migration, and some areas have yet to replace the experts and managers – key contributors to successful reform – who left soon after the Soviet collapse.

Disruptions in labour migration accompanied by worsening climate conditions in areas that are dependent on migration and external sources of support – mainly Tajikistan and Kyrgyzstan – are likely to increase vulnerability. The current volatile situation in the Middle East shows how severe climate events can contribute to growing socioeconomic and political tensions that ultimately resulted in a massive exodus of refugees to neighbouring countries and Europe.

In Central Asia, immigration and foreign labour are associated with the development of trade, industry and energy sectors. As noted by the International Organization for Migration China's economic expansion and the recovery of relations with its ethnic minorities – the Kazakhs, Kyrgyz, Tajiks and Uzbeks – were the cause of increasing immigration from China to Central Asia (IOM, 2015). Since 2011, Kazakhstan has issued more work permits for Chinese labourers than for any other group. In Kyrgyzstan and Tajikistan, Chinese immigrants have found work in trade and construction, respectively.

Several thousands of ethnic Kazakhs who had moved to China, Mongolia or elsewhere during the Soviet era of political repression, famine and agricultural collectivization at the beginning of the twentieth century are returning to Kazakhstan. Kazakh authorities refer to these returnees as "Oralman" and support them through social integration programmes, and by providing housing and financial assistance to start new businesses.

During famine, drought and instability, some Afghan people found shelter and refuge in the border areas of Central Asia, Pakistan and Iran, but many later returned to their home countries. The precarious current situation in Afghanistan, coupled with the impact of severe weather events and long-term climate change, may again force some ethnic groups associated with Central Asia (Tajiks, Uzbeks, Kyrgyz, Turkmen), residing in the border areas to emigrate to safer places.

2.4.2. Urbanization

Urbanization is seen as a way to make the access and use of resources more efficient by reducing transport and delivery costs. The trade-off is that urban residents are almost fully dependent on urban authorities for the delivery of public services such as drinking water supply, waste water disposal and energy supply, and can lack resilience when these services fail or degrade. The growth of urban areas in Central Asia can put significant pressure on these public services. Maintaining them in the face of increasing demand stresses governments while upgrading these services requires significant long-term capital investment that may be beyond the means of local governments.

The impact of seasonally harsh weather and long-term changes to climate can mean that a slow degradation or outright failure of urban services will place large numbers of people in disastrous conditions where quick-fix relief will be insufficient. An example would be a heatwave affecting a city with a contaminated water supply where overall supply already falls short of demand.

2.4.3. Environmental migration

Climate change is likely to affect different populations and areas in specific ways. The effects will vary by location, and according to the specific sensitivities of the affected communities. Similarly, the ability of communities to respond to climate change and to cope with the consequences will vary by each community's specific political, economic, environmental and social circumstances and where the ability of communities to respond is low may cause environmental migration. The migration policies in the future may significantly influence security, but the range of possibilities is wide: restricted migration would likely increase domestic economic and environmental pressures and instability, and more open migration would likely have the opposite effects.

In recent years, Central Asia has experienced several waves of migration and temporary displacement. Water deficits and drought in the Aral Sea region in the 1990s and again in 2000 and 2001 displaced many people (UN Environment and ICSD, 2006). The hardest hit area was the Amu Darya River delta (ENVSEC, 2011). Most people eventually returned to their original homes, but many are considering permanent migration (UNESCO, 2013). In the 1990s, former highland migrants to the lowlands (forcibly resettled by the Soviet authorities to support agricultural development projects) reversed course and returned to the mountain areas they had left, and are now exposed to natural hazards that are not present in the lowlands (University of Central Asia, 2012). The authorities consider most affected mountain dwellers to be "ecological migrants" and assist them in construction of houses and starting up businesses in safer locations.

An environmental migration from a semi-desert area in eastern Kazakhstan resulted from the radioactive contamination at the Semipalatinsk Test Site where the Soviets exploded nuclear bombs over the course of four decades. This previously restricted area was declared an environmental disaster zone at the end of the Soviet era, and the population fled in fear of radiation. The site was closed on 29 August 1991 by the decision of President N. Nazarbaev, and the clean-up and rehabilitation continues. The nuclear arsenal of Kazakhstan has been dismantled and, apart from environmental and safety considerations, this step was crucial in the global security and non-proliferation agenda. According to official estimates (President of Kazakhstan, 2009), the Semipalatinsk site affected 1.3 million people of several generations, a number that is probably comparable in scale to the Aral Sea crisis.

2.4.4. Religion

After independence the state authorities adopted a laissez-faire attitude toward religion, and Islam – the most practiced religion in the region – grew and expanded over time (Munster and Bosch, 2012; CORE IFSH, 2012). Islamic practices in Central Asia range from the traditional to the modern. Islamists were not the only religious group to express the desire to incorporate religious principles into governing, but after its civil war, Tajikistan became the first and only country in the region with an Islamic political party officially registered and active until 2015 (Munster and Bosch, 2012; CORE IFSH, 2012).

With Central Asia becoming open to the Islamic world, radical Islamists saw the opportunity to influence the region. The rise of radical movements has led to outbreaks of violence in some places (Munster and Bosch, 2012). Because of Afghanistan's proximity, extremists hiding there have been able to promote opposition, particularly in the years of civil unrest and limited control. The threat of fundamentalism remains among the common regional security concerns expressed by the Central Asian countries (Munster and Bosch, 2012; Zarifi, 2011; CORE IFSH, 2012; BBC News, 2013; Mamyrayimov, 2013).

2.4.5. Education

A relatively well-educated Central Asia population is one positive legacy of the Soviet era, and even today the literacy rate in the region is comparable to those in countries with developed economies. But public expenditures for education are lower since independence, and the education system has deteriorated. While the number of students and universities has grown in recent years, the quality of instruction, especially in the natural sciences and engineering, has declined (University of Central Asia et al., 2012). In the mountain countries, the awareness of climate change and other environmental issues may be insufficient because of inadequate education.

Resilience to extreme weather and climate change at the household level is related to income and education, and those households with sufficient incomes and educations are likely to be better prepared for any climate shocks. In addition, income from diverse sources adds to economic resilience by protecting households from the loss of income from a single source (World Bank SDU SDN, 2011). Education and knowledge help communities and citizens find solutions and alternate sources of income, and a certain level of knowledge is essential to the implementation of appropriate technologies to respond to climate change.

2.4.6. Poverty and welfare

Economic recession in the early years of independence after the collapse of the Soviet Union led to levels of poverty

in the mountain countries as high as 75-80 per cent (UNDP Kyrgyzstan, 2002; UNDP Tajikistan, 2012; UNECE, 2013). Donor support was critical at the peak of the poverty and humanitarian crisis, especially in the Tajik Pamirs, and poverty levels have declined dramatically. Poverty levels in Tajikistan, which remains the most impoverished country in the region, fell below 35 per cent by 2014 (World Bank, 2015).

Poverty rates in Tajikistan are highly seasonal (World Bank, 2015), and can vary significantly for several reasons. In rural areas, agricultural yields determine household income to a large extent. During harvest, there is more work and income for those who produce and sell agricultural products. Work and income outside the agricultural sector also vary seasonally; for example, remittances significantly increase in summer and autumn.

The Kyrgyz poverty level varied with the economic crisis and political disturbances – from 32 per cent in 2009 up to 38 per cent in 2012 (UNECE, 2013), and down to 30 per cent by 2014 (National statistics, 2015). In some areas, such as Batken and Dzhalal-Abad provinces, the poverty level is 45-50 per cent. Trade has come to a standstill at the largest country's market, Dordoi, which provided thousands of jobs, as a result of a number of factors in 2015 and 2016: joining the EEU, the deep economic crisis in Russia and Kazakhstan, the fall in global commodity prices and the growth of customs duties on goods from China, among others. Garment exports have fallen by 40 per cent hitting hard the most important source of jobs for women (National Statistics, 2015).

Poverty levels in Kazakhstan and Turkmenistan are below 5 per cent (UNECE, 2013).[2] Unemployment remains a problem, and many farmers and pastoralists migrate to find work abroad or in large cities. In Uzbekistan, 15 years ago poverty levels were at 27 per cent, but according to 2010 UNDP estimates, the rate fell below 20 per cent. Some people in Uzbekistan resort to labour migration to supplement their family incomes.

2.5. The economic situation

The countries economic conditions are among the most important determinants of their financial capacities to address climate challenges, to adapt their affected sectors to new circumstances, and to maintain a path to a green economy via economic modernization, and thus to reduce their contributions to global climate disruption.

Shocks and overall economic decline characterized the first decade of independence in Central Asia. The following decade, when the countries of the region were beginning to find ways to move forward, coincided with a global economic boom. The countries rich in fossil fuels benefited from growing demand and expanding manufacturing, while the other countries pursued new opportunities for labour migration and trade and services.

Central Asia's abundant natural resources are the foundation for the region's most important economic sectors. Rivers provide for hydropower development in the mountains, and for irrigated agriculture in the lowlands. Rich oil and gas reserves fuel the economies in lowland countries, and the mining sector is developing the vast mineral deposits that occur throughout the region. The exploitation of these natural resources without regard for environmental consequences has led to degradation, conflict and ecological catastrophes. The continuing reliance on these resources for economic and social stability is gradually shifting to an environmentally responsible approach, but the added pressures of climate change and a growing population complicate the situation.

The worst example of economic development, which has led to the environmental crisis and the impact on regional climate, is the disappearance of the Aral Sea as the result of withdrawals of large amounts of water for irrigation. A different approach and resource-saving technologies could have avoided this catastrophe.

During the economic decline in Central Asia during the 1990s – as has occurred elsewhere in recessions – greenhouse gas emissions declined. As the economies have recovered, growth has favoured less heavy industrial development. Emissions in low-carbon economies, such as in Kyrgyzstan and Tajikistan, have remained generally low and stable.[3] In Uzbekistan in the years since independence the gross greenhouse gas emissions remained almost unchanged with the economy and the population growing.[4] In Turkmenistan greenhouse gas emissions have increased due to growth in gas production and exports.[5] Most countries of the region have capitalized on the unintentional reductions to become good performers with respect to emissions in relation to output and population, but Turkmenistan and Kazakhstan greenhouse gas emissions per capita exceed the average global figure (World Development Indicators, 2015).

While the countries want to diversify and reduce their reliance on fossil fuels, the presence of subsidies and the absence of incentives inhibit progress, and the current economic realities do not favour a substantial reduction of climate change impacts. Those countries that intend to develop green economies and low-carbon industries face some challenges, the global recession among them.

The regional leaders in renewables, apart from hydropower, are Kazakhstan, with a focus on wind energy, and Uzbekistan, with a focus on solar energy.

Countries and communities have demonstrated that they can adapt to natural gas deficits and irregular supplies by resorting to coal or bottled gas and other traditional local fuels – dung brick fuel and fuelwood – but such conversions may entail complicated changes to technology and systems, especially in industries, and have an impact on the environment, health and climate.

Recent changes in global demand for and availability of fossil fuels, especially oil, affect the fossil fuel exporters and importers in Central Asia. The 2014-2015 drop in global fossil fuel prices reduced the income for several Central Asia states, especially Kazakhstan, and may reduce the ability of these governments to deliver social and economic benefits. But the knock-on effects for neighbouring countries of Central Asia that do not depend on oil and gas exports, such as Tajikistan and Kyrgyzstan, are also significant. Lower global prices for gas and oil have not led to increased growth in countries with net fossil fuel imports due to other factors such as declines in the value of the Russian rouble and in remittances, the increase in consumer prices and a decline in auto imports, among others.

The basic issue is not changes in fossil fuel prices per se, but the lack of predictability of the changes and the knock-on effects. In the current context, Central Asia is suffering from lower fossil fuel prices, economic challenges in Russia, disruptions in remittances and changing trade patterns. The Central Asia countries are dependent on external markets and vulnerable to market stresses, and have yet to develop natural resource management strategies that account for economic developments, including consumer shifts to more sustainable energy sources and long-term projections of low oil and gas prices.

The mining sector in the region is relatively small in terms of workforce size, but generates significant tax revenues. The fact that the central governments take most of these tax revenues could be a source of tension with the locals. A series of changes in the operators of the mines, and local perceptions of broken promises, dubious hiring practices, compensation inequities and environmental damage have all hardened resistance to mining ventures, especially in Kyrgyzstan (Bogdetsky et al., 2012). The melting of glaciers and permafrost in the mountains is complicating the infrastructure and waste management requirements of mining operations located there (Torgoev, 2013; Aleshin and Torgoev, 2015). For Kyrgyzstan, and in the long term for Tajikistan, the mining industry and ferrous metals are as important as the oil and gas sector in Kazakhstan and Turkmenistan, and their development will largely determine both the economic prosperity and environmental balance.

2.6. The availability and condition of natural resources

Natural resources such as land, water and biodiversity are essential for livelihoods. Their equitable and sustainable use is a precondition for the peaceful coexistence of communities and for national security. Scarcity, degradation or over-exploitation of natural resources can, however, lead to tension or impede important economic activities such as agriculture. Climate-induced degradation of natural resources in combination with unsustainable management may increase the overall risks to security and stability.

Central Asia boasts diverse physical, geographic and economic conditions. The northern part is mostly grasslands and steppes that have been partly converted to croplands in the middle of the twentieth century. Now they serve as the breadbasket of Kazakhstan and the region as a whole, including Afghanistan. The southern part of the region is the hottest and driest, and here crop production relies on irrigation water. Smaller pockets of rain-fed agriculture appear in and near the mountains.

Water is the region's most precious resource, and Central Asia has long depended on irrigated agriculture and soil moisture for much of its food and fibre production. Wasteful water use practices and overuse of pesticides and mineral fertilizers – legacies of the Soviet era – continue to cause problems today. A high proportion of irrigation water is still being wasted: some drainage water flows into the desert and evaporates, and some returns to the rivers carrying significantly higher than natural salinity. The irrigation system thus takes fresh mountain water and renders it unfit for use without filtering.

Most wildlife management and conservation areas are the responsibility of the states, but there are some private hunting areas. Many protected areas have low economic value, but their sheer size and the importance of the ecosystem services they provide make the condition of these areas an important consideration in the context of climate change mitigation and adaptation. In some instances, the use of the land or water for biodiversity conservation may conflict with other prospective uses, especially mining and energy production. The increase in size and diversity of protected areas across the region is a positive trend and contributes to ecosystem resilience in the face of climate change. Figure 4 provides the details.

2 See also: http://mdgs.un.org/unsd/mdg/Data.aspx
3 Second and Third National Communications of Tajikistan and Kyrgyzstan
4 Second National Communication of Uzbekistan and Third Communication draft
5 Third National Communication of Turkmenistan

Protected areas and migratory species

Protected areas
Ramsar sites
Reforestation initiatives

Sensitive migratory species

Snow leopard
Mountain sheep (Marco Polo sheep)
Saiga antelope
Caspian seal

Sensitive large lake ecosystems

Stressed water ecosystems of global importance
Endangered water ecosystems of global importance

Figure 4: Protected areas and migratory species

The percentage of forest cover in Central Asia is relatively low – from 3 per cent in Tajikistan to 9 per cent in Turkmenistan – and the lowland forests tend to be sparse while the mountain forests are denser. Most natural forests and plantations remain state owned. Individuals and associations manage a growing number of state-owned fruit and nut forests and plantations through long-term leases from the state. This practice of communal and private forest management has resulted in a boom in fruit and timber plantations, reduced deforestation and increased reforestation, all of which provide the benefits of carbon sequestration. On the other hand, the fragmentation of these areas can occur if leaseholders either fence their areas or cut artificial barriers to secure their holdings, and the conversion of forest lands to other uses remains a possibility.

The importance of mountain regions in the maintenance of natural and agricultural biodiversity is difficult to overstate. The distribution of species by elevation results in a wide range of species and the ecosystems that support them spread across a relatively small surface area. The mountains of Central Asia harbour genetic resources of the wild species of several domesticated plants and animals – wheat, apples, almonds, walnuts and pistachios, and horses, goats and yaks. Still, climate change may alter the agricultural biodiversity of the region.

Scarcity and degradation of resources is a common theme in studies of interactions of climate change and security. This report focuses on mountains and water ecosystems as the most precious resources that evoke the biggest concern in Central Asia with respect to environmental security and future development.

Central Asia as a whole appears on the surface to be well positioned to benefit from global demand for a range of resources, particularly in terms of fossil fuels, water-based energy generation, base commodities such as gold and uranium, and genetic resources to cite a few. However, if demand-driven global scarcities increase resource extraction and exportation from Central Asia, attention is needed to the environmental costs of extraction and to the equity of the distribution of the benefits.

Security-related tensions are likely to increase where increased extraction and exploitation leads to increased harm to the environment, and increased income is concentrated and does not benefit all stakeholders. Disagreements and tensions related to land, water and pastures appear in reports or news more frequently than any other type of natural resource dispute. Other environmental topics repeatedly covered in the news include the extraction of mineral and energy resources, safe waste storage and energy supplies and related deforestation. In some situations, the stress by adverse weather and climate factors serves to exacerbate these conditions.

2.7. Agriculture and food security

During the Soviet era, land was the property of the state, and agricultural production was the work of large collective farms. The Soviets particularly favoured cotton production – which uses large amounts of water – and built huge irrigated infrastructure and set aside vast tracts of lands. A fraction of lands was granted to rural and urban dwellers for use as kitchen gardens for their own benefit. Since independence, Uzbekistan has continued a similar approach pursuing crop diversification and agricultural reforms, though the state still plays a key role in farming and land ownership. In the other countries, market reforms have led to a range of responsibilities for land use and management. All across the region, efforts are underway to improve agricultural techniques for more efficient and sustainable use of land and water resources. Land-use practices for rain-fed crops in northern Kazakhstan have improved (Karabayev, 2012) and Integrated Water Resource Management has been initiated in several areas in the Ferghana and Zaraf-shan Valleys (Dukhovny and Stulina, 2008; Dukhovny, 2008) (See Figure 5.).

Figure 5: Agriculture, fisheries and land use

The large collective farms were reconfigured into smaller units with more individual farmers responsible for their own production. With growing self-determination, farmers have increasingly more say in what and how much to grow, and have to strike a balance between growing crops for cash or for food for their families (University of Central Asia et al., 2012), but lingering legacies of the Soviet system and the nature of land ownership mean that farmers are often still influenced by state policy, in particular when it comes to the production of cotton and wheat. Across the region 50 per cent of the population relies on their own agricultural production for food and income. The selection of crops is a function of the food-or-cash balance, elevation, terrain and climate. One result of the new regime is a narrower range of crops in rotation (University of Central Asia, 2013). In Tajikistan the increase in rain-fed lands designated for food production and the deforestation related to energy shortages have led to an increase in soil erosion in many mountain areas (PALM, 2011; University of Central Asia, 2013). Salinization of irrigated lands poses another major problem for crop productivity and affects the quality of irrigation run-off discharged into the rivers (ICARDA, 2007; ENVSEC, 2011).

In general, crop production in Central Asia has improved and diversified since independence, but agrometeorology services have declined and no longer provide sufficient support for farmers and pastoralists. Previously, farmers and pastoralists relied on agrometeorological and water advice and forecasts in their planning and management – for the timing of planting and the preparation for extreme weather, locust infestations and livestock grazing pattern, for example. The decentralization of agricultural production complicates the situation because now more individuals need the information. The uncertainties associated with climate change, in combination with the lack of agrometeorological and hydrological support, compromise the food and water security of these countries.

The region has achieved a substantial decrease in per capita and per hectare water use, and ongoing water sector reforms and better technologies promise even more improvements (Dukhovny, 2010). But the efficiency of water use in agriculture is lagging behind modern standards and is not sufficient to easily overcome climate change impacts, such as occasional severe droughts, and in the long term, water scarcity. In terms of water sources, the water scarcity index for 1980-2014 has increased for most countries of the Aral Sea basin from low and moderate to high, except for mountain areas rich in water. In the central part of the region, local and transboundary water sources are quite adequate, but the northern and southern regions of Central Asia and the Amu Darya delta experienced water scarcity, and the index has ranged from low to high (Shiklomanov, 2015).

Pastures remain in community or local government ownership, and serve nomadic pastoralists. Immediately after the end of the Soviet era, livestock numbers declined dramatically. High-mountain natural pastures were relieved from overgrazing, while those nearby settlements and in lowlands suffered extra pressure (PALM, 2011; University of Central Asia, 2012).

The livelihoods of many nomads depend on pastures both in the flatlands and in the mountains. The projections related to pastures come with large uncertainties in view of climate change, but in general, summer pastures may become less productive.[6] Winter pastures, however, are already under greater stress, and may experience additional negative effects from climate change.[7]

Many productive agricultural areas in the region are sensitive to the risk of desertification. Droughts, heatwaves and disrupted precipitation patterns all potentially contribute to increasing aridity, and all are likely in a changing climate. Increasing temperatures, higher rates of evapotranspiration and changes in precipitation patterns in northern areas of Central Asia, mainly in northern Kazakhstan, increase the risk of soil dryness and may reduce crop productivity by 30-50 per cent.[8] Such losses in productivity may affect bread prices and undermine food security both in Kazakhstan and in other countries in the region.

Regardless of land ownership in the region, governmental and institutional support for sustainable land management is insufficient to the task. Farmers lack reliable access to water for irrigation and quality seeds, and common grazing lands are overused and depleted. This general absence of capacity for land stewardship adds to the region's vulnerability to climate change. Some areas may benefit from an increase in precipitation, but flood and drought extremes are also likely.

Among the Central Asia states, Tajikistan is the most food insecure, and while the situation has improved over the past 10 years compared to the preceding decade, the Tajik diet is still inadequate in terms of calories consumed and diversity of foods consumed. Children, women and the poor are particularly affected.

2.8. Energy production and security

Both fossil fuel and hydropower energy producers face pressures related to climate change. The global climate change politics focus on reducing fossil fuel emissions, but efforts to reduce emissions may have economic consequences for energy producers. Hydropower offers the potential of meeting the challenge of fulfilling the energy needs at the country and regional levels, but climate change may reduce that potential by disrupting water regimes.

The future of coal is a potentially complicated issue in the region, which is discussed globally. In a keynote address at the International Coal and Climate Summit, UNFCCC Executive Secretary Christiana Figueres highlighted a number of issues related to the use of coal as a fuel, suggested that any strategy to curb greenhouse gas emissions may have economic, environmental and social implications for the coal industry, and called on industry leaders to transform and diversify beyond coal (UN Environment News, 2013). Figure 6 shows the energy sources by type across the region.

6 Second National Communication of Kazakhstan
7 Second National Communication of Kyrgyzstan
8 Second National Communication of Kazakhstan

Energy sources

Fossil fuel as primary energy source

- UZBEKISTAN — Oil and gas
- KAZAKHSTAN — Coal
- Oil or gas pipeline
- Projected oil or gas pipeline
- Oil or gas field
- Coal mining
- Thermal power plant (coal, oil, gas)

Hydropower as primary energy source

- TAJIKISTAN
- Hydroelectric power plant
- Hydroelectric power plant under construction or projected
- River
- Central Asian mountains: considerable unused hydropower potential
- Nuclear power plant
- Projected nuclear power plant
- International borders
- Disputed borders

0 200 km

Map produced by ZOI Environment Network, August 2016.
Source: Compilation of experts' opinion and analysis

Figure 6: Energy Sources

In Kazakhstan, coal is economically important and is a common, affordable fuel for households. Neighbouring countries, such as Kyrgyzstan, are dependent on Kazakh coal imports. On the other hand, modern and cleaner coal technologies and more efficient coal-fired plants and boilers can reduce carbon emissions. Important improvements have already reduced gas flaring in Kazakhstan through adoption of the new legislation and introduction of technologies for waste recycling.

In south-eastern Kazakhstan, growing urban and industrial agglomerations around the city of Almaty and in the Lake Balkhash vicinity are experiencing increasing demand for imported electricity. To tackle energy security concerns in the region, the authorities are actively developing alternative energy sources, particularly wind and solar, and are looking into the construction of a nuclear power plant on Lake Balkhash or the Irtysh River, or the construction of a large thermal power station.

Tajikistan and Kyrgyzstan – the least energy secure countries in the region – import natural and condensed gas and liquid fuels. Families and businesses often resort to local coal and wood, which are also in short supply. Power production has not kept pace with growth in demand, and the countries are no longer self-reliant for power. Their reliance on hydropower as their main energy source demonstrates the vulnerability of dependence on a single renewable energy source that cannot provide smooth, consistent production. A mix of energy sources offers insurance against episodic interruptions – such as the freezing of rivers in extreme cold or low water levels – and may compensate for inadequate capacity. The two countries plan to significantly increase the production of coal and develop coal-fired thermal power plants. Uzbekistan also plans to expand the use of coal for growing energy needs of population and economy, but simultaneously is developing solar energy.

Climate change is likely to become an increasing factor in the countries' energy planning. Long-term projections for water resources are highly uncertain, and extreme weather events, particularly cold and heatwaves and droughts, are increasingly likely to disrupt production conditions. Extreme rainfall and rapid snow and glacier melt events may create engineering problems associated with the protection of crucial infrastructure. All of these potential outcomes have downstream implications, and the downstream countries may push for water management that suits their own needs.

2.9. Water-agriculture-energy nexus

Agricultural land is a key resource throughout Central Asia. Water is also critical, not just for normal human consumption and the sustenance of the natural environment, but also for agricultural and industrial production. Likewise, energy resources are necessary to fuel both economic development and support a comfortable standard of living. This nexus among water, agriculture and energy makes climatic processes and the secondary effects of significant climate events – such as persistent droughts, fires or floods – even more critical. Impacts include crop losses and food shortages and energy shortages with consequences for entire countries and particular regions. The interdependencies between the respective areas are described in below figure.

Water-agriculture-energy nexus

- Water for Food: Irrigation, livestock, food processing
- Water for Energy: Heating, cooling thermal power plants, hydropower, irrigation of bioenergy crops, extraction and refining
- Energy for Water: Extraction and transportation, water treatment, desalinization, wastewater, drainage, treatment and disposal
- Energy for Food: Crop and livestock production, processing and transport, food consumption, energy for irrigated crops
- Food for Energy: Competition between bioenergy and food and fibre, production for water and land
- Food for Water: Impact on water supply, impact of run-off

As the five newly independent countries replaced the unified Soviet view and economic planning system, opinions on the appropriate balance in the use of water resources diverged sharply. In the case of hydropower development and the associated water use, perceived and actual inequities in the distribution of benefits and impacts became a source of disputes and economic hardships. The abundance and uneven distribution of benefits from fossil fuel resources had the same effect (ENVSEC, 2008, 2011).

The tension between the highlands and the lowlands over the use of water for energy production and irrigated agriculture

is a crucial issue in the region. The effects of climate change are likely to reverberate throughout the water-agriculture-energy nexus, and make a difficult situation worse.

The water resources in the Aral Sea basin are used to such an extent that any significant stress resulting from weather extremes and climate change affects all users, especially those downstream. The water infrastructure in Central Asia was designed in the Soviet era for the region to serve regional tasks and projects, but since independence each country owns and maintains its infrastructure with the exception of some cross-border canals, key reservoirs and pumping stations still held in common or operated jointly (ENVSEC, 2011).

The downstream states prefer to maintain the old status quo in regional water management, counting on the historical hydrology baseline, water allocations and arrangements. The upstream states opt for revision of the water management schemes in line with new political and economic realities (ENVSEC, 2011). In line with the growth and development of the national economies in the region, the countries are pursuing national and sector-level water reforms in the national interest. At the regional level, however, water reform discussions are in stalemate.The increasing demand for cheap hydropower is creating an opportunity for countries with abundant hydro sources to sell power to both close and distant neighbours, but current plans for significant growth in the capacity to produce hydropower and regulate water flow may intensify the upstream- downstream tensions.

When water resources are low, the mountain countries gain leverage with the more economically powerful and energy secure lowland countries, and can bargain for energy supply in exchange for the increased release of water that would ensure water security for agriculture and communities downstream. When water is abundant, however, the mountain countries cannot retain and regulate it all, and the lowland countries receive all the water they need for irrigation or even more without having to make concessions or maintain energy co-operation with the highlands.

In the past 20 years a lack of co-ordination or willingness to coordinate over water releases balancing hydropower against irrigated agriculture demands resulted in downstream flooding episodes in winter and deficits in summer. Upstream countries suffer from energy deficits or economic losses due to the limitations of energy exchange. As a result, plans for further hydropower developments in the upstream countries are viewed with suspicion by the downstream states, although mutually beneficial solutions exist. When the countries discontinued their energy exchange system, new markets formed, but the connections and markets are poorly developed. Trading fossil fuels for electric power or for the provision of water services is still a possibility. Whether the countries continue to pursue their own narrow national interests or take a collaborative approach at the regional level may determine whether the tensions escalate or diminish (ENVSEC, 2011). Climate change, as other challenges, can either contribute additional stress or provide the countries the impetus to cooperate for the common good.

2.10. Critical infrastructure

According to the IPCC (2014), “Critical national infrastructure is defined as assets (physical or electronic) that are vital to the continued delivery and integrity of essential services on which a country relies, the loss or compromise of which would lead to severe economic or social consequences or to loss of life.”

These types of infrastructure in Central Asia are both critical and sensitive to climate change and extreme weather conditions:

- High-elevation mining facilities located in permafrost with active or historical tailings
- Hydropower stations and power transmission lines
- Small dams and irrigation systems vulnerable to damage
- Oil and gas pipelines and facilities, especially on the Caspian Sea
- High-elevation strategic roads and other major traffic routes
- Municipal sewage and water supply systems and other vital services

Subsequent sections of this report provide the details and rationales on each of these sensitive and critical types of infrastructure and threats associated with climate change impacts and extreme weather conditions.

Climate trends and projections are available at the global, regional, national and sometimes local levels and usually consider the following:

- Average annual and seasonal temperature
- Number of hot days and nights and frequency of heat-waves
- Average annual and seasonal precipitation
- Number of days above and below precipitation thresholds
- Number (frequency) of extreme weather events

Among the reliable sources of climate information are the following:

- International Panel on Climate Change publications, including special reports and the Fifth Assessment Report, and international online resources with climate data and climate change models
- WMO and regional climate centre publications
- National communications to the United Nations Framework Convention on Climate Change
- Country statements, positions and presentations at international conferences
- National policies, programmes and plans related to environmental issues, natural resources and adaptation to climate change
- Peer-reviewed international research

An understanding of the climate trends and projections for a country and a region provides the basis for the analysis of climate change risks and hazards under this study. Such analyses, however, may be limited by weaknesses in the data and uncertainty in the projections.

3.1. Trends

The IPCC Fifth Assessment Report (AR5) finds that each of the last three decades were successively warmer than any previous decade since 1850, and that multiple independent datasets show warming in the range of 0.6°C to 1.0°C over the period of 1880-2012. The level of carbon dioxide in the planetary atmosphere is higher than at any time in the past 800 000 years.

In 2015, average level of carbon dioxide exceeded 400 parts per million – a symbolic threshold of continuing man-made impacts on the global atmosphere. According to WMO and National Aeronautics and Space Administration (NASA) estimates, 2015 became the hottest year over the entire period of meteorological observations, in part as a result of El Niño. The IPCC report notes that ice sheet losses were substantial, glaciers have diminished and the sea level has risen.

In consideration of the differences in the periods covered and the analytical approaches to climate change trend analysis between Central Asian countries and international researchers (Unger-Shayesteh et al., 2013), this report relies on the North Eurasia Climate Centre (NEACC) established by the hydrometeorological services of the Commonwealth of Independent States (CIS) to conduct climate monitoring and periodic reporting (NEACC, 2015).

According to the consolidated annual report on climate change in the territories of the CIS member states for 2014, since the mid-1970s both global and regional temperatures have increased (NEACC, 2015). The linear trend of annual average global temperatures for 1976-2014 shows an increase of 0.17°C/10 years, and for the CIS countries an increase of 0.41°C/10 years, which is almost two and a half times higher than the increase in global temperatures. In Central Asia, the most rapid growth of the average annual temperature occurs near the Caspian Sea and inland areas (Figure 7).

Annual average temperature change 1976 - 2012

(trend of change in °C/10 years)

Map produced by Zoï Environment Network, August 2016.
Source: Interstate Council on the hydrometeorology of the CIS

Figure 7: Annual average temperature change, 1976-2012

The Aral Sea region and the southern desert regions of Central Asia – in the south of Kazakhstan, Uzbekistan and Turkmenistan has experienced a decline in rainfall of over 5 per cent per decade (Figure 8).

Figure 8: Annual average precipitation change, 1976-2012

The most intensive temperature increase for the region happens in the spring, especially in the inland areas of Central Asia between the Aral Sea and Lake Balkhash. Summer temperatures have significantly increased in the Caspian region, as well as across Turkmenistan and Uzbekistan. Summer warming in the eastern parts of Kazakhstan, Tajikistan and Kyrgyzstan is weak. An autumn warming trend was observed throughout Central Asia, particularly in the Caspian and the northern areas of the region.

The southern parts of Central Asia, such as Turkmenistan and the Aral Sea region, have seen a decrease in precipitation. Some increase in precipitation has occurred in the mountains. A winter reduction in precipitation was registered in Turkmenistan, and in some areas of northern Kazakhstan. In contrast, precipitation in high mountain regions of Central Asia is growing.

In spring rainfall declined in the southern desert regions of Central Asia, while increasing in the northern steppe regions. Summer precipitation declined in some areas, but increased in others, especially in the mountains. Most of the central and northern Kazakhstan experienced a decline in autumn precipitation at a rate of over 5 per cent per decade. In this region higher surface temperatures combined with lower rainfall has led to an increase in evaporation and a reduction in soil moisture, increasing the risk of droughts and reducing vegetation potential (Shiklomanov, 2015).

Snowpack plays a critical role in the water cycle in Central Asia. For the last 30 years, according to MODIS space monitoring, higher temperatures have shifted the melting of the mountain snowpack to earlier dates. Since snow melt and rainfall are the two main sources of water run-off from the mountains of Central Asia, climate change effects will largely determine the availability of water. The melting and retreating of glaciers may have an even more significant effect on rivers largely fed by glaciers.

3.2. Scenarios

Since the release of the initial National Communications on climate change by the states of Central Asia roughly 15 years ago, much progress has been achieved in climate science and remote sensing, global climate models and the downscaling of these models to capture local specifics and to improve understanding of the effects on glaciers, run-off and ecosystems. On the negative side, those years have seen limited progress in global climate negotiations and greenhouse gas mitigation. The breakthrough came only in 2015 with the Paris Agreement supported by countries submitting their Intended Nationally Determined Contributions (INDCs) to reduce greenhouse gas emissions and adaptation. The Paris Agreement has inspired countries to unify their efforts to limit global warming to less than 2°C and significantly reduce emissions by the end of the century.

Nonetheless, the latest generation of climate change scenarios for Central Asia (IPCC, 2013; Mannig et al., 2013) suggest a 1°C to 3°C increase in temperature by the 2050s. But if greenhouse gas emissions are not reduced soon, temperatures could exceed today's by 4°C to 6°C by the end of the century. The largest increase in temperature and precipitation is expected in winter in the northern parts of Central Asia and in the mountains of Tajikistan and Afghanistan (Mannig et al., 2013). Summer and autumn conditions will likely become drier for most of Central Asia, while the largest increases in summer temperatures are expected in the southern areas (Mannig et al., 2013). In mountain and piedmont areas of Uzbekistan, increases in winter precipitation and reductions in summer rainfall are expected, while the annual amount is not likely to change.

Confidence is growing in projections that climate change will reduce precipitation in the entire Mediterranean region up to Iran and including southern areas of Central Asia (IPCC, 2013). The Tien Shan and Pamir mountains, however, could be an exception for which global climate models show an overall decrease in precipitation over these mountains whereas regional climate models show a trend towards wetter conditions. The second national communications had not considered this possibility, and the effects on large rivers may be less dramatic than the previous communications and assessments suggested. On the other hand, significant climate warming in the mountains and higher rates of evaporation may offset an increase in precipitation and result in the reduction of run-off, especially since the regulating role of glaciers will decline greatly.

3.3. Extreme events: Dynamics and projections

A recent IPCC report on extreme events and climate change (IPCC, 2012) as well as national communications of the Central Asia countries to the UNFCCC call attention to the prospect of more damaging extreme weather events in the future. Drought is an extreme event that comes with the potential for increased water insecurity and serious economic and human consequences.

Low-water years are particularly challenging due to population growth and increases in water needs, on the one hand, and strained inter-State relations over water, on the other (ENVSEC, 2011). The severe drought of 2000-2001 in the southern parts of Central Asia is a forerunner of severe weather events to come. The expert panel for climate risks in Uzbekistan confirmed that over 1971-2013 the number of dry days in Uzbekistan has increased. With the warming trend, low-water years are likely to increase.

Moreover, climate events occurring far beyond Central Asia may affect the region. Thus, changes in the atmospheric circulation in the Arctic, Siberia and even the Pacific Ocean can cause severe droughts in Central Asia. For example, future El Niño events in the Pacific Ocean may be more intense (Scott et al., 2013). Although there is no direct and immediate effect of El Niño in Central Asia, the last powerful episode of El Niño in 1997-1998 may have contributed to severe drought in the southern regions of Central Asia and in the whole of South Asia in 1999-2001. Similarly, the 2015-

2016 El Niño provoked droughts in India and other parts of South Asia. In 2015, in Mongolia, the echo of El Niño gave rise to a dangerous phenomenon known as “dzud”, in which livestock is not able to find food under the snow in winter, and a large number of animals die of hunger and cold.

Mountain glaciers, being in part reservoirs to regulate run-off, are melting and not capable of providing water supply in low-water years. In dry years, lowlands are the hardest hit by drought effects and get less water at a time when they need it most.

In the mountains, the increase in the number of days with heavy rainfall and rapid melting of snow due to high temperatures results in more frequent destructive mudflows.

The number of days with temperatures above 40°C has increased in the densely populated southern regions of Central Asia.[9] This change affects agriculture and the health of rural and urban populations suffering from the heat, but the authorities do not routinely issue extreme heat warnings, and have not introduced special regulations for working in such conditions.[10]

In some mountain areas and valleys of Tajikistan the number of instances of hail is decreasing due to changes in weather patterns, including fewer cold waves, while in Uzbekistan, the duration of precipitation in the form of hail has increased. The Surkhandarya and Kashkadarya regions are most susceptible to hail events, and thunderstorms, especially in the Ferghana Valley and at the foothills, are covering a wider area.

In Turkmenistan, especially in the Caspian region, the winds have become less strong.[11]

Many of the forested areas of Central Asia, including the saxaul desert forests, are less susceptible to wildfires, but the growth of the number of fire hazard days and conditions and inadequate forestry contribute to the increase in forest fires.

3.4. Slow onset events: Dynamics and projections

By their nature, slow onset climate events are less obvious, but climate change projections suggest that these events may have a greater overall effect than extreme events when social and economic systems lack resilience. The subtle long-term effects of rising temperatures and disrupted precipitation patterns will play out across the region with effects on different areas – glaciers, pastures, irrigated and rain-fed agriculture and large water reservoirs.

Mountain dwellers and hikers already report visible changes in glaciers, and measurements show that glaciers are thinning and retreating. Many low-elevation and small glaciers have disappeared. The rate of loss of glaciated area in the region is about 0.5 per cent per year (Savoskul and Smakhtin, 2013), with local variations depending on size, location and elevation. Over the past 50-60 years glaciers have shrunk by 5 per cent in interior high-altitude heavily glaciated areas of the Tien Shan and Pamir and by 15-20 per cent in lower altitude and smaller glaciated areas. In some regions, such as the south-western Pamir (Tajikistan) and the Dzungarian Alatau and Zailisky Alatau Mountains (Kazakhstan), glaciers have diminished by as much as 30-40 per cent (Vilesov and Seversky, 2013). Large glaciers declined minimally in area, but lost significant ice volume. Many glaciers have thinned and their ice bodies are now spotted with lakes and debris. The Fedchenko Glacier, the world largest mountain glacier outside the polar regions, has retreated by more than 1 km, and its surface dropped by 40-90 metres (Lambrecht et al., 2012).[12]

The 2014 World Bank report, “Turn down the heat”, suggests that about 50 per cent of the world’s glaciers will be lost at global warming of 2°C, and up to 70 per cent of glaciers at global warming of 4°C, but the large glaciers will continue for a long time.

Water flow in rivers fed by glaciers and by melting snow in the mountains shows an upward trend in recent years. Some rivers do not have significant changes in annual run-off, but have experienced some seasonal changes.

9 Second and Third National Communications of Tajikistan, Turkmenistan and Uzbekistan
10 Third National Communication of Tajikistan
11 Third National Communication of Turkmenistan
12 See also: Second National Communication of Tajikistan

4. CLIMATE HAZARDS AND STRESSORS

The range of climate-related hazards is broad and includes events that are both rapid onset and that have a slow cumulative development over time. Floods, extreme weather, avalanches and wildfires are generally rapid onset hazards. Drought, sea level rise and fluctuation, land degradation, changes in pest and disease patterns and crop suitability are hazards that unfold over periods ranging from months to years. Central Asia also experiences the melting of glaciers leading to glacial lake outbursts, where the development of lakes can take decades, but the outburst can happen explosively.

The rate of change for some climate-related hazards may occur slowly enough that normal management systems can adapt and prevent a crisis from developing. Wildfire, which seems to be relatively uncommon in much of Central Asia, may be an exception. Changes in average temperature and precipitation may contribute to a rapid increase in the number of wildfire events in some isolated parts of the region.

For either rapid or slow onset effects, the hazard analysis needs to consider the potential environmental, socioeconomic and political consequences. Climate data and trend analysis, climate modelling and hazard assessments can be time-consuming and costly, requiring accessible data and appropriate models, with extensive expert input. Fortunately, the number and diversity of climate change assessments, climate risk and hazard assessments and climate models have increased, providing a wealth of data for many countries and among international sources or organizations.

A summary of some of the more significant climate-related hazards in Central Asia is provided below.

4.1. Flooding and related hazards

Flooding is one of the most common hazards in Central Asia, takes many forms and can have locally significant impacts. River flooding occurs, but most of the major rivers in the region are heavily managed by dams, dikes and retention areas, and in the upper reaches the rivers run mainly through mountain terrain, leading to less damage than could happen in the flatlands.

An example is the Amu Darya River along the Tajik-Afghan border. The Tajik side of the river is more engineered than the Afghan side, and seasonal flooding is likely to be more severe in Afghanistan than Tajikistan. Afghan farmers are concerned that river protection works in Tajikistan are the cause of flooding in Afghanistan. The countries do, however, have a co-operation agreement on managing the Amu Darya/Panj River, but it does not directly regulate engineering works, flooding forecasts and public notification, or water sharing.

Flash flooding, landslides and torrential floods are common in the mountainous regions. Because of the heavy sediment and rock content in flash floods, they are often very destructive but this damage is usually confined to a small physical area such as a valley floor. Flash flooding and landslides are especially dangerous for hydropower generating facilities, power lines and waste storage areas.

For example, in Tajikistan in 1993, a temporary dam was destroyed, and other Rogun hydropower plant infrastructure under construction was damaged; subsequent landslides threatened the Baipazinskaya and Varzob hydropower plants. In the summer of 2015, flash flooding and landslides, caused by a combination of high temperatures, rain and sudden snowmelt, resulted in considerable damage in several parts of the country, paralyzing the most important roads, and destroying dozens of houses, bridges, pumping stations and irrigation channels.

In the south of Kyrgyzstan, in the spring of 1994, heavy rains resulted in a landslide that blocked the river in the area of the Maylusuu abandoned radioactive waste tailings. Some tailings reached the river, and a tank containing a toxic substance was destroyed causing a toxic cloud formation that posed an environmental threat to the whole of the Ferghana Valley.

Another type of flooding, which occurs more often in the flatter parts of Central Asia, is either due to rain falling on snow and frozen ground or rapid snow melt over deeply frozen ground. This flooding can result in large volumes of standing water in inhabited areas where this water can freeze and cause damage to structures, contents and infrastructure.

In parts of Central Asia, dams have been built on smaller rivers for domestic or agricultural use. Many of these dams were never designed for water flows from heavy precipitation or rapid snow melt and are not well controlled by central authorities. In March 2010 intense snow melt and torrential rains caused a dam failure upstream of Kyzyl-Agash, a village in south-eastern Kazakhstan, resulting in local flooding with significant economic damage and the loss of property and life. Similar accidents have occurred in other countries.

These examples show that human security and environmental, industrial, transport and energy security are vulnerable to the impact of extreme weather events. Flash flooding and other flooding risk assessments are few to date. The expert panel for climate risks in Uzbekistan and other assessments predict that population increases in the mudflow areas and increasing precipitation will lead to higher security risks. Also, areas exposed to flash flooding are likely to expand, mainly in piedmont areas.

4.2. Droughts

Taking into account the nature and area of distribution of droughts in Central Asia, the region as a whole is unlikely to face a large-scale drought. Droughts in the northern parts of Central Asia are related to the Arctic, Siberian and Atlantic atmospheric circulation systems, while in the southern regions, they can be caused by a variety of factors. Intensive climate warming in the Arctic and the El Niño intensification in the Pacific Ocean may have an impact on atmospheric circulation, but no conclusive evidence links droughts to these events. According to the expert panel for climate risks in Uzbekistan, global warming by 1.0-1.5°C may increase the number of days with droughts in the region by 15-18 per cent by mid-century.

Kyrgyzstan and Tajikistan have sufficient water to meet their needs even in years of drought and water shortage, but their energy security is reduced due to high dependence on hydropower and water flow. Turkmenistan and Uzbekistan have vast lands under irrigation, and high dependence on external water supplies, and are particularly affected by droughts and water shortage.[13] Uzbekistan experienced extremely dry years in 2000, 2001, 2008 and 2011.[14] The summer drought in 2012 in Kazakhstan destroyed grain crops on 1 million hectares, but did not pose a threat to food security. In all countries, rain-fed croplands are most at risk.

4.3. Extreme weather events: Heatwaves, cold waves, hailstorms and dust storms

Central Asia experiences a range of extreme weather events, with winter being dominated by blizzards and cold waves and summer by hail storms, heatwaves and dust storms. Extreme warm or cold events, and frost, can also occur during the fall and spring, with a particularly damaging impact on agriculture and fruit and nut crops, as happened in Kyrgyzstan and Tajikistan in 2008 and early 2015.

Hailstorms and dust storms form in the Pamir and Tien Shan mountains of southern Central Asia when local warm air meets cold air. These storms can damage crops and property. The trend is towards fewer such storms in the mountains of southern Central Asia because global warming is resulting in less cold air coming from the north.[15]

The health effects of extreme heat can be serious. Higher temperatures, particularly in summer, are expected to worsen the already difficult work conditions of agricultural fieldworkers in southern Central Asia.[16] Summer high heat has affected pregnancies, and resulted in birth anomalies related to exposure to summer heat late in pregnancy (Kayumova, 2013). In urban areas, the housing stock inherited from the Soviet era is not adapted to a hot climate, and the amount of urban green space is shrinking. Significant warming is likely to have health impacts in urban areas.

Extreme weather hazards are normal for Central Asia, even without climate change. The point is that in view of global warming and change in weather patterns, the frequency of some hazards will increase, while that of others will decline. While social, economic, agricultural, transport, governance and other systems has been effective at managing these hazards in the recent past, an increase in number or duration could create unanticipated levels of damage and hardship. Additional attention is needed to changes in health impacts, particularly among the elderly, children and pregnant women.

13 Second National Communication of Uzbekistan, Second and Third National Communication of Turkmenistan
14 Drought Monitoring Centre Uzhydromet
15 Second National Communications of Uzbekistan and Tajikistan
16 Second National Communication of Tajikistan

4.4. Changes in the hydrologic cycle

In south-eastern mountain areas of Central Asia and the Aral Sea basin, water resources are expected to increase to a peak in mid-century, followed by a moderate decline, according to an average global warming scenario (PPCR, 2011). Changes in regional hydrology will depend to a great extent on climate change effects on glaciers and snowpack. The expected changes in the seasonal distribution of water (earlier flow peaks, summer flow decline and winter increase) will require better planning for the timing and amount of water available, especially in light of a growing population. Many smaller low-elevation glaciers are likely to melt and change the course of small rivers, which, especially in the southern parts of Uzbekistan and Turkmenistan, are more susceptible to global warming.

The good news is that, despite shrinking and retreating glaciers, water flow in large and medium-sized rivers in Central Asia has not changed significantly.[17] In some basins increased melting of glaciers and permafrost has raised water flow. Some experts believe that the little-known rock glaciers and alpine permafrost contain about the same amount of frozen water as the visible part of mountain glaciers, and this "invisible" part, can compensate for the adverse effects of warming, over a certain time period (Kotlyakov and Seversky, 2009).

Certain populations and sectors of the economy in the southern regions of Central Asia are especially sensitive to water deficiencies in dry years, and several consecutive dry years may threaten both security and survival. The general trend of increasing flow of high mountain rivers and major international rivers, notably the Amu Darya and the Syr Darya, can be expected to continue for another three or four decades.

4.5. Region-specific hazards: Avalanches and glacial flooding

4.5.1. Avalanches

While they could be considered as part of extreme weather, avalanches deserve special mention from a climate hazard perspective. The challenge with avalanches is that they can affect critical road traffic infrastructure in Kyrgyzstan and Tajikistan linking the north and south of each country. If climate changes bring about less snowfall, and fewer weather events that can generate avalanches, then the economic, social and political impact of this hazard would be reduced. But the opposite scenario is also possible.

4.5.2. Glacial lake outburst and retreating glacier floods

The number of glacial lakes is expected to grow as a result of climate change (Vilesov et al., 2006). Projected climate warming will affect the stability and properties of mountain rocks, permafrost and glacial moraines, which in combination with the intensified melting associated with climate change may lead to an increased risk of glacial lake outburst floods (GLOFs), but geomorphology is an important factor and conditions vary from place to place.

In Kyrgyzstan alone, 70 GLOFs were reported between 1952 and 2007. There is increasing concern that glacial retreat associated with changes in climate conditions will increase the number of glacial terminal lakes, and cause lakes that are blocked by frozen dams to become active. The threat of GLOFs exists in numerous cross-border watersheds in eastern Central Asia. GLOFs also threaten heavily populated areas, most notably Almaty and Bishkek. The potential threat from GLOFs can be localized to specific glacial retreat conditions, and a lake that can give rise to a GLOF does not develop with the retreat of every glacier. Remote sensing and other monitoring provide a means to identify and monitor what will likely be an increasing threat.

The advance of glaciers can also be a threat. For example, in recent years Medvezhy Glacier in the Pamir rapidly blocked the riverbed to form a large lake that could have released its water suddenly with disastrous results. In Kyrgyzstan, near the largest gold mine, Kumtor, the advance of Davydov Glacier is mainly due to empty rock stockpiling on the glacier (Kuzmichenok, 2012). Modern satellite-based monitoring tools allow for recording the advances of glaciers and for taking appropriate action.

17 Second National Communication of Uzbekistan UNFCCC, Second and Third National Communications of Tajikistan

5. ASSESSMENT OF CLIMATE CHANGE AND SECURITY IMPLICATIONS AND VULNERABILITY

The vulnerability assessment, which includes an assessment of security implications, determines how climate change related hazards in combination with other cumulative pressures may affect the environmental, socioeconomic and political conditions, and how these in turn may affect security and stability within and across borders. Critical to the assessment is a consideration of climate change adaptation capacity – the potential for a system or a society to respond effectively to climate change – and resiliency; and how they apply to governments, institutions, key sectors (such as food and energy), infrastructure, social dynamics, income diversity and migration patterns at the local, national and regional level.

Some of the relationships may be fairly straightforward, and some may be highly complex. Floods or extreme cold waves, for example, may cause immediate human and economic losses (which may be difficult to estimate), may trigger an energy or food crisis and may threaten livelihoods. Changes in the hydrologic cycle, in contrast, may cause environmental degradation over a longer time period, with repercussions for the economy, and food and power production for the growing population in the coming years. The security implications may be far-reaching and complicated by a variety of other factors. (See Chapter 1, Methodology, for a complete description of the process.) The results of the assessments are presented below.

Within this assessment a series of national meetings in each country as well as a regional consultation meeting contributed to the participatory assessment of climate change and security implications and vulnerability. Stakeholders from various line ministries, and academic and civil society representatives gathered to discuss the most vulnerable economic sectors and socioeconomic challenges posed by climate change as well as the implications for security. Participants examined the issues from the viewpoint of human security: this encompasses economic, social and political security, food security, personal and community security, and environmental security. The national consultations on climate change and security, held in Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan in 2014, mentioned agriculture and water management among the common problems. Participants in Turkmenistan and Kyrgyzstan identified the energy sector, while those in Kazakhstan and Tajikistan highlighted the social sector as priorities. Discussions in Kyrgyzstan spoke about forest ecosystems, and in Tajikistan they pointed to the transport sector and industry, along with mountain ecosystems, as specific national issues. Consultations on climate change and security in Uzbekistan were held in conjunction with another meeting. In addition, the team of report authors consulted the latest information on climate risk in Uzbekistan, and applied that information throughout the report. A regional consultation meeting for Central Asia took place on October 6, 2015, in Bishkek, Kyrgyzstan, and was hosted by the Government of Kyrgyzstan and UNDP.

5.1. Structural, socioeconomic and environmental consequences of climate change

5.1.1. Changes in human and livelihood security

The Almaty region and some central and northern regions of Kazakhstan are recognized as being among the most vulnerable to climate change in the country due to a number of factors, but threats to human security perhaps are most found in the piedmont and mountain zones. Floods due to rapid snowmelt and heavy rains in many inland areas also pose a threat to people and property. In the long run, climate change will lead to the decline of crops yields and pasture degradation in vulnerable areas, and water security will be jeopardized.

In the southern Kyrgyzstan mountains and the Ferghana Valley, unpredictable weather events affect communities reliant on cash crops such as apricots, nuts and cotton, as well as those relying on subsistence crops such as rice and grain. Rolling losses can affect entire provinces and lead to grievances and dissatisfaction with poverty remaining high. Nomadic communities in the interior and high mountain pastoral communities have suffered cattle losses related to winter weather. Kyrgyzstan, with natural areas harbouring bubonic plague, is concerned that climate change could affect the spread of this disease or lead to an uncontrolled outbreak.

In southern Tajikistan, flooding and flash floods due to heavy rain, heatwaves and snow melt alternate with droughts, and aggravate challenging conditions in the area on the insecure Tajik-Afghan border. Tajikistan is small enough that large-scale severe weather events such as heatwaves, heavy rains and snowfall can affect virtually the entire country at once, and is therefore vulnerable to an energy or food crisis, the collapse of transportation or other misfortune.

Between 2007 and 2010, a series of unrelated events – frequent power shutdowns, sharp fluctuations in world and local food prices, and the global economic crisis – affected the security of many households in Tajikistan and Kyrgyzstan, and highlighted their vulnerability to a mix of natural and economic shocks.

Turkmenistan's ample public benefits and financial reserves engender confidence in the future, but the country remains vulnerable to the vagaries of weather impacts, especially in the coastal areas of the Caspian Sea and in the hot south. Communities in the Turkmen Aral Sea region suffer from insufficient or poor quality water supplies. Along the border with Afghanistan, apart from insecurity risks, the country is threatened by insect infestations, malaria and dust storms.

The Uzbek government is a leading employer and insurer, with a variety of public benefits, but the populated areas of Karakalpakstan, the Amu Darya delta and Kashkadarya oasis are vulnerable. In these areas, even without climate change, vulnerability to water shortages, drought and land degradation is quite high. A warming climate only adds to the stress.

At the regional level, three kinds of areas face potential livelihood insecurity – coastal and delta communities with uncertain water supplies and water-related risks; interior areas that are neglected by central systems and that have limited capacity to plan; and populated piedmont areas that rely on the production of cash and subsistence crops, especially on rain-fed lands.

5.1.2. Additional pressures and competition over scarce natural resources

The physical size of Kazakhstan compared to the size of its population means that the country has not yet faced significant pressure on its natural resources. In addition, national statistics show that water use is not growing in lockstep with population growth and economic development. Water resources are, however, unevenly distributed in the country, and about half of Kazakhstan's water supply originates outside the national borders. These supplies are covered by agreements, but the effects of climate change on water resources outside the country is likely to become the main source of future pressure on the country's water supply. In addition, climate change may affect the country's deserts and steppes, with implications for transhumance and crop production.

A higher population density and the physical limits of the surrounding mountains combine to increase the competition for water, land and pastures in southern Kyrgyzstan, where ethnic differences are present. Climate change adds a layer of uncertainty to this mix. Moreover, the change in high-elevation agricultural areas, such as fruit and nut forests, may result in a change of residence for people who rely on the production of these forests. A shift of high-elevation vegetation zones may prompt inter-community disputes over resources in bad years.

The situation is similar in Tajikistan where the habitable area is circumscribed by the mountains and where population growth is increasing population density. About 75 per cent of the population lives in rural areas and depends on natural resources. Long-term climate projections and modelling results suggest that Tajikistan's traditional crops will move 500 m up in elevation by 2050 – an outcome that will require a decision about whether to try to move with the crops or change to other crops or climate-adapted varieties.

Turkmenistan provides strong support for its agriculture sector, but 90 per cent of the country's water supply originates outside its borders, and climate change pressures may affect ongoing water supply and security. Nomadic communities face climate-related uncertainties that may pose a challenge to survival in the desert. A small change may make all the difference in a desert well or a salt flat, and if wells dry up or vegetation changes, competition and tensions may rise.

With its high population density in irrigated oases, Uzbekistan has already experienced a drought that forced a temporary displacement that was managed in a peaceful, controlled manner. The Ferghana Valley is the main area of competition for natural resources in the country, and with the highest population pressure in Central Asia and a history of tensions, this is a potential problem area. The effects of climate variability on the socioeconomic mix of challenges appear to be uncertain, but of potential concern.

The Central Asia countries and densely populated oases dependent on external water supplies are likely to experience the most climate-related uncertainty and concerns for scarce land and water resources, and the countries may not have much influence on the response to climate change in the source countries.

At the international level, water shortages may motivate, if not oblige, countries to cooperate. Thus, in the dry, low-water years co-operation and balanced water management should ensure water security and survival.

Efficient and adequate management may be the most effective solution to growing water deficits. Nomadic and agriculture communities, despite being well adapted to varying weather conditions, may have to make long-term adjustments in light of climate change.

5.1.3. Changes in agricultural productivity and food security

Most large-scale adverse impacts of climate change on agriculture in the region are expected in Kazakhstan, particularly in its northern grain growing areas, the breadbasket for Central Asia and other countries. Droughts, heatwaves and other weather extremes could cause crop failures. Climate change can also reduce the yield. At this stage, however, food security is not a cause of concern. Social protests in this part of the region provoked by extreme weather events and crop failures seem unlikely.

Relatively stable water flows that feed the fertile areas in the north of Kyrgyzstan, currently and in the medium term (until 2030), can meet the needs of agriculture, even in warming conditions. Economic growth and higher population levels will increase the burden on resources. Water availability issues in the south are more serious than in the north. In addition, the southern regions are more prone to the devastating impact of floods, landslides, hailstorms, frost and other hazards. The mountain slopes used for agriculture are subject to extensive erosion in some places. Climate modelling indicates that heavy rainfalls may increase and, as a result, worsen soil erosion.

The southern regions of Tajikistan are characterized by hot weather and more hazardous agricultural conditions compared to other densely populated areas. In addition to drought, floods and flash floods cause a lot of agricultural damage, destroying irrigation canals, pumping stations and gardens. Locust infestations may occur on a grand scale. In the context of climate change, agriculture in Tajikistan could face growing uncertainty, loss of crops and increasing degradation of arable land.

Turkmenistan and Uzbekistan have the largest tracts of irrigated land in the region. Timely and efficient water supply, field management and soil fertility largely determine the yield. Water scarcity and changes in river flow, and respectively, water supply patterns under the influence of climate change are major threats to irrigated farming. Uzbekistan continues to expand rain-fed agriculture on land most vulnerable to the effects of climate change, and where hot weather spells can significant cause crop losses. In addition, climate aridity, a drop in precipitation and increasing heat in the central and southern deserts increase the risk of desertification and soil salinization.

In terms of future food security in a changing climate, a joint assessment of the World Food Programme[18] and the United Kingdom Meteorological Agency offers a few scenarios of global emissions and the implications for the climate system and adaptation measures (Met Office, 2015). In almost all scenarios, the southern regions of Central Asia and neighbouring Afghanistan are likely to experience an increase in stress and threats to food security. For instance, “medium” emissions and “moderate” adaptation may result in 15-25 per cent deterioration in food security.

5.1.4. Economic changes

Industrialized countries are adopting new energy technologies and developing countries are advancing this trend. The accelerating development and introduction of alternative energy sources around the world, the global oil glut and the implementation of the Paris Agreement are providing incentives for increasing clean energy capacity, new economic models of growth and development, and the gradual reduction of national economies’ dependence on production, export, import and use of oil, gas and coal.

Kazakhstan has developed legal instruments, government programmes and incentives for the development of clean energy and a green economy. Despite the difficult circumstances, the country can become the Central Asia leader in clean energy, driven by goals and actions on climate change and renewable energy development.

Kyrgyzstan and Tajikistan are using their hydropower potential for electricity generation, but their access to the electricity markets is dependent on weather and climate. Both countries are particularly vulnerable in winter, when the actual hydropower potential is reduced, and during long cold waves the amount of energy produced is insufficient to meet domestic demand. Energy deficits, along with severe weather events, lead to major losses in agricultural production and trade. The countries plan to develop both small and large hydropower for sustainable economic development and low levels of greenhouse gas emissions. In order to increase energy security, they also plan to boost coal production for thermal power plants.

Turkmenistan’s economy relies on the oil and gas sector and is, consequently, little exposed to the risks that may accompany climate change. In view of the giant gas reserves, the country does not plan large-scale projects to develop alternative energy sources. Uzbekistan is the region’s largest agricultural producer, and its diversified economy is quite resistant to shocks, including weather and climate impacts. Moreover a growing population, energy shortages and the need for economy modernization have created the basis for a solar energy boom.

Mountainous countries that rely on hydropower will likely continue to feel the effects of climate change, including those for the electricity market. Other countries have a wide variety of energy sources, and their energy systems and macroeconomics are less vulnerable to weather and climate factors. Climate change goals and growing energy needs, however, will help increase the share and volume of alternative sources in their energy mix.

5.1.5. Social tensions

As a country with middle level income by international standards, Kazakhstan tries to achieve a balanced income distribution. The country faces no obvious cases of weather shocks or climate change that may trigger tensions. Water shortages or extreme weather events and natural disasters can disrupt lifestyles in some communities, but so far have not led to social unrests or tensions. Even though certain areas are especially vulnerable to climate change, Kazakhstan faces little risk of losing control over the situation.

Social tensions that previously resulted in coups and revolutions in Kyrgyzstan can be still felt in society at large, but successful parliamentary elections in 2015 offer hope for stability and resilience in the current socioeconomic and political system in Kyrgyzstan. Recollections of ethnic clashes in the south of the country are still painful, but much has been done to support peace and unity. There are concerns about repeated clashes in the Ferghana Valley over access to limited natural resources, and climate change only adds to the stress. The 2015-2016 economic crisis, which originated in Russia and Kazakhstan, may have implications for Kyrgyzstan.

Southern and central regions of Tajikistan and the Pamir valleys repeatedly experienced social and economic difficulties due to crop losses, extreme weather and climate events, and security threats. In Tajikistan, many men are outside the country as migrant workers, relieving the pressure on natural resources and maintaining family incomes. The potential for social tensions provoked by poor harvests, rising food and energy prices, natural disasters and income losses has been estimated until recently as very low. But as in Kyrgyzstan, the knock-on effects of the economic crisis in Russia and Kazakhstan, and the recent changes in migration policy may lead to a mass return of migrant workers and increase the pressure on labor markets and natural resources.

With available resources, strong social support systems and relatively tight control over society, neither Turkmenistan nor Uzbekistan has yet experienced any tensions related to climate change. Even though there are areas with high climate risks, the situation in both countries is currently not a matter of concern.

Droughts in Uzbekistan and Turkmenistan caused temporary displacements and migration, but the situation has improved and the displaced persons have returned. Climate change is likely to bring subsequent droughts and a dry climate, and displacements may become permanent migrations. At this stage, it is hard to estimate how such processes may affect social tensions.

Policy-makers and people in Central Asian areas bordering on Afghanistan are concerned about security risks coming out of Afghanistan and the growing influence of fundamentalism, including the so-called Islamic State in the Middle East. Though these concerns have nothing to do with climate change, they should be accounted for in the analysis of security risks.

The impacts of climate change can be different for men and women. In rural areas in the mountain countries in particular, where many men work abroad and women take care of the families, women and children are more vulnerable to climate change. Usually the women are responsible for provision of clean drinking water and food for the family, household and animals and the time spent on these tasks is increasing. In the absence of men, women take over such basic tasks as irrigation and the other responsibilities of subsistence agriculture. Additionally, heatwaves and cold waves combined with unreliable energy and water supplies mean a high risk for pregnant women.

Gender differences in climate politics are of special interest. For example, in Kazakhstan and Kyrgyzstan, women are involved in decision-making, and often are among activists and experts on climate change. In Tajikistan and Turkmenistan, policies and decisions related to climate change are mainly in the hands of men.

5.1.6. Infrastructure vulnerability

The oil and gas pipelines and production facilities in the Caspian Sea areas of Kazakhstan and Turkmenistan are vulnerable to sea level rise, storm, wind and ice events and other weather extremes, and both countries have responded to these hazards with research on climate risks to critical infrastructure, and have produced relevant recommendations.

Kyrgyzstan and Tajikistan are concerned about climate effects at high elevations and how these effects increase the risks associated with tailing dams. Existing water infrastructure – from village irrigation systems to major power plants – faces climate hazards, too. New projects are subject to climate-proofing, but the existing facilities are vulnerable.

18 http://www.wfp.org

In the mountains of Uzbekistan, the risk of avalanches is present, but the government minimizes the risk through meteorological warnings and protection for sensitive infrastructure.

5.1.7. Changes in the spread of diseases

In recent years, southern Central Asia has experienced significant locust infestations. Climate change may worsen the conditions, but the lack of controls is a larger concern. Changes in precipitation may influence vegetation stages, and changes in temperature may affect activity levels. The wind may limit or increase mobility.

Prompted by increasing temperatures, some types of diseases are very likely to be spread more quickly, thereby increasing the risk to human health and wildlife. Heat stress contributes to cardiovascular disease, and warming may increase the risk of malaria. Torrential rains in areas with inadequate water supply and sanitation systems may increase the risk of infections transmitted by water – typhoid fever, salmonellosis and dysentery, for example.[19]

5.1.8. Changes in income and poverty

Worldwide, experts and leading organizations dealing with climate change issues recognize that poor countries will suffer more from climate change impacts in part because they have less capacity to prevent or adapt to the changes. The groups most vulnerable include elderly populations, those living in rural areas, and those with below-average incomes and living standards. There seem to be little or no comparable data or findings specifically available for Central Asia.

Given the large proportion of the rural population with low income in Tajikistan, Kyrgyzstan and Uzbekistan, extreme and adverse weather and climate factors can raise poverty levels, or further reduce incomes of many families and worsen their food and economic security.

5.1.9. Changes in migration

Short-term displacements occur in the region mainly as a result of extreme weather events. Areas with high population density need to become particularly resilient to climate change. The spread of disease is faster and the consequences of water or food contamination are graver because more people are potentially exposed to the hazards. The more crowded the living conditions are, the more vulnerable the people will be to whatever hazards are present.

Migrations and large-scale displacements caused by climate factors in Central Asia remain a poorly studied issue. Still, the deepening of the humanitarian crisis in the Middle East is an indicator of the role and knock-on effects of climate change on conflict escalation.

The increase in extreme weather events and disasters is likely to increase short-term displacements and migration, and the degradation of the ecosystems that sustain livelihoods is expected to accelerate both seasonal and long-term migration. Whether the causes are economic or environmental, migration has been an effective strategy to maintain stability and reduce poverty and vulnerability in the region. In the context of climate change, migration and displacement may become a part of an adaptation strategy. The question of whether or not the destinations can continue to accommodate new migrants remains open, and the additional stress that a growing population puts on local resources is an important consideration.

5.2. Adaptive capacity

Adaptive capacity typically includes social and economic measures such as education, poverty levels and diversity of income, along with institutional capacities related to governance and management of natural resources. Technology exchange and external assistance play major roles, as not all countries have the financial capacity to engage in economy reforms to combat climate change. Ecosystems, regions, countries and economic sectors with resilience and a high capacity for adaptation are less vulnerable to climate change, and strong well-balanced economies and effective governance improve adaptive capacity, while healthy ecosystems ensure higher resilience.

5.2.1. Financial capacity

Financial assistance for climate change projects across different sectors in Central Asia is becoming a more prominent part of the work of development banks, the United Nations and other donors. The European Union is a major sponsor for climate change assessments; it has representatives in all the Central Asia countries, and is interested in promoting climate change awareness and actions in the region, emphasizing the climate mitigation priorities of the EU. The EU supports political and technical co-operation on climate and the environment and bilateral and regional technical aid projects, grants and investments. Development agencies of Germany, Switzerland, Japan, the United Kingdom and the United States often integrate climate change into the development projects they sponsor.

Kazakhstan allocates considerable support measures for a green economy and the development of clean energy, and EXPO-2017 on the energy future is an example of the Kazakh commitment. For the other countries in the region, the effectiveness of their measures to implement the Paris Agreement will depend largely on external aid. Uzbekistan became a leader in attracting investments in the Clean Development Mechanism of the Kyoto Protocol, in addition to major international investment in clean energy and finance measures from their own fund for reconstruction and development, but for water and soil conservation, climate risk assessment and implementation of demonstration technology, the country relies on aid.

Prospects and realities of large-scale international financing of climate measures are of great interest of all countries in the region and give the impetus for taking actions, but they also have to develop the potential that is necessary for the effective implementation of these measures.

Until recently the Global Environment Facility (GEF) has been the major source of international environmental and climate funding. The Green Climate Fund (GCF), established in 2010 as accessory to GEF, has already accumulated substantial initial funds and started giving grants and loans in 2015. Other climate funds support projects in Central Asia help address climate change concerns while strengthening their economies, reducing poverty and improving environmental performance.

5.2.2. Institutional capacity

The countries of the region dispose over basic institutional capacity to plan and implement climate change measures, with some countries having stronger capabilities than others. Following the adoption of the Paris Agreement, all countries need to enhance their institutional capacity, and may need to direct more efforts to attracting and using international aid.

As the only regional organization with all five Central Asia states as members, the International Fund for Saving the Aral Sea serves as a political structure for discussion and management of regional environmental issues. The IFAS Executive Committee rotates among the capitals of the member countries, and at the time the assessment was being completed was based in Ashgabat, Turkmenistan. The IFAS Aral Sea Basin Program – which is reviewed and approved by the countries – serves as a long-term action programme on sustainable development of the region and takes climate change into account. The organization has launched regional climate assessments and has sponsored glacier research, but its efforts to secure international donor support for climate change funding have been more passive than proactive until recently.

In 2015, the World Bank and IFAS reached an agreement on CAMP4ASB – the joint implementation of a major regional climate change programme for the Aral Sea Basin.

As members of the UNFCCC, all Central Asia countries have the appropriate institutions and focal points to meet the obligations of the Convention. Kazakhstan, Kyrgyzstan and Tajikistan have special departments and centers for climate change, working with both national and international partners. In Turkmenistan and Uzbekistan, experts on climate and UNFCCC obligations are well integrated into the decision-making system, and work as one team.

In Kazakhstan, the government transferred the climate change function to the Ministry of Energy, and some forestry functions to the Ministry of Agriculture. The state company Jasyl Damu, created after the transformation of the Kazakh Research Institute of Ecology and Climate in 2013, deals with greenhouse gas inventories, carbon emissions trading, and climate change assessments, and supports decision-making on climate change. Nazarbayev University in Astana is part of a global network of climate technology. The Green Academy provides training to civil servants, representatives of enterprises and NGOs on climate change. Civil society activists work on climate change issues and often work with government agencies providing advice on regulatory and technical issues, acting as climate analysts and managing projects at the local level.

Kyrgyzstan's high-level Climate Change Co-ordination Commission, which is chaired by the First Deputy Prime Minister, ensures inter-agency co-ordination on climate and related issues. The membership of the Commission includes heads of key governmental agencies, with the State Agency for Environmental Protection and Forestry (lead governmental body for climate change) acting as its secretariat. Practical support to the work of the Commission (and the agency on climate matters) is provided by the Climate Change Centre, which works at arm's length to the Agency and is considered the main climate change think tank.

The climate network of Kyrgyzstan, coordinated by the civic foundation UNISON, is another vehicle to promote and coordinate climate change action among NGOs. On the local level, five Kyrgyz cities (as of February 2016) have signed the Covenant of Mayors on climate change. The Kyrgyz-Russian Slavic University and the Kyrgyz National University provide climate-related training.

The leading Tajik authorities with climate decision-making responsibilities include the Executive Office of the President, the Committee for Environmental Protection and the Agency on Hydrometeorology with its Climate Change Center. The Ministry of Energy and Water Resources is one of the key players in implementation of national climate change measures in the energy sector and water sector adaptation. NGOs are active promoters of innovations and international developments in domestic climate actions and policy through the climate change network. They often work on practical local activities, education and awareness.

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The institutional framework for addressing climate change in Turkmenistan consists of a number of ministries and agencies. Until recently, the Ministry of Nature Protection and the Institute of Deserts provided analytical support. (During the process of this assessment the Ministry of Nature Protection was being reorganized into the Nature Protection and Land Resources Committee.)

Uzbekistan's key state players for climate change are the hydrometeorological service under the Cabinet of Ministers, the Ministry of Water and Agriculture, the Ministry of the Economy and other environmental authorities. Uzbekistan also has an inter-agency co-ordination structure that coordinates efforts to develop policy documents such as the low-emissions strategy. On the local level, NGOs are actively participating in the implementation of projects on water and soil conservation technologies, small renewable energy sources, health and education issues.

5.2.3. Regional processes

Several regional processes, agreements and organizations have the potential to contribute to the collective ability of the Central Asian countries to respond to climate change challenges.

Two commissions under IFAS serve the main priority areas of the organization. The Interstate Commission for Sustainable Development (ICSD) assesses regional environmental conditions, and coordinates the planning and implementation of regional environmental and sustainable development programmes and projects. The Scientific Information Centre of the ICSD is based in Ashgabat. The Interstate Commission on Water Co-ordination (ICWC) consists of the national water authorities, and determines water allocations and conducts basin-wide water management in the Aral Sea basin. The Scientific Information Centre of the ICWC is located in Tashkent and maintains a water database. The Amu Darya and Syr Darya Rivers have basin water organizations. These organizations are not basin commissions.

The Framework Convention for the Protection of the Marine Environment of the Caspian Sea (the Tehran Convention), the five-party agreement on the saving the Aral Sea and the Regional Environmental Action Plan are examples of regional efforts to protect the shared environment, though climate change is not a key issue under their scope. Figure 9 provides an overview of regional co-operation on climate change and the environment.

A number of regional centres have been established in the region to serve the needs of environmental, water and climate-related co-operation. The Regional Environmental Centre of Central Asia (CAREC) based in Almaty, Kazakhstan, collaborates with governmental and non-governmental partners, maintains national offices in each of the countries and is implementing climate change projects across the region. Other regional centres based in Kazakhstan – on hydrology (under IFAS) and on glaciers (under the United Nations Educational, Scientific and Cultural Organization) – are supposed to collect and disseminate data and knowledge of regional scale and significance, but currently limit their activities to a subregional level. The Regional Mountain Centre of Central Asia (RMCCA under ICSD) based in Bishkek, Kyrgyzstan, promotes co-operation for the protection of mountain ecosystems and now focuses its activities on climate change impacts in the mountains and on experience exchange on adaptation. The Central Asia Institute of Applied Geosciences (CAIAG), also based in Bishkek, cooperates extensively with scientists from the region and abroad on glacial lake outburst flood risk assessment, monitoring of global environmental changes in the mountains and other remote assessments. Tashkent hosts the Regional Centre on Renewable Energies (under ICSD). Other planned regional centres include the Central Asia Centre for Disaster Response and Risk Reduction (Almaty), the Regional Drought Management Centre (Tashkent) and the Regional Centres on Climate Change and Green Technologies (Ashgabat and Astana respectively).

One challenge faced by the regional centres in Central Asia is that many of them have not been able to sustain a regional focus past their initial funding stage. International donors provided the support to initiate the centres, and the centres that remain dependent on outside funding are vulnerable: when funding is low, the centres tend to shift their focus to the host country and serve national rather than regional interests.

The North EurAsia Climate Centre in Russia conducts climate monitoring, collects data throughout the region, maintains a climate change information platform and publishes regular climate bulletins covering all CIS countries.

Within the UNFCCC, the small mountain countries of Central Asia – Tajikistan and Kyrgyzstan – have joined with Afghanistan and Bhutan to form a Group of Mountain Landlocked Developing Countries to discuss common concerns and progress within the convention. Speaking as a group gives the countries a stronger voice in UNFCCC negotiations, and helps raise the profile of the participants.

Climate change actions and regional environmental cooperation

- Predominantly international funding of measures against climate change
- Predominantly domestic funding of measures against climate change
- Regional (international) centre
- National centre
- RUSSIA — Members of the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Tehran Convention)
- UZBEKISTAN — Members of the International Foundation for Saving the Aral Sea and the Aral Sea basin programme
- AFGHANISTAN — Aral Sea basin riparian state, not a member of the regional agreements. Kyrgyzstan: participation in the Aral Sea-related processes suspended since May 2016
- Members of the UNFCCC Group of Mountain Landlocked Developing Countries
- Major mitigation activities
- Major adaptation activities
- Seas, lakes, rivers or river basins covered by regional cooperation agreements

Figure 9: Climate change actions and regional environmental co-operation

5.2.4. Resilience

By modern standards, Central Asia's water, agriculture and energy efficiency, except for a few areas, is relatively low, and provides ample room for low-cost improvements with available technology. Political will and economic incentives can clear the way for a transformational change at the national level and across the sectors towards low-carbon, climate-friendly and sustainable development. The provision of proper insurance, the introduction of improved crop varieties and conservation of the local genetic resources can bolster resilience at the local level.

Many recent studies find that agricultural pricing policies are ineffective because farmers have too little money to take advantage of financial incentives. Persistent poverty among the rural population may become a destabilizing force, but affordable technical approaches to adopting new agricultural practices, combined with information on climate change, may produce incremental progress towards economic security in rural areas. Such a strategy may prepare farmers for drought years, and may introduce improved crop selection, more crop diversity and more effective crop rotations.

Even small-scale, but regular and extensive, reforms in energy efficiency may pay big dividends, and ongoing development of renewable energy potential – including hydropower – would reduce fuel consumption and emissions and improve run-off regulation and adaptation potential. Water pricing reform remains a sensitive subject, but could produce essential improvements in efficiency and change water management practices both at the national level and among the farmers. Hydrologic monitoring, reliable water use statistics and the transparent and timely sharing of data would aid planning and reduce conflicts. Improved agrometeorological services could provide early warnings in case of drought. The previous success of the international community in providing independent assessments and mediation to alleviate tensions related to hydropower developments in the region may provide a model for future assistance. Growing regional experience in assessing ecosystem services can help in the implementation of innovative economic mechanisms of nature management and environmental solutions between upstream and downstream imbalance.

Joint efforts aimed at mitigating climate change risks for regional security in hotspots will help to reduce the tensions, but strategies, approaches and adaptation measures should take into account links with other vulnerable sectors and communities, in order not to harm adaptation elsewhere.

The education of the population, mainly children and young people, as well as farmers and public associations can be a good way to motivate to action, and to demonstrate new and alternative technologies for enhancing resilience and improving water, food and energy security and availability. Awareness-raising and planning measures can reduce the risk and damage of natural disasters. Climate change considerations should be a part of implementation of major new infrastructure projects. These steps would move the countries of the region in a direction consistent with the global momentum for a green economy that would maintain competitiveness.

The adoption of the Paris Agreement and global Sustainable Development Goals in 2015 and their implementation are the obligations of all countries. Soon the countries in the region will determine exactly how they can participate in achieving these objectives. The elevation of climate change to the highest political level and the prospects for significant international financial support create a good basis for the implementation of the measures. Moreover, raising awareness, improving knowledge and developing motivation for action at all levels lay a foundation for long-term success.

5.2.5. National climate change policies and plans

All countries of the region have developed national strategies and actions plans on climate change and a low-carbon economy, and have launched projects on mitigation and adaptation. Kyrgyzstan's Climate Change Co-ordination Commission is probably the best example in the region of the elevation of climate change to the top policy level of regular discussion and decision-making through inter-agency integration. In 2014, Kazakhstan established the Council for Sustainable Development for better inter-agency co-ordination and cross-sectoral integration measures, including climate issues. Tajikistan's Secretariat of the Pilot Program for Climate Resilience (PPCR), funded by the Asian Development Bank, is an example of a large donor-funded coordinating entity for climate projects.

As the host of the seventh Environment for Europe Ministerial Conference in 2011, Kazakhstan set a national direction towards a green economy, and allocated substantial budget resources to implement its ambitious environmental plans and reforms. The Concept of Transition of the Republic of Kazakhstan to Green Economy adopted in May 2013 takes a long-term (until 2050) strategic approach to promote best available technologies, introduce new financial mechanisms and incentives, improve environmental performance of all key economic sectors and curb greenhouse gas emissions in the energy sector. The greenhouse gas emissions trading system and the National Plan deserve special attention.

This green economy approach builds on previous government programmes, such as the Green Country programme, which promoted active afforestation, and the Green Growth programme, which helped develop Integrated Water Resources Management and solve some of industrial and household waste issues. Currently supported by the European Union and supervised by the Water Resources Committee under the Ministry of Agriculture, the green economy model is being implemented in the water sector.

International development players in co-operation with the Central Asia Mountain Partnership have contributed to improved pasture management practices in Kyrgyzstan through participatory and community-based approaches that reduced pressure on grazing lands, improved breeds and introduced a flexible pasture management system (University of Central Asia et al., 2012). These measures can contribute to pasture adaptation to climate change. In light of the poverty in the country, the Kyrgyz government adopted a policy to keep energy prices low. The country produces and sells hydropower at the lowest cost in the region, but the problem with low tariffs is that the pricing does not allow for the necessary maintenance and upgrades and creates disincentives for investors. A transparency initiative in the country's energy sector may promote future reforms.

As a result of its World Bank ranking of vulnerability to climate change, Tajikistan was invited to participate in the Pilot Program for Climate Resilience, an initiative designed to help countries adopt a climate-resilient development path, and to increase awareness of climate change. The PPCR budget of Tajikistan grew to US $150 million, and funded projects in hydropower, agriculture, land use and other sectors. Through participation in the PPCR projects, Tajikistan has become a pioneer in the region in incorporating climate change considerations into planning related to key economic sectors, and in linking outside investments to long-term climate effects.

The State Program for the Study and Conservation of Glaciers, the only one of its kind in Central Asia, combines research and practical approaches. Tajikistan is also the first country in Central Asia to establish a water co-operation agreement with Afghanistan on the management of water resources of the Panj River. The current bilateral co-operation process focuses on hydrology and the environment.

In 2012, Turkmenistan participated in the United Nations Sustainable Development Conference Rio+20. The country takes climate change seriously at the highest political level, and has recently demonstrated leadership in the region by offering to host a regional centre on climate change adaptation and climate technologies under the auspices of the United Nations.

Uzbekistan has developed, with UNDP support, legislation to revise energy efficiency building codes, prepared a climate hazards profile and initiated the national low-carbon development strategy. In the energy, chemical and gas sectors, as well as in agriculture and water resources, managers are engaged with climate change impacts, adaptation measures and prospective projects.

6. CLIMATE CHANGE AND SECURITY HOTSPOTS

Climate change and security hotspots are areas with ongoing tensions or environmental concerns where climate change is expected to undermine social or economic stability, threaten infrastructure or livelihoods, or compromise security by exacerbating political or social tensions, conflicts or instability.

Defining climate change and security hotspots

This project identifies and assesses climate change and security hotspots across Eastern Europe, Central Asia and the Southern Caucastus. These hotspots are identifiable in geographic terms, and are characterized by ongoing tensions, environmental concerns or both. In each of these hotspots, climate change through one or more pathways is expected to undermine social or economic patterns, threaten infrastructure or livelihoods, or compromise security by exacerbating political or social tensions, conflicts or instability. Areas with weak institutions or lacking the effective mechanisms for transboundary environmental and security co-operation are especially vulnerable.

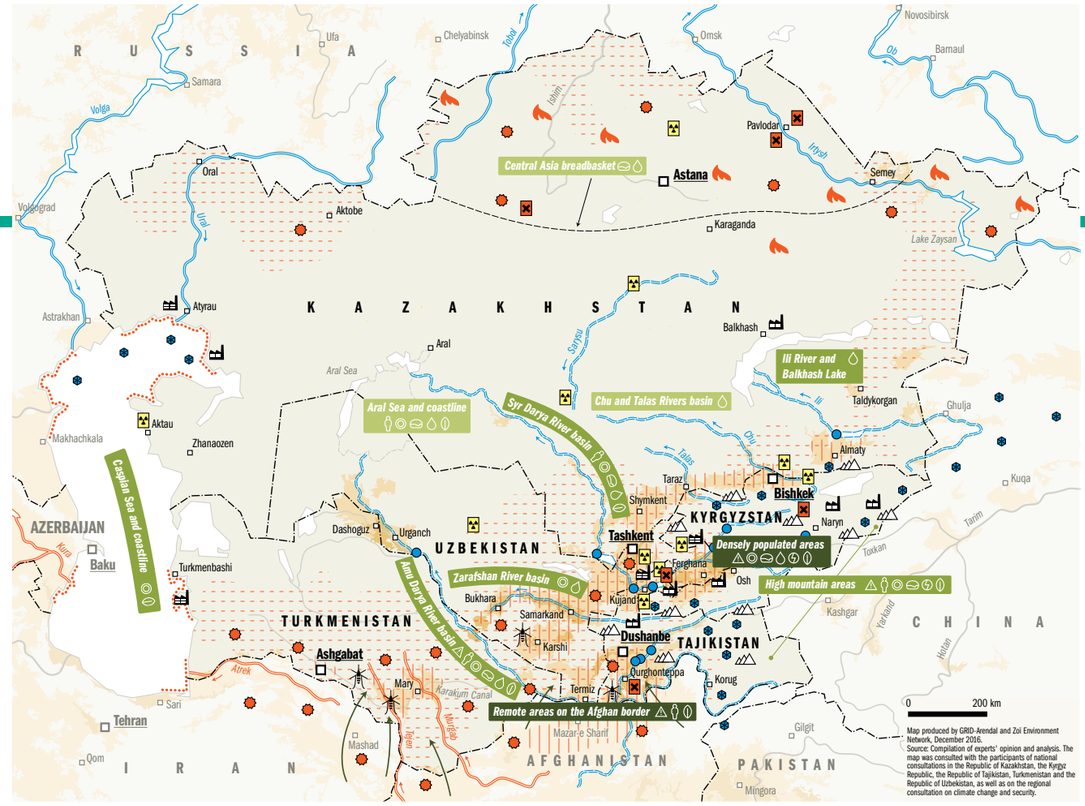
The analysis of hotspots, which has been discussed with stakeholders in the countries during several consultations, recognizes the value of natural resources both economically and in terms of security, and considers the tensions associated with the value of resources. Such tensions may arise from criminal activity conflicting with legitimate uses or from questions of who can use a resource, and how. How climate change may affect these situations is of particular interest.

The hotspots included here reflect the judgement of the project analysts and the stakeholders, as well as the outcomes of the national and regional consultations conducted between 2014 and 2016. The analysis considered the following:

- Existing or prospective vulnerability to climate change
- Existing instability or security risks
- Analytical conclusions regarding the connections between climate change and security
- Other existing political, socioeconomic and environmental factors

6.1. Regional/transboundary hotspots

Regional hotspots have regional security implications, and may extend across ecosystems in more than one country. The Central Asia regional hotspots include densely populated areas, remote areas on the Afghan border, high mountain areas, and transboundary waters. The transboundary waters include seven specific areas. All of these climate and security hotspots are regional in nature. The mountainous and densely populated areas, the southern periphery of Central Asia (the border with Afghanistan) deserve special attention. Figure 10 provides an overview of the hotspots in the region.



Climate change and security hot-spots in Central Asia

Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Turkmenistan and Republic of Uzbekistan

Category of security implication

- Social insecurity
- Human health insecurity
- Economic and livelihood insecurity, damage to infrastructure
- Food insecurity
- Water insecurity, water resources scarcity
- Energy insecurity
- Land degradation, biodiversity, cultural and natural heritage
- Densely populated and industrialized regions near mountains: environmental stress, water and energy insecurity
- Desertification
- High mountain areas at risk: energy insecurity, major ecosystem changes, natural disasters, infrastructure damages
- Caspian Sea: risk of flooding due to sea level fluctuation
- Fire-prone area
- Severe drought impacts

Population density (inhabitants per km²)

5 50

Areas with climate change and security risks by 2030

- High
- Medium
- Low
- A b c — Regional/transboundary hotspots

Predicted change in annual river flow

- Projected increase of river flow by mid-century
- Projected increase of river flow till 2030 - 2050 followed by overall decrease and seasonal change
- Projected decrease of river flow by 2030 - 2050
- no change/no information

- Locust invasions and spread of dangerous infections; potential risk of cross-border spread of invasive species and new diseases
- Hazardous waste sites and industries potentially affected by natural disasters and climate change
- Storage of pesticides or fertilizers; contamination by pesticides in the event of flooding
- Storage of radioactive waste
- Reduction of ice cover
- Hydropower plant

Figure 10: Climate change and security hotspots

6.1.1. Densely populated areas

One of the most problematic densely populated regions is the Ferghana Valley – shared by Uzbekistan, Kyrgyzstan and Tajikistan – where people historically traded broadly across borders and pursued agriculture business (See Figure 11). Roads and irrigation channels criss-crossed borders that were only nominal during the Soviet era, but after independence they became cross-border routes. The countries imposed new travel and trade restrictions and intensified the restrictions in recent years. In the past five years, major Uzbek-Kyrgyz ethnic clashes have occurred in Osh and Jalalabad in southern Kyrgyzstan, and over the same period Tajik-Kyrgyz clashes occurred mainly in enclaves, disputed borders and roads. In many of these cases, the underlying causes included trade and access to roads, pastures, land and water.

Ferghana Valley

- Lake
- Irrigated areas
- Hazardous waste
- Fortified borders
- Vulnerability of hydropower and water infrastructure to climate change
- Risk of industrial pollution
- Water pollution from urban areas without appropriate water treatment
- Water removal for irrigation
- Increasing discharge and risk of floods due to rapid snow- and glacier melting

Figure 11: Ferghana Valley

Enclaves are making an already difficult life harder. With the advent of border fences, trenches and armed guards, these isolated communities in the Ferghana Valley have become even more isolated and marginalized resulting in vulnerability and insecurity. Piedmont areas of the Ferghana Valley in all three countries have unattended and obsolete storage facilities of hazardous mining waste (uranium, mercury, antimony, heavy metals) and dumps of old pesticides left after the collapse of the Soviet Union. These facilities represent a current and long-term environmental hazard near densely populated areas and beyond (See Figure 12).

Dozens of the small rivers that originate in the Kyrgyz mountains and flow into the Ferghana Valley are subject to destructive floods and flash flooding. Water diversions designed to serve the needs of a growing population may compete with other interests, and local disputes over water use are commonly reported (ENVSEC, 2005). Fortunately, the flows of small rivers draining into the valley are generally stable or growing.[20] Joint efforts to manage the small cross-border river basins in the Ferghana Valley are gaining momentum and building awareness and confidence among water managers, politicians and users through information exchange and public meetings. These efforts have not yet become river basin commissions officially sanctioned by government, but they are moving in that direction. Pilot projects in the valley have already demonstrated the high potential for Integrated Water Resources Management to

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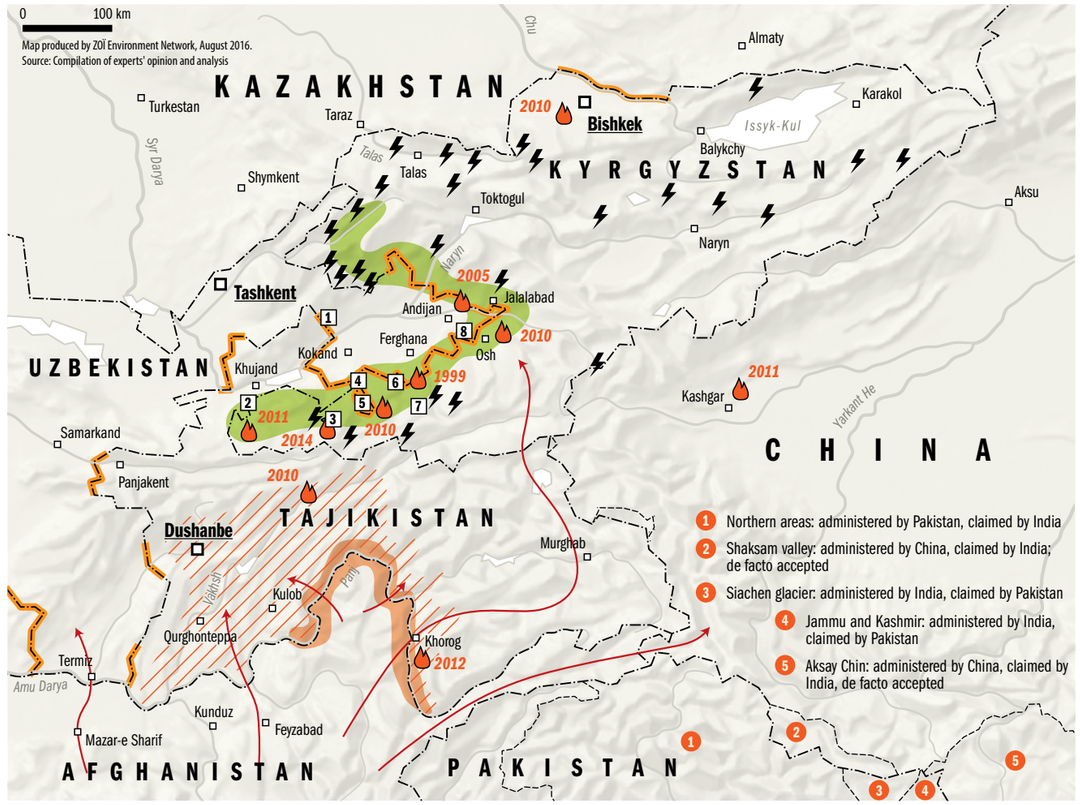


Insecurity in the mountains

- Civil unrest 1992-1997: humanitarian and environmental crisis
- Border insecurity
- Disputes over natural resources
- Local resistance to mining
- Acts of violence, skirmishes and inter-ethnic clashes
- Suspected routes of drug smuggling
- Fortified border

Enclaves

1. Sarvan (Tajikistan)
2. Kairagach (Tajikistan)
3. Vorukh (Tajikistan)
4. Chong-Kara (Uzbekistan)
5. Sokh (Uzbekistan)
6. Jangy-ayyl (Uzbekistan)
7. Shakhimardan (Uzbekistan)
8. Barak (Kyrgyzstan)

Figure 12: Insecurity in the mountains

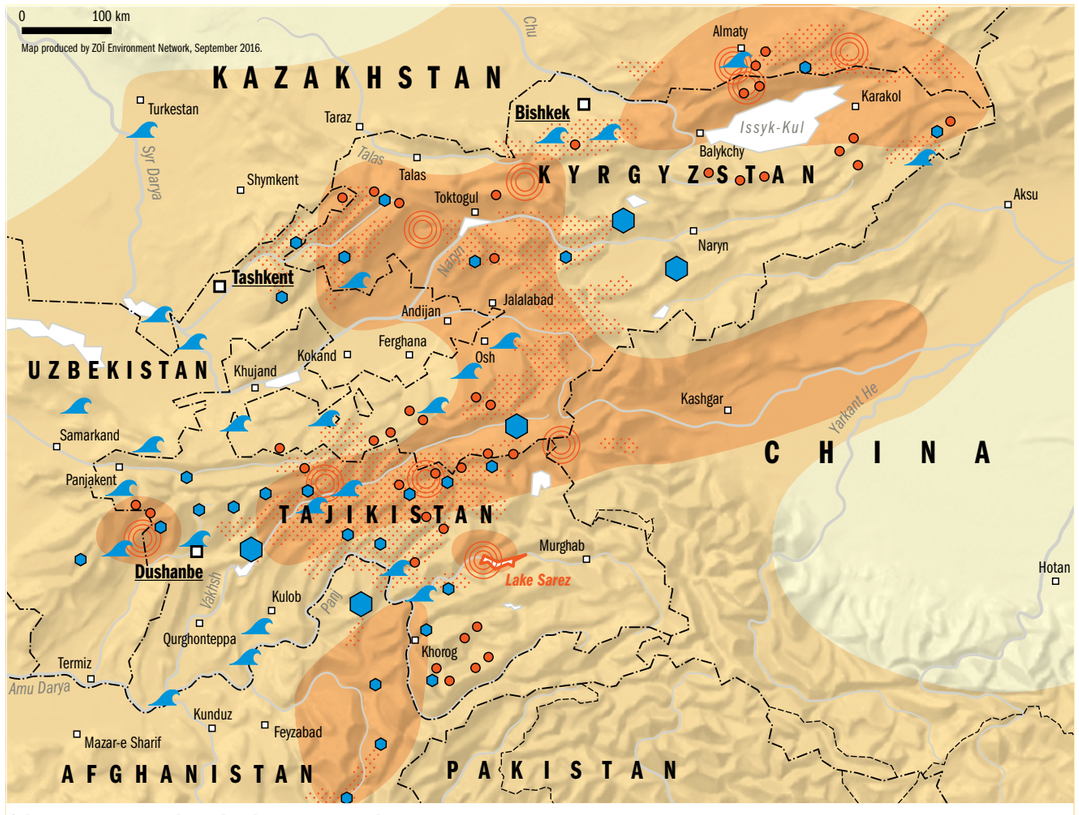
yield significant benefits – a reduction in total water use, the improvement of crop conditions and a more democratic distribution among users, all of which improve resiliency to climate change and reduce the potential for conflict (Dukhovny et al., 2008; Dukhovny, 2010).

The Kayrakum dam and reservoir, built more than 50 years ago on the Syr Darya River in Tajikistan's part of the Ferghana Valley, helps downstream regions by mitigating flood risks and providing water for irrigation. Over time, siltation has rendered the reservoir less efficient, and increases in glacial melt water have made the dam more vulnerable to deterioration. As part of climate change adaptation actions, Tajikistan decided to modernize the hydropower station and dam and reduce siltation, thus making the reservoir more effective for the country and the region.

The Ferghana Valley, a complex of socioeconomic and environmental issues, is not the only hotspot in the context of climate and security with high population density. Other similar areas are large irrigated oases, highly dependent on river water (with outside water sources), mainly along the Amu Darya and Syr Darya Rivers, as well as piedmont metropolitan areas.

Examples of vulnerable oases along the Amu Darya are its delta, shared by Uzbekistan and Turkmenistan, and the Kashkadarya oasis, which lies within Uzbekistan, but is heavily dependent on water from the Amu Darya on the territory of Turkmenistan. Agricultural land in these oases is threatened by erosion, low water and crop failures. Through co-ordination and agreements on water supply and high-level state support, Uzbekistan and Turkmenistan have minimized the impact of climatic risks, social tension and tensions between the two countries.

Most of the major cities of Central Asia are located near or below mountains, a proximity that confers security with respect to the availability of water resources. On the other hand, being downstream has its risks (Figure 13). Melting glaciers create unpredictable circumstances, in particular, the formation of glacial lakes and the possibility of glacial lake outburst floods resulting in mudslides and damage to critical infrastructure. Earthquakes represent a larger threat, and in combination with other risks could be catastrophic. The influx of people from rural to urban areas is increasing the number of people at risk.



Climate and geological risk in the mountains

Hydrometeorological risk

- Risk of flooding and mudflows
- Risk of major avalanches
- Glacial lakes and lake outburst flood risk areas
- Extreme snow and harsh winter impacts on local communities

Seismic risk

- high
- moderate
- low
- Epicentres of main earthquakes
- Landslide risk

Sources: Global Seismic Hazard Assessment Program (www.seismo.ethz.ch/static/GSHAP); National Geophysical Data Center / World Data Service (NGDC/WDS) Significant Earthquake Database, Boulder, Colorado, United States (www.ngdc.noaa.gov/nndc/struts/-form?t=101650&s=1&d=1); Global Risk Data Platform, UNEP/GRID-Geneva (http://preview.grid.unep.ch)

Figure 13: Climate and geological risk in the mountains

Overall, however, short-term and long-term threats in the context of climate change and security of the Ferghana Valley, its enclaves and border zones are estimated as higher than in the other densely populated areas, given past clashes, a high density of population, competition for resources and other factors for tensions. In other densely populated oases and metropolitan areas threats in terms of climate and security are less visible and identified, but they are still there.

6.1.2. Remote areas on the Afghan border

The national consultations on climate change and security, the national communication to the UNFCCC, international analytics and news sources all identify Central Asia southern remote areas, notably the Tajik-Afghan and the Turkmen-Afghan border areas, as security hotspots and environmental hotspots in light of extreme weather events and climate change.

Even if there is no direct connection between these two factors (remote areas and climate change issues), they can overlap aggravating existing difficulties. Monitoring and forecasting of water flows for the largest river in Central Asia, the Panj/Amu Darya, which is shared with Afghanistan, has not been conducted for many years because of persistent security threats along the border. The same applies to crop pests and disease vectors.

When this assessment was started in 2013-2014 the main hotspot was identified as the Tajik-Afghan border area, but the sudden deterioration in security along the Turkmen-Afghan border in 2015 changed the perception of regional threats in the southern remote area of Central Asia. During the regional consultations on climate and security, the participants made a proposal to add other southern regions of Central Asia, especially Turkmenistan, to the list of hotspots.

As the latest analyses of the dynamics and forecasts of climate change and underlying factors in the southern part of Central Asia and adjacent regions of South Asia suggested, climate change and extreme weather events in the area could lead to water shortages, widespread droughts, dust storms, insect infestations, heatwaves, and malaria and other disease outbreaks that could worsen morbidity and mortality rates. Together these effects may aggravate the already precarious situation of food security, and lead to migrations. Adaptation capacities in these areas are limited by the inadequate educations and lack of alternative sources of income for many people.

Instability and security risks posed by Afghanistan include drug trafficking, a danger that extends far beyond the border. The grim mixture of factors creates a climate and security hotspot since climate change can intensify already existing security risks. Short-term and long-term climate and security threats for the southern regions of Central Asia are estimated as high. Uzbekistan with the shortest and perhaps the most secure border with Afghanistan is not considering the border area a security hotspot.

6.1.3. High mountain areas

Interstate disagreements on water distribution in Central Asia are largely associated with how water is used in upstream areas where the flow is being formed at high elevations. In addition, higher poverty and isolation of the mountain communities, frequent and devastating natural disasters, and visible climate change effects contribute to increased vulnerability. The last attacks of extremists in this region occurred in alpine zones and corridors, and discontent and unrest in some mountainous regions have existed until the present day.

As evidenced by the retreating glaciers and snowpack and by the melting of permafrost, the complex high mountain environments are particularly sensitive to climate change. The warming climate is also disrupting precipitation patterns, and all these changes in the hydrologic cycle ultimately trickle down to the lowlands.

Mountains are experiencing more frequent natural disasters, with attendant risks to waste facilities and bacterial contamination in run-off. Projections for 2030 and beyond suggest a reduction in river flows and greater inter-annual fluctuations, which are likely to raise competition for water for energy and irrigation. Water shortages will endanger energy security of the mountainous countries and regions that rely on hydropower, and impact food security of downstream areas relying on irrigated agriculture.

Precipitation in the mountains is projected to increase. The mountain water flows are unchanged, and sometimes increased, but this dynamic is not all positive. Increased precipitation in the mountains in the form of snow and sudden changes in snowpack make it difficult for the nomads, raise the risk of avalanches and increase the cost of maintaining mountain roads. With such dynamics, there are more risks of flash flooding and floods associated with the rapid melting of snow and glaciers, as evidenced by the events of the hot summer of 2015, and large-scale disasters affecting most mountainous areas.

Mountain pastures are a potential point of conflict over limited resources, and climate change and extreme weather – particularly in the form of droughts, heavy winter snow cover and other extremes – may exacerbate the problem. With scarcity of arable land in the mountains, there is tilling of slopes, which are highly susceptible to erosion, and such practices may affect food security for mountain communities. Many mountain rivers are characterized by a high content of suspended solids and sediments that have a negative impact on the infrastructure – canals, pumping stations

and hydropower stations. Due to poor sanitary conditions and natural sources of dangerous infections in the mountains, the outbreak of diseases and bacterial contamination of water can have serious health implications.

In Kyrgyzstan, most of the large mineral reserves are in the high mountains, as they are in Tajikistan, where the mining reserves are less developed and the resources are not as well known. Mining conflicts are constraining mining sector development in Kyrgyzstan. On the one hand, incidents related to glaciers melting and disruptions in other nature patterns in the mountains are sometimes perceived by the local population as negative impacts of mining activities. This adds fuel to the ongoing tensions. On the other hand, hazardous waste storage sites in the mountains affected by natural disasters and degradation due to permafrost, and their gradual deterioration can pose another environmental threat.

The Issyk-Kul region witnessed a number of violent protests related to the mining sector, and the government declared a temporary emergency rule in spring 2013. These protests have roots in social and governance issues, but environmental factors have become more prominent.

The potential for conflict is balanced by the potential of hydropower projects to improve energy security and climate resiliency for downstream areas while promoting economic development (ENVSEC, 2011). If these projects can also store water and release it in a timely fashion, taking into account the interests of all users, security is likely to improve on all fronts.

In view of the high vulnerability of mountainous regions to climate change, the significant damage from natural disasters threatening life, energy and industrial security, as well as the isolation and poverty of these communities, and social tensions and instability in the past, climate change threats to security are assessed as high.

6.1.4. Central Asia breadbasket

The grain-producing area in northern Kazakhstan, where grains and other crops are being grown, is identified in the country's national communication to UNFCCC as a climate change hotspot, which is confirmed by this assessment and the national and regional consultations. Agricultural land resources are particularly vulnerable to changes in precipitation patterns and disruptions in the water cycle, and to weather extremes. This is the breadbasket for both Kazakhstan, and all Central Asia. As the assessment revealed, however, in terms of security it is not a current national hotspot, as grain production is sufficient to meet the country's needs and export obligations. Climate change may lead to reduced crop yields, but not to the extent that would jeopardize security. No less important is that in this part of Central Asia, the potential social unrest, tensions and destabilization, including those provoked by climate change impacts and extreme weather conditions, are quite unlikely, thus in the context of security this is not a hotspot. The considerations, however, are not only national: local grain production affects the other countries of Central Asia and its neighbours, including Afghanistan. Soaring grain prices or crop deficits may undermine food security and stability and it has therefore been identified as a regional hotspot.

According to the Food and Agriculture Organization of the United Nations (2016), currently about 2 million ha of farmland in Kazakhstan employ sustainable agriculture practices. Sustainable agriculture helps reduce risks of soil erosion, increase organic carbon content and improve nutrients and moisture retention through soil protection practices such as zero tillage. Even in the conditions of the severe drought in 2012, some farmers practicing the zero tillage method in the Kostanai region of northern Kazakhstan reached yields twice the amount of past years. In addition to increased productivity, farmers significantly save on fuel, while wheat production is accompanied by lower emissions of greenhouse gases. Farmers in northern Kazakhstan are actively introducing the principles of sustainable agriculture, but in other Central Asia countries, the use of these practices remains limited. With low prices for irrigation water, farmers across the region have little incentive for the introduction of water and soil saving technologies, even in the face of growing climate risks.

Transboundary water ecosystems

Water is, perhaps, Central Asia's most crucial natural resource, and plays the key role for agriculture, the energy sector and human life. In summer it is in high demand for agricultural oases, and in winter mountain countries often experience energy and fuel deficits in the coldest period when water for hydropower production is scarce. In line with population growth, energy and food demands have been growing. Finding the balance between hydropower generation and water supplies is proving difficult and has been politically sensitive over many years.

For Tajikistan and Uzbekistan, the completion of the planned Rogun dam and hydropower plant – a massive hydropower project in central Tajikistan located on the Vakhsh River, a major tributary of the Amu Darya – became a source of tensions and hot discussions (ENVSEC, 2011). The World Bank has facilitated an independent technical, socioeconomic, environmental and social impact assessment, and is acting as a neutral party in an effort to resolve the matter. Similar interstate tensions are centred on the Kambarata Cascade in the upper Syr Darya/Naryn River in Kyrgyzstan. As the demand for energy and food in the region continues to grow, tensions surrounding water may escalate (See Figure 14). Once again, climate change is likely to multiply the threat.

Hydropower developments in the mountains

Hydropower facilities with small water storage (0.01-1 km³) and run-of-river schemes:
- > 500 MW
- < 500 MW
- proposed

Hydropower facilities with significant water storage capacity (> 1 km³):
- > 500 MW
- < 500 MW
- proposed

- Large dam: existing, proposed
- Rivers subject to interstate tensions over hydropower projects and dam operation
- Transmission line
- Projected transmission line
- Glacier cover vulnerable to climate change impacts

Sources: CASA-1000 Project (http://casa-1000.org); Electric power sector of Tajikistan, Barki Tojik, 2011; Afghan Energy Information Center (http://afghaneic.org)

Figure 14: Hydropower developments in the mountains

Water quality is deteriorating due to organic and inorganic pollution from inadequate upstream sanitary conditions and because of run-off of contaminated water from farms, cities and production sites. The climate impacts – whether intense rainfall washing off sewage and hazardous waste in the mountains, or low water reducing run-off and increasing salinity – negatively affect public health.

With better understanding of climate change impacts on regional water ecosystems, the donors and the states are changing their activities and incorporating climate content, as evidenced by CAMP4ASB, a joint programme on climate change of IFAS and the World Bank in the Aral Sea basin. Other positive trends are the introduction of more automated water monitoring stations in the region, the intensification of the exchange of data and the improvement of forecasting systems. Nevertheless, there are no major shifts in water co-operation to achieve an optimal balance for the use of water.

6.1.5. The Amu Darya river basin

Snow and glacier melt provide most of the flow of the Amu Darya River throughout its watershed basin in Tajikistan and

Afghanistan. As a result of global warming the glaciers are receding and seasonal glacial melt is likely to diminish over time.

Projections of future water availability in the large rivers, including Amu Darya, vary (Unger-Shayesteh et al., 2013 and PPCR, 2012b).[21] Several projections indicate dwindling water resources and inter-annual water fluctuations. But the good news is that in the next two or three decades (or until 2030-2040), no significant water resource changes in the large rivers are anticipated (Bernauer and Siegfried, 2012). Projections for annual river flow for large rivers beyond 2050 depend on whether climate change follows a hot and dry path, a warm and wet path or something in between (PPCR, 2011a and 2011b). International research think tanks, national institutes and hydrometeorological services continue to investigate how climate change can impact water availability in this large river.

The demand side is difficult to predict in view of a number of factors, including Afghanistan's water extraction from the Amu Darya River; if demand increases, downstream users are likely to experience reduced flows.

Another consensus is that summer water flows will decrease with flow peaks shifting to earlier dates. In low-water years, the Amu Darya delta has as much water, if not more, from field drainage, as it receives naturally, adding to stress for ecosystems and human health. The situation will change for the better if water efficiency and management is boosted in the basin (Schluter et al., 2013).

The Amu Darya delta suffers most due to pressures on water ecosystems of the river (ENVSEC, 2011). Many lakes and wetlands along the Amu Darya delta have dried up or shrunk to a tiny fraction of their former size. Water in the delta is scarce and of poor quality because of high mineral content. In the severe droughts of 2000 and 2001, the Amu Darya delta provided an example of how to survive a crisis without resorting to violence through a combination of migration and tolerance.

In low-water years, the competition for water increases, exacerbating water distribution issues. Proper management of the resource could reduce this stress (ENVSEC, 2011).

Reaching a balance in hydropower, irrigation and water ecosystems of the Amu Darya is the determining factor in the development of good neighbourly relations among the countries. Climate risks for the basin remain high, but short-term climate change is unlikely to affect security threats. Long-term prospects and forecasts are uncertain, but anticipated reductions and seasonal changes in water flow create additional and significant stresses. Another factor of uncertainty and instability is Afghanistan's use of water and its future security situation. Climate change and security risks are medium in the midterm and uncertain in the long-term

6.1.6. The Syr Darya river basin

The Syr Darya River, with only about half the annual flow of the Amu Darya, is more regulated and more dependent on precipitation. While the Syr Darya basin has fewer glaciers and is more dependent on snow melt contributions than the Amu Darya, the projected increase in rainfall is likely to compensate for the expected water reductions (Savoskul and Smakhtin, 2013b). Long-term projections, however, suggest changes in monthly or seasonal hydrology. The environmental conditions in the smaller Syr Darya delta are better than in the Amu Darya delta.

In spite of the fact that all the Central Asia states are members of the ICWC, the decision-making process in low-water years and disputes over water use and distribution in the Syr Darya basin remain a problem. Hydropower and irrigation developments have dramatically altered the seasonal flow of the Syr Darya, and downstream communities sometimes receive too much water in winter and less than needed in summer. The largest upstream facility is the Kyrgyz Toktogul hydropower dam and reservoir operation on the Naryn River, a principal tributary of the Syr Darya, which as part of the Naryn-Syr Darya Cascade, enables multi-annual regulation of the highly variable river runoff. Even in the water-rich country of Kyrgyzstan, low water levels in the rivers recently have caused a power production reduction, and affected all downstream installations.

One project – the Shardara dam and reservoir on a Kazakh portion of the river – resulted in the unintentional creation of the Aydar-Arnasay lakes in Uzbekistan. Kazakhstan built the dam in 1966 for hydropower and irrigation, and in the record high water year of 1969 overflows from the reservoir found a natural depression and started the formation of the lakes. These lakes now cover 4 000 km^2 making them the largest artificial lakes in the region (FAO, 2004). Over the years Uzbekistan has come to regard the lakes as fortuitous compensation for the loss of the Aral Sea. In the late 1980s and the 1990s, half of the country's annual fish catch has come from these lakes, and Uzbekistan wants to preserve them.

Kazakhstan regulates the reservoir levels for its own purposes and not necessarily to maintain the lakes. The country is interested in improving water security and flood protection for its downstream communities in the Kyzylorda Province. For this purpose in 2011 Kazakhstan built the Koksaray dam 160 km downstream of Shardara. The climate change effects are likely to increase the medium-term flow of the Syr Darya, so the lakes may hold their current levels or even grow, but the long-term effects are uncertain and national priorities may change as well. The future of the lakes is an international issue, and their long-term stability would benefit from efforts among the countries to find a coordinated approach.

21 See also: Second National Communication of Uzbekistan, Second and Third National Communications of Tajikistan, and Third National Statement of Turkmenistan

In the industrially developed piedmont areas of the basin, mainly within the Ferghana Valley, hazardous waste sites contain obsolete pesticides and uranium and mercury waste. These sites are subject to erosion and natural disasters, and any releases of these hazardous substances may enter the river system, and may entail cross-border impacts.

As with the Amu Darya, the future arrangements related to hydropower, water security and irrigation will affect the countries' relations. In the Syr Darya, the management of water flows and allocations may exacerbate the impacts of too much or too little water of the main populated areas nearby, but proper management may compensate for river flow changes caused by global warming. Currently, 25 million people are residing in this area and their number will continue to grow. For some countries, too little water implies energy insecurity, and for others it implies food insecurity. Too much water threatens personal and livelihood security for those living in flood plains.

The current climate risks for the basin are medium and high, and include a range of threats – from human security in light of downstream flooding to industrial security endangered by erosion risks and run-off of waste in midstream and upstream regions. Medium-term outlooks of climate change are unlikely to aggravate existing problems and tensions. The long-term prospects are uncertain.

6.1.7. The Zarafshan river basin

The Zarafshan River rises in the mountains of Tajikistan and flows through narrow canyons before forming a large alluvial fan in Uzbekistan and providing water to the ancient cities of Samarkand and Bukhara and irrigation for 0.5 million ha. The Zarafshan basin is home to 6 million people, but has no river commission or other form of water co-operation.

One important source of the Zarafshan River is the Zeravshan glacier. Between 1927 and 2009, the Zeravshan glacier retreated by 2.5 km. Almost half of that loss occurred during an intense melting period between 1991 and 2009. Overall river flow has not changed significantly, but a sign towards more water in spring and less in summer has been noticed.

On the Uzbek stretch of the Zarafshan, water demand is high and available water is fully used and drainage water is recycled. In terms of climate risk for agriculture until 2050, the Samarkand region of Uzbekistan – the main area of the densely populated Zarafshan basin – is of most concern.[22]

In Tajikistan the river flows naturally in the mountains with little water abstraction or infrastructure. Uzbekistan is satisfied with the status quo, but population growth and climate change loom as significant factors in the future of the river. In Tajikistan, the indigenous cultures that survive in mountain communities, particularly in Kukhistoni Matcha and Yagnob, could be more vulnerable to climate change than other groups living in the river basin. With a high degree of isolation and little knowledge or access to adaptation, these cultural islands may not be able to respond effectively. The southern slopes of the Turkestan range and the northern slopes of the Zarafshan range in Tajikistan are vulnerable to natural disasters and climate change. Figure 15 shows the distribution of activities and pressures in the basin.

Zeravshan river basin

Lake
Irrigated areas
Proposed hydropower plant
Melting glaciers due to climate change effects
Social and environmental changes in the mountains
Social and environmental changes in the lowlands
Water removal for irrigation

Figure 15: Zarafshan river basin

22 UNDP, 2015 climate risk profile of Uzbekistan

Security implications of climate change in this basin include interstate tensions and community disruptions related to perceived or actual changes in the water regime of the river. Both Tajikistan and Uzbekistan stand to benefit from a cooperative effort to share climate and water data. A system for forecasting seasonal and long-term flows would improve the ability to anticipate floods and to plan for irrigation. Sharing risk information related to climate change and natural disasters would enhance preparedness in both countries, and reduce the potential for rising tensions (ENVSEC, 2011).

Security and inter-State tension concerns due to climate change in the Zarafshan basin are assessed as medium, but present day climate risks both for mountains and mountain dwellers and for densely populated valleys remain high. Climate change and security risks are uncertain in the long-term.

6.1.8. The Ili River and Balkhash Lake

The largest lake in Central Asia, Lake Balkhash, lies in south-eastern Kazakhstan. About 80 per cent of its water comes from the Ili River, which originates in China. The depletion of the area's saxaul forests and the overgrazing of winter pastures over the last two decades have increased pressure on the environment surrounding the lake. In the Chinese part of the Ili basin, the developments are less well known, but rapid economic growth there is associated with increasing water use, and clear evidence shows a total increase in irrigated lands of 1 000-1 500 km² over the last two decades of the past century (Christiansen and Schöner, 2004).

The Ili-Balkhash basin has a fifth of the country's population (over 3 million people), the largest city, Almaty, and critical production and energy sites of south-eastern Kazakhstan.

The Kapchagai reservoir, built along the middle reaches of the Ili River in 1966, provides hydroelectric power generation and water supply for irrigation. The increased water use for irrigation decreased flows into the lake, and added environmental stress to the Ili delta and the lake ecosystem, but fortunately, Lake Balkhash avoided the development of the kind of large-scale irrigation projects that led to the Aral catastrophe, and irrigated agriculture has even declined in the area.

Further industrial development, in both the Chinese and the Kazakh parts of the Ili basin, in combination with climate change impacts may affect water quality, water use and availability in the region. The city of Balkhash has a copper smelter that has been in operation for many years, and as more deposits are discovered, more large industrial installations may come to the area. The development of a coal-fired or nuclear power station on the shores of Lake Balkhash is another possibility. Such a major, long-term investment will need to consider the effects of climate change on water resources as the cooling of coal-fired and nuclear stations requires significant amounts of water, and any resulting decrease in river flow or lake levels may make the Ili River and Balkhash Lake more vulnerable to climate change.

Currently, climate change is having mixed effects on the lake and the rivers draining into it (Figure 16). Glaciers in the basin have lost approximately 40 per cent of their former area and volume since the 1950s, and expert assessments indicate that glaciers will nearly disappear in this basin by the 2080s if not earlier. Moreover, business development projects in the Chinese part of the basin can jeopardize the Ili water flow and quality.

So far the melting of glaciers together with an increase in precipitation contributed to an increase in river flow, but produced no significant change in the lake hydrology – its levels have been fluctuating around 342-meter mark over the last 10 years. Meanwhile, higher temperatures have increased evaporation from the lake. A series of dry years could have a dramatic effect on water resources in the basin because the glaciers will no longer be large enough to compensate for diminished precipitation. Current bilateral relations between Kazakhstan and China are friendly and the countries have signed the bilateral co-operation agreements on environment and disasters affecting transboundary rivers.

Climate change risks associated with environmental, industrial and energy concerns and interstate relations in the Balkhash-Ili basin are assessed as moderate, but if industrial and energy development and water use in this basin become too intense, climate change may become a more prominent factor with security and sustainability implications. Climate change and security risks are uncertain in the long-term.

Figure 16: Ili River and Lake Balkhash

6.1.9. The Chu and Talas river basin

The Chu (Shu, in Kazakhstan) and Talas Rivers, now physically separated but sharing a common hydrological past, originate in the Kyrgyz mountains and terminate in the Moyunqum desert of Kazakhstan, and are used by both countries (See Figure 17). In Kazakhstan, they are a part of the common, Shu-Talas water basin. With several major dams and other water management facilities located in Kyrgyzstan, and with Kazakhstan dependent on the proper functioning of those facilities, the situation requires both technical and managerial co-operation. In the 1990s, loosely applied Soviet principles guided water management in the Chu-Talas basin. In 2006, the two countries with support of OSCE, UNECE and the United Nations Economic and Social Commission for Asia and the Pacific established a joint commission for the operation of the water management infrastructure. With experience, the commission has improved co-operation and efficiency, and has collaborated with international organizations to consider climate change and water management issues in the basin (UNECE, 2014).

Chu and Talas river basin

- Irrigated areas
- Water removal for irrigation
- Highly stressed downstream ecosystems with uncertain future
- Melting glaciers due to climate change effects
- Water pollution from urban areas without appropriate water treatment

Figure 17: Chu and Talas river basin

Currently, the water in the basin is fully allocated, but recent work shows that efficiency can improve by 25 per cent and more – a major potential for savings that may become increasingly important in light of the projections that climate change in the mountains will affect downstream conditions.

According to current estimates, an increase in river flow (as a result of glaciers melting and an increase in precipitation) will likely reach a peak by 2030, after which glacier resources will be exhausted, and flow will decline (UNECE, 2014). In peak water season of 2016, the water levels were so high that some important elements of infrastructure were affected in both rivers and countries.

In the Chu River basin, water resources are expected to be sufficient for the population's needs until 2030, but population growth and economic development are likely to result in a water deficit after 2030. In the Talas basin, however, economic development is intense and water resources are almost fully used, thus the situation is potentially more stressful. The area has already seen vigorous protests against new mining projects that may damage water resources. This timeline provides ample opportunity to develop effective responses in both basins.

The countries, with international assistance, have recently taken a common approach to climate scenarios and development of the adaptation strategy as part of the Strategic Action Plan and the transboundary diagnostic analysis. The recent decision (30 November 2016, Bishkek) to establish climate change working group under the Chu-Talas Water Commission is a promising step to plan and implement climate adaptation actions jointly and overcome a degree of scepticism and divergence of opinion on climate change impacts. The joint Commission and the basin approach to water resources planning in each country provides a good basis for the solution of regional problems, rather than national concerns, including those in connection with climate change risks relevant for both countries of the river basin.

The near-term climate change and security risks associated with the Chu/Shu-Talas basin are low, and the longer-term risks are medium. If the planned climate adaptation measures and global climate actions would be fully implemented, the risk levels in the basin would go down.

6.1.10. The Caspian Sea and coastline

While rich in oil and gas resources, the Caspian Sea is vulnerable to climate change and water level fluctuations, especially in the north where the sea is shallow and in the near-sea lowlands. Disruptions in precipitation patterns and rising temperatures can alter the water regime and ice cover, change the conditions for oil and gas exploration and extraction and affect marine biodiversity. The population of Caspian seals declined by 90 per cent over the twentieth century due primarily to unsustainable hunting practices (ENVSEC, 2008), and now the seals are threatened by climate change and industrial pollution, among other forces.

In the Central Asia countries that border the Caspian – Kazakhstan and Turkmenistan – the population density near the sea is low. The marginal desert environment and the region's substantial capital investments in oil and gas make for a stark contrast between rich and poor, reflecting in relative income of workers, residents and foreigners. These factors have developed into labour conflicts that escalated into violence in the past.

The sea level rise experienced by countries with ocean coastlines is different from the fluctuations of the Caspian. The communities and economies on the Caspian have grown accustomed to rises and drops attributable to climate conditions. In the view of development of industrial, tourist and residential infrastructure along the coastline, future sea level fluctuations and storm surges will continue to pose risks to coastal areas (ROSHYDROMET, 2005 and 2008), but long-term projections are highly uncertain. The current sea level is 2 metres higher than levels 30 years ago, but over the last 5-7 years it has dropped by 30-60 cm, depending on location (CASPCOM, 2012), and a further drop is possible due to reduction in the Volga River water input (NEACC, 2012 and 2015).

More new infrastructure is vulnerable to storm surges, and local authorities and industry operators must plan for sea level fluctuations (ROSHYDROMET, 2008). Previous attempts to regulate water levels (as at the large Kara-Bogaz-Gol Bay) have been unsuccessful. See Figure 18 for details.

Caspian Sea: Climate change, disasters, desertification

- Hazardous waste sites and industries potentially affected by disasters
- Observed increase in air temperatures
- Shrinking glaciers and rapid snow melt; risk of flashfloods
- Storm surges
- Projected flow increase, earlier onset of spring waters
- Projected flow decrease
- Risk of flooding due to storm surges and sea level fluctuations
- Sea-ice events and changing winters
- Severe desertification

Figure 18: Caspian Sea: climate change, disasters, desertification

Depending on whether the Caspian is legally defined as a sea or a lake, the international borders linked to the coastline may move with the fluctuations in sea level. A more reliable definition of marine borders would lessen the opportunity for border disputes (ENVSEC, 2008). Among potentially disputable reserves are some offshore oil fields between Azerbaijan and Turkmenistan, though the countries have managed to maintain good co-operation.

In the Central Asia part of the Caspian, climate change concerns centre on personal safety and oil and gas infrastructure. Security risks are assessed as low to medium in the near-term and midterm. Climate change and security risks are uncertain in the long-term due to lack of reliable models and knowledge of the Caspian Sea level fluctuations in response to global climate change.

6.1.11. The Aral Sea and coastline

Over the last 50 years, Central Asia has witnessed the unfolding of an ecological tragedy of epic proportions – the Aral Sea, once the fourth largest lake in the world has shrunk to a sliver of its former size. Starting in the 1960s, the Soviet government diverted waters from the Amu Darya and Syr Darya Rivers for large-scale land reclamation. Environmental degradation continues to this day with ongoing desertification. Winds carry salt and agricultural chemicals with sand and dust from the exposed seabed to areas as far away as 150-300 km. The Aral Sea is likely to continue to lose water due to higher temperatures and to low run-off reaching the sea, and human interference with water resources remains a much more significant factor than climate variability and change.

The contemporary Aral Sea is commonly divided into northern and southern parts. The northern sea is fed by the Syr Darya, while the southern sea is fed by the larger Amu Darya. Salinity levels in the southern sea are too high to support life, but water resources management in the north has raised water levels and reduced salinity to levels suitable for fisheries, thanks to a dam built by the Kazakh Government with international support. Efforts to construct and maintain small dams and plantations to maintain numerous lakes and riverside ecosystems in the Amu Darya delta were less successful due to the much larger area and the highly variable river flow, among other reasons.

In a positive twist, areas exposed by the receding sea are open to oil and natural gas exploration – which have begun recently in the southern part of the Aral and shows promise for significant reserves and new economic development of the region. Plans are in place to make the new gas fields operational and build new gas capacities in the near future. The development of these resources is expected to provide gas for the Amu Darya delta region and for export, and to improve economic and energy security.

Like all large water bodies, the Aral Sea once acted as a climate regulator, moderating the summer heat and the winter cold. Now the sea is at the mercy of the climate, and the rates of warming and drying in the region are greater than in the surrounding area.[23] Future climate change effects on the sea are of little concern, since human activities are likely to be more prominent than climate change. Similarly, climate-related security threats for the sea and its coastline are not currently a concern. The coastline remains susceptible, however, to extreme weather conditions, especially in relation to salty-dust storms, drought and extreme temperatures, and the area continues to suffer from frequent water shortages and poor water quality. So far, these factors have not resulted in tensions.

While there are no obvious links between climate change and security for the Aral Sea, it continues to play a symbolic role, uniting the countries in addressing regional issues of environment protection and climate change. CAMP4ASB is one example of the current collective effort.

Climate change threats to the ecosystem of the Aral Sea and its coastline are not high, but the population and economy of the Aral Sea region are at high climate risk, especially in low water years. Nevertheless, destabilization or social unrest has not been witnessed even in low-water years. Climate change and security risks are medium in the short-term and uncertain in the long-term.

6.2. National overviews of climate and security issues

None of the domestic climate change and security issues facing the individual countries of Central Asia rises to the level of a hotspot as defined in this assessment, but each country has concerns that warrant ongoing attention. The following sections provide brief descriptions of the countries' circumstances with respect to incipient or potential climate change effects on security.

6.2.1. Kazakhstan

Kazakhstan, the largest country in Central Asia, consists mostly of vast deserts, grasslands and mountains (Figure 19). With borders on the Caspian and Aral Seas, Kazakhstan reaps the benefits of fisheries and oil and gas resources. Most of the country's rivers originate outside of Kazakhstan, and some pass through Kazakhstan and flow on to other countries.

23 Second National Communication of Uzbekistan

Climate change and security concerns in Kazakhstan

- Marine and coastal ecosystem change and damage.
- Kazakh "breadbasket": risk of crop losses and food insecurity. Forest fire hazard.
- High national dependency on coal. Tightening national and global emissions obligations.
- High mountain area. Impacts of extreme weather and disasters on livelihoods. Melting glaciers. Sensitive infrastructure, vulnerable and isolated communities.

Predicted change in annual river flow

- Projected increase of river flow by mid-century
- Projected increase of river flow till 2030 - 2050 followed by overall decrease and seasonal change
- no change / no information

Figure 19: Climate change and security concerns in Kazakhstan

Heatwaves and low precipitation have dried soils and contributed to crop failures and forest fires in northern areas. Changing land use practices are restoring soil cover and increasing the capacity for carbon storage and as a result grain yields have increased. Extreme weather events resulting from climate change have produced dramatic swings from record high to record low agricultural production. Northern and eastern provinces of Kazakhstan are considered most vulnerable to climate change impacts. The size of the country, variations in trends, scenarios and climate change effects call for a diversified national approach and flexible strategies to the development of climate change policy.

The national consultations on climate change and security in Kazakhstan included discussions of the need for such administrative enhancements in insurance and agrometeorological services, better inter-agency co-ordination on climate risks, assignment of a state body responsible for adaptation, and increasing the role of the state in social support. The consultations also identified the need for more reliable climate projections and weather forecasts and for better land use practices and the improvement of crops.

Regional hotspots with relevance for Kazakhstan, apart from northern grain producing areas, include high mountain ecosystems, densely populated piedmont areas, the Aral Sea and coastline, the Caspian Sea and coastline, the Syr Darya River, the Balkhash Lake and the Ili River, and the Shu and Talas Rivers.

6.2.2. Kyrgyzstan

Kyrgyzstan has been democratically developing modern lifestyles while retaining traditional practices based on natural grazing and farming. Climate change and variability are beginning to affect grazing lands and practices. Rising temperatures are also affecting the country's important mining sector as melting glaciers and permafrost complicate already challenging mining and tailing safety conditions (Bogdetsky et al. and 2012; Torgoev, 2013). Most of the current mining in Kyrgyzstan occurs at elevations above 2 500-3 000 m, a trend that is expected to continue.

Climate change may alter bioclimatic zones in the mountains and affect the state and distribution of pastures and forests. Extreme weather events often affect the productivity of grazing and the walnut-fruit forests and plantations. The mining sector, an engine of the entire economy and a major taxpayer, is influenced by climate change, and disruptions in mining may affect the macroeconomic situation. Moreover, conflicts around the mining sector are complicated by further development, without climate risks.

Intense rainfall and snowfall, floods and landslides caused by glacial lake outburst floods, water scarcity and heatwaves and cold waves may all affect security of the population, agriculture sites, the energy sector and transport infrastructure. Climate change in Kyrgyzstan may create conditions for the spread of dangerous diseases and affect the natural genesis of plague in the mountains. See Figure 20.

Climate change and security concerns in Kyrgyzstan

- Main area of animal husbandry: loss in pasture productivity and availability, climate risks and epizootic outbreaks. Energy insecurity, high energy prices and low ability to pay.
- High natural hazard area. Mining waste legacies threatening downstream communities. Weak social support. Likelihood of unrest and tensions.
- Mining activities at high elevations: engineering challenges, growing environmental risks and mine-related tensions.
- Issyk-Kul Lake region. Inadequate wastewater systems, depleted fish stocks and illegal fishing. Melting glaciers, fluctuations in lake level. Mining waste mismanagement.
- Areas above 3 000 metres

Predicted change in annual river flow

- Projected increase of river flow till 2030 - 2050 followed by overall decrease and seasonal change
- no change / no information

Figure 20: Climate change and security concerns in Kyrgyzstan

Kyrgyzstan's climate risk profile (CAMP Alatoo and UNDP, 2013b) and the national consultations on climate and security both identify the three southern provinces – Jalalabad, Osh and Batken – as most exposed and vulnerable to the impacts of climate change on livelihoods. Floods and extreme snow events are prominent among the area's natural hazards. The Batken Province is considered the most problematic, since in addition to high climate risks and high poverty, the area hosts several enclaves and diverse ethnic communities, and features undefined borders. Local natural resource conflicts are frequently reported here. These areas are included in the regional hotspots under the densely populated piedmont areas (as a part of the Ferghana Valley and its enclaves).

The ecological pearl, and a tourist mecca of Kyrgyzstan – Lake Issyk-Kul – is already experiencing the combination of anthropogenic pressure due to intense tourism development and coastline construction and the collapse of fisheries due to overfishing in the past. Since there are no outflows, glaciers melting are leading to increases in water levels causing higher tensions over land use nearby. As tourists tend to travel to safe and quiet destinations, instability reports from the region are constraining economic development. The participants of the national consultations on climate and security in Kyrgyzstan identified Lake Issyk-Kul among the country's priorities. Regional hotspots with relevance for the country include mountainous and densely populated areas, and the Syr Darya, Chu and Talas Rivers.

The Kyrgyz national consultations identified a number of constraints that the country is encountering when dealing with climate change threats: political and other instability, low public awareness and administrative capacity, insufficient financial resources and lack of monitoring and assessment tools.

6.2.3. Tajikistan

The mountains of Tajikistan are greater in number, elevation and density than those in any other country of Central Asia, and provide most of freshwater in the Aral Sea basin. Extreme precipitation and heatwaves are the cause of destructive flash flooding and floods in the mountains and droughts in the densely populated southern and northern parts of the country.[24] In Tajikistan, nearly 75 per cent of the rural population relies on rain-fed and irrigated agriculture. The mountain terrain often precludes irrigation, and crop-producing slopes are prone to extensive erosion. Figure 21 provides an overview of climate change and security concerns in the country.

The mountain communities in central Tajikistan suffer from a multitude of climatic and geological hazards. The Murgab District in the eastern part of Gorno-Badakhshan Autonomous Region, in the Pamir Mountains bordering China, is a remote and sparsely populated high mountain desert area mainly populated by Kyrgyz-and-Tajik speaking nomads living in very difficult economic and climate conditions and subject to numerous environmental stresses and climate change impacts on ecosystems, including permafrost melting. Other areas of the autonomous region are also vulnerable to environmental and climatic stress. Lowland deserts of the south of Tajikistan with irrigated oases suffer most from droughts and heatwaves, and the proximity of troubled Afghanistan creates additional security risks.

As a landlocked mountain country with limited fossil fuel reserves, Tajikistan faces a great energy challenge and the highest prices for fossil fuels in the region. High energy prices inevitably affect the cost of food, the cost of living and the cost of doing business. To enhance energy security, the country has increased coal production and intensified coal consumption by industry, the energy sector and households. Coal is the least desirable energy source in terms of mitigating the impacts of climate change, but an energy deficit is a worse alternative in the national view. On the other hand, fuel deficits and high prices have triggered a shift from gasoline to liquefied petroleum gas in more than half of the country's cars, a more climate-friendly alternative that helps reduce greenhouse gas emissions.

Tajikistan's national climate change and security consultations emphasized the importance of the participation of local stakeholders and the use of traditional knowledge in the development of adaptation strategies. The participants discussed the need to improve inter-agency co-operation and to strengthen the legal and regulatory framework for adaptation in order to prevent climate change and security risks, and called for effective communications and raising public awareness.

Regional hotspots with relevance for Tajikistan include high-elevation and densely populated piedmont areas and oases, the Tajik-Afghan border regions (the longest stretch of over 1 500 km) and the Amu Darya, Syr Darya and Zaraf-shan Rivers.

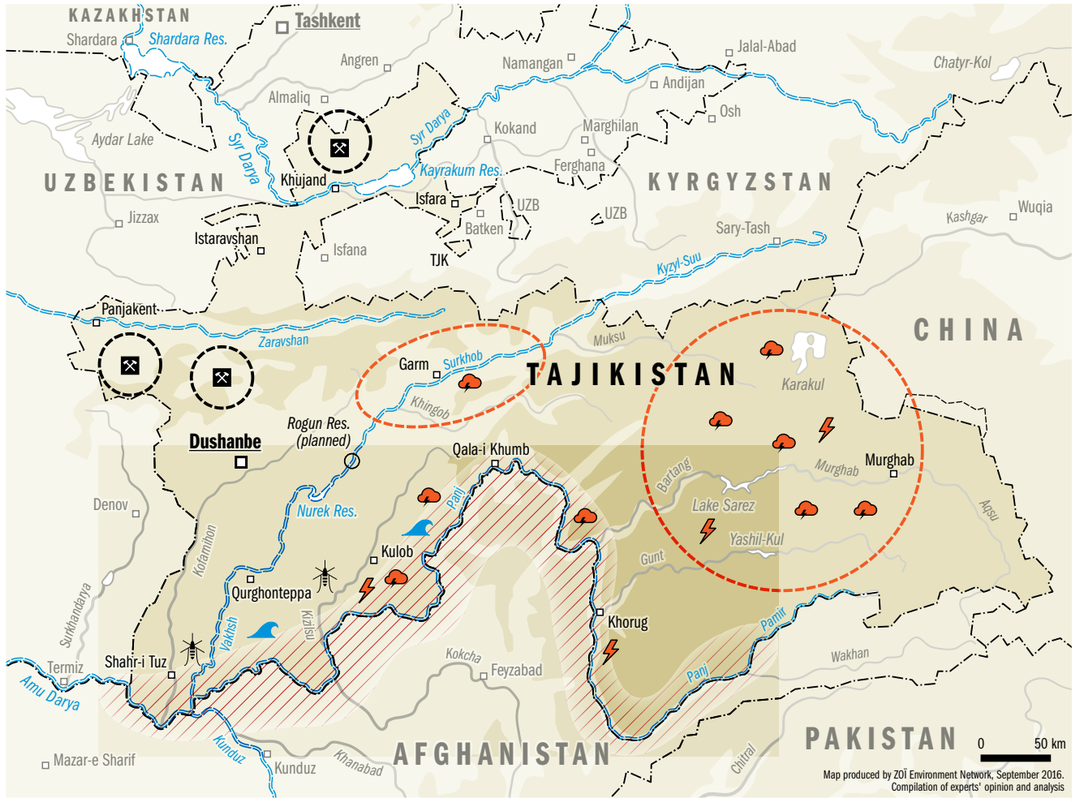


Figure 21: Climate change and security concerns in Tajikistan

6.2.4. Turkmenistan

Turkmenistan, in contrast to its Central Asia neighbours, relies heavily on natural gas production and exports, and it follows a challenging national policy of providing its citizens an affordable, reliable water supply despite being a desert country. To its great credit, Turkmenistan has experienced no violence either domestically or with neighbours.

Turkmenistan adheres to the principles of neutrality, recognized in United Nations resolutions, and conducts a peaceful foreign policy for security and sustainable development. Refusal to participate in international military political alliances allowed the country to avoid being drawn into any form of military confrontation in the region, including in neighbouring Afghanistan. No conflicts over natural resources or social unrest following extreme weather events have been reported in the country.

As the southernmost country in Central Asia, Turkmenistan is the hottest and driest, with summer temperatures soaring to +50°C at Repetek and rainfall ranging from 75 to 380 mm in different parts of the country.[25] Many sectors

24 Second and Third National Communications of Tajikistan

25 Second and Third National Communications of Turkmenistan

and communities are well adapted to the harsh desert climate, and the knowledge of how to cope with water deficits makes the country more capable of managing the desertification problems and climate threats. But dangerous climate variability does affect Turkmenistan: a severe regional drought in 2000-2001 and a cold spell in winter 2008 are recent examples.

Most of Turkmenistan's water for urban areas and large-scale irrigation schemes comes from upstream states, and any reduction in water will make the country highly vulnerable. The country's second national communication and its national strategy on climate change adaptation identify a secure water supply for agricultural and other purposes as the top priority.

Apart from the Amu Darya River, southern areas of Turkmenistan rely on a few small rivers that originate in Afghanistan or Iran. Even if upstream water use does not change, climate change projections for Central Asia southern areas, northern Afghanistan and Iran anticipate less precipitation and change in snow melting periods in the future. Moreover, small rivers are susceptible to sudden and destructive floods. The climate change effects on small rivers may result in less water and human security, but no research on this issue has been conducted yet. (See Figure 22 for an overview of climate change and security concerns in the country.)

Climate change and security concerns in Turkmenistan

Irrigated cotton and grain production dependent on external water supply and inefficient irrigation. Crop losses and food insecurity.

South Caspian oil-gas infrastructure: marine and coastal ecosystem change and damage.

Southern periphery of Central Asia: geopolitically unstable areas

Predicted change in annual river flow

Projected increase of river flow till 2030 - 2050 followed by overall decrease and seasonal change

Projected decrease of river flow by 2030 - 2050

no change / no information

Figure 22: Climate change and security concerns in Turkmenistan

The Turkmenistan national consultations on climate and security considered the implications of changes in precipitation patterns and increases in temperatures on water resources and agriculture, including planting and harvesting periods and crop productivity. The participants also discussed transboundary water resources and the potential conflict between water use for energy or agriculture, a conflict that may intensify. Climate-related health concerns included increased mortality due to heatwaves and cold spells, and increases in the spread of diseases.

Turkmenistan has no national climate change and security hotspot. The government provides significant support for a strong social safety net, and the country has no unrest.

The national consultations in 2014 focused on the regional hotspots of interest to Turkmenistan – areas and provinces adjoining the Caspian Sea coast, the Aral Sea and Amu Darya River. Following the security deterioration in Afghanistan in 2015, especially along the Turkmen border, experts paid attention to this area as a potential hotspot.

6.2.5. Uzbekistan

Uzbekistan is the most populous country in the region and has the most diverse economy and largest security force. It also has a diverse natural landscape with mountains and glaciers, sandy and stony deserts and broad river valleys with irrigated agriculture (Figure 23).

Climate change and security concerns in Uzbekistan

Hydrological disruptions. Irrigated cotton/grain production; external water supply; inefficient irrigation. Crop losses; food insecurity.

Declining water resources. High population density in the Ferghana Valley. Local conflicts over natural resources.

Declining water resources. Densely populated Amu Darya delta. Acute water shortages; health problems; mass displacements.

Predicted change in annual river flow

Projected increase of river flow till 2030 - 2050 followed by overall decrease and seasonal change

Projected decrease of river flow by 2030 - 2050

no change / no information

Figure 23: Climate change and security concerns in Uzbekistan

Geographically, Uzbekistan lies in the centre of Central Asia, and the Soviets located most regional institutions here. After independence these institutions adopted important national roles and remain well respected. Uzbekistan has supported efforts to save the Aral Sea. Working with donors, Uzbekistan has implemented water and land reforms that are in effect investments in climate change adaptation.Most of the crucial water resources in Uzbekistan come from the neighbouring mountain countries. Upstream economic developments have the potential to alter water regimes and water use patterns, and, if regional water management remains poorly coordinated, may affect water security and increase current tensions over water resources.

Uzbekistan was a major cotton producer in the Soviet era, but after independence the country converted significant parts of its cotton production area to grain and other food crops. This has improved food security to the extent that the country now produces enough food for domestic consumption and exports its surplus. Uzbekistan's second national communication on climate change warns of the impacts of heatwaves, high temperatures and other weather extremes on agriculture. Both poor access to, and the degradation of, grazing lands increase the climate vulnerability of rural dwellers. The availability of insurance and low-interest loans would reduce drought risks and improve economic and food security.

Regional hotspots relevant to Uzbekistan include densely populated areas (especially the Ferghana and Zarafshan Valleys, the Amu Darya delta, and Kashkadarya Province), the Aral Sea coastline, and the Amu Darya, Syr Darya and Zarafshan Rivers.

The table below summarizes the hotspots in Central Asia.

Table 1: Summary of climate change and security hotspots

Hotspot	Political, socioeconomic and environmental conditions and trends	Climate change hazard	Security implications	Security risk: 2030/ 2050-2100	Adaptive capacity
Regional/transboundary hotspots					
Densely populated areas	High population density, conflict history in the Ferghana Valley Mountain enclaves with restricted access Pockets of instability and periodic violence	Melting glaciers Glacial lake outburst floods Extreme events: hailstorms, frosts	Economic and livelihood insecurity, damage to infrastructure Food insecurity Water insecurity, including shortterm risks of conflict over water and land access and use Energy insecurity Land degradation, losses in biodiversity, cultural and natural heritage Social insecurity as well as ethnic relations and border tensions	High/High	Medium Improving resiliency through Integrated Water and Land Resources Management
Remote areas on the Afghan border	Heavy reliance on the agriculture sector for employment Labour migration Illegal trade, narco-trafficking Food, energy and personal insecurity Growing demand for irrigated land	Extreme events: floods and droughts Pest infestations	Social insecurity as well as border tensions, such as spill over of instability from Afghanistan Human health insecurity Land degradation, losses in biodiversity, cultural and natural heritage	High/High	Low Low education and skill levels Marginalized women
High mountain areas	Isolated communities with little external support Mining at high elevations, sensitive infrastructure	Extreme winter weather and droughts Glacial lake outburst floods, melting permafrost	Social insecurity Human health insecurity Economic and livelihood insecurity, damage to infrastructure, including mining conflicts Food insecurity Energy insecurity Land degradation, losses in biodiversity, cultural and natural heritage	Medium/high	Low to Medium Improved climate resiliency and reduced energy insecurity under consensus-based hydropower development, or added tensions under disputed development
Central Asia breadbasket	Stable economic region with strong agricultural sector Historical land degradation	Changes in precipitation patterns Extreme weather events	Water insecurity Food insecurity	Low/ uncertai n in the long term	High

Hotspot	Political, socioeconomic and environmental conditions and trends	Climate change hazard	Security implications	Security risk: 2030/ 2050-2100	Adaptive capacity
Regional/transboundary hotspots					
The Amu Darya river basin	High dependency on irrigation and hydropower; plans for hydropower expansion upstream and water storage capacities downstream General environmental degradation in the Amu Darya delta Loss of biodiversity	Melting glaciers Likely increasing rainfall and heat-waves	Human health insecurity Food insecurity Water insecurity in low-water years Livelihood insecurity in water scarce especially in the river delta Land degradation, losses in biodiversity, cultural and natural heritage Social insecurity and longer-term risks including conflict over irrigation vs. hydropower and growing water deficits and mismanagement	Medium/ uncertain in the long term	Low to medium
The Syr Darya river basin	High dependency on irrigation and hydropower Risk from toxic and radioactive waste	Melting glaciers Increased rainfall	Human health insecurity, including from risk of disaster damage and erosion of hazardous waste storage sites Economic and livelihood insecurity, damage to infrastructure Food insecurity Water insecurity Land degradation losses in biodiversity, cultural and natural heritage	Medium/ uncertain in the long term	Low to medium Early warning and water information bulletin Control and rehabilitation of waste sites Balanced river regulation
The Zarafshan river basin	Risk of upstream pollution from growing industrial activities and mining, and down stream pollution from agriculture Water resources totally allocated	Melting glaciers Flooding in the mountains	Livelihood insecurity in downstream areas due to upstream hydropower development Water insecurity, due to longer-term security risks associated with disruptions in the water cycle	Medium/ uncertain in the long term	Low in mountain communities High in downstream areas
The Ili River and Balkhash Lake	Rapid economic growth in the Chinese part of the basin Energy and industrial developments around the lake in Kazakhstan	Melting glaciers Increased temperatures	**Water insecurity:** • Potential water shortages • Fluctuations in lake levels • Potential longer-term challenges for transboundary water management	Medium/ uncertain in the long term	Medium
The Chu and Talas river basins	Growing population and economic development Active agriculture, hydropower and mining sectors	Melting glaciers Flooding in the mountains, drought downstream	**Water insecurity:** • Water deficits projected for mid-century	Low/medium	Good co-operation between Kazakhstan and Kyrgyzstan with consideration of climate change impacts and strategies Existing river basin commission potential aid in averting conflicts
The Caspian Sea and coastline	Low population density in Kazakhstan and Turkmenistan, but high in Iran and Azerbaijan	Fluctuations in precipitation Storm surges and flooding	Economic and livelihood insecurity, including potential longer-term risks related to income and labour disparities and some damage to infrastructure Land degradation, losses in biodiversity, natural and cultural heritage	Medium/ uncertain in the long term	Medium

Hotspot	Political, socioeconomic and environmental conditions and trends	Climate change hazard	Security implications	Security risk: 2030/ 2050-2100	Adaptive capacity
Regional/transboundary hotspots					
The Aral Sea and coastline	Ongoing degradation and desertification	Increased temperatures and aridity	Human health insecurity Food insecurity Water insecurity Livelihood insecurity due to poor water quality Land degradation, losses in biodiversity, including loss of fisheries, natural and cultural heritage	Low-to-medium/ uncertain in the long term	Medium Inadequate in relation to the size of the catastrophe

7. CONCLUSIONS AND RECOMMENDATIONS

The Central Asia hotspots with the highest climate and security risks are the remote areas on the Afghan border, the densely populated areas and the high mountain areas. Climate risks and climate change effects increase stresses on natural and socioeconomic systems, which are themselves characterized by higher risks for human, food and industrial security. They are more prone to rising tensions and conflicts.

Transboundary water ecosystems in Central Asia and the vast northern grain-producing regions of Kazakhstan can also be considered as hotspots in the context of climate change and security, though threats to stability are less apparent. At present, no Central Asia hotspot has critical or alarming concerns over climate change and security issues.

Low water supplies due to climate change impacts will continue to reduce energy security of the mountain areas and food insecurity in the plains and low-lying lands, but are not likely to lead to rising tensions. Drought, water shortages and crop failures can cause temporary migrations and deprive families of income and adequate diets, but, until now, these and other climatic factors have not materialized into social tension and shocks, thanks to active government and donor support, and the ancient traditions of mutual aid and family support.

Even if climate change effects in densely populated areas do not directly affect incomes and lifestyles, many people may be under additional stress, particularly in the areas of competition for access to natural resources coupled with energy insecurity, poverty and insufficient economic alternatives, and climate challenges exacerbate their situation. Climate change impacts in the sparsely populated mountainous areas, where major mines or hydropower plants are located, can also affect the countries' economies, especially with ongoing nearby tensions, both local and cross-border. Slow onset changes in the environment and mountain ecosystems challenge lifestyles and alter the identity of the mountain areas. It is hard to imagine the Altai, Pamir and Tien Shan without glaciers.

High mountains and densely populated areas will remain vulnerable in terms of climate change and security, but climate effects will be less important to security than geopolitical and socioeconomic forces. Raising living standards, reducing isolation of regions and enclaves, introducing advanced water technology and agriculture practices can enhance their security. Future extreme weather events may still lead to casualties and damage to critical infrastructure, but forecasts, early warning systems and regular monitoring, alongside engineering solutions and proper planning, can help significantly reduce or avoid these disasters.

Among shared climate concerns identified in the national communications to the UNFCCC, the Central Asia countries list drought, heat stress, and reduced productivity of crops and pastures with implications for food security. In the long term, the rate of climate change and the severity of their consequences, coupled with population dynamics and socioeconomic status and freedom of movement, will be among the main factors that determine peace and prosperity of the densely populated areas.

The high level of male labour migration of several countries adds social stress on the women and children left behind, and makes them highly vulnerable to shocks from crop failures, climate extremes and disasters.

Over the medium term (2030-2050), population growth and economic development are likely to increase demand for water and land resources in Central Asia. Climate and water projections show a sufficient supply for the next 10-15 years, but somewhere between 2030 and 2050 the region is expected to pass the peak of water availability in many medium and small rivers across the interior and southern areas. Long-term projections may be uncertain, but improvements in water and land management require technical solutions that have to be implemented sooner rather than later, especially as, regardless of climate change, they can reduce stress on the socioeconomic and natural systems. The importance of transboundary water ecosystems suggests that water basin commissions may be one of the tools for solving water issues.

The table below summarizes the climate change and security issues and recommendations by hotspot in the Central Asia region.

Table 2: Climate change and security issues and recommendations in the Central Asia Region

Hotspot	Security implications and risks related to climate change	Recommendations	Target group
Regional/transboundary hotspots			
Densely populated areas	Economic and livelihood insecurity, damage to infrastructure Food insecurity Water insecurity, including short-term risks of conflict over water and land access and use Energy insecurity Land degradation, losses in biodiversity, cultural and natural heritage Social insecurity as well as ethnic relations and border tensions	**General** • Establish a participatory approach and dialogue for sharing vital natural resources (water, arable land and pastures), especially during extreme and adverse weather events • Promote good neighbourly relations and introduce early warnings /preventive measures to reduce tensions over limited natural resources • Conduct public awareness campaigns to ensure growing awareness on potential security implications induced by climate change **Health** • Provide more education and employment opportunities for women and address the issues of children and mothers living in the conditions of higher temperatures, especially during heatwaves • Introduce measures and a regime to mitigate impacts of high temperatures, drought, other extreme weather events with regard to human health and labour conditions with a focus on vulnerable groups **Water management** • Improve accessibility to clean water and sanitation in combination with preventive measures to reduce epidemics and dangerous infections • Improve the efficiency of resource use (water, arable land and pastures) with modern technology approaches in conjunction with traditional methods • Introduce agriculture and water reforms to boost resilience and to address long-term climate change impacts **Agriculture** • Introduce climate change resilient and reliable crops, develop insurance schemes in rural areas to support vulnerable groups in case of extreme weather events • Introduce agriculture and water reforms to boost resilience and to address long-term climate change impacts **Energy** • Increase the share of locally available energy sources through energy diversification to enhance energy security and increase the share of renewable sources **Infrastructure** • Rehabilitate tailings and waste sites and fortify other infrastructure that threatens downstream populated areas with potentially hazardous material • Implement action plans and programmes to forecast natural disasters and to minimize their impacts, especially for critical infrastructure	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, energy, industry, infrastructure, health care systems, hydrometeorology, forest and water services International organizations and donors Non-governmental organizations, civil society

Hotspot	Security implications and risks related to climate change	Recommendations	Target group
Regional/transboundary hotspots			
Remote areas on the Afghan border	Social insecurity as well border tensions, such as spill over of instability from Afghanistan Human health insecurity Land degradation, losses in biodiversity, cultural and natural heritage	**General** • Promote scientific, business and educational ties with neighbouring countries, including on the environment, energy, food security and climate change threats within the framework of multilateral and bilateral arrangements and the Economic Cooperation Organization • Incorporate climate change into policies and measures to strengthen security on the Central Asia southern borders, including considerations of potential migration and destabilization in Afghanistan under climate impacts and uncontrollable environmental effects • Exchange information on assessment of climate change impacts and risks regarding livelihoods with neighbouring countries • Exchange information and experience and implement pilot projects with neighbouring countries on assessment of climate change impacts and risk reduction regarding livelihoods, preservation of agricultural biodiversity and monitoring of and responses to malaria, pests and dust storms **Forests** • Conduct afforestation and reforestation on the southern borders of Central Asia to improve microclimates, combat erosion, protect infrastructure and reduce dust storms **Health** • Promote dialogue, exchange of information and mutual notification between Afghanistan and its southern Central Asia neighbours regarding the monitoring of and responses to malaria, pests and dust storms • Develop and implement warning and response mechanisms to deal with natural disasters and extreme weather events, and develop co-operation in monitoring activities	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, energy, industry, infrastructure, health care systems, hydrometeorology, forest and water services International organizations and donors Non-governmental organizations, civil society
High mountain areas	Social insecurity Human health insecurity Economic and livelihood insecurity, damage to infrastructure, including mining conflicts Food insecurity Energy insecurity Land degradation, losses in biodiversity, cultural and natural heritage	**General** • Support isolated high mountain communities • Provide remote sensing in hard-to-reach areas • Diversify income and food sources • Develop and implement sustainable landscape plans for mountain areas based on forecasts and impacts of climate change **Energy** • Diversify power generation and channels of energy imports and exports in order to reduce the risk of energy crises in extreme weather events (scarce water, cold waves and low water flow in large and small rivers, devastating flash flooding and floods) **Infrastructure** • Incorporate climate change content into planning and maintenance of critical infrastructure (impact of melting permafrost and avalanches or landslides on communication routes, hazardous waste storage sites and mines)	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, energy, industry, infrastructure, health care systems, hydrometeorology, forest and water service International organizations and donors Non-governmental organizations, civil society

Hotspot	Security implications and risks related to climate change	Recommendations	Target group
Regional/transboundary hotspots			
Central Asia breadbasket	Water insecurity Food insecurity	**Agriculture** • Facilitate farming practices that use zero soil tilling • Test crop types resilient to extreme events	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, hydrometeorology, forest and water services Non-governmental organizations, civil society
The Amu Darya river basin	Human health insecurity Food insecurity Water insecurity in low-water years Livelihood insecurity in water scarce areas especially in the river delta Social insecurity and tensions and longer-term risks including of conflict over irrigation vs. hydropower and growing water deficits and mismanagement	**General** • Facilitate co-ordination and exchange of information in the preparation of projections and assessments of climate change impacts, and search for common approaches to adaptation and response measures • Develop and implement comprehensive public awareness campaigns on climate security, adaptation measures and personal responsibility and contributions **Water management** • Identify and improve water use practices for the reduction of damage to vulnerable areas from climate change • Engage all the countries of the basin (including Afghanistan) in monitoring, forecasting, assessment and current and long-term water planning and use • Strengthen the role of the International Fund for Saving the Aral Sea with regards to its activities in water management of the Amu Darya River	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, energy, industry, infrastructure, health care systems, hydrometeorology, forest and water services International organizations and donors Non-governmental organizations, civil society

Hotspot	Security implications and risks related to climate change	Recommendations	Target group
Regional/transboundary hotspots			
The Syr Darya river basin	Human health insecurity, including from risk of disaster damage and erosion of hazardous waste storage sites Economic and livelihood insecurity, damage to infrastructure Food insecurity Water insecurity Land degradation, losses in biodiversity, natural and cultural heritage	**General** • Improve transboundary co-ordination mechanisms and ensure that obligations are met • Support capacity-building and experience replication • Facilitate the co-ordination and exchange of information with regard to projections, climate change assessments and seasonal forecasts, and develop common approaches to adaptation • Develop a common understanding of climate change impacts and search for mutually acceptable solutions to the water-food-energy nexus dilemmas • Develop and implement comprehensive public awareness campaigns on climate security, adaptation measures and personal responsibility and contributions • Mitigate natural disaster effects • Strengthen capacities at local level on adaptation to climate change and security risks including through experience replication **Water management** • Continue to improve early warning bulletins for the Syr Darya River • Co-ordinate regulation of water regimes, and ensure that obligations are met • Mitigate natural disaster effects • Strengthen the role of the International Fund for Saving the Aral Sea with regards to its activities in water management of the Amu Darya River	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, energy, infrastructure, health care systems, hydro-meteorology, forest and water services International organizations and donors Non-governmental organizations, civil society
The Zarafshan river basin	Livelihood insecurity in downstream areas due to upstream hydropower development Water insecurity, due to longer-term security risks associated with disruptions in the water cycle	**General** • Facilitate development of a common understanding of climate change impacts and search for shared approaches **Water management** • Increase water use efficiency in combination with traditional methods • Implement renewable technologies • Develop a system for forecasting seasonal and long-term flows • Enhance sharing of information related to climate change and natural disasters	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, health care systems, hydro-meteorology, forest and water services International organizations and donors Non-governmental organizations, civil society

Hotspot	Security implications and risks related to climate change	Recommendations	Target group
Regional/transboundary hotspots			
The Ili River and Balkhash Lake	**Water insecurity:** • Potential water shortages • Fluctuations in lake levels • Potential longer-term challenges related to transboundary water management	**General** • Incorporate climate change into planning and use of water resources and economic development • Support transboundary dialogue and co-operation on management of water resources and climate change adaptation	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, hydro-meteorology, forest and water services“ International organizations and donors Non-governmental organizations, civil society
The Chu and Talas River basin	**Water insecurity:** • Water deficits projected for mid-century	**General** • Continue discussions on climate change impacts in the transboundary context and enhance co-operation on adaptation • Evaluate investment costs for eco-friendly services and adaptation measures	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, energy, industry, infrastructure, health care systems, hydrometeorology, forest and water services International organizations and donors Non-governmental organizations, civil society
The Caspian Sea and coastline	Economic and livelihood insecurity, including potential longer-term risks related to income and labour disparities and some damage to infrastructure Land degradation, biodiversity losses,natural and cultural heritage	**General** • Extend practices of climate risks assessment for vulnerable infrastructure and onshore and offshore oil and gas production sites • Improve water supplies for local populations and minimize oil sector impacts on the environment and on income sources (fisheries, pastures and the others) • Manage domestic migration and balance income distribution	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, energy, infrastructure, health care systems, hydro-meteorology, forest and water services International organizations and donors Non-governmental organizations, civil society

Hotspot	Security implications and risks related to climate change	Recommendations	Target group
Regional/transboundary hotspots			
The Aral Sea and coastline	Human health insecurity Food insecurity Water insecurity Livelihood insecurity due to poor water quality Land degradation, biodiversity losses,including loss of fisheries, natural and cultural heritage	**General** • Introduce additional and support current, practices and ongoing efforts to cut back on environmental migration, and maintain adequate living conditions • Develop and implement comprehensive public awareness campaigns on climate security, adaptation measures and personal responsibility in the field of risk reduction	Governmental institutions, local authorities, environmental agencies Particularly, ministries of agriculture, health care systems, hydro-meteorology, forest and water services International organizations and donors Non-governmental organizations, civil society

Note: Some recommendations in this table were selcted from the Outcome Statement of ENVSEC's Central Asia Regional Consultation Meeting,held in Bishkek, Kyrgyzstan, 6 October 2015, based on their assessed medium to high relevance of action on climate-related aspects

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Food and Agriculture Organization of the United Nations Statistics (AQUASTAT) < http://www.fao.org/nr/water/aquastat/gis/index2.stm >

Food and Agriculture Organization of the United Nations Statistics (FAOSTAT) < http://faostat.fao.org >

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Global Environmental Facility (GEF) < http://www.thegef.org >

Global Water Systems Project datasets < http://wiki.gwsp.org/joom/index.php?option=com_content&task=blogcategory&id=34&Itemid=63 >

Intergovernmental Panel on Climate Change (IPCC) < www.ipcc.ch >

LandScan Global Population Database 2007, Oak Ridge National Laboratory < www.ornl.gov/sci/landscan >

NASA Visible Earth < http://visibleearth.nasa.gov >

NASA Goddard Institute for Space Studies < data.giss.nasa.gov >

Rivers in Crisis database < http://www.riverthreat.net >

Small Arms Survey (SAS) < http://www.smallarmssurvey.org >

Transboundary Water Management in Central Asia ("Water Unites") < http://waterca.org >

United Nations Framework Convention on Climate Change (UNFCCC) < http://unfccc.int >

United Nations Millennium Development Goals Indicators (UN MDGI) < http://mdgs.un.org/unsd/mdg/Data.aspx >

United Nations Sustainable Development Knowledge Platform < http://sustainabledevelopment.un.org/ >

US Census Bureau International Programme (USCB IDB). International database < http://www.census.gov/population/international/data/idb/informationGateway.php >

World Food Programme (WFP) food security < http://www.wfp.org >

World Bank Development Indicators (WDI) < http://publications.worldbank.org/WDI/ >

Worldwide Governance Indicators (WGI) < www.govindicators.org >

CLIMATE CHANGE AND SECURITY PROJECT PARTNER WEBSITES:

Environment and Security Initiative (ENVSEC Initiative) < http://www.envsec.org >

UN Environment < http://www.unep.org >

United Nations Economic Commission for Europe (UNECE) < http://www.unece.org/env/welcome >

United Nations Development Programme (UNDP) < http://www.undp.org >

Organization for Security and Co-operation in Europe (OSCE) < http://www.osce.org >

Regional Environmental Center for Central and Eastern Europe (REC) < www.rec.org >

GRID-Arendal < http://www.grida.no >

Zoï Environment Network < http://www.zoinet.org >

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