Islamic Republic of Afghanistan

National Environmental Protection Agency

SECOND NATIONAL COMMUNICATION
UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

Submitted by the
National Environmental Protection Agency,
December 2017

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PREFACE

The National Environmental Protection Agency (NEPA) takes great pleasure in presenting Afghanistan's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC). Compilation of this important report was not without its challenges, particularly concerning the availability of reliable and accurate data. Nonetheless, NEPA are proud of the efforts of the National Study Teams and the cooperation of the Central Statistics Organisation in overcoming these challenges. The National Study Teams, comprising representatives of government ministries and agencies as well as academia, were able to compile the most up-to-date and in-depth study of Afghanistan's climate change situation yet produced despite data shortages and capacity constraints.

These experiences have only served to strengthen the resolve of the Government and People of the Islamic Republic of Afghanistan to address climate change, as probably the greatest risk facing this or any other generation. NEPA recognises that Afghanistan's involvement in UNFCCC processes is critical to this, and is thus glad to submit this Second National Communication in pursuit of the country's commitments under this and other multilateral environmental agreements. Moreover, NEPA and all other national stakeholders look forward to the Biennial Update Report, Third National Communication and other processes whereby Afghanistan's will be able to improve the accuracy and detail of its reports on how the country is addressing climate change.

FOREWORD

On behalf of the Government of the Islamic Republic of Afghanistan, it gives me great pleasure in presenting Afghanistan's Second National Communication to the United Nations Framework Convention on Climate Change, in fulfilment of our commitment under Article 12 of this Convention.

The Second National Communication informs the UNFCCC parties, all relevant decision-makers and the broader public on current trends of climate change and its consequences in Afghanistan, provides an updated inventory of greenhouse gas emissions and flows for the country, and describes the ability of Afghanistan to contribute to climate change mitigation and adaptation. This Communication also provides a brief overview of completed, ongoing and planned measures of the Government, general public, business community and donors aimed at addressing climate change issues. It thus not only describes our endeavours towards addressing the challenges of climate change but also outlines our future strategies and planned efforts to achieve the goal of sustainable development.

The main content of the Second National Communication was discussed through a series of national workshops engaging with and attended by a wide range of stakeholders, as well as international experts and the media. All suggestions and comments received were thoroughly analysed and, as far as possible, addressed whilst finalising the document

I wish to congratulate all those involved in the process of preparing the Second National Communication, particularly the members of the National Study Teams and the National Climate Change Committee. The Communication was prepared involving all key stakeholders within these multi-disciplinary study teams and through a broad consultative process coordinated by the National Environmental Protection Agency.

The Government of the Islamic Republic of Afghanistan would like to acknowledge the financial and technical support of the Global Environment Facility and the United Nations Environment Programme that assisted in the fulfilment of this national obligation. Moreover, the Government would like to use this Second National Communication to reiterate the commitment of Afghanistan and its people to the principles of the UNFCCC and the fulfilment of our national obligations under it.

Schah-Zaman Maiwandi
Director General
National Environmental Protection Agency
Islamic Republic of Afghanistan

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ACRONYMS

ACCSAP	Afghanistan Climate Change Strategy and Action Plan
ACD	Avalanche Control Department
AITF	Afghanistan Infrastructure Trust Fund
ARTF	Afghanistan Reconstruction Trust Fund
AMD	Afghanistan Meteorological Department
ANPDF	Afghan National Peace and Development Framework
ANDMA	Afghanistan National Disaster Management Authority
ANDS	Afghanistan National Development Strategy
APAN	Asia Pacific Adaptation Network
ARD	Agriculture and Rural Development (Cluster)
ARTF	Afghanistan Reconstruction Trust Fund
AQI	Air Quality Index
BCM	Billion Cubic Metres
CARD-F	Comprehensive Agriculture and Rural Development – Facility
CBN	Cost of Basic Needs
CC	Citizens' Charter
CDC	Community Development Council
CDKN	Climate Development Knowledge Network
CDM	Clean Development Mechanism
CEC	Committee for Environmental Coordination
CH4	Methane
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
COP	Conference of Parties
CSO	Central Statistics Organization
CTCN	Climate Technology Centre and Network
CFCs	Chlorofluorocarbons
DDMC	District Disaster Management and Response Committees
DRR	Disaster Risk Reduction
EITI	Extractive Industries Transparency Initiative
FAO	Food and Agriculture Organization of the United Nations
FEWSNET	Famine Early Warning System Network
GCF	Green Climate Fund
GDP	Gross Domestic Product

ACRONYMS

GEF	Global Environment Facility
GHG	Greenhouse Gas
GIRoA	Government of Islamic Republic of Afghanistan
HCDM	High Commission for Disaster Management
HDI	Human Development Index
HFC	Hydrofluorocarbons
ICE	Inter-ministerial Commission for Energy
ICIMOD	International Centre for Integrated Mountain Development
ICRE	Inter-ministerial Commission on Renewable Energy
IDA	International Development Assistance
INC	Initial National Communication under the UNFCCC
INDC	Intended Nationally Determined Contribution
IPCC	Inter-governmental Panel on Climate Change
ISAF	International Security Assistance Force
kWh	Kilowatt hour
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LEDS	Low Emission Development Strategies
MAIL	Ministry of Agriculture, Irrigation and Livestock
MDG	Millennium Development Goal
MEA	Multilateral Environmental Agreement
MEW	Ministry of Energy and Water
MoEc	Ministry of Economy
MoEd	Ministry of Education
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoHE	Ministry of Higher Education
MoIA	Ministry of Interior Affairs
MoMP	Ministry of Mines and Petroleum
MoPH	Ministry of Public Health
MoPW	Ministry of Public Works
MoT	Ministry of Transport
MPH	Ministry of Public Health
MRRD	Ministry of Rehabilitation and Rural Development
MUDA	Ministry of Urban Development Affairs
MW	Mega Watt

ACRONYMS

N2O	Nitrous Oxide
NABDP	National Area-based Development Programme
NADF	National Agricultural Development Framework
NAMA	Nationally Appropriate Mitigation Actions
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NCCC	National Climate Change Committee
NCSA	National Capacity Needs Self-Assessment
NCSP	National Communication Support Programme
NDC	Nationally Determined Contribution
NDMIS	National Disaster Management Information System
NEAC	National Environmental Advisory Council
NEAP	National Environmental Action Plan
NEESAP	National Environmental Education Strategy and Action Plan
NEPA	National Environmental Protection Agency
NES	National Environment Strategy
NFMP	National Forestry Management Policy
NGO	Non-governmental Organization
NMVOC	Non-Methane Volatile Organic Compounds
NOX	Nitrogen Oxides
NPP	National Priority Programme
NRAP	National Rural Access Programme
NREL	National Renewable Energy Laboratory
NRVA	National Risk and Vulnerability Assessment
NSP	National Solidarity Programme
NST	National Study Team
O3	Ozone
PDMC	Provincial Disaster Management and Response Committees
PFC	Perfluorocarbons
PPM	Parts-Per-Million
PPMv	Part-Per-Million by volume
PPMw	Parts-Per-Million by weight
RCP	Representative Concentration Pathway
Ru-WatSIP	Rural Water Supply, Sanitation and Irrigation Programme
SAARC	South Asian Association of Regional Cooperation

ACRONYMS

SCCF	Special Climate Change Fund
SCWAM	Supreme Council for Water Affairs Management
SDG	Sustainable Development Goal
SEAC	Sub-national Environmental Advisory Council
SNAP	Strategic National Action Plan
SNAP	Strategic National Action Plan for Disaster Risk Reduction
SNC	Second National Communication under the UNFCCC
SO2	Sulphur Dioxide
SOE	State of Environment
STAR	GEF's System for Transparent Allocation of Resources
TCF	Trillion Cubic Feet
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency of International Development
USGS	United States Geological Survey
UV-B	Ultraviolet B Solar Radiation
UV-Index	Ultraviolet Index
V&A	Vulnerability and Assessment
WCS	Wildlife Conservation Society
WHO	World Health Organization
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

Wakhan, Badakhshan/ © Alec Knuerr, UN Environment

NATIONAL CIRCUMSTANCES

Afghanistan is a landlocked country in South and Central Asia, with a rich history, diverse population, and a total geographic area of 652,864 km^2. Afghanistan has some of the most complex and varied geology in the world, with more than a quarter of its territory having an altitude of 2,500 metres or more, and it is split east to west by the Hindukush mountain range.

Afghanistan's Central Statistics Organization (CSO) estimated the country's population at 29.7 million in 2017. This population has a fast growth rate as well as a youth bulge, with persons under 14 years of age accounting for nearly half of the total population. According to the Human Development Index (HDI) for 2016, Afghanistan is ranked 169 among 188 countries, making it the lowest in Asia. Poverty is widespread, affecting more than a third of the country's total population. Nevertheless, over the past 15 years, considerable gains have been made in the areas of education and health. More children than ever are going to school, and literacy rates are also increasing with more than half of youth (15-24 years old) able to read and write.

Afghanistan's varied topography has created a number of diverse habitat types, with temperature and precipitation changing considerably at different elevations. The species that occupy these habitats are uniquely adapted to their ecosystems and, therefore, vulnerable to the impacts of climate change. Afghanistan is home to more than 700 species of animals and 3,500-4,000 native vascular plant

species. Human activity, especially habitat fragmentation, is the primary cause of biodiversity loss, though climate change is expected to become the single largest global cause of biodiversity loss before the end of the century.

Afghanistan has important forest and rangeland resources that help support much of the country's rural livelihoods. These forests and wooded areas are particularly valuable in dryland areas because they provide fuel wood and timber, as well as other forest products such as nuts and medicinal plants. Nevertheless, the trees and plants that make up Afghanistan's forests and rangelands face a number of climate change risks and adaptation challenges as temperatures increase and availability of water resources decreases. Afghanistan's forests are already severely damaged as a result of decades of deforestation, overharvesting, mismanagement, and drought, and today account for only approximately 1.5-2 percent of the country's total land cover.

Afghanistan's annual renewable surface water resources are estimated at 57 billion m^3 distributed across five river basins. Afghanistan has an estimated overall surface water availability of 2,775 m^3 per capita per year, which is considerably higher than other countries in the region. Nevertheless, these water resources are not evenly distributed across the country or equally accessible at all times of the year. The availability of water in Afghanistan is also characterized by considerable intra- and inter-annual variations, and has the lowest per capita water storage capacity in the region. This reduces the opportunity to harness surface resources and renders the country more vulnerable to drought and other water-related climate shocks.

Agriculture is the foundation of Afghanistan's economy and livelihoods, supporting some 80 percent of the country's population, either directly or indirectly. Of the country's total agricultural lands, it is estimated that only approximately 2.5 million hectares are irrigated and regularly cropped, while another 1.1 million hectares are rain-fed and cropped opportunistically, depending on precipitation.

Livestock products contribute more than 50 percent of agricultural GDP. Over the past 30 years, livestock populations in Afghanistan have fluctuated between periods of prosperity and drought from highs of more than 5 million cattle and over 30 million sheep and goats to lows of only 3.7 million cattle and 16 million sheep and goats. Increasing pressure on available land over the last two to three generations has led to expansion of rain-fed wheat cropping into traditional grazing lands and high mountains.

Following nearly four decades of conflict, much of Afghanistan's infrastructure and energy facilities have been destroyed or severely damaged. Currently, domestic energy production is at nearly the same level as it was just prior to the invasion of the Soviet Union in 1978, while the condition of these energy facilities is greatly degraded. Only 28 percent of Afghan households are connected to power supply systems. Afghanistan also relies heavily on electricity imports from neighbouring countries, which account for more than three quarters of total electricity usage. Afghanistan's abundant water resources offer considerable potential for

hydropower development (estimated at 23,310 MW), which currently accounts for nearly half of domestic electricity installed capacity, with the remainder made up by thermoelectric and diesel generators. Domestic oil production in Afghanistan is insignificant, and the country relies on imports of petroleum products to meet domestic consumption needs. In addition to hydropower resources, Afghanistan also has excellent wind and solar potential estimated at 66,726 MW and 222,852 MW respectively, which provide great hope for long-term energy sustainability, especially in rural areas.

Rehabilitating the country's core transportation infrastructure has been a major national priority in order to increase connectivity across the country and between rural and urban areas. With the improvement of transportation infrastructure, the number of vehicles being imported and on the road has increased significantly to nearly 2 million. Moreover, over the years, air traffic has grown considerably and as of 2015/16 includes 6 government-owned and 12 private airplanes.

During the early 2000s, Afghanistan experienced high economic growth rates, but this was accompanied by high volatility due to the prominence of the agriculture sector. More recently, Afghanistan's growth has slowed and foreign aid inflows have declined, while the deteriorating security environment and political uncertainty undermine private sector confidence and economic activities. According to the Asian Development Bank, economic growth in 2018 is projected at "2.5 percent, which is comparable to growth in 2017, but up from 2.4 percent in 2016 and 1.3 percent in 2015."

Urban areas are also seeing a significant increase in population growth, and it is expected that the urban population will double within the next 15 years. Major environmental issues in Afghanistan's urban areas include air, water, and soil pollution, access to clean water, and solid waste management. Urban areas are also prime contributors to climate change as they consume some 70 percent of the country's energy and produce nearly half of its CO_2 emissions. The main sources of these gases in urban areas are energy generation, vehicles and transportation, and biomass combustion for heating.

Protection of the natural environment is the responsibility of the state, as enshrined in the constitution of the Islamic Republic of Afghanistan. In 2007, Afghanistan approved the Environment Law, which established the regulatory framework for the sustainable use and management of Afghanistan's natural resources base, and provides for the conservation and rehabilitation of the environment towards achieving the country's social, economic, reconstruction, and ecological development goals. The National Environmental Protection Agency (NEPA) is an independent institutional entity, responsible for coordinating, monitoring conservation and rehabilitation of the environment, and the implementation of the law. This national communication was prepared by NEPA in partial fulfilment of Afghanistan's obligations and commitments to the United Nations Framework Convention on Climate Change (UNFCCC).

NATIONAL GREENHOUSE GAS INVENTORY

The estimated total net emissions of greenhouse gases (GHGs) for Afghanistan in 2013 comprised 60,237 Gg CO_2e, with no net removals. This was made up of 20,395 Gg of CO_2 (33.9 percent of total Gg CO_2e), 519 Gg of CH_4 (31.0 percent or 18,684 Gg CO_2e) and 71 Gg of N_2O (35.1 percent or 21,158 Gg CO_2e). The greatest contributor to overall GHG emissions was the Agriculture sector (accounting for 64.3 percent of total emissions), followed by Land-Use Change and Forestry (18.8 percent), and Energy (16.2 percent). Industrial Processes and Waste each comprised 0.3 percent of total emissions.

VULNERABILITY ASSESSMENT AND CLIMATE CHANGE ADAPTATION

Since 1950, Afghanistan's mean annual temperature has increased significantly and considerably by 1.8°C. This warming is most pronounced in the South, which experienced a temperature increase of 2.4°C, as well as the Central Highlands and North that experienced increases of 1.6°C and 1.7°C, respectively. In terms of future projections, under an optimistic (RCP 4.5) scenario, Afghanistan shows a trend of warming by approximately 1.5°C until 2050, followed by a period of stabilization and then additional warming up to approximately 2.5°C above current temperatures by 2100. In contrast, a pessimistic (RCP 8.5) scenario shows extreme warming across the whole country of approximately 3°C until 2050, with further warming up to 7°C above current temperatures by 2100. Under both scenarios there are regional differences, with higher temperature increases expected at higher altitudes than in the lowlands.

Historical analysis of precipitation patterns reveals that mean annual quantities have not changed significantly across the country; however, detailed analyses of spring and winter precipitation levels reveal that these changes are simply levelled out as spring precipitation decreased (by up to a third) while winter precipitation slightly increased. The decrease in springtime (March-May) precipitation is particularly relevant for agriculture, since spring crops are typically rain-fed and dependent on sufficient rainfall during this period. Moreover, the regions most significant for agricultural production are also strongly by the decrease in spring precipitation. The Central Highlands, for example, saw a decrease of nearly 40 percent in springtime precipitation between 1950 and 2010. Future projections of precipitation in all scenarios suggest that there will be a decrease in precipitation of between 5-10 percent during springtime (March-May) for the agriculturally important North, the Central Highlands and the East from 2006 until 2050.

Based on these historical trends and future projections, the sectors with the greatest adaptation needs are: water, agriculture, forests and rangelands, biodiversity and ecosystems, health, and energy. Priority adaptation actions for these sectors were identified in the National Adaptation Programme of Action (NAPA) as well as previous national communications. These are encapsulated in the Nationally Determined Contribution (NDC), which asserts Afghanistan's commitment to pursuing Low Emission Development Strategies (LEDS) as well as outlines needs for financial, technological, and capacity support for adaptation valued at US$10.79 billion over ten years.

POLICIES AND MEASURES ON CLIMATE CHANGE

As part of its national commitments to the UNFCCC and in order to strengthen climate protection measures, Afghanistan has prepared two national communications on climate change. Despite the country's many competing development needs, Afghanistan has made steady progress towards mainstreaming climate change into national planning mechanisms and approaches.

Afghanistan's premiere inter-ministerial coordination body for climate change is the National Climate Change Committee (NCCC). In addition, a number of other national-level, inter-ministerial forums provide valuable entry points for addressing climate change in the areas of agriculture, biodiversity, forests and rangelands, energy, disaster preparedness, and water. In each of these areas, Afghanistan has developed and adopted a wide range of laws, policies, strategies, and plans that are relevant to climate change. Mainstreaming climate change into these areas and across a greater breadth of national planning structures will also be achieved through the thorough adoption and application of Afghanistan's Climate Change Strategy and Action Plan (ACCSAP).

RESEARCH AND SYSTEMATIC OBSERVATION

Before 1979, Afghanistan had one of the most advanced meteorological monitoring systems in the region. Unfortunately, most equipment was rendered non-functional or destroyed due to years of conflict and war. Under the Taliban regime, Afghanistan's Meteorological Department (AMD) was dissolved and its weather records were destroyed under the pretext that weather forecasting was sorcery.

Since 2001, there has been some rehabilitation of non-functional weather stations and installation of new stations. AMD has also been reinstated and is the lead agency in collecting, processing and reporting of weather data including temperature, precipitation and weather forecasts.

In recent years, Afghanistan has established and accessed a growing number of research networks that serve to collate environmental information and data about Afghanistan in order to better inform technical experts and decision-makers about environmental matters.

EDUCATION AND AWARENESS-RAISING

Environmental education is recognized as an essential component of preparing the next generation of environmental stewards in Afghanistan. Primary- and secondary-level education curricula already have environmental subjects taught, but there is not a specific focus on climate change. At the tertiary level, two environmental science faculties have been established at two universities, which teach on issues of climate, resilience, and natural resource management.

Public awareness and understanding of climate change is low in Afghanistan; however, as more and more children attend school and are educated about environmental issues, this information is expected to become more widespread across communities. Since 2001, Afghanistan has experienced a large growth in non-governmental organizations, as well as in media outlets and organizations. Increasing the involvement of these non-governmental organizations and media outlets in public education about climate change will be an important step towards

raising greater awareness about sustainable development and environmental management.

In addition, Afghanistan both shares and accesses information on climate change through a number of regional and international online networks. These networks support Afghanistan by providing valuable data, guidance, samples, and lessons learned from other countries in the region and further abroad with similar environmental and socio-political contexts.

CONSTRAINTS, GAPS, AND RELATED FINANCIAL AND TECHNICAL NEEDS

Through the preparation of its National Adaptation Plan of Action (NAPA), Initial National Communication (INC), Second National Communication (SNC), and Nationaly Determine Contribution (NDC), Afghanistan has identified constraints, gaps, and financial, technical and capacity needs to be addressed to enhance the national communication system and fulfil other commitments made to the UNFCCC.

Within the process of generating national communications, the greatest challenges are related to the non-availability and non-accessibility of data for the GHG inventory. For example, some data do not exist, sometimes there are conflicting data depending on the source, and some data are treated as proprietary and not publicly accessible. Thus, in order to address these challenges, this national communication identifies actions for Afghanistan's priority areas in data needs, capacity development and enhancement needs, and institutional networking and coordination needs.

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NATIONAL CIRCUMSTANCES

Bamyan, Afghanistan/ ©UN Environment

1.1 GEOGRAPHIC PROFILE

Afghanistan is a landlocked country in South and Central Asia with a rich history and diverse population. Afghanistan shares borders with six countries: Pakistan to the south and east, Iran to the west, Turkmenistan, Uzbekistan and Tajikistan to the north, and China in the far northeast. With a total geographic area of 652,864 km^2, Afghanistan is the 41st largest country in the world.[2]

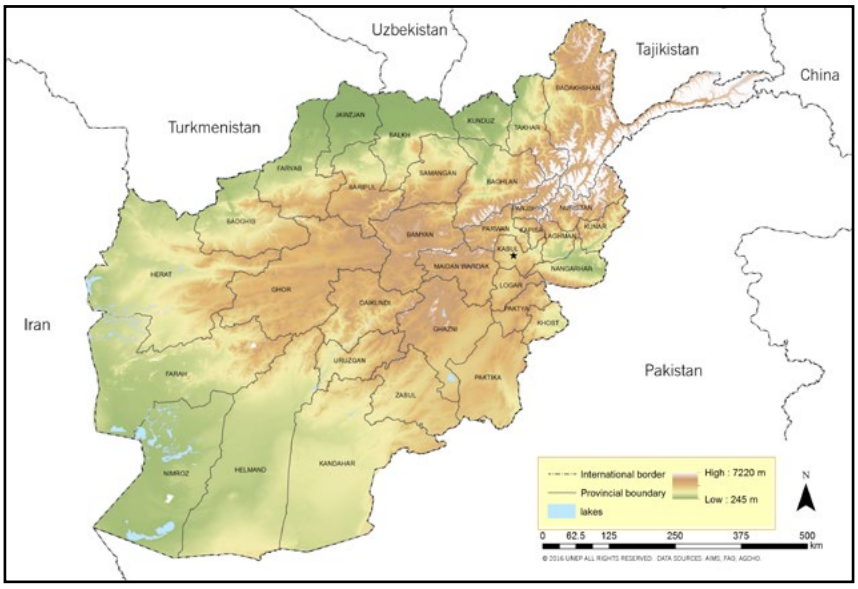


Figure 1: Political Map of Islamic Republic of Afghanistan

Afghanistan has some of the most complex and varied geology in the world, with more than a quarter of its territory having an altitude of 2,500 metres or more. Afghanistan is split east to west by the Hindukush mountain range, forming a central core from where ridges fan out to the west and south, with the Parapamisus mountains extending westwards towards Iran. In the far northeast, the Hindukush rises into the high-altitude Wakhan Corridor, home to the country's highest point of 7,315 metres at Noshaq Peak. This narrow strip of land, where the Pamir and

Karakoram mountains meet, separates Tajikistan from Pakistan and shares a short border with China. Afghanistan's most extensive flatlands are located in the southwest, centred around the internal drainage basin of the Helmand River, and the north, between the northern foothills of the Hindukush and the Amu Darya (Oxus), marking Afghanistan's borders with Tajikistan and Uzbekistan Both the southwest and north regions include large areas of sandy desert.

1.2 HISTORICAL OVERVIEW

The territory that today constitutes the Islamic Republic of Afghanistan is an ancient focal point of the Silk Road and a location of global significance for human migration. Afghanistan sits at an important geostrategic location that connects the Middle East with Central Asia and the Indian subcontinent, which has been home to various peoples through the ages. The land has witnessed many military conquests since antiquity, notably by Alexander the Great, Chandragupta Maurya, and Genghis Khan. It has also served as a source from which local dynasties such as the Greco-Bactrians, Kushans, Saffarids, Ghaznavids, Ghorids, Timurids, Mughals and many others have established empires of their own.

The political history of modern Afghanistan began in the 18th century, when the Hotaki dynasty rose to power in Kandahar in 1709 followed by Ahmad Shah Durrani's rise to power in 1747. The capital of Afghanistan was shifted in 1776 from Kandahar to Kabul, and parts of its lands were ceded to neighbouring empires in 1893. In the late 19th century, Afghanistan became a buffer state in the "Great Game" between the British and Russian empires, a legacy which has influenced the country's international borders until the present.

During this period, Afghanistan endured a series of wars with the British Empire, including the First Anglo-Afghan war from 1839 to 1842, the Second Anglo-Afghan War from 1878 to 1880, and the Third Anglo-Afghan War from May to August 1919. At the end of the Third Anglo-Afghan War, and following the signing of the Treaty of Rawalpindi, Afghanistan regained control over its foreign policy from the British and functioned as a fully independent state. In more recent decades, Afghanistan has also experienced extended periods of conflict. Beginning with the 1979 invasion and occupation by the Soviet Union, followed by a period of civil war and the Taliban era in the 1990s, and most recently the military operations led by the United States that overthrew the Taliban in 2001. In December 2001, the United Nations Security Council authorized the creation of an International Security Assistance Force (ISAF) to help the Government of the Islamic Republic of Afghanistan (GIRoA) maintain the country's peace, security, and stability.

1.3 POPULATION AND DEMOGRAPHICS

Afghanistan has a population of 29.7 million.[3] Afghanistan also has a fast growth rate of 2.03 percent per annum as well as a youth bulge, with persons under 14 years of age accounting for nearly half of the total population.[4,5] Afghanistan's population is split nearly even along gender lines, with 14.51 million women and 15.20 million men.[6] The country is also ethnically, culturally, and linguistically diverse, comprised of Pashtuns, Tajiks, Hazaras, Uzbeks, Aimaks, Turkmens, and other groups, with Dari and Pashto designated as the country's two official national languages.

According to the Human Development Index for 2016, Afghanistan is ranked 169 among 188 countries, making it the lowest in its region of South Asia.[a] Poverty in Afghanistan is widespread, where 39.1 percent of the population lives below the target of meeting the Costs of Basic Needs (CBN), which represents the minimum cost of obtaining 2,100 calories per day (approximately 687 Afghani).[b] Poverty also affects a majority of Kuchis (53.8 percent), and 37.7 percent of the rural population compared to 30 percent of the urban population. Although these rankings reveal the profound difficulties the country faces in seeking to advance the well-being of its citizens, encouraging advances have been made in the provision of health and education services.

Over the past 15 years, child and maternal mortality rates have decreased, and in many rural areas Afghans now enjoy access, for the first time, to health facilities providing basic care on maternal new born health, immunization, and disability services. According to the National Risk and Vulnerability Assessment (NRVA) 2011/12, 86.7 percent of urban populations are now located within a two-hour distance of public health facilities by any means of transport.[7]

Afghanistan's under-5 mortality rate is among the highest in the world, but has decreased considerably over the past 15 years, from 257 per 1,000 live births in 2000, to 161 in 2007/08, and further down to 91 deaths per 1,000 live births in 2013.[8] For the period 2010-2015, the under-5 mortality rate was 55 deaths per 1,000 live births.[9] And from 2000 to 2006, basic immunization coverage increased from 27 to 37 percent, and further up to 45 percent of male children (aged 12-23 months) and 46.4 percent of female children in 2015.[10]

Health services targeting pregnant women are also improving. For the period 2011-2015, 49.9 percent of pregnant women had professional birth attendants during delivery, which is an increase from 2008/09 when professional birth attendants assisted in 31 percent of deliveries, a 5 percent increase from 2007/08. Similarly, for the period 2001-2005, Afghanistan had the second highest maternal mortality rate in the world at 1,600 deaths per 100,000 live births, which has since decreased to 1,291 deaths per 100,000 live births in 2015.[11]

An analysis of educational opportunities in Afghanistan shows that, since 2001, primary and secondary enrolment rates have expanded considerably, and more children than ever attend schools. Nevertheless, education performance in Afghanistan remains poor with limited education opportunities, especially for girls and women, rural, and Kuchi populations. Afghanistan's Living Conditions Survey 2013/14 indicates that Afghanistan's development targets on education will not be achieved by 2020.[12]

As of 2014, Afghanistan recorded school attendance rates of 54.5 percent for primary education (62.4 percent and 45.5 percent of school age boys and girls, respectively), and 37.2 percent for secondary education (46.7 percent and 26.9 percent of school age boys and girls, respectively).[13] Literacy rates also continue to increase countrywide, with 52 percent of youth (15-24 years old) able to read and write, up from only 31 percent in 2005.[14]

[a] Countries included in the 2016 Human Development Index region of South Asia include: Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan and Sri Lanka.

[b] The CBN poverty line represents the level of per capita consumption at which the members of a household can be expected to meet their basic needs, such as food consumption to meet their caloric requirement. CSO. (2016a). *Afghanistan Living Conditions Survey 2013-14: National Risk and Vulnerability Assessment.*

Geographically disaggregated data reveal considerable discrepancies in educational participation across provinces, with Kabul and other urban areas boasting the highest enrolment rate. Insecurity, social and cultural beliefs, geographical coverage of schools, inadequate facilities, lack of separate schools for girls, the demand for domestic work, and poor educational quality are some of the causes of the inequitable educational opportunities and the high numbers of drop-outs.

1.4 BIODIVERSITY AND ECOSYSTEMS

Afghanistan's varied topography has created a diverse number of habitat types, with temperature and precipitation changing considerably at different elevations. The species that occupy these habitats are uniquely adapted to their ecosystems and, therefore, vulnerable to the impacts of climate change. According to Afghanistan's National Biodiversity Strategy and Action Plan (NBSAP), Afghanistan is home to more than 700 species of mammals, birds, reptiles, amphibians, fish, butterflies, and a staggering 3,500-4,000 native vascular plant species, though recent studies suggest that biodiversity loss is accelerating across the country.[15] Human activity, especially habitat fragmentation, is the primary cause of biodiversity loss, though climate change is expected to become the single largest global cause of biodiversity loss before the end of the century.[16]

In Afghanistan, climate change-induced increases in temperature and decreases in water availability will likely have considerable impacts on the country's ecosystems. Natural adaptation could be manifested by shifting habitats or changing life cycles. Ecosystem-based adaptation, which integrates the use of biodiversity and ecosystem services into climate change adaptation, can provide a cost-effective approach that both maintains biodiversity and reduces negative impacts from climate change. Examples of ecosystem-based adaptation applicable in Afghanistan include: reduction of habitat loss and fragmentation, as well as habitat conservation through establishment of protected areas; afforestation to stabilize slopes, enhance soil integrity and regulate water flow; the promotion of agroforestry systems using diverse crops and plant species; and the sustainable management and restoration of watersheds linking upstream and downstream areas.

1.5 FORESTS AND RANGELANDS

Afghanistan's forests and rangelands can be broadly categorized into the following four eco-regions: 1) temperate coniferous forests in the east; 2) minor occurrence of temperate grasslands, savannahs and shrub-lands in the northern region; 3) grasslands and shrub-lands in the northern, southern and western parts of the mountainous regions; and 4) deserts and xeric shrub-lands in the southwest. These forests and wooded lands are particularly valuable in Afghanistan's dryland areas because they provide fuel wood and timber, as well as other forest products such as nuts and medicinal plants.

Moreover, these ecosystems provide valuable services. For example, extensive tree cover can help to moderate local climatic conditions and reduce potentially damaging runoff after sudden rainfall. In many situations, water courses in

forested land will retain their dry-season flows better than those in un-forested land, making water available for human consumption and irrigation during critical periods.[18]

The trees and plants that make up Afghanistan's forests and rangelands face a number of climate change risks and adaptation challenges as temperatures increase and availability of water resources decreases. Afghanistan's forests are already severely damaged as a result of decades of deforestation, overharvesting, mismanagement, and drought, and today account for only approximately 1.5-2 percent of the country's total land cover.[19]

As a result of this degradation, forests in Afghanistan can only provide limited ecosystem services, and two of the forested areas most affected by degradation are the Northern Pistachio Belt (characterised by *Pistacia* and *Amygdalus* species) and Eastern Forest Complex (characterised by *Quercus*, *Pinus*, *Cedrus*, *Picea* and *Abies* species).[20] The functioning of northern watersheds, for example, is reliant on the Northern Pistachio Belt, including for the maintenance of water flow and accretion of soils.

Likewise, the Eastern Forest Complex (see Figure 2, below) occurs over a smaller geographical extent, stretching across Nuristan, Kunar, and Nangarhar, but provides diverse habitat for globally significant biodiversity (e.g. the snow leopard *Uncia uncia*, the Himalayan black bear *Ursus thibetanus* ssp. *laniger* and the markhor *Capra falconeri*) and contains a biodiversity hotspot. The habitat diversity of the Eastern Forest Complex is underpinned by two main forest types, namely Sclerophyllous Oak Forest and Conifer Forest.[21]

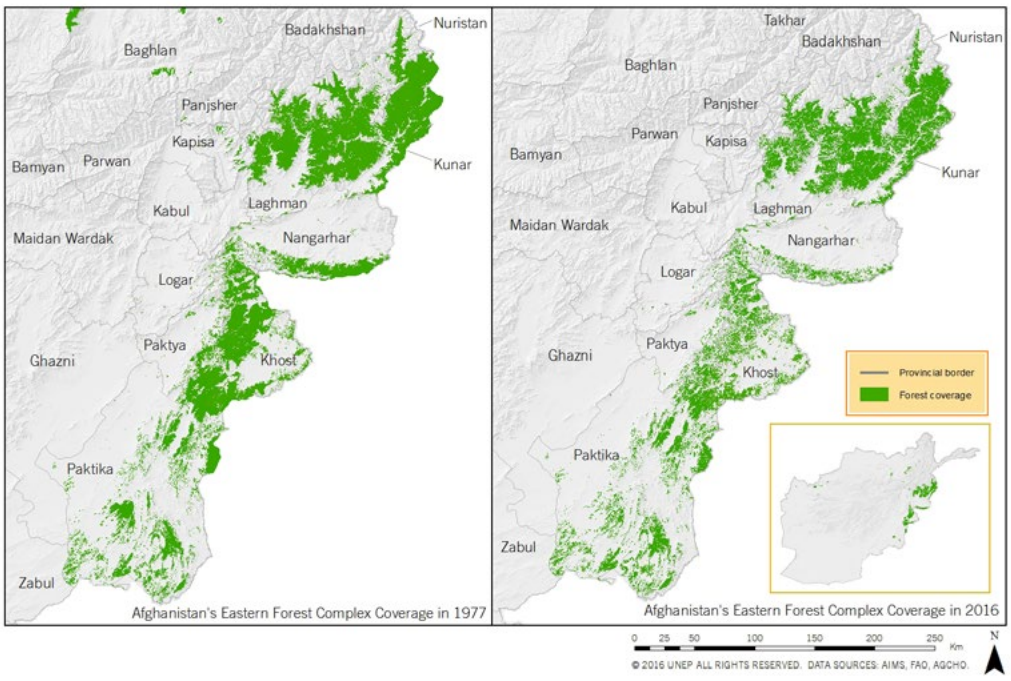


Figure 2: Loss of Forest Cover in Eastern Forest Complex between 1977 and 2016 (Nangarhar, Kunar and Nuristan Provinces)[22]

At present, the Northern Pistachio Belt and Eastern Forest Complex are increasingly overexploited as a result of a rapidly growing population and limited governance in forest management.[23] Specific threats include: i) firewood collection; ii) overgrazing of livestock; iii) felling of trees for construction and timber; iv)

insufficient incentives for reforestation; v) limited community awareness of and involvement in forest management; vi) clearing for agricultural and urban expansion; vii) pistachio root excavation; viii) unsustainable nut harvesting; xi) local conflicts and uncertain land tenure rights; xii) soil erosion; and xiii) limited law enforcement.[24]

Besides forests, Afghanistan's rangelands also support a significant level of animal husbandry through sedentary, seasonal transhumance and migratory systems, which is estimated to account for more than 50 percent of the country's total agricultural GDP. Unfortunately, overgrazing has resulted in heavy land degradation, and conversion to rain-fed wheat production has resulted in extensive desertification and decreased productivity.[25] Afghanistan's rangelands are an especially valuable resource as they cover more than half of the country's total land area and, in addition to supporting animal husbandry, provide vital food, fuel, building materials, medicinal plants, and habitat for wildlife, which collectively form the natural resource base that supports the vast majority of the country's population.[26]

With warmer temperatures, forest and rangeland plant species are expected to see a shift in their geographic range to more northern latitudes and higher altitudes thereby altering vegetation cover and increasing the risk of desertification, erosion, flooding, avalanches, and landslides.[27] A warmer climate would also impact the biological diversity of plant species, as not all would be able to adapt to warmer conditions. New pests, diseases, and invasive plant species better suited to a warmer climate could also compete with native species, resulting in alterations to the ecosystem. Likewise, the increase in temperature and decrease in availability of water resources would likely increase the severity of droughts, and although many tree species are able to cope with limited droughts, extreme changes could put many forest and rangeland plant species at risk, along with the people that depend upon them for their livelihoods.

1.6 WATER RESOURCES

Afghanistan's annual renewable surface water resources are estimated at 57 billion m^3 distributed across five river basins (Figure 3). This equates to an overall surface water availability of 2,775 m^3 per capita per year, which is considerably higher than the standard figure of 1,700 m^3 per capita per year that is considered sufficient to satisfy average population demands for domestic, food production, industrial, energy, and environmental needs.[28]

Figure 3: Afghanistan's Five River Basins and 34 Sub-basins[29]

However, although the country has sufficient water to meet its needs, these resources are not evenly distributed or equally accessible at all times of the year. There are important countrywide variations within and across river and sub-river basins, which do not always correspond with the location of the irrigable land and the settled populations. For example, while the Panj-Amu river basin holds almost 40 percent of the country's available water resources, at nearly 6,500 m^3 per capita per day, it only accounts for 13 percent of the irrigated land. By contrast, the Northern river basin holds 20 percent of all irrigated land, yet only 3 percent of the country's total water resources flow within the basin's hydrological borders. This represents less than 700 m^3 per capita per year, which is perilously close to absolute water scarcity (*See Figure 3 and Table 1*).[30]

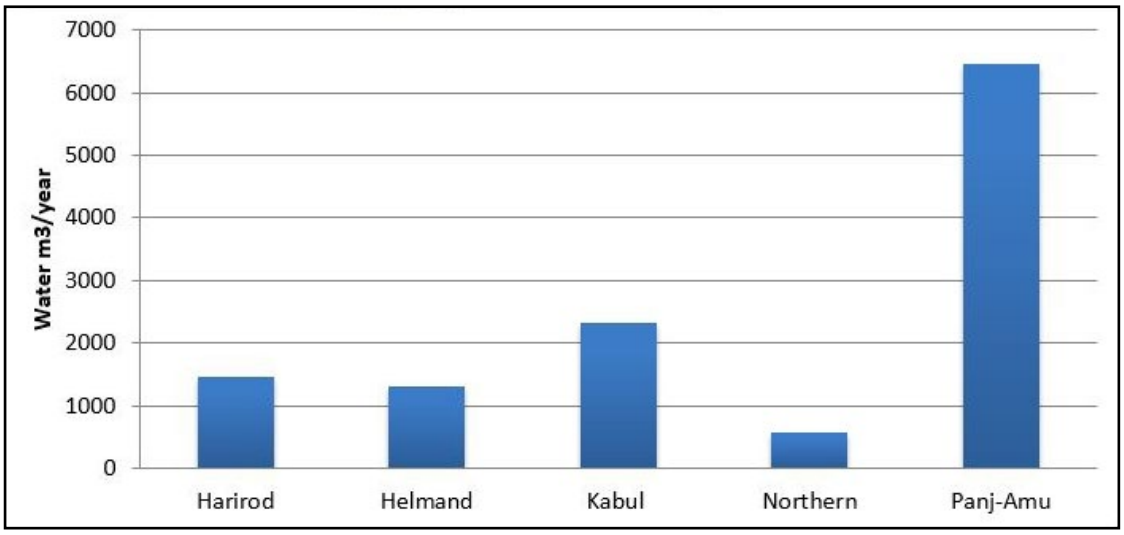


Figure 4: Annual River Basin Per Capita Water Availability31

Table 1: Water Availability in Afghanistan Five River Basins[32]						
River Basin	Water density/year		Area		Population	Potential water availability/person
	Billion m^3	Total %	Thousand km^2	Total %	Million	m^3/year
Panj-Amu	22.00	39	91.5	14	3.4	6,470
Harirod-Marghab	3.06	5	78.4	12	2.1	1,457
Helmand	9.30	16	264.9	41	7.1	1,310
Kabul	20.76	36	77.7	12	8.9	2,333
Northern	1.88	3	71.7	11	3.3	570

The availability of water in Afghanistan is also characterized by considerable intra- and inter-annual variations. Compared with neighbouring countries, Afghanistan's storage capacity of 140 m^3 per capita is the lowest in the region and far lower than the average for Asia of 353 m^3 per capita.[33] Thus, if water becomes abundant during certain periods in the year, it cannot be stored to meet demand during periods of shortage. This reduces the opportunity to harness surface resources and renders the country more vulnerable to drought and other water-related climate shocks.

Current climate change projections show that precipitation levels in Afghanistan will remain relatively stable up to 2100, but the overall increase in temperature across the country will lead to an increase in evaporation and evapotranspiration that will not be compensated by a sufficient increase in precipitation, thereby negatively impacting the water cycle and availability of water resources.[34] Moreover, temperature increases will cause increased glacial melting in the Hindukush region, and a corresponding decline in groundwater recharge rates.

These changes will likely occur in conjunction with a steady increase in population and demand for water. Warmer temperatures will also change seasonal precipitation patterns, likely causing earlier snow melt and causing more precipitation to fall as rain rather than snow. This will increase the risk of flooding during the spring and drought during the summer. These risks are further compounded by the heavy degradation of forests and rangelands, reducing cover of vegetation that formerly helped stabilize watersheds and attenuate runoff, while also limiting desertification and soil erosion.

1.7 AGRICULTURE AND ANIMAL HUSBANDRY

Agriculture is the foundation of Afghanistan's economy and livelihoods, supporting some 80 percent of the country's population, either directly or indirectly.[35] Although the relative importance of agriculture is expected to decline in the future along with economic development, the sector will increase in absolute size and presents a primary focus for economic recovery, poverty reduction, and poppy eradication.

With a growing population and the return of refugees from abroad, the country's agricultural resource base is under stress. Of the country's vast agricultural lands, it is estimated that only approximately 2.5 million hectares is irrigated and regularly cropped, of which only approximately 10 percent relies on modern irrigation engineering technologies.[36,37] Meanwhile, an additional 1.1 million hectares of land is rain-fed and cropped opportunistically, depending on precipitation.[38] Increasing pressure on available land over the last two - three generations has led to expansion of rain-fed wheat crops into traditional grazing lands and high mountains.

In addition to crops, it is estimated that livestock products contribute more than 50 percent of agricultural GDP. Over the past 30 years, livestock populations in Afghanistan have fluctuated between periods of prosperity and drought from highs of more than 5 million cattle and over 30 million sheep and goats to lows of only 3.7 million cattle and 16 million sheep and goats. Many experts in Afghanistan see mismanagement, especially overgrazing, and conversion to rain-fed wheat production as causing deterioration of rangelands resulting in extensive desertification and decreasing productivity.[39]

1.8 ENERGY AND INFRASTRUCTURE

As a result of more than three decades of near constant conflict, much of Afghanistan's infrastructure has been destroyed or severely damaged. Since 2001, the restoration and development of the country's physical capital has been a priority of international development agencies, but due to the heavy damage and massive investments required, progress has advanced at varying speeds. For example, the Afghanistan Reconstruction Trust Fund (ARTF) and Afghanistan Infrastructure Trust Fund (AITF) are both large-scale multi-donor initiatives that aim to rehabilitate the country's infrastructure, particularly roads and transportation, energy, water resource management, and provision of social services.

These services are especially important in rural areas where the lack of necessary infrastructure has had negative impacts on economic development, market access, transportation, health, and education. Thus, it is imperative that climate change considerations are integrated into Afghanistan's rural development initiatives from the outset, to ensure that advancements made in recent years are not undone by extreme weather events or severe climatic shifts.

Afghanistan's energy sector has also been especially hard hit by decades of conflict and neglect. Currently, domestic energy production is at nearly the same level as it was just prior to the invasion of the Soviet Union in 1978, while the condition of these energy-producing facilities is greatly degraded.[40] Afghanistan's abundant water resources mean that the country has considerable potential for hydropower development, which at present accounts for approximately 50 percent of installed domestic electricity capacity, with the remainder made up by thermoelectric and diesel generators.[41]

Afghanistan also relies heavily on electricity imports from neighbouring countries, which account for more than three quarters of Afghanistan's total electricity usage.[42] In order to reduce reliance on imported electricity, Afghanistan has made

it a national priority to promote domestic energy production, and quite reasonably the national Energy Sector Strategy emphasizes the strong potential of domestic hydropower development in order to meet the country's energy needs and promote economic growth.[43] However, the uncertain impacts of climate change on the availability of water resources and increased risk of natural disasters, such as floods, raise questions about the safety and sustainability of hydropower dams.

Domestic oil production in Afghanistan is insignificant, producing around 400 barrels per day of crude oil; however, U.S. government estimates suggest total oil reserves could be as much as 270 billion barrels.[44] At present, Afghanistan relies on imports of petroleum products to meet domestic consumption needs, which during the 2014/15 year accounted for 455,709 metric tonnes of diesel, 368,503 metric tonnes of petrol, and 474,723 metric tonnes of liquid natural gas.[45]

Domestic production of natural gas and coal are further significant sources of energy, but production has yet to reach major output levels(*See table 2*). According to the Energy Sector Strategy there is uncertainty about natural gas reserves, but "regardless of the whether reserves are 1 TCF [28.32 BCM] or more, there is still sufficient gas to justify immediate exploration and develop and utilization in power and, possible, for Compressed Natural Gas (CNG) vehicles." Coal is used primarily for household cooking and heating, but as production grows its use is expanding to cement industries as well as thermal power plants.

Table 2: National Production of Coal and Natural Gas in Afghanistan[46]

Hydrocarbon Product	2013/14	2014/15	2015/16
Coal (thousand tons)	1,347.00	1,517.40	1,364.80
Natural Gas (million m^3)	154.50	141.90	146.20

Only 28 percent of Afghan households are connected to power supply systems.[47] Thus, renewable energy offers the greatest energy hope for Afghanistan in general, and rural energy in particular. This includes hydro, solar, wind, geothermal, biomass and wood(*See table 3*). Although hydropower represents the greatest untapped energy resource, Afghanistan also has excellent wind potential, particularly in the northern and eastern regions, with an estimated potential installed capacity of up to 66,726 MW.[48] Likewise, Afghanistan has strong solar energy potential, with more than 300 sunny days per year and average solar radiation of about 6.5 kWh per m^2 per day. In addition, biomass/biogas and geothermal sources can provide significant renewable and decentralized energy for rural communities. Regulation of the energy sector in Afghanistan is the mandate of the Ministry of Energy and Water (MEW).

Table 3: Renewable Energy Potential and Development Status in Afghanistan		
Resource	**Potential**	**Status**
Hydropower	MEW estimates Afghanistan's hydropower potential to be around 23,310 MW.[49] Nearly all of this amount is located in the Panj-Amu river basin, which has an estimated hydropower potential of 20,137 MW. Next largest is the Kabul river basin with 1,941 MW, followed by the Northern (760 MW), Helmand (270 MW), and Harirod (202 MW) river basins.	MEW records indicate that a total of 2,188 completed mini and micro hydropower projects across the country have the combined installed capacity of 36,925 KW.[50] In addition, MEW has surveyed 40 additional projects that have the capacity to generate 10,144 KW of power, and around 450 additional projects with the combined installed capacity of 5,845 KW are currently under construction.[51]
Wind	Commercially exploitable wind resources exist in many parts of the country, with an estimated total energy potential of 147,563 MW, out of which only 66,726 MW has feasible energy capacity.[52] Major wind resource areas include northwestern Nimroz, western Farah, western Herat, eastern Balkh, northern Takhar and wind corridor areas include Near Jabalsaraj, Sarobi, and Tirgari in eastern Afghanistan.	Only a few micro wind turbines have been installed in the country. Afghanistan's first ever power-generating wind farm was built in Panjshir in April 2008 with a total installed capacity of 100 KW.[53] In total, 6 wind projects have been completed with an installed capacity of 230 KW, while another 16 wind projects have been surveyed.[54]
Solar	Afghanistan has excellent solar energy resources, typically averaging over 5.5 kWh/m2/day annual global horizontal insolation and estimated at least 300 days for most of the country, with the south having the highest insolation. Estimates of solar energy potential for the country are approximately 65,982,912 MW, of which approximately 222,852 MW of installed capacity potential is located in feasible areas.[55]	Some 2,364 solar projects have been completed across the country with an installed capacity of 1802 KW, while another 43 projects with a capacity of 67 KW have been surveyed.[56] Figures for decentralized and household-level solar usage are harder to estimate.
Biomass/ Biogas	MEW estimates that the electrical energy production potential from 3,723,015 tons/year of municipal solid waste is 819,063 MWh/year, electrical energy production potential from 39,187,641 tons/year of animal manure is 7,367,277 MWh/year, and electrical energy production potential from 6,494,820 ton/year of crop residue of is 27,083,399 MWh/year.[57]	An estimated 200 small biogas digesters have been installed in Kandahar, and about 100 plants have been installed in the Jalalabad area.

Geothermal	In Afghanistan, active geothermal systems are located in areas of the Hindukush, which runs along the Herat fault system, up to the Wakhan corridor in the Afghan Pamir. There is potential for direct-use applications of these resources, such as in the food processing, fruit drying, refrigeration, fish hatchery and farming, carpet and wool processing, recreation and tourism and other small-scale industries. Development of potential geothermal prospects for commercial use, reconnaissance surveys are required to identify resources.	Prospects of low to medium temperature geothermal resources are widespread all over Afghanistan, but no substantial harvesting of geothermal energy has been initiated.

1.9 GEOLOGY AND MINERAL RESOURCES

Afghanistan's oldest rocks are Archean, which are succeeded by rocks from the Proterozoic and every Phanerozoic system up to the present day. The country also has a long and complicated tectonic history, partly related to its position at the western end of the Himalayas. This diverse geological foundation has resulted in a significant mineral heritage with over 1,400 mineral occurrences recorded to date. Historical mining concentrated mostly on precious stone production, with some of the oldest known mines in the world believed to have been established in Afghanistan to produce lapis lazuli for the Egyptian Pharaohs. More recent exploration in the 1960$_s$ and 1970$_s$ resulted in the discovery of significant resources of metallic minerals, including copper, iron and gold, and non-metallic minerals, including halite, talc and mica. The bedrock geology of Afghanistan can be thought of as a jigsaw of crustal blocks separated by fault zones, each with a different geological history and mineral prospectively. This jigsaw has been put together by a series of tectonic events dating from the Jurassic period.

Recent research from the U.S. Geological Survey (USGS) estimates that Afghanistan's untapped mines have a potential value of approximately US$1 trillion.[58] These deposits include copper, iron ore, cobalt, gold and lithium, as well as huge deposits of niobium, rare earth elements, and hydrocarbons. In particular, the Aynak copper and Hajigak iron ore projects are attracting large-scale foreign investments, and could be the start of the country's major earnings from the extractive sector.

If managed fairly and transparently, the exploitation of these natural resources could substitute a major share of Afghanistan's current external aid. Afghanistan is a candidate for the Extractive Industries Transparency Initiative (EITI), the global standard for improved transparency in the oil, gas, and mining sectors. The EITI process was initiated in March 2009 when the Government formally endorsed the principles of EITI, signalling its commitment to transparent and accountable sector governance.

1.10 Economic Profile

During the early 2000s, Afghanistan's economy experienced high growth rates in the double digits, but this was accompanied by high volatility due to the prominence of the agriculture sector, which is subject to weather changes. In more recent years, Afghanistan's growth has slowed, and foreign aid inflows have declined, while the deteriorating security environment and political uncertainty undermine private sector confidence and economic activities.[59] According to the Asian Development Bank, economic growth in 2018 is projected at 2.5 percent, which is comparable to growth in 2017, but up from 2.4 percent in 2016 and 1.3 percent in 2015.[60]

In terms of sectoral contributions to GDP, the service sector led the country's growth and accounted for more than half of the GDP (52 percent), with both agriculture and industry tied for second place with 22 percent.[61] This also reflects the continued contraction of the agriculture sector, as demonstrated in recent years, which is closely linked to poverty and rural livelihood indicators. Similarly, GDP per capita also showed little growth, from US$755 in fiscal year 2014/15 to US$688 in 2015/16 and US$696 in 2016/17.[62]

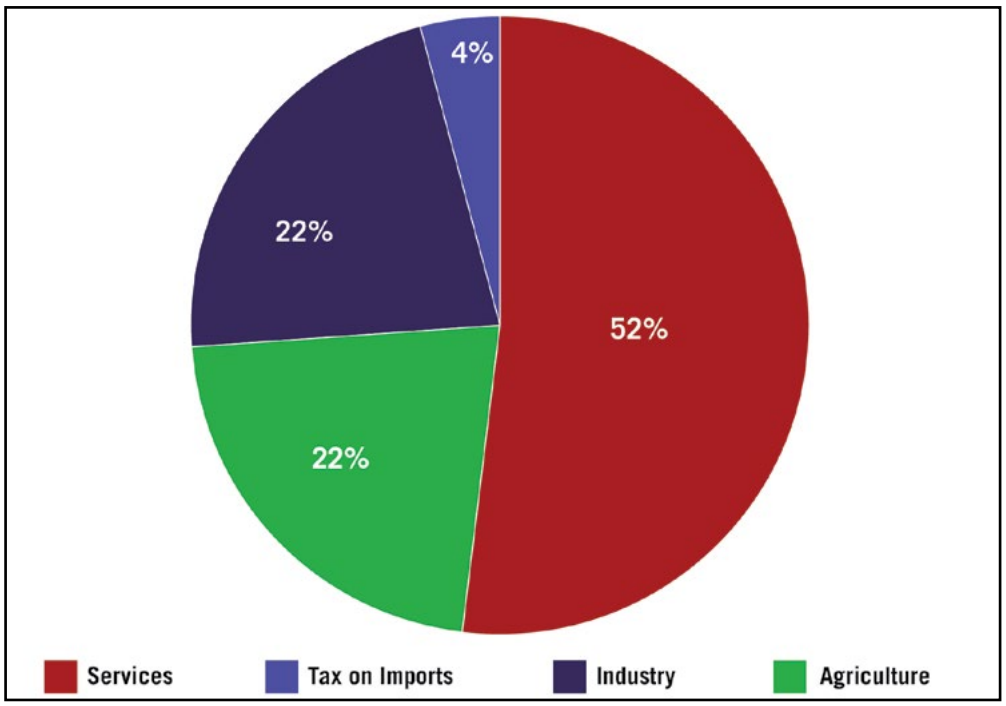


Figure 6: Sectoral Contributions to GDP 2016/17[63]

In the medium to long term, economic analysis suggests that Afghanistan will face a slow economic recovery over the coming years. Assuming that the security situation does not deteriorate, the political situation is stabilized, and reform efforts are made to improve government and business functions, growth rates are expected to gradually increase to over 3 percent in 2018.[64]

1.11 TRANSPORTATION SECTOR

In 2001, only 10 percent of the country's estimated 130,000 km of major and rural roads network was in good condition.[65] Rehabilitating Afghanistan's core transportation infrastructure, while creating quick employment, has been a major national priority that featured prominently in the strategy to consolidate

countrywide peace and security. Because of its labour-intensive nature, the rehabilitation of rural roads was considered crucial to generate immediate employment opportunities while improving rural access to basic services and markets.

The World Bank, through both International Development Assistance and ARTF resources, has been supporting those programmes with a primary objective of creating employment in rural areas, and working up to more extensive involvement in building institutional capacity in the Ministry of Public Works (MoPW) and Ministry of Rural Rehabilitation and Development (MRRD). In parallel, USAID and the Asian Development Bank have focused their financing on major highways, with a view to restoring the national-level ring highway that links all major cities and main border crossing points.

With the improvement of transportation infrastructure, as well as the vast improvements in the country's economy since the establishment of democracy, the number of vehicles being imported and on the road has increased significantly (*See table 4*). Similarly, over the years, air traffic has grown considerably and as of 2015/16 includes 6 government-owned and 12 private airplanes, with a total combined seat capacity of 2,184.[66]

Table 4: Number of Vehicles in Afghanistan and Type

Vehicle Type	2005/06[67]	2010/11[68]	2015/16[69]
Lorries	100,883	184,799	311,905
Busses	41,731	74,834	104,543
Passenger Cars	262,700	691,573	1,156,215
Motorcycles	64,817	141,833	259,237
Total	470,131	1,093,039	1,831,900

The Transport Sector Strategy continues to give high priority to rehabilitation of the badly damaged road system. The main programmes of the strategy are: i) regional, national highways and provincial roads; ii) rural roads; iii) urban transport; iv) civil aviation; v) transport sector maintenance; vi) pubic transport; and vii) railway programme. A Transport Sector Inter-Ministerial Working Group has also been formed to coordinate the work of the ministries in the sector to assure that projects are properly designed to obtain the highest returns and greatest impact on the poverty reduction goals.

1.12 URBANIZATION AND URBAN AREAS

According to the Afghanistan Statistical Yearbook 2016/17, out of the total settled population of 29.7 million, 6.9 million people lived in various cities of Afghanistan, representing nearly a quarter of the population.[70] At current rates, it is expected that the population of Afghan cities will double within the next 15 years, and by 2060 nearly half of the country's population will live in urban areas.[71] Of the total urban population, 3.7 million (55 percent) live in Kabul, while other main cities are Herat, Mazar-e Sharif, Jalalabad and Kandahar.

Rapid and unplanned urbanization across the country has put significant pressures on city infrastructure, creating a number of challenges and constraints such as[72]:

- Low coverage of basic services and inadequate public resources to meet growing needs,
- A rapid pace of urbanization partly due to returning refugees and rural-urban migrants, leading to high population density,
- Widespread urban poverty and limited access to productive employment,
- A high proportion of informal settlements and associated problems,
- Lack of capacity and coordination among urban sector institutions,
- Limited scale of private sector investment in urban enterprises, facilities or services,
- Lack of accurate data on which to base critical policy decisions,
- Land security and titling: absence of proper land registration system, land grabbing, inadequate legal instruments and institutions,
- Lack of available financial funds due to limited interest of donors in the urban sector.

In order to address these issues, the Government has developed a new Urban National Priority Programme (U-NPP) as a guide for: i) strengthening urban governance and institutions; ii) ensuring adequate housing and access to basic services; and iii) harnessing urban economy and infrastructure.

Major environmental issues in Afghanistan's urban areas include issues of air, water, and soil pollution, access to clean water, and solid waste management. Urban areas are also prime contributors to climate change; although cities cover less than 2 percent of Afghanistan's surface, they consume 70 percent of the country's energy and produce about half of its CO_2 emissions, as well as significant amounts of other GHG emissions (*See Section 2*). The main sources of these gases are energy generation, vehicles and transportation, the brick kiln industry, and biomass use.

As a result of climate change, it is estimated that urban populations across the country will be forced to contend with depleted aquifers and groundwater sources, erratic precipitation, floods, stronger and more frequent storms, and more extreme temperature fluctuations. In addition, most economic and social infrastructure, government facilities, and assets are located in cities, increasing the relevance of mainstreaming climate change into urban planning and development. Urban populations most likely to be affected by climate change are the poor – slum dwellers, refugees, and returnees – many of whom tend to live along river banks, on hillsides and slopes, near polluted grounds, on unregistered land, or in unstable structures.

1.13 GOVERNANCE STRUCTURES AND LEGISLATIVE PROCESSES

Afghanistan is a democratic Islamic republic comprised of executive, legislative, and judicial branches, whose powers are enshrined by the Constitution at the highest levels in the President, National Assembly, and Supreme Court, respectively.[73] The Constitution of the Islamic Republic of Afghanistan was adopted by the delegates of a constituent assembly (*Loya Jirga*) representing the Afghan people, held between December 13, 2003 and January 4, 2004. It was formally ratified by the President on January 26, 2004.

The President appoints the ministers, Attorney General and Supreme Court justices. Legislative authority in Afghanistan is a bicameral National Assembly with a House of People (*Wolesi Jirga*) and a House of Elders (*Meshrano Jirga*). Duties are enumerated under Article 90 of the Constitution. Judicial power is composed of the Supreme Court, Courts of Appeal and Primary Courts. Cases are resolved in courts taking into consideration the quality and nature of the case in two stages, primary and appeal. The Supreme Court deals with the referred cases of Courts of Appeal only in terms of accurate application of law (to see if any provision of law is breached or accurately applied), unless it has been authorized by law to resolve a case taking into consideration the quality and nature of the case. The legislative process in Afghanistan means that any law has to be approved by both Houses of the National Assembly before it is endorsed by the President. Laws can be proposed by either the National Assembly or the members of the Government.

The Constitution also establishes that the administration of the country be divided into the units of ministries at the central level and provinces at the local level. Each province is governed by a publicly elected Provincial Council and a presidentially appointed Governor. Provinces are further sub-divided into the units of districts and villages, each of which can establish publicly elected councils to oversee activities and ensure active public participation in local-level administration.[74] In urban areas, municipalities are established to administer city affairs, and governed by a publicly elected Mayor and Municipal Council.[75] Across the country, local-level administration also includes Community Development Councils (CDCs) that lead community-based governance as well as reconstruction and development projects.

1.14 ENVIRONMENTAL GOVERNANCE

According to Article 15 of the Constitution of the Islamic Republic of Afghanistan, "the state shall be obligated to adopt necessary measures to protect and improve forests as well as the living environment." In 2007, both houses of the parliament passed the Environment Law, which was subsequently ratified by the President, and provides the basis for environmental governance in Afghanistan. The Environment Law also establishes a regulatory framework for the sustainable use and management of Afghanistan's natural resources base, and provides for the conservation and rehabilitation of the environment towards achieving the country's social, economic, reconstruction, and ecological development goals.[76]

The primary aim of the Environment Law is the conservation and management of environmental resources and their sustainable use to: i) support livelihoods; ii) protect the health of humans, flora and fauna; iii) maintain ecological functions and evolutionary processes; iv) secure needs of present and future generations; v) conserve natural and cultural heritage; and vi) facilitate reconstruction and sustainable development of national economy. The National Environmental Protection Agency (NEPA) is an independent institutional entity, responsible for coordinating, monitoring conservation and rehabilitation of the environment, and the implementation of the law.

As per the Constitution and the Environment Law, people of Afghanistan have the following rights (individuals and their associations) with regard to the environment:

- The right of everyone to receive environmental information that is held by

public authorities (access to environmental information),
- The right of both women and men to participate in environmental decision-making (public participation in environmental decision-making),
- The right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general (access to environmental justice).

NEPA, which is headed by a Director-General, has its central office in Kabul and provincial offices in each of the country's 34 provinces. As per the Environment Law, the National Environmental Advisory Council (NEAC) has been established to advise NEPA on financial matters, regulatory matters, and environmental matters of public interest. In addition to NEAC, the Committee for Environmental Coordination (CEC) is constituted to promote the integration and coordination of environmental issues and fundamental principles of the law at the central level as well as at provincial level. The CEC is composed of representatives of line ministries, national institutions, provincial councils, and district and village councils. Additional inter-ministerial coordination mechanisms established for environmental governance in Afghanistan include the Subnational Environment Advisory Councils (SEACs), Parliamentary Committee on the Environment (PCE), National Climate Change Committee (NCCC), Afghanistan Wildlife Executive Committee (AWEC), Biodiversity Working Group (BWG), and Protected Area Working Group (PAWG).[77]

1.15 PREPARATION PROCEDURES FOR SECOND NATIONAL COMMUNICATION

The Islamic Republic of Afghanistan, with technical support from UN Environment and financial support from the Global Environment Facility (GEF), prepared this SNC under the UNFCCC. In preparation of this report, the following steps were taken:

- Establishment of a Project Management Office (PMO), led by SNC Project Coordinator, by NEPA and UN Environment.
- Organization of an Inception Workshop with key stakeholders and agreed on the composition of six National Study Teams (NSTs) to lead the research and preparation of the SNC report. The details on the composition of the six NSTs are provided in Annex II.
- Selection of working modalities by NSTs, including study of the guidelines and handbook, understanding of the procedures, regular and periodic consultations and meetings, presentations of the thematic report to NST members, and preparation of thematic reports.
- Compilation of the SNC report by the PMO using the research and thematic reports from the NSTs.
- Organization of a Validation Workshop to present the completed draft of the SNC and seek formal approval from all NST members, PMO, and senior leadership.
- Presentation of the final draft of the SNC report to the NCCC for their recommendation for approval.
- Formal approval of the final SNC report by NEPA.

2

NATIONAL GREEN HOUSE GAS INVENTORY

2.1 INTRODUCTION

As a non-Annex I party to the UNFCCC, Afghanistan is required to communicate to the Conference of the Parties a national inventory of anthropogenic emissions and removals of GHGs not controlled by the Montreal Protocol. This is in accordance with Article 4, paragraph 1(a) and Article 12, paragraph 1(a) of the Convention.[78] Given that Least Developed Countries (LDCs) such as Afghanistan have the flexibility to select the year of GHG inventory, the inventory was estimated for the fiscal year 2013–2014 (reported as 2013) because of the relative availability of data for this period.

2.2 METHODOLOGIES FOR GHG INVENTORIES

This GHG inventory was developed following the methodologies of the Inter-Governmental Panel on Climate Change (IPCC) "Revised 1996 Guidelines for National Greenhouse Gas Inventories". Five main sectors were identified for estimation of national GHG emissions and removals, namely:

- **Energy:** this includes emission of all GHGs from electricity generation, heat production, manufacture of solid fuels, other energy industries, manufacturing industries and construction, transport, commercial, residential, agricultural/forestry/fishing, as well as fugitive emissions from coal mining and oil and natural gas activities,
- **Industrial Processes:** this includes emission of all GHGs from industrial processes. Emissions from fuel combustion in industry are reported under the Energy sector, with the focus under Industrial Processes on mineral products, chemical industry and metal production,
- **Agriculture:** this includes emission of all GHGs from enteric fermentation, manure management, agricultural soils, and field burning of agricultural residues,
- **Land-Use Change and Forestry:** this includes emission and removal of all GHGs from forest and land-use change activities such as changes in stocks of forest and other woody biomass, conversion of forest and grassland, and soil emissions and removals,

- **Waste:** this includes emission of all GHGs from solid waste disposal,
- **Solvent and Other Product Use:** this category was not estimated because of lack of data.

The data used for this inventory were primarily derived from the Central Statistics Organization's "Afghanistan Statistical Yearbook 2013–2014." Where relevant data were not available in the yearbook, other sources from global datasets or specialised studies were consulted. As there are no nationally-specific emission factors for Afghanistan, a Tier 1 approach using IPCC default emission factors was followed to calculate gigagrams (Gg) of GHG emissions.

This inventory covers the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), carbon monoxide (CO), other nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2), and hydrofluorocarbons (HFCs). Global Warming Potentials from the 2013 IPCC Fifth Assessment Report were used to calculate the CO_2 equivalents (in Gg CO_2e) for CO_2, CH_4 and N_2O for a 100-year time horizon.

2.3 TOTAL EMISSION OF AFGHANISTAN

The estimated total net emissions of GHGs for Afghanistan in 2013 comprised 60,237 Gg CO_2e, with no net removals, which equates to approximately 2,028 kg CO_2e per capita. This total was made up of 20,395 Gg of CO_2 (33.9 percent of total Gg CO_2e), 519 Gg of CH4 (31.0 percent or 18,684 Gg CO_2e) and 71 Gg of N_2O (35.1 percent or 21,158 Gg CO_2e). The greatest contributor to overall GHG emissions was the Agriculture sector (accounting for 64.3 percent of total emissions), followed by Land-Use Change and Forestry (18.8 percent), and Energy (16.2 percent). Industrial Processes and Waste each comprised 0.3 percent of total emissions. A summary of the estimated total emissions and removals of GHGs for 2013 for the Energy, Industrial Processes, Agriculture, Land-Use Change and Forestry, and Waste sectors is provided in Table 5, below.

Table 5: GHG Emissions for Six Sectors in Afghanistan for 2013 (all figures in Gg).

GHG SOURCE AND SINK CATEGORIES	CO_2		CH_4	N_2O	NO_x	CO	NMVOC	CO_2e
	Emissions	Removals						
Total Emissions and Removals	20,395		519	73	70	541	45	60,237
1. Energy*	9,639		3	0	61	235	45	9,747
2. Industrial Processes	210		0	0	0	0	0	210
3. Solvent and Other Product Use	NE	NE	NE	NE	NE	NE	NE	NE
4. Agriculture			489	72	4	110		38,762
5. Land-Use Change & Forestry**	10,546		22	0	6	197		11,338
6. Waste			5	0				180

* *Including fugitive emissions.*
** *Net emissions comprising both emissions and removals.*

2.4 SECTORAL GHG EMISSIONS

2.4.1 ENERGY SECTOR

Afghanistan has amongst the lowest per capita energy consumption globally, leading to the Energy sector only contributing 16.5 percent of total GHG emissions (9,747 Gg CO_2e). This sector was also responsible for 87 percent of Afghanistan's NO_x emissions (61 Gg), 43 percent of CO emissions (235 Gg) and almost 100 percent of NMVOC (45 Gg). Emissions were estimated from fuel combustion (excluding biomass), with the transport sub-sector comprising 51.1 percent (4,924 Gg CO_2) of the total and the energy industries sub-sector comprising the remaining 48.9 percent (4,715 Gg CO_2). The contributions of other sub-sectors were not estimated, owing to paucity of data availability. Emissions from the transport sub-sector constituted 72 percent of the NO_x (44 Gg) and almost 100 percent of both CO (234 Gg) and NMVOC (45 Gg) for the energy sector as a whole. Fugitive emissions from solid fuels contributed 2 Gg CO_2. A summary of the GHG emissions from the Energy sector is provided in Table 6, below.

Table 6. GHG Emissions for the Energy Sector in Afghanistan for 2013 (all figures in Gg).

GHG SOURCE AND SINK CATEGORIES	CO_2		CH_4	N_2O	NO_x	CO	NMVOC
	Emissions	Removals					
Energy Sector Total	9,639		3	<1	61	235	45
A. Fuel Combustion	9,639		1	<1	61	235	45
1. Energy Industries	4,715		<1	<1	18	1	<1
2. Manufacturing Industries and Construction	NE		NE	NE	NE	NE	NE
3. Transport	4,924		<1	<1	44	234	45
4. Other Sectors	NE		NE	NE	NE	NE	NE
B. Fugitive Emissions from Fuels	0		2		0	0	0
1. Solid Fuels			2		0	0	0
2. Oil and Natural Gas			NE	NE	NE	NE	NE

2.4.2 INDUSTRIAL PROCESSES

The main industries responsible for GHG emissions in Afghanistan in 2013 were cement (87 kt), lime (127 kt), iron/steel (24 kt) and ammonia (48.6 t) production, along with small amounts of paper (111 t) and food (5 kt). These industries were collective responsible for approximately 0.3 percent of total GHG emissions (210 Gg CO_2) for the country. Almost half of this came from lime production (100 Gg CO_2), followed by production of cement (43 Gg CO_2), and iron/steel (38 Gg CO_2). Table 7, below, provides a summary of the GHG emissions from the Industrial Processes sector.

Table 7. GHG Emissions for the Industrial Processes Sector in Afghanistan for 2013 (all figures in Gg).							
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**CO_2**		**CH_4**	**N_2O**	**NO_x**	**CO**	**NMVOC**
	Emissions	**Removals**					
Industrial Processes Sector Total	210	0	0	0	0	<0.01	<0.01
A. Mineral Products	144						
B. Chemical Industry	<1		0	0	0	<0.01	<0.01
C. Metal Production	66						
D. Other Production	<1						
E. Production of Halocarbons and Sulphur Hexafluoride	NE		NE	NE	NE	NE	NE
F. Consumption of Halocarbons and Sulphur Hexafluoride	NE		NE	NE	NE	NE	NE
1. Solid Fuels			2		0	0	0
2. Oil and Natural Gas			NE	NE	NE	NE	NE

2.4.3 SOLVENT AND OTHER PRODUCT USE

Emissions from this sector were not estimated, owing to lack of information on production for 2013.

2.4.4 AGRICULTURE

The Agriculture sector (including both crops and livestock) accounted for approximately 94 percent of Afghanistan's overall CH_4 emissions (489 Gg or 17,604 Gg CO_2e). Given the high Global Warming Potential of CH_4, this means that this sector is also the largest contributor (38,762 Gg CO_2e or 64.3 percent) of overall GHGs emissions in the country. This primarily originated from enteric fermentation from livestock (414 Gg or 84 percent), with lesser amounts emitted in manure management (40 Gg or 8 percent) and cultivation of rice (29 Gg or 6 percent). Emissions of N_2O from agricultural soils constituted 72 Gg, which made up almost 100 percent of the emission of this gas in Afghanistan. The GHG emissions from the Agriculture sector are summarised in Table 8, below.

Table 8. GHG Emissions for the Agriculture Eector in Afghanistan for 2013 (all figures in Gg).						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**CO_2**		**CH_4**	**N_2O**	**NO_x**	**CO**
	Emissions	**Removals**				
Agriculture Sector Total			**489**	**72**	**4**	**110**
A. Enteric Fermentation			414			
B. Manure Management			40	0	0	<0.01
C. Rice Cultivation			29			
D. Agricultural Soils				72		
E. Prescribed Burning of Savannas			0	0	0	0
F. Field Burning of Agricultural Residues			5	0	4	110

2.4.5 LAND-USE CHANGE AND FORESTRY

The Land-Use Change and Forestry sector forms the largest proportion (51.7 percent) of Afghanistan's CO_2 emissions at 10,546 Gg CO_2. It also contributes the second largest proportion of the overall emissions of CO (197 Gg or 36 percent). Changes in woody biomass comprise 4,034 Gg (38 percent) of CO_2 emissions in this sector, while the conversion of forest and grasslands comprises the bulk of the emissions of all GHGs by this sector. See Table 9, below, for a summary of GHG emissions from the Land-Use Change and Forestry sector.

Table 9. GHG emissions for the Land-Use Change and Forestry Sector in Afghanistan for 2013 (all figures in Gg).						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**CO_2**		**CH_4**	**N_2O**	**NO_x**	**CO**
	Emissions	**Removals**				
Land-Use Change and Forestry Sector	**10,546**		**22**	**0**	**6**	**197**
A. Changes in Forest and Other Woody Biomass Stocks	4,034		0	0	0	0
B. Forest and Grassland Conversion	6,512		22	0	6	197
C. Abandonment of Managed Lands	NE		NE	NE	NE	NE
D. CO2 Emissions and Removals from Soils	NE		NE	NE	NE	NE

2.4.6 WASTE

Owing to the limited provision of waste management services across Afghanistan as well as the limited availability of data concerning such services, estimations for the Waste sector were based only on information from Kabul. Moreover, waste water is not collected and treated, thus calculations were restricted to emissions from solid waste management. These emissions are restricted to 5 Gg of CH_4 (180 Gg CO_2e) from solid waste disposal. An overview of GHG emissions for the waste sector is provided in Table 10, below.

Table 10. GHG emissions for the Waste sector in Afghanistan for 2013 (all figures in Gg).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4	N_2O	NO_x	CO
	Emissions	Removals				
Waste Sector Total			5	0	0	0
A. Solid Waste Disposal on Land			5	0	0	0
B. Wastewater Handling	NE		NE	NE	NE	NE
C. Waste Incineration	NE		NE	NE	NE	NE

2.5 CONSTRAINTS

The primary constraint to a more thorough and accurate inventory of GHG emissions for Afghanistan is the paucity of available data. There are limited data on the various sectors for preparation of these calculations. Where such data do exist, they are often insufficiently detailed to allow for in-depth calculations in all relevant sectors and sub-sectors. This is particularly relevant for time-series data (e.g. for land-use change calculations), as historical records have been poorly curated, especially during the late 1900s.

The accuracy of the available data is also of concern. Different and often conflicting data are available from different sources of information. Moreover, there is much information that is not collected, particularly from the informal sector, illicit activities, and in areas that are inaccessible to the government. This is further confounded by limited access to available data, e.g. where data are considered as proprietary by the institution curating it. Furthermore, a variety of methods are employed to collect, analyse and report data, which makes collation thereof for producing a harmonized GHG inventory challenging.

Finally, there is inadequate information to use Tier 2 or Tier 3 approaches for any of these calculations. A more detailed and accurate assessment for the purposes of future GHG inventories would require considerable strengthening of data collection and analysis capacities within and across all sectors.

3

VULNERABILITY ASSESSMENT AND CLIMATE CHANGE ADAPTATION

Bamyan, Afghanistan/ ©Zahra Khodadadi, UN Environment

3.1 RECENT CLIMATE TRENDS

Afghanistan is a mountainous and dry country, and has an arid and semi-arid continental climate characterized by cold winters and hot summers. However, research and observation of climatological and meteorological conditions over recent decades show changes in temperature and precipitation levels compared to historical norms, with considerable variation between the various climate regions of the country (*See figure 7*).

Since 1950, Afghanistan's mean annual temperature has increased significantly and pronouncedly by 1.8°C (Figure 8 and Figure 9). The spatial distribution of the warming between the 30-year periods from 1951-1980 and 1981-2010 shows a strong warming trend across large parts of the country. In the South, this warming was extraordinarily strong at 2.4°C, while in the Central Highlands and North warming was noticeably distinct with 1.6°C and 1.7°C increases, respectively. In the Hindukush region, warming was around 1°C. Most of the East showed warming of only 0.6°C, with some sub-regions showing little or no warming or even a slight decrease in temperature.

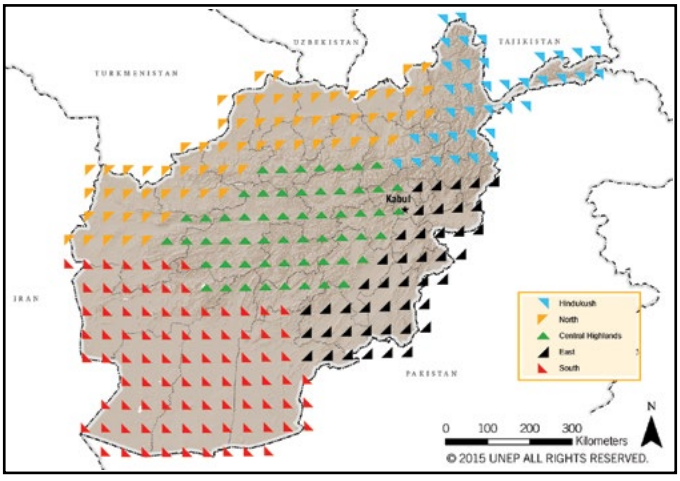


Figure 7: Eco-regions Used for Climate Analysis of Historical Change and Future Projections: North, Hindukush (northeast), East, South, and Central Highlands.[79]

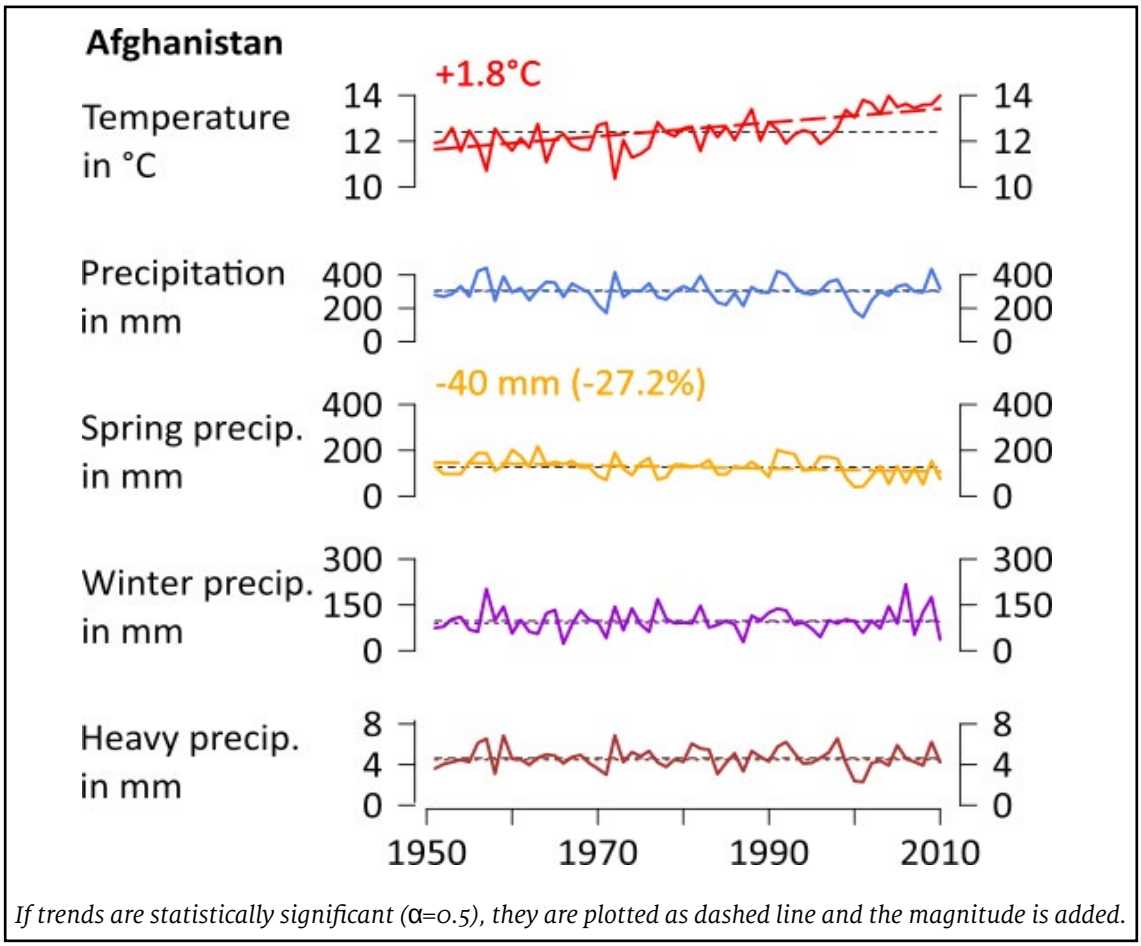


Figure 8: Trends for Temperature, Annual Precipitation, Spring Precipitation (March-May), Winter Precipitation (November-January), and Heavy Precipitation (95th percentile) for Afghanistan from 1951-2010 Derived from Reanalysis Data (GSWP3)[80]

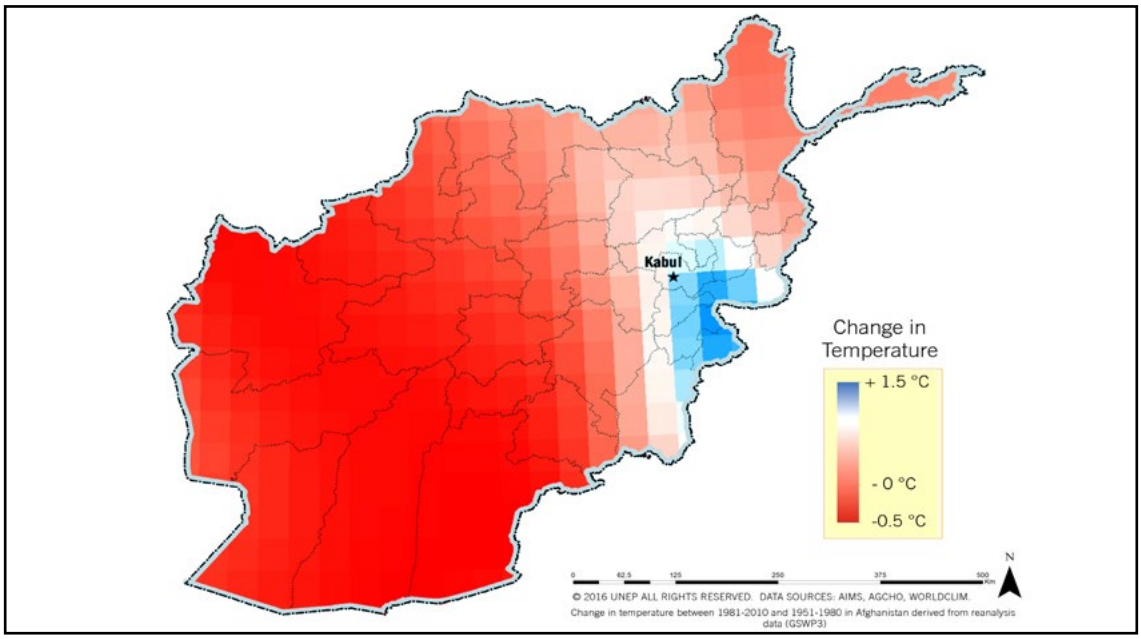


Figure 9: Change in Temperature Between 1981-2010 and 1951-1980 in Afghanistan Derived from Reanalysis Data (GSWP3)81

Historical analysis of precipitation patterns reveals that mean annual quantities have not changed significantly across the country; however, detailed analyses of spring and winter precipitation levels reveal that these changes are simply levelled out as spring precipitation decreased (by up to a third) while winter precipitation slightly increased. The decrease in spring (March-May) precipitation is particularly relevant for agriculture, since spring crops are typically rain-fed and dependent on sufficient rainfall during this period. The regions most significant to agricultural production – the East, Central Highlands and North – are strongly affected by the decrease of spring precipitation. From 1950 to 2010, the Central Highlands region saw a decrease of nearly 40 percent in springtime precipitation, while the Hindukush and South regions saw less distinct decreases. Winter precipitation, contrastingly, has increased in most parts of the country, or only slightly decreased, and none of the regional trends are significant.

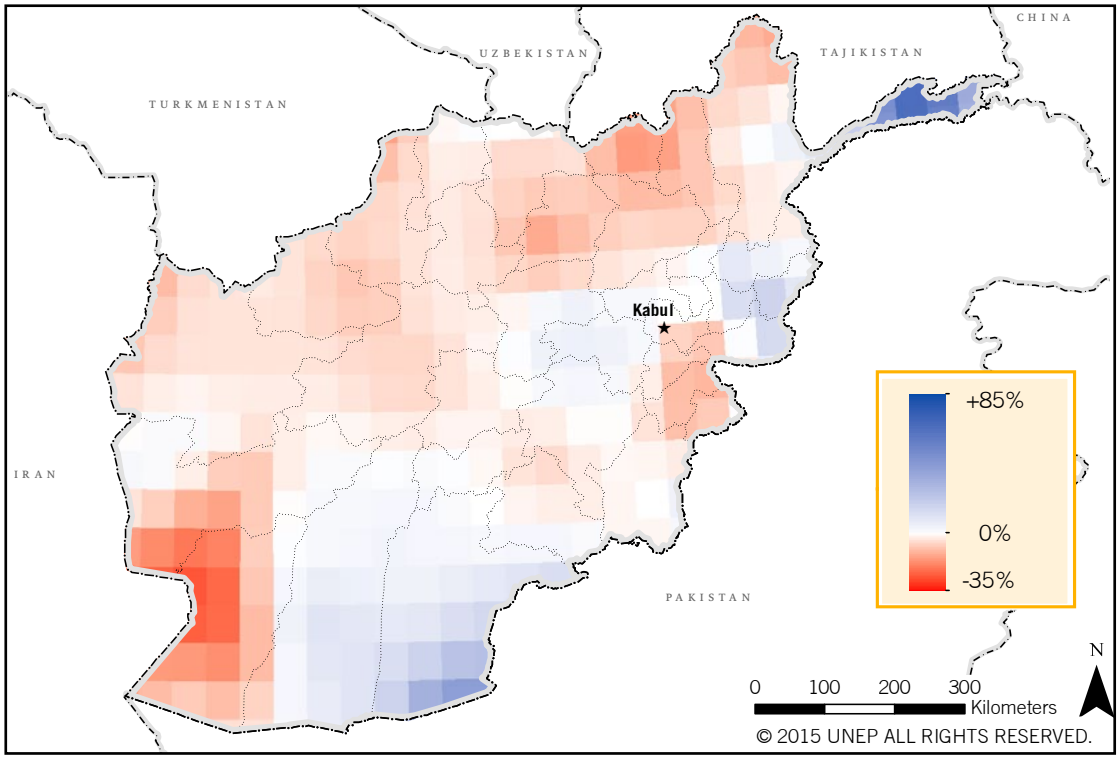


Figure 10: Change in Annual Precipitation Between 1981-2010 and 1951-1980 in Afghanistan Derived from Reanalysis Data (GSWP3)[82]

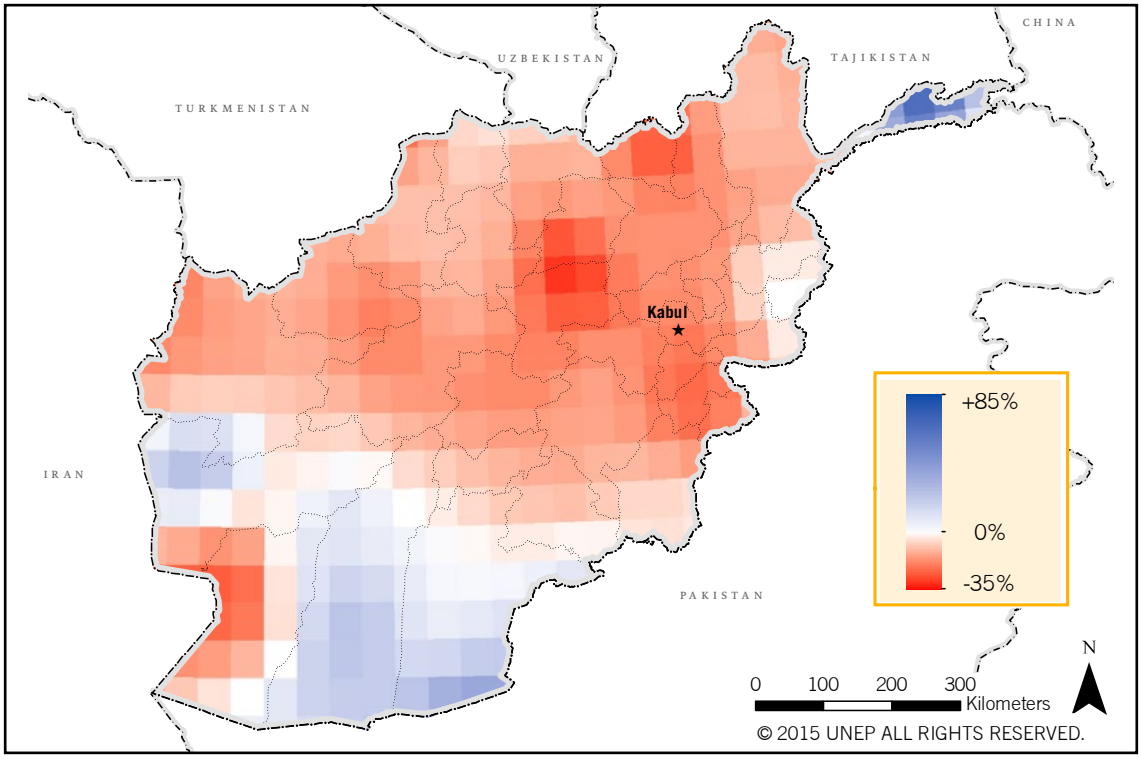


Figure 11: Change in Spring Precipitation (March-May) between 1981-2010 and 1951-1980 in Afghanistan Derived from Reanalysis Data (GSWP3)[83]

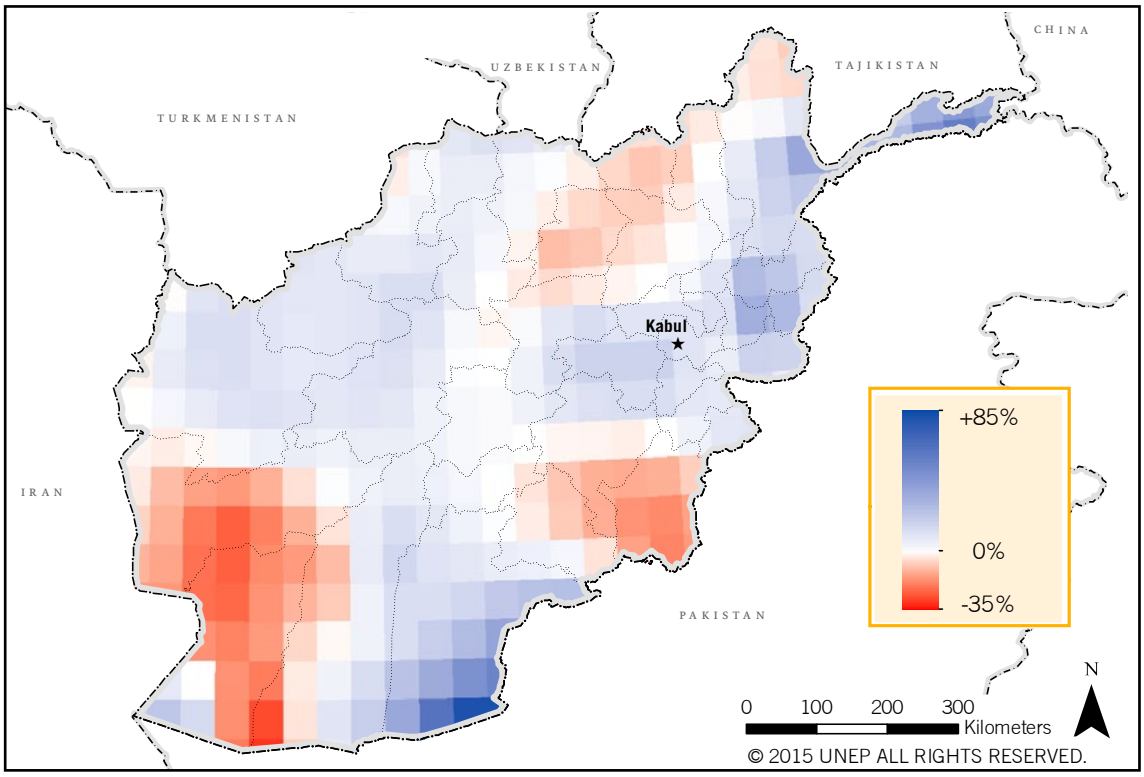


Figure 12: Change in Winter Precipitation (November-January) between 1981-2010 and 1951-1980 in Afghanistan Derived from Reanalysis Data (GSWP3)[84]

In addition to these seasonal trends, heavy precipitation has often been reported to have increased during the last decades, leading to more frequent and intense flooding, landslides and other related hazards. Analysis of historical trends from 1950 to 2010 of heavy precipitation (defined at 95 percentile of annual rainfalls), however, does not reveal any noticeable increase in heavy precipitation rates (Figure 13). Nevertheless, increases in heavy precipitation are not the sole cause of the aforementioned hazards; for example, higher temperatures can lead to earlier and faster spring snow melt resulting in increased risk of flash flooding. Similarly, droughts can increase impacts of heavy precipitation by hardening soils and reducing permeability, resulting in greater risk of flash floods and landslides. In addition, increasing exposure and/or vulnerability against certain hazards might have increased the risk and perception of increased heavy precipitation.

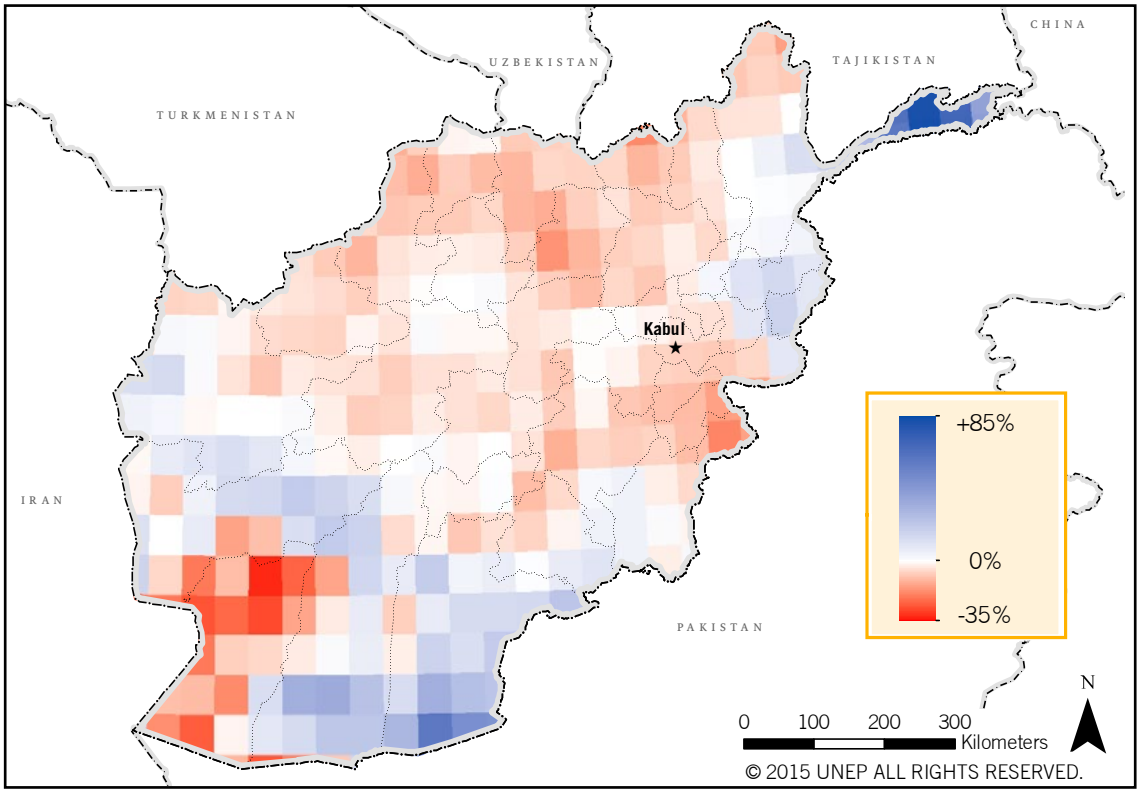
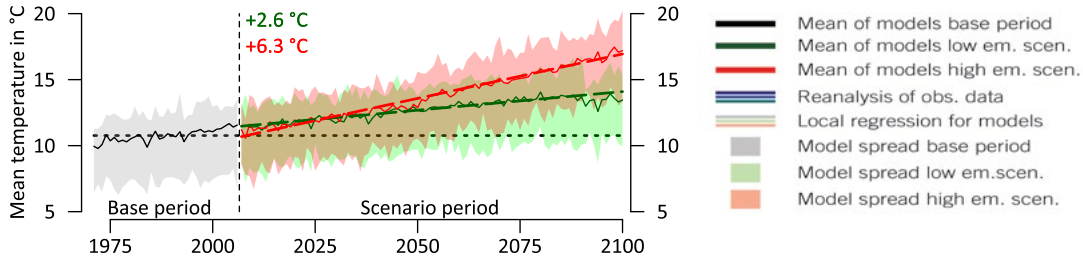


Figure 13: Change in Heavy Precipitation (95 percentile) between 1981-2010 and 1951-1980 in Afghanistan Derived from Reanalysis Data (GSWP3)[85]

3.2 SURFACE AIR TEMPERATURE PROJECTIONS

Using currently available climate data, in conjunction with regional climate models from the Cordex experiment, NEPA and UN Environment developed the country's most detailed and up-to-date climate change projections in 2016.[86] These projections show an overall increase in mean annual temperature, considerably higher than global mean projections, when compared to a baseline period of 1976-2005 (see Figure 14 and Figure 15). Under the optimistic (RCP 4.5) scenario, Afghanistan shows a trend of warming approximately 1.5°C until 2050, followed by a period of stabilization and then additional warming of approximately 2.5°C until 2100. In contrast, the pessimistic (RCP 8.5) scenario shows extreme warming across the whole country of approximately 3°C until 2050, with further warming by up to 7°C by 2100.

Under both scenarios there are regional differences, with higher temperature increases expected at higher altitudes than the lowlands. In the Central Highlands and the Hindukush, warming over a 30-year period in the near future (2021-2050) is projected to range from 1.5°C to 1.7°C compared to the base period (1976-2005), while in the lowlands the increase ranges from 1.1°C to 1.4°C. The band of uncertainty for these projections is approximately ±2°C and all model runs show the same tendency, confirming projections from earlier studies that relied solely on general circulation models (GCMs).[87]



The spread of the models are depicted as transparent areas and the means as lines. Both trends are statistically significant and depicted as dashed line. The magnitudes of the trends are plotted in the relative colours

Figure 14: Mean Annual Temperature for Afghanistan for Seven Regional Climate Models for a Base Period (grey, 1970-2005) and a Scenario Period (2006-2100) with Limited GHG Emissions (green, RCP 4.5) and Uncontrolled GHG Emissions (red, RCP 8.5)88

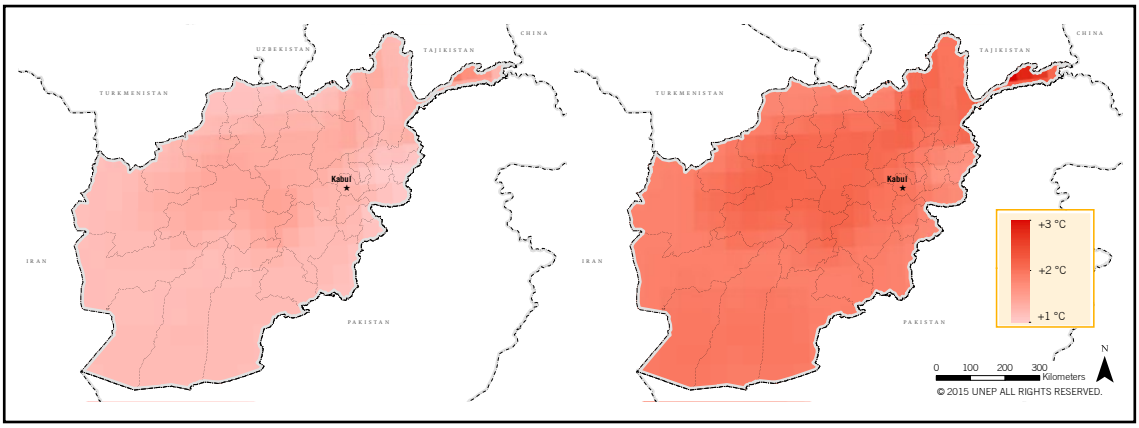
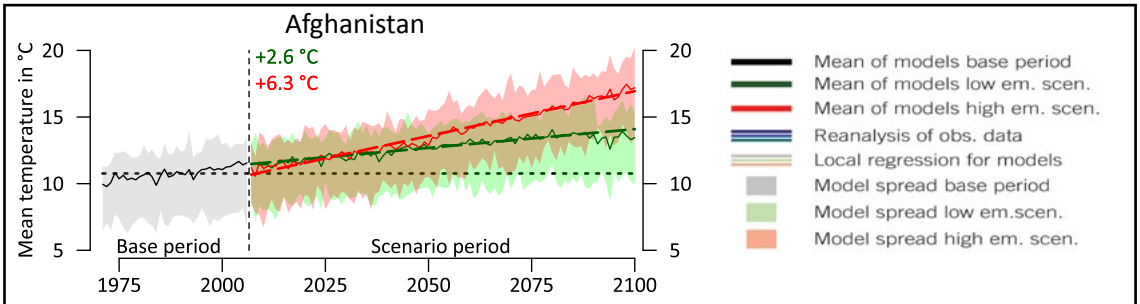


Figure 15: Projected Changes in Temperature in °C for Afghanistan as Mean of Seven Regional Climate Models between a Scenario Period (2021-2050) and a Base Period (1976-2005) with Limited GHG Emissions (left, RCP 4.5) and Uncontrolled GHG Emissions (right, RCP 8.5)

3.3 ATMOSPHERIC PRECIPITATION PATTERN PROJECTIONS

In contrast to temperature projections, the uncertainty of model projections for precipitation is higher, and regional and seasonal differences are more distinct. The mean of the model ensembles shows a significant decrease of precipitation during springtime (March-May) for the North, the Central Highlands and the East from 2006 until 2050 between 5-10 percent. This decrease is offset by a slight increase of precipitation during autumn and wintertime (October-December) in these regions. For the Hindukush, the model ensembles project a significant and substantial increase in precipitation during the winter season of approximately 10 percent, whereas during the spring season precipitation is projected to stay stable. For the arid South of the country, the models do not project significant trends for precipitation. In terms of changes to the frequency of annual rainfall, visual analysis of the scenarios does not reveal any significant change (see Figure 16 and Figure 17).

Overall, the decrease of precipitation during springtime is particularly relevant since this is the period of main plant growth for agricultural production. In addition, this precipitation decrease is projected to take place in the regions with the highest agricultural productivity of Afghanistan (East, North, and Central Highlands). In combination with the overall increase in temperature and the related increase in evapotranspiration across the country, this will most likely negatively impact the hydrological cycle, agricultural productivity, and availability of water resources.



The spread of the models are depicted as transparent areas and the means as lines. The statistically significant trend of RCP4.5 is depicted as a dashed line and its magnitude is plotted in green.

Figure 16: Annual Precipitation for Afghanistan for Seven Regional Climate Models for a Base Period (grey, 1970-2005) and a Scenario Period (2006-2100) with Limited GHG Emissions (green, RCP 4.5) and Uncontrolled GHG Emissions (red, RCP 8.5)[90]

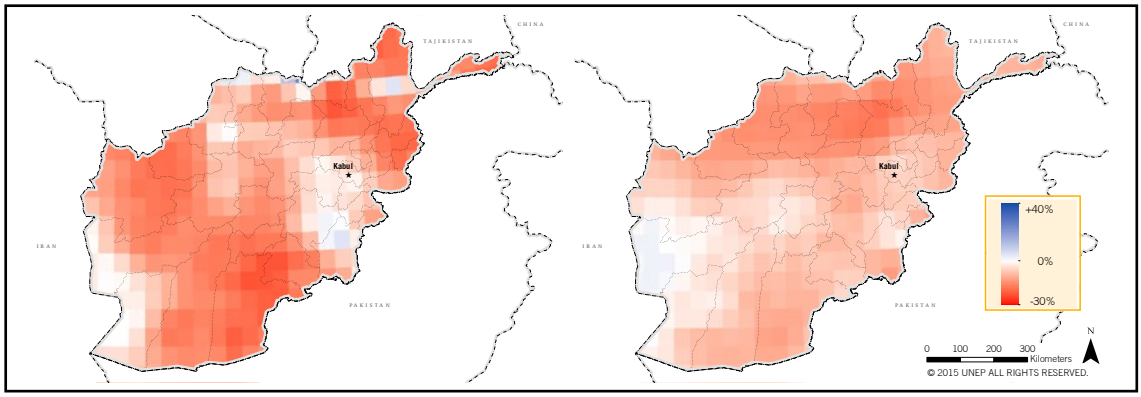


Figure 17: Projected Changes of Annual Precipitation in Percentage for Afghanistan as Mean of Seven Regional Climate Models between a Scenario Period (2021-2050) and a Base Period (1976-2005) with Limited GHG Emissions (left, RCP 4.5) and Uncontrolled GHG Emissions (right, RCP 8.5)[91]

3.4 CLIMATIC HAZARDS

Afghanistan is highly prone to natural hazards, and over the past three decades nearly every province has been affected by at least one natural disaster. According to the Afghanistan National Disaster Management Authority (ANDMA), the most frequent hazard is flooding, followed by earthquakes and epidemics.[92] Over the past century, earthquakes have accounted for approximately 50 percent of hazard-induced human casualties, followed by floods (19 percent) and epidemics (17 percent).[93] Floods are also reported as causing the largest amounts of economic damage, while droughts affect the largest proportion of the population.

Since 1969, Afghanistan has experienced several extended droughts that have had severe consequences on the country's land and people. Droughts recorded in 2000, 2006 and 2008 affected 2.58 million, 1.9 million and 280,000 people, respectively.[94] Likewise, the 1997-2002 drought was one of the most critical, affecting some 5 million families and causing another 1 million families to migrate to neighbouring countries. This drought also changed the hydrological regime in some parts such as Kabul City; before 1980, the river was snow-fed, but due to the persistent drought it has become rain-fed.

Afghanistan's NAPA, through a process of countrywide participatory discussions, identified the most common natural hazards and provided an assessment of their impacts on: loss of life and livelihoods; human health; food security and agriculture; environment; water availability, quality and accessibility; and general trends. Through this process, participants noted that all hazards were occurring with growing frequency, with floods, droughts, and rising temperatures as the having the greatest impacts on loss of life. A summary of the climatic hazards and related impacts is provided in Table 11.

Table 11: Narrative Description of Climatic Hazards and Impacts[95]

Climatic Hazard	Description	Loss of Life and Livelihoods	Human Health	Duration	Food Security and Agriculture	Environmental Effects	Water availability, quality, and accessibility	Trends
Periodic drought	Decrease in productivity of crops; forced migration; changes in livelihood; decrease in amount of exports; financial losses	Livestock herders, irrigated griculturalists, and dryland farmers; ~10,000 casualties per year of severe drought	Malnutrition; spread of diseases (malaria, leishmaniasis, cholera, typhoid, taeniasis, ascariasis, diarrhoea).	Up to 8 years	Loss of agricultural production, between 1998-2005, 75% wheat, 85% rice, 85% maize, 50% potatoes	Pistachio, pine nut, wild almond and conifer forest production decreased; waterfowl sanctuaries dried up; wildlife displaced	Decreased availability of groundwater, springs, and kareze degradation of watersheds; drop in water level at reservoirs and dams	Increasing frequency and intensity
Floods due to untimely and heavy rainfall	Collapse and sedimentation of irrigation canals; destruction of agricultural lands; loss of crops and livestock; collapse of dwellings; spread of endemic diseases; destruction of infrastructure; damage to national economy	~750 casualties per year	Increased incidence of cholera, typhoid, diarrhoea, malaria	3 months	Loss of 10% agricultural production and gardens in riverine areas.	Soil degradation; loss of natural forest; increased water siltation and sedimentation; displacement of wildlife	Infrastructure damage of ~US$300M	Increasing frequency and intensity

Flooding due to thawing of snow, ice and avalanche	River levels rise; damage to riverine agricultural and non-agricultural lands; land-slides; soil erosion; destruction of infrastructure such as bridges and gabions	~100 casualties per year	Increased incidence of cholera, typhoid, diarrhoea, malaria	4 months	2% damage of riverine agricultural lands	Soil degradation; loss of natural forest; increased water siltation and sedimentation; displacement of wildlife	Destruction of river banks, agriculture land and infrastructure of ~US$400M	Increasing frequency
Rise in temperature	Increased incidence of diseases for humans, livestock and agriculture; habitat changes affect wildlife; changes in vegetation cover and grazing patterns	~1,000 casualties per year	Increased incidence of malaria, leishmaniasis, typhoid, diarrhoea	3 months	Decreased agriculture, livestock, and horticulture production	Less productivity of natural system; displacement and changing of wildlife habitat	Increase devapo transpiration; reduction in water level	Increasing frequency and intensity
Frost and cold spells	Degradation of fruits, crops, and vegetable health; poor economy and poverty increase	Loss of fruits and potatoes; ~300 indirect casual-ties per year	Increased incidence of illnesses asso-ciated with cold weather	3 days, twice a year	20% of gardeners affected	Affects forest rehabilitation and afforestation projects (especially nurseries)	Low impact	Increasing frequency and intensity
Hail, thunder, and lightning	Destruction of crops; human and livestock losses	~150 casualties per year	Increased incidence of illnesses asso-ciated with cold weather	~20 days	~20% loss in horticulture and agriculture production	Low impact	Low impact	Increasing frequency and intensity
Monsoon and 120-day winds	Desertification; degradation of agricultural lands and crops; destruction of infrastructure; air pollution	~10 casualties per year	Ocular and respiratory illnesses	120 days	Decreased crop production; degradation of rangelands	Desertification; decreased plant cover	Losses (temporary and permanent) of infrastructure; siltation of water sources	Increasing frequency and intensity

3.5 SECTORAL CLIMATE VULNERABILITIES

Afghanistan's NAPA identifies the country's key areas most vulnerable to climatic hazards: agriculture, water resources, forestry and rangeland, biodiversity, health, energy, and waste. Through countrywide consultations with key stakeholders and the subsequent analysis of findings, a vulnerability index was established for each of these seven areas as the sum product of socio-economic assessment and review of major climatic and climate-induced parameters using expert judgement and the Thomas Saaty weighting method.

The results of this vulnerability index are summarized below (Figure 18 and Figure 19), where socio-economic measurements ranged from 1 to 9 and climatic parameters ranged from -9 to 9, in accordance with the Thomas Saaty approach. Thus, the minus sign shows the adverse impact of climate change. The sub-sectoral vulnerability indices are calculated by multiplying the socio-economic rank to the summation of vulnerability ranks to climatic parameters. Then sectoral vulnerability index is calculated by summation of the sub-sectoral vulnerability indices.

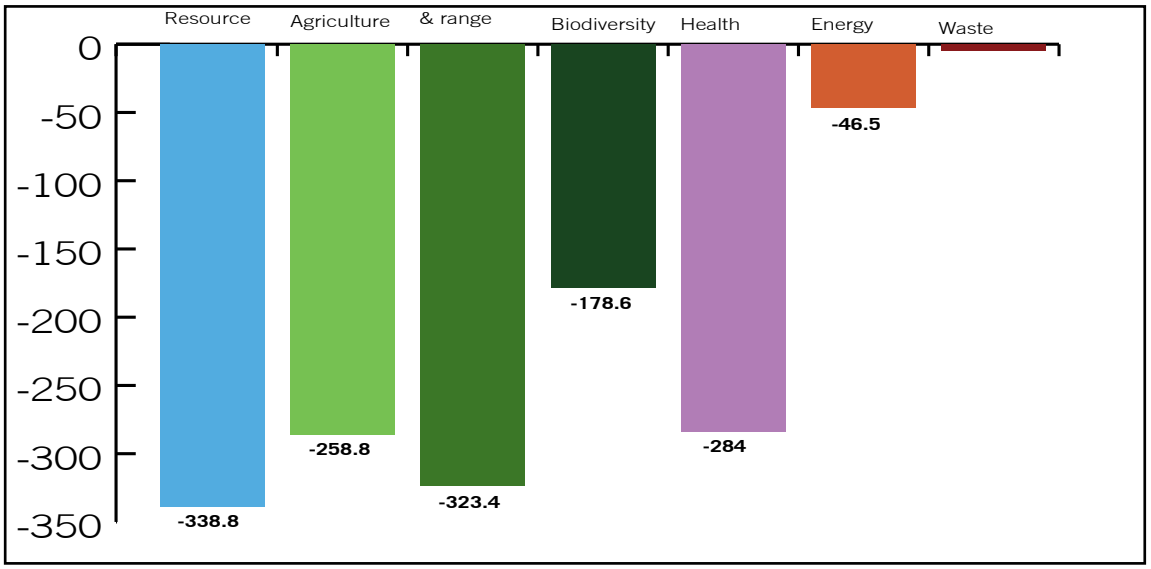


Figure 18: Vulnerability Ranking of Sectors to Climatic Hazards[96]

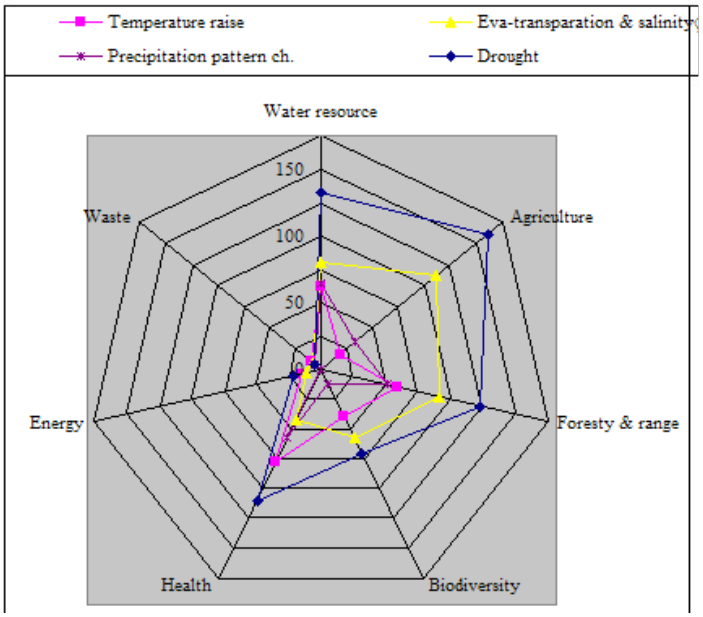


Figure 19: The Vulnerability of Different Sectors to Climatic Changes[97]

3.6 SECTORAL ADAPTATION NEEDS

3.6.1 WATER

The Hindukush region is often referred to as the 'water tower of Asia' as it stores large volumes of water in the form of ice and snow that is released gradually during the dry seasons. Nearly 61 percent of Afghanistan's total area is located within the Hindukush area and 4.4 percent of the Hindukush's total glaciated area is located in Afghanistan.[98] As mountains are the major sources of water in Afghanistan, the impact of climate change on hydrology is likely to have significant repercussions not only in the mountains, but also in populated and lowland regions that depend on mountain water resources for domestic, agricultural, and industrial purposes as well as hydropower generation.

Current climate change projections developed show that precipitation levels will remain relatively stable up to 2100, but the overall increase in temperature across the country will lead to an increase in evaporation and evapotranspiration that will not be compensated by a sufficient increase in precipitation, thereby negatively impacting the water cycle and availability of water resources.[99] Widespread mass losses from glaciers and reductions in snow cover over recent decades are projected to accelerate throughout the 21st century, reducing water supplies and hydropower potential as well as changing the seasonality of flows in basins supplied by melt-water from snow and ice.[100] These changes will also occur in conjunction with a steady increase in population and demand for water. Warmer temperatures will also change seasonal precipitation patterns, likely causing earlier snow melt and causing more precipitation to fall as rain rather than snow. This will increase the risk of flooding during the spring and drought during the summer. These risks are further compounded by the degradation of forests and rangelands, where vegetation formerly helped stabilize watersheds and attenuate runoff, while also limiting desertification and soil erosion.

3.6.2 AGRICULTURE

As agriculture is the foundation of the country's rural livelihoods and supports the majority of the country's population, negative impacts on agricultural productivity would have myriad effects on the economy, stability, and food security. Most agricultural crops are highly dependent on specific climate conditions, and climatic changes can have both positive and negative impacts on the ways that crops are cultivated. For example, an increase in atmospheric CO_2 could prove beneficial for some crops, assuming that the sufficient levels of nutrients, water, and soil moisture are maintained. Likewise, a warmer climate could increase the duration of the growing season and accelerate plant growth. But for many grain crops, faster growth may reduce the amount of time that seeds have to grow and mature, resulting in lower crop yields.

A warmer climate could also alter the range of pests and diseases, presenting additional challenges for crop species that previously would not have encountered such infestations or outbreaks. With a changing climate, rain-fed agriculture will be particularly vulnerable, possibly resulting in a widespread decrease in agricultural production and increase in need for irrigation, which would in turn put greater stress on the country's water resources.

Considering the agricultural sector's vulnerability to climate change, and its importance in Afghanistan, it is essential that climate change be effectively integrated into national agricultural programming. Nevertheless, key challenges impacting the integration of climate change into Afghanistan's plans, policies, strategies, and projects on agriculture and irrigation include low levels of awareness on the adverse impacts of climate change and available adaptation methods, and limited resources and competing priority development areas (security, health, education, etc.), among others.[101]

3.6.3 FORESTS AND RANGELANDS

The trees and plants that make up Afghanistan's forests and rangelands face a number of climate change risks and adaptation challenges as temperatures increase and availability of water resources decreases. Afghanistan's forests are already severely damaged as a result of deforestation, mismanagement, and drought, and today account for only approximately 2 percent of the country's total land cover. Likewise, Afghanistan's rangelands support a significant level of animal husbandry through sedentary, seasonal transhumance, and migratory systems, which is estimated to account for more than 50 percent of the country's total agricultural GDP. Unfortunately, overgrazing has resulted in heavy land degradation, while conversion to rain-fed wheat production has resulted in extensive desertification and decreased productivity. Afghanistan's rangelands are an especially valuable resource as they cover more than half of the country's total land and, in addition to supporting animal husbandry, provide vital food, fuel, building materials, medicinal plants, and habitat for wildlife, which collectively form the natural resource base that supports the vast majority of the country's population.[103]

With warmer temperatures, forest and rangeland plant species are expected to see a shift in their geographic range to more northern latitudes and higher altitudes, thereby altering vegetation cover and increasing the risk of desertification, erosion, flooding, avalanches, and landslides. A warmer climate would also impact the biological diversity of plant species, as not all would be suited to a warmer climate. For example, weedy species with a high ecological tolerance will have an advantage over cold-adapted species, resulting in changes to countrywide vegetation land cover.[104] While warming may have positive effects on the growth of some trees, new pests, diseases, and invasive plant species better suited to a warmer climate could also increase competition with native species resulting in alterations to the ecosystem. Warmer winters will also likely lead to reduced snow cover and less carryover of water to the growing season, which could lead to drought-induced forest decline.[105]

3.6.4 BIODIVERSITY AND ECOSYSTEMS

Climate change is becoming one of the largest drivers of biodiversity loss in Afghanistan, and is expected to become the single largest global cause of biodiversity loss before the end of the century.[106] Owing to Afghanistan's varied topography and diverse number of habitat types, with temperature and precipitation changing considerably at different elevations, most species are uniquely adapted to their ecosystems, ranging from desert to monsoon forest. Afghanistan is home to more than 700 species of mammals, birds, reptiles, amphibians, fish, butterflies, and a staggering 3,500-4,000 native vascular plant species, though recent studies suggest that biodiversity loss is accelerating across the country.[107]

Climate change-induced increases in temperature and decreases in availability of water resources will likely have considerable impacts on the country's ecosystems. Natural adaptation could be manifested by shifting habitats or changing life-cycles. Ecosystem-based adaptation, which integrates the use of biodiversity and ecosystem services into climate change adaptation, can provide a cost-effective approach that both maintains biodiversity and reduces the negative impacts from climate change. Examples of ecosystem-based adaptation applicable in Afghanistan include: i) reduction of habitat loss and fragmentation, as well as habitat conservation through establishment of protected areas; ii) afforestation to stabilize slopes, enhance soil integrity and regulate water flow; iii) the promotion of agroforestry systems using diverse crops and plant species; and iv) the sustainable management and restoration of watersheds linking upstream and downstream areas.

3.6.5 HEALTH

Improving human health is a key issue for all the country's population, as well as one of its major development targets. Afghanistan's climate change vulnerability will likely be compounded by high population growth that will put increased stress on the natural environment and natural resource base. In particular, heat waves in urban areas will present health risks for vulnerable populations (children, elderly, sick, etc.), and in rural areas heat waves can increase stress on livestock putting them at risk of exhaustion, disease, and death. Additional health risks posed by climate change include worsened air quality, longer transmission seasons for infectious diseases, and altered geographic range of disease vectors. Also, decreased water availability can lead to increased water stress influencing dehydration, and indirectly, to malnutrition as agricultural productivity is hampered.

In addition, correlations between climate change and disease propagation suggest that risks from infectious diseases will worsen in the near- to mid-term. For example, malaria requires temperatures of 16-18°C for the parasite to live, and higher temperatures cause faster development of the vector. Consequently, climate change is expected to directly impact upon the spread of food, water, and vector-borne diseases, requiring strategic actions in disease prevention, medical services, sanitation, and public health.

3.6.6 ENERGY

In order to satisfy domestic energy needs, Afghanistan relies heavily on electricity imports from neighbouring countries which account for more than three quarters of the country's total electricity usage. Although Afghanistan's Energy Sector Strategy heavily emphasizes the potential of domestic hydropower development in order to meet the country's energy needs and promote economic growth, the uncertain impacts of climate change on the availability of water resources and increased risk of natural disasters, such as floods, raises questions about the safety and sustainability of hydropower dams.[108]

Renewable energy offers Afghanistan the greatest hope for meeting domestic energy needs and reducing dependence on energy imports. In addition to hydropower, Afghanistan has strong potential for solar, wind, geothermal, and biomass/biogas energy production. Initial exploration of these renewable energy sources has begun in Afghanistan, but much more effort and resources are required to ramp up large-scale energy production (see Table 3). Afghanistan's first request for technical assistance from the Climate Technology Centre and Network (CTCN) includes a focus on climate-smart technologies and renewable energy, in order to provide improved guidance and support for future energy development.

3.7 PRIORITY ADAPTATION ACTIONS

According to Afghanistan's NDC, its vision for addressing climate change through adaptation "aims to protect the country and its population by enhancing adaptive capacity and resilience, effectively respond to the vulnerabilities of critical sectors, and efficiently mainstream climate change considerations into national development policies, strategies, and plans".[109] This necessitated the development of a national climate change adaptation strategy that includes community-level vulnerabilities to build up adaptive capacity, with an emphasis on the following medium- and long- priority actions:

1. Reducing vulnerability of the country and its population through enhancement of adaptive capacity and resilience, and deployment of disaster risk reduction approaches
2. Integrating climate change consideration into the national planning processes
3. Promoting economic development and sustainable rural livelihoods through sustainable management of environmental resources and increase access to modern forms of efficient and sustainable energy services
4. Improvement of technical capacity in governmental institutions
5. Adaptive and integrated land and water management
6. Improving access by rural communities and farmers to water to support food security, reduce poverty and improve agricultural productions
7. Raising awareness for people of Afghanistan on climate change impacts and adaptation measures[110]

In addition, the NAPA identifies a number of short- and medium-term priority projects for building adaptive capacity and resilience, based upon the most vulnerable sectors identified. From a long-list of 50 projects proposed in stakeholder consultation workshops, a preliminary list of 11 priority projects was selected following their analysis and impact weighting:[c]

Table 12: NAPA Semi-Final Priority Projects[112]

Priority	Project Title	Outline of Project Concept
1	Improved Water Management and Use Efficiency	Improved water management and use efficiency through the introduction of drip and sprinkle irrigation, improved physical structures and increased public awareness
2	Land and Water Management at the Watershed Level	Land and water management at the watershed level. Community based forest management and afforestation projects in ways that conserve land, water resources and wood production; realize afforestation of catchment areas and stabilization of unstable slopes; soil conservation techniques
3	Development of Horticulture	Development of horticulture through use of improved varieties, establishment of nurseries and plant protection
4	Improved Terracing, Agro-forestry and Agro-silvo Pastoral System	Terracing, agro-forestry, and agro-silvo-pastoral system that reduce soil erosion and runoff on steep slopes; conserve land, water resources and wood production; soil conservation techniques
5	Agriculture Research	Research into draught resistance seeds, different varieties of plants and livestock and plant protection, including establishment of agricultural firms
6	Rangeland Management	Rangeland management including the development and implementation of system of rotational grazing and production of improved fodder along grazing routes (mixed grasses, legume)
7	Development of Disaster Management Strategy	Disaster Management Strategy-planning for food security and emergency supplies for vulnerable communities
8	Improved Food Security	Improving food security measures through diversification; promotion of household-level industries, including chicken farms, beekeeping and silk farms; and development of market potentials for agriculture products

9	Improved Livestock Production	Improved livestock production through the creation of livestock unions, cooperatives and associations; introduction of improved species and veterinary services
10	Creation of Off-farm Employment	Create more off-farm or cash earning job opportunities for farmers who are affected by crop loss due to climate change effects
11	Climate Related Research and Early Warning System	Installation of Agro-Meteorological Stations, early warning system, hazard mapping; survey, assessment and projection of the impact of deep wells on the water table and future water supplies. Build capacity and expertise for assessment of climate change adaptation including technical capacity to monitor and analyse climate trends, plan and implement adaption activities, improve forecasts and inform policy makers

From this list of 11 priority projects, the NAPA selected the following top two priority projects for development into brief priority project profiles for addressing the country's most urgent climate change adaptation needs. Full details of these projects are included in the NAPA.[d]

Table 13: NAPA Final Two Priority Projects

#	Title	Objective
1	Improved Water Management and Use Efficiency	To reduce livelihood vulnerability in drought-affected communities through improved water management and use efficiency.
2	Land and Water Management at the Water-shed Level	To improve livelihood quality at the watershed level through improved natural resource use and management.

3.8 CLIMATE-SMART TECHNOLOGY TRANSFER AND DEVELOPMENT

Afghanistan recognizes that technology transfer is a critical aspect of building adaptive capacity to climate change, as well as reducing future GHG emissions. Afghanistan has been successful in accessing the CTCN, which has provided the country with technical assistance in identifying capacity-building and technological needs in three key sectors: agriculture, energy, and water.

However, in order to effectively address the country's urgent climate change adaptation and mitigation needs, coordinated efforts are needed at the national level, and with support from the international community, to facilitate the development and transfer of these technology in locally appropriate ways that are suitable to local needs and requirements.

[c] All proposed projects were weighted against criteria that assessed: i) loss of life; ii) human health; iii) food security; iv) agriculture; v) water availability, quality and accessibility; vi) impact on vulnerable groups; vii) essential infrastructure; viii) cost of the project; ix) biological diversity; and x) land use management and forestry. NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA)*, p. 76.

Afghanistan's technological, capacity-building, and financial needs for climate change adaptation and mitigation are further highlighted in its Intended Nationally Determined Contribution (INDC) that was prepared and submitted to the UNFCCC Secretariat in the lead up to the Paris Climate Conference in December 2015[e]. In this INDC, Afghanistan estimated that it will require a total of US$10.79 billion for climate change adaptation and US$662 million per year for mitigating GHG emissions and pursuing a LEDS. For further details, see Chapter 7: Constraints, Gaps, and Related Financial and Technical Needs.

[d] For full details of these two priority projects, including project rationale, objectives, inputs, short-term outputs, potential long-term outcomes, institutional arrangements, risks and barriers, monitoring and evaluation, see NEPA & UNEP. (2009), p. 80-85.

[e] The INDC was ratified in 2017 and submitted to the UNFCCC as Afghanistan's NDC.

4

POLICIES AND MEASURES ON CLIMATE CHANGE

Validation Workshop, Kabul/ ©Zahra Khodadadi, UN Environment

4.1 NATIONAL DEVELOPMENT PLANNING

The Afghanistan National Peace and Development Framework (ANPDF) is the Government's five-year (2017-2021) strategic framework for reaching stability and self-reliance. The ANPDF presents the country's immediate and long-term development plans by providing high-level guidance to government and other stakeholders. In addition, the ANPDF highlights Afghanistan's key reforms, outlines priority investments needed to achieve development goals in these critical areas, and sets the economic, political and security context for sustainable development, focusing on agriculture, extractive industries, and trade.

The ANPDF recognizes climate change as a serious threat to Afghanistan that needs to be addressed, particularly in the areas of agriculture production, increased risk of natural hazards arising from changing temperature and precipitation patterns, and renewable energy development to reduce GHG emissions.[113] Moreover, the ANPDF recommends increasing regional collaboration to mitigate impacts of climate change and increase climate change adaptation across the trans-Himalayan region.[114]

4.2 INSTITUTIONAL ARRANGEMENTS FOR ADDRESSING CLIMATE CHANGE AND DISASTER RISK REDUCTION

Afghanistan is highly prone to natural disasters, and over the last several decades nearly all of the country's 34 provinces have been affected by at least one natural disaster.[115] Under conditions of climate change, it is predicted that the incidence of extreme weather events, including heat waves, floods, and droughts, will increase. Similarly, climate change-linked disasters such as glacial lake outburst floods risk becoming more common. Climate change projections also suggest that Afghanistan's vulnerability to natural disasters will be compounded by high population growth that will put increased stress on the natural environment and natural resource base.

In addition to NEPA, which is responsible for the overall governance and management of the country's environmental issues, other key institutions that share responsibility of addressing climate change and hazards risks include:

- Afghanistan Meteorological Department (AMD)
- Afghanistan National Disaster Management Authority (ANDMA)
- Ministry of Agriculture, Irrigation and Livestock (MAIL)
- Ministry of Energy and Water (MEW)
- Ministry of Rural Development and Reconstruction (MRRD)

In addition, the Ministry of Economy (MoE), Ministry of Finance, and Ministry of Foreign Affairs (MoFA) all have key roles in planning, allocation, and securing of resources to address the country's urgent climate change adaptation needs. At the sectoral level, numerous other institutions and stakeholder groups require coordination to address sectoral climate change issues and provide technical guidance and expertise. Numerous institutional arrangements to lead this coordination have already been established in Afghanistan, particularly in the high priority areas of environmental conservation, climate change, and disaster risk reduction.

Table 14: Sectoral Inter-Ministerial Coordination Mechanisms

Sector/Area	Inter-ministerial Coordination Mechanisms
Climate Change Adaptation and Mitigation	1. National Climate Change Committee
Agriculture	1. Agriculture and Rural Development Cluster
	2. Inter-Ministerial Committee on Food Security
	3. Sector-wide Coordination Mechanism in Agriculture
Biodiversity and Ecosystems	1. Committee for Environmental Coordination (CEC)
	2. National Environment Advisory Council (NEAC)
	3. Subnational Environment Advisory Councils (SEACs)
	4. Afghanistan Wildlife Executive Committee (AWEC)
	5. Biodiversity Working Group (BWG)
	6. Parliamentary Committee on the Environment (PCE)
	7. Protected Area Working Group (PAWG)
	8. High Level Commission on Air Pollution Control
	9. Supreme Committee for Environment
	10. Designated National Authority Steering Committee for Clean Development Mechanism
Energy	1. Inter-ministerial Commission for Energy (ICE)
	2. Inter-ministerial Commission for Renewable Energy (ICRE)
Forests and Rangelands	None
Resilience and Disasters	1. The High Commission of Disaster Management (HCDM)
	2. Provincial Disaster Management and Response Committees (PDMCs)
	3. District Disaster Management and Response Committees (DDMCs)
Water	1. Supreme Council for Water Affairs Management (SCWAM)
	2. River Basin Councils and Sub-basin Councils
	3. Water User Associations
	4. High Council on Water and Land

4.3 NATIONAL LEGISLATION, POLICIES, AND PLANNING ON SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL PROTECTION

In striving for sustainable and environmentally sound development, Afghanistan has developed and enacted a number of pieces of legislature, policy, and approaches to address key sectors. Although the country is still developing its legislative and governance documents for climate change, the following table summarizes the existing legislature and government planning from key sectors and areas that are of significance to climate change.

Table 15: Sectoral Legislation, Policies, and Planning on Sustainable Development and Environmental Protection

Sector/Area	National Legislation, Policies, and Planning	
Climate Change Adaptation and Mitigation	Law	None
	Framework	None
	Strategy	Afghanistan Climate Change Strategy and Action Plan
	Policy	None
	Plan	National Adaptation Plan
	Other	Nationally Determined Contribution
Agriculture	Law	Rangeland Law (O.G. 795)
		Improved Seed Law (O.G. 1005)
		Agriculture Cooperative Law (O.G. 958)
		Agricultural Pesticide Law (O.G. 1229)
		Land Management Law (O.G. 958)
		Law of Land Survey, Verification and Registration (O.G. 346)
		Law on Land Expropriation (O.G 794)
		Veterinary Services Law (O.G. 1229)
		Law on Food Security (O.G. 1222)
	Framework	National Agriculture Development Framework (NADF)
	Strategy	None
	Policy	None
	Plan	None
	Other	Wheat Strategy Regulation (O.G. 998)
		Regulation on Grains and Root Crops Reserve (O.G. 998)
		Regulation on Imports, Distribution and Application of Pesticides (O.G. 795)

Biodiversity and Ecosystems	Law	Environment Law (O.G. 912)
		Wildlife Conservation and Hunting Law (O.G. 795)
		Nature Conservation Law (O.G. 795)
		Law on Conservation of Plant Diversity (O.G. 1229)
		Plant Quarantine Services Law (O.G. 795)
	Framework	None
	Strategy	National Biodiversity Strategy and Action Plan (NBSAP)
		National Environment Strategy
		Natural Resource Management Strategy
	Policy	National Environmental Impact Assessment Policy
		National Waste Management Policy
	Plan	National Environmental Action Plan (NEAP)
	Other	Clean Air Regulation (O.G. 991)
		Environmental Impact Assessment Regulations (O.G. 939)
		Plant Quarantine Services Regulation (O.G. 795)
		Afghanistan Protected Areas Interim Procedures
		Regulation on Reduction and Prevention of Air Pollution (O.G. 991)
		Regulations on Controlling Materials Destructive to Ozone Layer (O.G. 894)
Energy	Law	Minerals and Hydrocarbons Law (O.G. 972)
		Mining Law (O.G. 1143)
		Law on Managing Electricity Energy Service (O.G. 1231)
		Nuclear Energy Law (O.G. 1182)
	Framework	None
	Strategy	Energy Sector Strategy
		Rural Renewable Energy Strategy
		Energy Efficiency Strategy [draft]
	Policy	Power Sector Strategy [draft]
		National Energy Policy
		National Renewable Energy Policy (NREP)
		Rural Renewable Energy Policy (RREP)
		National Mining Policy
	Plan	None
	Other	Mining Regulation (O.G. 1007)
		Procedures Related to Renewable Energy Policy [draft]
		Regulation on Fuel Consumption of Agricultural Machinery (O.G. 667)
Forests and Rangelands	Law	Law on Managing the Jungle Affairs (O.G. 1087)
		Law on Managing Land Affairs (O.G. 958)
		Rangeland Law (O.G. 795)
		Wildlife Conservation and Hunting Law (O.G. 795)
	Framework	None
	Strategy	None
	Policy	Policy and Strategy for Forest and Range Management Sub Sector National Forestry Management Policy (NFMP)
	Plan	Sustainable Rangeland Management Plan [draft]
	Other	None

Resilience and Disasters	Law	Law on Disaster Response, Management, and Preparedness (O.G. 1089)
	Framework	None
	Strategy	Disaster Management Strategy
	Policy	Food Management Policy and Strategy [draft]
	Plan	National Disaster Management Plan
		Strategic National Action Plan for Disaster Risk Reduction (SNAP)
	Other	National Emergency Guidelines
Water	Law	Water Law (O.G. 980)
	Framework	Strategic Policy Framework for the Water Sector
	Strategy	Water Sector Strategy
	Policy	Draft policies on Groundwater, Trans-boundary Water and Capacity Building for Water Sector are being developed
	Plan	Procedures for Developing National Water Master Plan and River Basin Master Plan [draft]
	Other	Regulation on Water Usage in Agriculture (O.G. 500)
		Regulation on control and safeguarding water quality (O.G.1212)
		Water Resource Territory and Infrastructure Regulation (O.G. [117]8)

4.4 ONGOING AND COMPLETED NATIONAL PROGRAMMES AND PROJECTS ON CLIMATE CHANGE

Table 16: Ongoing and Completed National Programmes and Projects on Climate Change

Project Name	Executing Agency	Brief Description
National Adaptation Programme of Action for Climate Change and National Capacity Needs Self-assessment for Global Environmental Management	NEPA (with support from UN Environment)	Afghanistan completed its NAPA/NCSA in 2009 in order to identify the country's priority capacity needs for the implementation of the Rio Conventions (UNFCCC, UNCBD and UNCCD) and the key activities to mitigate the negative impacts of climate change in the country. As the first comprehensive report on climate change in Afghanistan, the information in the NAPA/NCSA has thus informed further climate change programming in the country and facilitated Afghanistan's access to global climate financial resources, particularly from the GEF.
Preparation of Afghanistan's Initial National Communication under the UNFCCC	NEPA (with support from UN Environment)	All countries signatory to the UNFCCC are required to submit periodic National Communications that summarize their implementation of the convention. In 2012, NEPA published Afghanistan's INC as the country's first official communication to the UNFCCC, which became the country's foremost official document on climate change.
Building Adaptive Capacity and Resilience to Climate Change in Afghanistan	NEPA (with support from UN Environment)	This four-year project, launched in May 2013, is the first full-sized GEF climate change adaptation project granted to Afghanistan. This project's four objectives are to: i) strengthen Government capacity on climate change monitoring and forecasting; ii) mainstream climate change adaptation into policies and planning; iii) promote ecosystem management for climate change adaptation; and iv) increase knowledge and awareness of climate adaptation and best practices at the national, provincial, and community levels.

Developing Core Capacity for Decentralized MEA Implementation and Natural Resource Management in Afghanistan	NEPA (with support from UN Environment)	This three-year GEF project, launched in late 2014, aims to strengthen Afghanistan's fulfilment of its obligations under the UNFCCC, UNCDB, and UNCCD. This project's objectives are to: i) improve inter-ministerial coordination of climate change, biodiversity, and land degradation objectives; ii) build stakeholder participation in MEA implementation; iii) support the translation of MEA commitments into practice; and iv) strengthen national financial and execution mechanisms for the UNFCCC, UNCDB, and UNCCD.
Second National Communication under the UNFCCC	NEPA (with support from UN Environment)	In 2014, NEPA and UN Environment launched a new project for the preparation of the SNC, which builds upon the outcomes and successes of the INC. The SNC aims to strengthen the information base and technical capacity in Afghanistan, integrate climate change priorities into development strategies, increase the awareness of climate change, as well as increase information exchange and cooperation between all stakeholders across government, civil society, non-governmental organizations, academia and the private sector.
Action on Climate Today (ACT)	Oxford Policy Manage-ment	ACT is a five-year project, launched in 2014, working across Afghanistan, India, Nepal and Pakistan in order to support the integration of climate change into national policies, plan and budgets. Specific areas of work include: i) support the design and delivery of climate resilience; ii) promote investments for climate compatible development; iii) build the knowledge base of decision makers; and iv) attract further climate change investment from the public and private sector.
Strengthening the Resilience of Rural Livelihood Options for Afghan Communities to Manage Climate Change Induced Disaster Risks	MAIL (with support from UNDP)	This five-year project was launched in January 2015 and is Afghanistan's second full-sized GEF climate change adaptation project, which aims to reduce livelihood vulnerability in drought- and flood-prone communities through the rehabilitation and sustainable management of critical rangelands and watersheds, while enhancing and diversifying rural incomes and livelihood opportunities.
Climate Technology Centre and Network	NEPA (with support from UN Environment)	Afghanistan's first CTCN Technical Assistance began in early 2015, at the request of NEPA, and focuses on capacity building and identifying technical needs and priorities in the three key sectors of agriculture, energy, and water. The CTCN is a global initiative hosted by UN Environment that aims to enhance the development and transfer of climate smart technologies in order to promote adaptive capacity and climate change mitigation efforts in developing countries.
Strengthening the Resilience of Afghanistan's Vulnerable Communities Against Natural Disasters and Climate Change	Afghanistan Resil-ience Consortium (ARC)	This five-year project, launched in early 2015, aims to address the root causes of vulnerability to natural disasters and climate change through a combination of institutional strengthening, sectoral coordination, and community-based resilience-building activities. This project is accredited by the UK's International Climate Fund (ICF), and includes components on climate early warning, climate-smart agriculture, and integrated watershed management across 9 of Afghanistan's most disaster-prone provinces.

Building the Resilience of Communities Living Around the Northern Pistachio Belt and Eastern Forest Complex of Afghanistan through and EbA Approach	NEPA (with support from UN Environment)	This is Afghanistan's third full-sized GEF climate change adaptation project, granted in late 2015, with the aims of: i) strengthening the capacity of national and local Government and other stakeholders to address climate change risks by improving watershed functioning; ii) improving community-based watershed management through the restoration of degraded forest ecosystems; and iii) increasing knowledge of the role of ecosystem-based adaptation in improving watershed functioning and building climate resilience.
Community-based Sustainable Land and Forest Management in Afghanistan	MAIL (with support from FAO)	This three-year GEF project with the overall objective of reducing GHG emissions by promoting community forestry, and removing barriers to sustainable biomass energy, while laying the groundwork for climate change mitigation in Afghanistan. In particular, this project will focus on training, awareness-raising, capacity-building, and piloting of community-based natural resource management projects related to forestry and renewable energies.
Adapting Afghan Communities to Climate-Induced Disaster Risks	MAIL (with support from UNDP)	This is Afghanistan's fourth full-sized GEF climate change adaptation project, which began in 2017. The project will promote adaptation to the impacts of climate change by building capacities for decision-making and implementation of climate-induced disaster risk reduction measures, establishing community-based early warning systems, promoting climate-resilient livelihood options (with a focus on marginalised groups), and enhancing capacities of government institutions to integrate climate change into development planning.

4.5 ONGOING AND COMPLETED PROGRAMMES AND PROJECTS SUPPORTIVE TO CLIMATE CHANGE

Table 17: Ongoing and Completed Programmes and Projects Supportive to Climate Change

Agro-Meteorology (Agromet) Project	MAIL & USGS	The Agromet project was established as a collaboration between MAIL and the USGS to generate and disseminate climatic data relevant to agricultural production. Agromet's objectives include assisting the government in the collection and analysis of meteorological and agricultural data relevant to crop production, irrigation, water supply, and energy, as well as building national capacity on agro- and hydro-meteorology, statistical monitoring and assessment of droughts and floods, and the dissemination of meteorological data for the agriculture sector. As of June 2014, USGS ended its involvement in the Agromet Project, and it has since been integrated fully into MAIL.

Famine Early Warning System Network (FEWS NET)	MAIL	FEWS NET is a project that aims to deliver early warnings of hazards, food insecurity and famine. FEWS NET is embedded within MAIL in order to generate, analyse, and share critical data to monitor rising or waning food insecurity situations, including harvests, food prices, market factors, population movements, and climate and weather data in order to help decision-makers deploy resources in advance of famine.
National Area-Based Development Programme (NABDP)	MRRD	NABDP was established in 2002 with the goal of contributing to a sustainable reduction of poverty and an improvement of livelihoods in rural Afghanistan. NABDP is based on the Social and Economic Development pillar of the ANDS and is aligned with the NPPs in the ARD cluster. In terms of rural development, NABDP's scope covers a number of community-based activities: the construction of roads and bridges; provision of rural electricity systems; construction of culverts; retaining walls and gabions in flood-prone areas; provision of clean drinking water facilities; construction of agriculture and irrigation infrastructure; construction of community and government buildings; economic empowerment and cottage industry initiatives for rural women; and the provision of temporary labour for rural income generation.
Rural Water Supply, Sanitation and Irrigation Programme (Ru-WatSIP)	MRRD	Ru-WatSIP was established in 2003 in order to develop policies, formulate strategies and plans, and implement activities for rural water supply, sanitation, and hygiene. Major activities of this project include the establishment of a national policy framework for water sector, construction of water wells and pumps to provide clean drinking water to rural communities, construction of sanitation facilities to improve hygiene in rural communities, and provision of capacity building trainings on water, sanitation and hygiene to government staff, NGOs, private sector companies, and local communities.
Comprehensive Agriculture and Rural Development-Facility (CARD-F)	MAIL, MRRD, MCN & MoF	CARD-F is a joint entity established in 2009 under the ARD cluster ministries in order to facilitate growth in legal rural income and employment by strengthening licit agricultural markets and minimizing adverse incentives to revert to opium production by supporting commercially viable agricultural value chains (poultry, dairy, cotton, honey, grapes and vegetable) as well as improvements in rural infrastructure (irrigation, rural access roads, and food storage facilities).
Ecosystem-based Disaster Risk Reduction (Eco-DRR)	NEPA & UN Environment	This four-year project, launched in 2012, aimed to promote ecosystem management for disaster risk reduction in order to achieve sustainable and disaster resilience development. This included the mainstreaming of ecosystem-based adaptation approaches into disaster and resilience planning, and working directly with local communities in the Shah Foladi Protected Area on community-based natural resource management pilot demonstrations, including landscape-level planning, community nursery establishment, and forestry initiatives for landslides and avalanche risks, and integrated watershed management.

Afghanistan's National Biodiversity Strategy and Action Plan (NBSAP)	NEPA (with support from UN Environment)	NEPA developed Afghanistan's NBSAP was in 2013, with the goal of conserving all aspects of the country's biodiversity and ensure that future utilization of biodiversity resources is sustainable. The NBSAP also identifies short-, medium-, and long-term actions that need to be taken, institutional responsibilities, and financial needs for the identified actions and implementation of the UNCBD. The NBSAP identifies climate change as a serious risk to biological diversity in Afghanistan, particularly as a result of drought and desertification, but also notes "climate change has not been a consideration in the national or sectoral plans of the Government."
Review and Update of Afghanistan's National Biodiversity Strategy and Action Plan (NBSAP)	NEPA (with support from UN Environment)	In 2014, Afghanistan began the process of updating its NBSAP in order to assess progress made towards the achievement of national biodiversity targets as well as provider greater assessment of the drivers of biodiversity loss in the country as well as the recommended steps to be taken for the greater protection of the country's natural heritage.
Establishing Integrated Models for Protected Areas and their Co-management	MAIL (with support from UNDP & WCS)	This project was begun in January 2014, and has the primary objects of: i) enhancing the capacity of Afghanistan's government to design, establish and co-manage protected areas in the country; ii) consolidating and expanding the protected area network including developing management plans and co-management structures; and iii) improving management effectiveness and promote climate-resilient Sustainable Land Management (SLM) within the protected area network and adjacent areas.
Conservation of Snow Leopards and their Critical Ecosystem in Afghanistan	MAIL (with support from UNDP & WCS)	This full-sized GEF project links biodiversity and climate change with a focus on Afghanistan's iconic Snow Leopards and their Himalayan ecosystem.

4.6 MAINSTREAMING CLIMATE CHANGE INTO ENVIRONMENTAL AND SECTORAL DEVELOPMENT POLICIES

The many uncertain effects of climate change pose significant risks for sustainable development and require coordinated action across numerous sectors to ensure that development progress is not undermined. Afghanistan is already highly vulnerable to natural hazards, and a changing climate is likely to exacerbate their impacts unless measures are taken to increase the country's adaptive capacity. In the long term, for climate change adaptation to be effective, it must be supported by an integrated and cross-cutting policy approach that mainstreams climate change into national development planning.

The lead coordination mechanism for the mainstreaming of climate change in Afghanistan is the NCCC, which oversaw the development of both the INC in 2012 and this SNC in 2016/2017. Additional responsibilities of the NCCC include the provision of policy guidance and advice, and building the country's institutional, scientific, technical, informational, and human capacity with respect to climate change for the sustainable implementation of the UNFCCC.[116] The NCCC is led by NEPA and is comprised of representatives from relevant government and academic institutions. Article 10 of the NCCC charter also specifies that the NCCC is meant to meet at least once every two months. At present, the NCCC is asserting its functions, but still needs considerable support and technical guidance in order to effectively mainstream climate change into the country's development policies, plans, and strategies.

In addition, in 2009, Afghanistan completed its NAPA in order to "identify priority activities that respond to their urgent and immediate needs with regard to adaptation to climate change – those needs for which further delay could cause increased vulnerability or lead to increased costs at a later stage".[117] Afghanistan conducted its NAPA as a joint exercise with the National Capacity Needs Self-assessment for Global Environmental Management (NCSA), which is itself a mechanism for realizing a comprehensive assessment of a country's capacity, and capacity needs, for the fulfilment of the Rio Conventions.

Building upon these commendable past achievements, NEPA led the development of the ACCSAP, with the following aims: i) integrate and mainstream climate change into the national development framework; ii) support the creation of a national framework for action on climate change adaptation; iii) identify LEDS; iv) improve coordination and partnerships between government institutions, civil society, the international donor community, and the private sector; and v) increase availability and access to additional financial resources for effectively addressing climate change. The ACCSAP also identifies policy initiatives to address climate change adaptation in the vulnerable sectors and areas of agriculture, food security, water, biodiversity, natural disasters, health, and infrastructure.

In addition, the ACCSAP includes a considerable emphasis on LEDS and Nationally Appropriate Mitigation Actions (NAMA), both of which have the strategic objective of reducing GHG emissions. More specifically, five NAMAs are proposed in the ACCSAP: i) support the development of policies and practices on energy efficiency; ii) implement policies and guidelines on sustainable urban development, including renewable energies and solid waste management and energy recovery; iii) enact policies and guidelines for sustainable urban transportation; iv) promote energy efficient cook stoves for rural communities; and v) regenerate forests and rangelands for environmental conservation and agriculture and food production.

4.7 INTERNATIONAL COMMITMENTS AND PARTICIPATION IN CLIMATE CHANGE NEGOTIATIONS

Afghanistan is an active global player on environmental issues and is a party to 16 multilateral environmental agreements (MEAs):

Table 18: Multilateral Environmental Agreements to which Afghanistan is a Party

#	MEA Name	Date of Signature	Date of Accession
1	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	30 Oct 1985	28 Jan 1986
2	United Nations Framework Convention on Climate Change Convention (UNFCCC)	12 Jun 1992	19 Sep 2002
3	United Nations Convention on Biodiversity (UNCBD)	12 Jun 1992	19 Sep 2002
4	United Nation Convention to Combat Desertification (UNCCD)	12 Nov 1994	01 Nov 1995
5	Vienna Convention for the Protection of the Ozone Layer	12 Mar 1985	17 Jun 2004
6	Stockholm Convention on Persistent Organic Pollutants	22 May 2001	20 Feb 2013
7	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	10 Sep 1998	06 Jan 2013
8	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	22 Sep 1998	25 Mar 2013
10	Convention on the Conservation of Migratory Species	1983	01 Aug 2015
11	The Montreal Protocol on Substances that Deplete the Ozone Layer	26 Sep1985	17 Jun 2004
12	Kyoto Protocol to the UNFCCC	11 Dec 1997	25 Mar 2013
13	Cartagena Protocol on Biosafety to the UNCBD	15 May 2000	20 Jan 2013
14	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the UNCBD	05 Jun 1992	17 Jan 2017
15	Minamata Convention on Mercury	10 Oct 2013	02 May 2017
16	Paris Agreement	22 Apr 2016	15 Feb 2017

Afghanistan is also member of several regional cooperation groups that include work streams on sustainable development and environmental issues:

Table 19: Relevant Regional Groups in which Afghanistan is a Member		
#	**Regional Group Name**	**Date of Accession**
1	Asian Cooperation Dialogue (ACD)	2012
2	South Asian Association for Regional Cooperation (SAARC)	2007
3	The Economic Cooperation Organization (ECO)	1992
4	South Asia Cooperative Environment Programme (SACEP)	1982
5	Organization of Islamic Cooperation (OIC)	1969
6	Parliamentary Union of the OIC Member States	2008

Afghanistan takes an active role in international climate meetings and negotiations. In the lead up to the 2015 Paris Climate Conference (COP21), a high-level inter-ministerial initiative led to the development of the INDC, culminating with the attendance of a 22-person delegation at the conference, including the President of the Islamic Republic of Afghanistan, H.E. Mohammad Ashraf Ghani, and then NEPA Director-General, H.E. Mostapha Zaher. Likewise, at the 2016 Marrakech Climate Conference (COP22), H.E. Mostapha Zaher led the national delegation and further advanced Afghanistan's commitments and steps towards combating climate change. At the 2017 Bonn Climate Conference (COP23), NEPA Director-General H.E. Schah-Zaman Maiwandi re-affirmed Afghanistan's commitments to fulfilling the obligations of its international climate and environmental agreements, as well as exercising its important role as a global environmental actor.

5

RESEARCH AND SYSTEMATIC OBSERVATION

Wakhan, Badakhshan/ © Alec Knuerr, UN Environment

5.1 METEOROLOGICAL OBSERVATION AND ANALYSIS

Before 1979, Afghanistan had one of the most advanced meteorological monitoring systems in the region. Unfortunately, most equipment was rendered non-functional or destroyed due to years of conflict and war. Under the Taliban regime, AMD was dissolved and its weather records were destroyed under the pretext that weather forecasting was sorcery. Since 2001, there has been some rehabilitation of non-functional weather stations and installation of new stations. AMD has also been reinstated and is the lead agency in collecting, processing and reporting of weather data including temperature, precipitation and weather forecasts.

With support from International Civil Aviation Organization (ICAO), an Aviation (automated) Weather Observing System (AWOS) is currently being installed at Kabul International Airport which will complement the MESSIR System under the Government of Afghanistan. In addition, MEW operates hydrological monitoring stations covering all the five river basins

5.2 RESEARCH PROGRAMMES ON THE ENVIRONMENT AND CLIMATE CHANGE

MAIL is involved in agricultural research, including the continuation of a collaborative project with the US Government called Agro-Meteorology Project (Agromet), focusing on systematic research and analysis of meteorological conditions and impacts on crop production. MAIL is further supported by a large number of international partners that are supporting agricultural research work and national capacity building initiatives.

The US Government's National Renewable Energy Laboratory (NREL) has also conducted research on wind energy potentials, solar energy potentials and assessments of the biomass in Afghanistan and their utilization. Published results of the research works have been very encouraging showing huge potential of renewable energy development in Afghanistan (see Section 0 for more details).

5.3 PARTICIPATION IN RESEARCH AND SYSTEMATIC OBSERVATION NETWORKS

Over recent years, Afghanistan has established and accessed a growing number of research networks that serve to collate environmental information and data about Afghanistan in order to better inform technical experts and decision-makers about environmental matters. These networks include:

- Afghanistan Disaster Risk Info: a public platform for creating, sharing and accessing geospatial data and maps for decision-making about disaster risk.
- Afghanistan Environmental Data Centre (AEDC): an online repository of Afghanistan's environmental data, knowledge, and research products.
- Afghanistan Spatial Data Centre (ASDC): an online resource of GIS data, maps, and spatial analysis of Afghanistan.
- NEPA Online Portal: an online library of environmental documents in Afghanistan.

6

EDUCATION AND AWARENESS-RAISING

Bamyan University, Bamyan/ ©UN Environment

6.1 ACADEMIC COURSES ON ECOLOGY AND CLIMATE CHANGE

NEPA places a strong emphasis on environmental education in order to train and prepare the next generation of environmental stewards. At present, environmental subjects are taught in primary and secondary level education (grades 1-12) to an estimated 9 million students in government and private schools. Afghanistan's National Environmental Education Strategy and Action Plan (NEESAP) provides a framework and precedent for both increasing the prominence of environmental issues into education, as well as mainstreaming environment across existing fields of study.

In higher (tertiary) education, two environmental science faculties have been established at Kabul University and Kabul Polytechnic University, which provide undergraduate-level courses on environmental issues. At Kabul University, a new Natural Disaster department under the Environmental Science Faculty is providing education on hazard, vulnerability, and climate change.

In order to increase national capacity on climate change, greater emphasis should be placed on mainstreaming climate change into academic programmes. Areas of particular importance include the science of climate change analysis and modelling to generate projections. In addition, it is important to provide students and the next generation of professionals with opportunities for classroom-based knowledge as well as practical learning for increasing adaptive capacity and reducing vulnerability, such as adaptive agriculture or renewable energy studies. Areas of particular interest for climate change mainstreaming include ecosystem studies, agriculture, energy and engineering, meteorology, and computer science.

6.2 PUBLIC AWARENESS AND PARTICIPATION IN CLIMATE CHANGE ACTIVITIES

Public awareness and understanding of climate change is low in Afghanistan; however, as more and more children attend school and are educated about environmental issues this information will become more widespread across communities.

Since 2001, Afghanistan has also experienced a large growth in non-governmental organizations that are involved in awareness-raising, outreach, and capacity building on the themes of resilience, disaster risk, and the environment. Likewise, the number of media outlets across the country is rapidly growing – there are currently more than 150 radio channels, 70 television channels, and 1,000 print media actively working on issues ranging from politics, society, economics, culture, and the environment.

Increasing the involvement of these media outlets in public education about climate change will be an important step towards raising greater awareness about sustainable development and environmental management. This, in turn, will help generate greater momentum, political will, and pressure to address the country's urgent climate change adaptation and mitigation needs.

6.3 INFORMATION AND NETWORKING

Regional and international climate change information-sharing networks provide Afghanistan with opportunities to disseminate important environmental documents and data with a wider global community, as well as access a greater number of resources to help inform and influence domestic climate change planning and preparations. Afghanistan is a member of the following major regional and international climate change and environmental networks:

- Asia Pacific Adaptation Network (APAN): www.asiapacificadapt.net
- Climate Adaptation Knowledge Exchange (CAKE): www.cakex.org
- Climate and Development Knowledge Network (CDKN): http://cdkn.org
- Climate Action Network South Asia (CANSA): www.cansouthasia.net
- ClimateTech Wiki: www.climatetechwiki.org
- FEWS NET: http://www.fews.net
- Global Adaptation Network (GAN): http://ganadapt.unep.org
- South Asia Network for Security and Climate Change (SANSaC): http://southasianetwork.blogspot.com
- South Asia Youth Environment Network (SAYEN): www.sayen.org
- WeADAPT: www.weadapt.org

7

CONSTRAINTS, GAPS, AND RELATED FINANCIAL AND TECHNICAL NEEDS

Bamyan/ ©Najeeb Azad, UN Environment

7.1 OVERVIEW OF CONSTRAINTS AND GAPS

This chapter provides information on Afghanistan's constraints and gaps associated with the preparation of the national communications, as well as the needs to develop national capacity for the improvement of national communications and implementation of activities to address climate change adaptation and mitigation. With more scientific understanding and increasing awareness, further areas of work could also be identified, including the continuing need for improving the quality of national GHG inventories, vulnerability assessment of various sectors at national and sub-national levels, identification of adaptation measures, assessment of mitigation potential with detailed cost/benefit analysis including exploring the opportunities for technology transfer, enhancing the national capacities in doing climate change-related research with a systematic observation system in place, and making citizens more informed about the likely impacts of climate change as well as appropriate adaptation options.

Through the preparation of its NAPA, INC, SNC, and NDC, Afghanistan has identified the constraints, gaps, and the financial, technical and capacity needs needed in order to enhance the national communication system and fulfil other commitments made to the UNFCCC. Afghanistan, being amongst the world's least developed and most vulnerable countries to climate change, remains determined to address climate change by utilizing its limited resources and expects the necessary technical and financial support from developed country (Annex I) parties in strengthening national capacities to respond to the climate change issue.

7.1.1 PREPARATION OF NATIONAL GREENHOUSE GAS INVENTORY

Major constraints and gaps in Afghanistan's GHG inventory estimation include the non-availability and inaccuracy of data. In particular, the time-series data required for the estimation of GHG inventories are not available for all key sectors, and accuracy of the data is uncertain because different sources have different data. For example, the data on the population of Afghanistan published by CSO are different

to estimates from other credible sources, while records on import of petroleum products are reported differently. In the informal sector and less organized sectors of the economy (like agriculture, forestry, and small-scale industries), there are not many data available. In addition, often there are differences between supply-side and demand-side reporting of key data. For example, figures reported for import of diesel in CSO's trade statistics and use of diesel reported by different sectors (transport, energy, agriculture and others) differ. The reason may be due to aggregation errors, missing sources, and/or organization of data.

Similarly, the non-accessibility of data is another challenge in Afghanistan, because data is often treated as proprietary. In the preparation of future national communications, some of the data required will be considered confidential. Thus, there is the need to sensitize data owners and curators about the purpose and data needs for GHG inventory reporting. Another constraint is the non-availability of data in electronic form, which renders collation and analysis of data difficult. Therefore, another priority needed is to sensitize data owners and curators on the importance of the data for the purpose of fulfilling Afghanistan's national obligations, and that data should preferably be shared in electronic form.

In Afghanistan, different institutions use different formats and report differently on their activities, therefore there is a need to develop harmonized data-collection frameworks that are aligned with IPCC guidelines. Moreover, sectoral ministries should be trained in developing and maintaining frameworks for the collection and organization of data and reporting to CSO and NEPA. There is also a need for training and establishing a database for collating data for use in IPCC GHG inventory methodologies in key sectoral organizations like CSO and NEPA. As there is important data missing for the key sectors, such as imports of petroleum products and energy production, there is the need to fill this gap by identifying sources that have reliable time-series data.

In summary, addressing the data gap is the biggest priority for quality assurance and quality control of GHG estimation in Afghanistan. This requires sustained commitment of resources and setting up of appropriate institutional frameworks.

7.1.2 NEEDS FOR GREENHOUSE GAS INVENTORY DEVELOPMENT AND IMPROVEMENT

Similar to many developing and least developed countries' needs for improving GHG inventory estimations, Afghanistan has three broad categories of needs:

- Data Needs: design consistent data-reporting formats; collect data for formal and informal sectors of the economy; enhance data quality to move to higher tiers of inventory reporting; and conduct detailed measurements for specific emission coefficients.
- Capacity Development and Enhancement Needs: institutional capacity development requires financial support, technological support, instrumentation support, and networking; individual capacity development requires training of national professional and sectoral staffs on methodologies, software, models, screening tools and reporting formats, and greater involvement of national professionals in the measurement of national coefficients.
- Institutional Networking and Coordination Needs: institutional networking and coordination is a critical factor for establishing new data frameworks and reporting formats in various sectors; the national communication reporting processes have contributed to initiate processes but need to be further strengthened.

As a party to the UNFCCC, Afghanistan is fully committed to have a national GHG inventory development system for reporting to the Convention regularly as required. The sustained and timely financial and technological support from the developed country parties and also from multilateral and regional institutions including the GEF is critical to this.

7.2 VULNERABILITY AND CLIMATE CHANGE ADAPTATION

In the preparation of this national communication, Afghanistan prepared the most detailed and advanced climate change projections to date. These new projections serve to help better understand the anticipated impacts of climate change and refine priority actions for building adaptive capacity. Nevertheless, Afghanistan continues to face a number of challenges related to assessing vulnerability to climate change, such as the country's sporadic and poor quality socio-economic data that makes it difficult to conduct econometric modelling or robust cost/benefit analyses of adaptation and mitigation policy. Poor national security also restricts the ability to undertake structured fieldwork to assess potential mitigation and adaptation options.

Through the development of its NAPA, Afghanistan identified priority action programmes on the most vulnerable sectors in Afghanistan (see Sections 4.5 Sectoral Climate Vulnerabilities and 4.7 Priority Adaptation Actions for details). This process identified the most vulnerable sectors, as well as the country's institutional strengthening needs to better address climate change. Afghanistan urgently needs to enhance the capacity of government and national experts to ensure that the best practice climate assessments, adaptation approaches and low carbon development strategies can be applied in Afghanistan in order build the country's adaptive capacity.

Mainstreaming climate change into Afghanistan's development processes is an essential step towards building institutional capacity; however, Afghanistan also needs external investment and technical support to overcome these challenges. As of 2017, the country's most salient vulnerability and adaptation needs are summarized in the NDC, which focuses on the technological, capacity, and financial support required for bolstering climate action:

Table 20: Afghanistan's Technological, Capacity-building, and Financial Needs for Climate Change Adaptation[118]

Action and Planning Needs	Technology Needs	Capacity Building Needs	Finance Needs (USD)
Development and adoption of the Afghanistan Climate Change Strategy and Action Plan.	--	--	Own contribution
Development of a system to monitor and assess vulnerability and adaptation to climate change.	Climate science technology	Climate science institutes with university	0.02 Billion
Identification and mainstreaming of climate change adaptation technologies into the sectoral policies, strategies and development plans, and promotion of regional and international cooperation and coordination for adaptation technology transfer.	Climate policy technologies and methods	Training Afghan climate policy expertsa	0.01 Billion

Strengthen and expand meteorological and hydrological monitoring networks and services, including a national database to archive and store meteorological and hydrological data.	Hydrological, meteorological and data equipment and integrated systems	Operators and analysts for hydrological, meteorological and data integrated systems	0.1 Billion
Development of water resources through rehabilitation and reconstruction of small-, medium-, and large-scale infrastructure.	Improved designs and methodologies for catchment management technology	Ecological engineering and spatial planning for water resources	0.75 Billion
Planning for proper watershed management and promoted through community-based natural resources management.	Full catchment planning technology and models	Practitioners for watershed management	2.5 Billion
Increasing irrigated agricultural land to 3.14 M-ha, through restoration and development of Afghanistan's irrigation systems.	Eco-agriculture and climate friendly irrigation technology transfer to Afghanistan	Vocational and engineering capacity to design, build and maintain climate friendly irrigation networks and local schemes.	4.5 Billion
At least 10% of Afghanistan land area and the habitat of selected species under a system of conservation	Conservation ecology methods and tools	Protected areas and species ecologists, and ecological economists trained and working.	0.3 Billion
Behavioural change and opportunities for provision and development of alternative and renewable energy sources for 25% of the rural population above existing levels (15%), in order to contribute to a reduction in the unsustainable usage of natural resources and decreasing the strong reliance on fossil fuels by rural communities.	Technology transfer of renewable energy and sustainable energy	National centre for sustainable energy strengthened and expanded. Combine public and private competencies.	0.105 Billion
Regeneration of at least 40% of existing degraded forests and rangeland areas (the area covered will be approximately 232,050 ha for forestry; and 5.35 million ha for rangelands).	Forest and rangeland management tools and methods transferred	Practitioners group built in university, government and local delivery levels.	2.5 Billion
TOTAL FINANCIAL RESOURCES NEEDED:			10.79 Billion

7.3 MITIGATION ASSESSMENT AND TECHNOLOGY TRANSFER

As Afghanistan is a Least Developed Country (LDC) and a non-annex I party to the UNFCCC, it is not required to set or meet the targets of GHG reductions. However, Afghanistan is committed to a low-emission development path and recognizes the value and importance of environmentally friendly development, which protects the country's ecosystems and natural resources. Afghanistan's plans and commitments to reducing GHG emissions are encapsulated in the NDC, which estimates that international support of approximately US$662 million per year is required in order to cover the country's needed technology and capacity building needs:

Table 21: Climate Change Mitigation Gaps and Barriers and Support Needs[119]		
Sector	**Technology and Capacity Building Needs**	**Finance Needs (USD)**
Energy Efficiency in Buildings and in Transport Sector	• Carbon finance and project development skills. • Information on available technologies, measures, and financing skills. • Traditional customs and administered pricing. • Building codes, and standards on appliances and equipment. • Clean cooking, heating and power projects.	100 Million/Year
Energy	• Human and institutional capacity for adoption of cleaner technology. • Capital markets that encourage investment in decentralized systems. • Information and intellectual property rights for mitigation technologies. • Renewable energy, entry costs support, access to capital, and subsidies. • Environmental compliance standards (emission and indoor).	188 Million/Year
Waste Management	• Landfill management, decentralised wastewater treatment. • Climate Project development skills.	74 Million/Year
Forests and Rangelands	• Carbon sequestration on forest/rangelands, and forest carbon skills. • Funding institutional capacity to monitor and verify projects. • Better spatial planning for community and production agriculture. • Reduce rural peoples' dependence on fuel for cooking and heating.	100 Million/Year
Industry and Mining	• Cleaner coal mining, leave-it-in-the-ground approaches, combustion, and transportation of minerals. • Hydrocarbon fields management. • Technical industrial capacity to link basic industry and mining private and public sector with climate sector experts.	100 Million/Year
Agriculture and Livestock	• National herd, reduction in fuel used, or cleaner fuel technologies. • South-south collaboration on low-carbon agriculture, study tours. • Funding for R&D activities. • Improved national dataset on agriculture, food security data.	100 Million/Year
TOTAL FINANCIAL RESOURCES NEEDED:		**662.00 Million/ Year**

BIBLIOGRAPHY

NATIONAL LEGISLATION

Afghanistan. (2004). *Constitution of the Islamic Republic of Afghanistan*.

Afghanistan. (2006). *Presidential Decree on the Establishment of the Interministerial Commission for Energy*.

Afghanistan. (2007). *Environment Law*.

Afghanistan. (2009c). *Water Law*.

Afghanistan. (2012b). *Law on Disaster Response, Management and Preparedness*.

NATIONAL POLICY AND STRATEGY DOCUMENTS

Afghanistan. (2008a). *Afghanistan National Development Strategy (ANDS) 2008-2013*.

Afghanistan. (2008b). *Energy Sector Strategy*.

Afghanistan. (2008c). *Water Sector Strategy*.

Afghanistan. (2010a). *Agriculture and Rural Development Cluster National Priority Programme 1: National Water and Natural Resources Development*.

Afghanistan. (2010b). *Agriculture and Rural Development Cluster National Priority Programme 2: National Comprehensive Agriculture Production and Market Development*.

Afghanistan. (2014b). *National Biodiversity Strategy and Action Plan. Kabul: National Environmental Protection Agency*.

Afghanistan. (2016). *Afghanistan National Peace and Development Framework (ANPDF) 2017-2021*.

ANDMA. (2011). *Afghanistan Strategic National Action Plan (SNAP) for Disaster Risk Reduction: Towards Peace and Stable Development. Kabul: Afghanistan National Disaster Management Authority*.

MAIL. (2009). *National Agriculture Development Framework*. Kabul: Ministry of Agriculture, Irrigation and Livestock.

MAIL. (2012a). *National Forestry Management Policy*. Kabul: Ministry of Agriculture, Irrigation and Livestock.

MAIL. (2012b). *Rangeland Management Policy*. Kabul: Ministry of Agriculture, Irrigation and Livestock.

MEW. (2004). *Strategic Policy Framework for Water*. Kabul: Ministry of Energy and Water.

MEW. (2007). *Trans-boundary Water Policy*. Kabul: Ministry of Energy and Water.

MEW. (2014c). *Afghanistan National Renewable Energy Policy*. Kabul: Ministry of Energy and Water.

MoPH. (2005). *National Malaria Strategic Plan 2008-2013*. Kabul: Ministry of Public Health.

NEPA. (2010). *National Environmental Action Plan*. Kabul: National Environmental Protection Agency.

GOVERNMENT PUBLICATIONS

Afghanistan. (2009a). *Fourth National Report to the UN Convention on Biological Diversity.*

Afghanistan. (2009b). *National Risk and Vulnerability Assessment 2007/2008: A Profile of Afghanistan.*

Afghanistan. (2012a). *Initial National Communication under the UNFCCC. Kabul: National Environmental Protection Agency.*

Afghanistan. (2014a). *Fifth National Report to the United Nations Convention on Biological Diversity*. Kabul: National Environmental Protection Agency.

Afghanistan. (2015a). *Intended Nationally Determined Contribution (INDC)*. Kabul: National Environmental Protection Agency.

Afghanistan. (2015b). *National Progress Report on the Implementation of the Hyogo Framework for Action (2013-2015)*. Kabul: Afghanistan National Disaster Management Authority.

CPHD. (2011). *Afghanistan National Human Development Report - The Forgotten Front: Water Security and the Crisis in Sanitation*. Kabul: Centre for Policy and Human Development, Kabul University.

CSO. (2005). *Afghanistan Statistical Yearbook 2004-2005*. Kabul: Central Statistics Organization.

CSO. (2006). *Afghanistan Statistical Yearbook 2005-2006*. Kabul: Central Statistics Organization.

CSO. (2007). *Afghanistan Statistical Yearbook 2006-2007*. Kabul: Central Statistics Organization.

CSO. (2008). *Afghanistan Statistical Yearbook 2007-2008*. Kabul: Central Statistics Organization.

CSO. (2009). *Afghanistan Statistical Yearbook 2008-2009*. Kabul: Central Statistics Organization.

CSO. (2010). *Afghanistan Statistical Yearbook 2009-2010*. Kabul: Central Statistics Organization.

CSO. (2011). *Afghanistan Statistical Yearbook 2010-2011*. Kabul: Central Statistics Organization.

CSO. (2014). *Afghanistan Statistical Yearbook 2013-2014*. Kabul: Central Statistics Organization.

CSO. (2015a). *Afghanistan Statistical Yearbook 2014-2015*. Kabul: Central Statistics Organization.

CSO. (2015b). *Afghanistan Trade Statistics 2014-2015*. Kabul: Central Statistics Organization.

CSO. (2016a). *Afghanistan Living Conditions Survey 2013-14: National Risk and Vulnerability Assessment*. Kabul: Central Statistics Organization.

CSO. (2016b). *Afghanistan Statistical Yearbook 2015-2016*. Kabul: Central Statistics Organization.

CSO. (2016c). *Afghanistan Statistical Yearbook 2015-2016: At a Glance*. Kabul: Central Statistics Organization.

CSO. (2016d). *Estimated Settled Population by Civil Division, Urban, Rural and Sex 2015-16*. Kabul: Central Statistics Organization.

CSO. (2017a). *Afghanistan Statistical Yearbook 2015-2016: At a Glance.* Kabul: Central Statistics Organization.

CSO. (2017b). *Estimated Settled Population by Civil Division, Urban, Rural and Sex 2016-17*. Kabul: Central Statistics Organization.

CSO. (2017c). *Estimated Population by Sex and Age Groups 2017-18*. Kabul Central Statistics Organization.

CSO, MoPH, & ICF International. (2016). *Afghanistan Demographic and Health Survey 2015: Key Indicators.* Kabul & Rockville, Maryland: Central Statistics Organization, Ministry of Public Health and ICF International

DABS. (2013). *Energy Sector Overview*. Kabul: Da Afghanistan Breshna Sherkat.

MEW. (2014a). *Afghanistan Biomass Resource Potential Map*. Kabul: Ministry of Energy and Water.

MEW. (2014b). *Afghanistan Hydro Resource Potential Map*: Including Mini and Micro Hydropower Plants. Kabul: Ministry of Energy and Water.

MEW. (2014d). *Afghanistan Solar Resource Potential Map*. Kabul: Ministry of Energy and Water.

MEW. (2014e). *Afghanistan Wind Resource Potential Map*. Kabul: Ministry of Energy and Water.

MEW. (2014f). *Renewable Energy Magazine*. Kabul: Ministry of Energy and Water.

MEW. (2014g). *Renewable Energy Projects Status Chart*. Kabul: Ministry of Energy and Water. Available at: http://red-mew.gov.af

MoEc. (2015). *Afghanistan Poverty Status Update.* Kabul: Ministry of Economy.

MoMP. (2011). *Sustainable Development of Natural Resources Project II*. Kabul: Ministry of Mines and Petroleum.

MoPH. (2014). *Afghanistan Health Indicators Fact Sheet*. Kabul: Ministry of Public Health.

NEPA & ADB. (2007). *Afghanistan Green House Gas Inventory Report*. Kabul: National Environmental Protection Agency & Asian Development Bank.

NEPA & UNEP. (2008a). *Afghanistan's Environment*. Kabul: National Environment Protection Agency & United Nations Environment Programme.

NEPA & UNEP. (2008b). *Biodiversity Profile of Afghanistan: An Output of the National Capacity Needs Self-Assessment for Global Environmental Management (NCSA) for Afghanistan*. Kabul: National Environmental Protection Agency & United Nations Environment Programme.

NEPA & UNEP. (2008c). *Joint Press Release: National Environmental Advisory Council (NEAC) Islamic Republic of Afghanistan Inaugural Meeting*.

NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA)*. Kabul: National Environmental Protection Agency & United Nations Environment Programme.

NEPA, UN Environment & WFP. (2016). *Climate Change in Afghanistan: What Does it Mean for Rural Livelihoods and Food Security?* Kabul: National Environmental Protection Agency, UN Environment and World Food Programme.

PEER-REVIEWED PUBLICATIONS

Adger, N. (2000). 'Social and Ecological Resilience: Are They Related?' *Progress in Human Technology,* Vol. 24, 347-364.

Aich, V., Akhundzadah, N.A., Knuerr, A., Khoshbeen, A.J., Hattermann, F., Paeth, H., Scanlon, A. & Paton, E.N. (2017). 'Climate Change in Afghanistan Deduced from Reanalysis and Coordinated Regional Climate Downscaling Experiment (CORDEX) – South Asia Simulations.' *Climate* 5(2): 38.

Delattre, E. & Rahmani, H. (n.d.). *A Preliminary Assessment of Forest Cover and Change in the Eastern Forest Complex of Afghanistan: Report Submitted to WCS Afghanistan and USAID* [unpublished]. Available at: http://pdf.usaid.gov/pdf_docs/PA00K5BF.pdf

Elliott, D. (n.d.). *Wind Resource Assessment and Mapping for Afghanistan and Pakistan: South Asia Regional Initiative for Energy Cooperation and Development (SARI-Energy).* National Renewable Energy Laboratory. Available at: http://www.nrel.gov/international/pdfs/afg_pak_wind_june07.pdf

Freitag H. (1971a). 'Studies in the Natural Vegetation of Afghanistan.' In Davis, P.H. (Ed). (1971). *Plant Life of South-West Asia*. Edinburgh: Royal Botanic Garden.

Freitag, H. (1971b). 'Die Natürliche Vegetation Afghanistans, Beiträgezur Flora und Vegetation Afghanistans.' *Vegetation*, 22, 285–344.

Ghimire, S., Choudhary, A. & Dimri, A. P. (2015). 'Assessment of the Performance of CORDEX-South Asia Experiments for Monsoonal Precipitation Over the Himalayan Region during Present Climate: Part I.' *Climate Dynamics*, 1-24.

Groninger, J.W. (2006). 'Forestry and Forestry Education in Afghanistan.' *Journal of Forestry,* Vol. 104, 426–430.

Groninger, J.W. (2012). 'Reforestation Strategies Amid Social Instability: Lessons from Afghanistan.' *Environmental Management*, Vol. 49: 4, 833–845.

Hassan, Z. & Kant, P. (2011). REDD *in Afghanistan: Empowering women and Increasing Access to Energy, IGREC Working Paper IGREC-20:2011.* New Delhi: Institute of Green Economy.

Himmelsbach, T. (2008). *Groundwater Resources at Risk*. Kabul & Hanover: Bundesanstalt für Geowissenschaften und Rohstofffe.

King, M. & Sturtewagen, B. (2010). *Making the Most of Afghanistan's River Basins: Opportunities for Regional Cooperation.* New York: EastWest Institute.

McSweeney, C., New, M., & Lizcano, G. (2010). *UNDP Climate Change Country Profiles: Afghanistan*. New York: United Nations Development Programme.

McSweeney, C., New, M., Lizcano, G. & Lu, X. (2010). 'The UNDP Climate Change Country Profiles. Improving the Accessibility of Observed and Projected Climate Information for Studies of Climate Change in Developing Countries.' *Bulletin of the American Meteorological Society,* Vol. 91, 157-166.

Meehl, G.A., Covey, C., Delworth, T., Latif, M., McAvaney, B., Mitchell, J.F.B., Stouffer, R.J., & Taylor, K.E. (2007). 'The WCRP CMIP3 Multi-model Dataset: A New Era in Climate Change Research.' *Bulletin of the American Meteorological Society,* 88, 1383-1394.

Peters, G.S., Ludington, S.D., Orris, G.J., Sutphin, D.M, Bliss, J.D. & Rytuba, J.J. (eds.). (2007). *Preliminary Non-Fuel Mineral Resource Assessment of Afghanistan 2007*. Washington, DC: United States Geological Survey.

Peters, S.G., King, T.V.V., Mack, T.J., & Chornack. M.P. (eds.). (2011). *Summaries of Important Areas for Mineral Investment and Production Opportunities of Nonfuel Minerals in Afghanistan*. Washington, DC: United States Geological Survey.

Pittroff, W. (2011). 'Rangeland Management and Conservation in Afghanistan.' *International Journal of Environmental Studies*, Vol. 0 , Iss. 0,0.

Qureshi, A.S. & Akhtar, M. (2004). *A Survey of Drought Impacts and Coping Measures in Helmand and Kandahar Provinces of Afghanistan* [unpublished]. International Water Management Institute.

Saba, D. (2001). 'Afghanistan: Environmental Degradation in a Fragile Ecological Setting.' *International Journal of Sustainable Development and World Ecology*, Vol. 8 (4), 279-289.

Savage, M., Dougherty, B., Hamza, M., Butterfield, R., & Bharwani, S. (2009). *Socio-economic Impacts of Climate Change in Afghanistan*. Oxford: Stockholm Environment Institute.

Shroder, J. (2012). 'Afghanistan: Rich Resource Base and Existing Environmental Despoliation.' *Environmental Earth Sciences,* Vol. 67, 1971-1986.

Singh, S.P., Bassignana-Khadka, I., Karky, B.S., & Sharma, E. (2011). Climate Change on Hindukush-Himalayas: *The State of Current Knowledge*. Kathmandu: International Centre for Integrated Mountain Development.

Peters, S.G., King, V.V.T., Mack, T.J., & Chornack, M.P. (Eds.). (2011). *Summaries of Important Areas for Mineral Investment and Production Opportunities of Nonfuel Minerals in Afghanistan.* Reston, Virginia: United States Geological Society.

T.R. Klett, T.R., Ulmishek, G.F. , Wandrey, C.J., & Agena, W.F. (2006). *Assessment of Undiscovered Petroleum Resources of Northern Afghanistan.* Washington, DC: United States Geological Survey.

UNDP. (2016). *Human Development Index 2015*: Work for Human Development. New York: United Nations Development Programme.

UNDP. (2017). *Human Development Index 2016*: Work for Human Development. New York: United Nations Development Programme.

UNEP. (2003). *Post-conflict Environmental Assessment: Afghanistan*. Geneva: United Nations Environment Programme.

UNEP. (2009). *Women and Natural Resources in Afghanistan*. Kabul: United Nations Environment Programme.

UNEP. (2007). *A Guide to Afghanistan's 2007 Environment Law*. Kabul: United Nations Environment Programme.

PUBLICATIONS RELEVANT TO CLIMATE CHANGE IN AFGHANISTAN

ADB. (n.d.). *Economy: Afghanistan*. Available at: https://www.adb.org/countries/afghanistan/economy

Addison, M.W. (2007). *Energy Sector Strategy of Islamic Republic of Afghanistan for the Afghanistan National Development Strategy.* Kabul: USAID & Bearing Point.

Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives.* Kabul: National Environmental Protection Agency (NEPA) and UN Environment. Available at: https://postconflict.unep.ch/publications/Afghanistan/UNEP_AFG_CC_SciencePrespective_20161215.pdf

Ashok, K. & Saji, N.H. (n.d.). *On Impacts of ENSO and Indian Ocean Dipole Events on the Sub-regional Indian Summer Monsoon Rainfall* [unpublished]. Available (December 2016) at: http://www.jamstec.go.jp/frsgc/research/d1/iod/publications/newmons-provaccept.pdf

Azad, A.W. (2015). *Solid Waste Management in Kabul City of Afghanistan.* Unpublished MA thesis. Available at: https://www.academia.edu/12919045/Solid_waste_management_in_Kabul_city_of_Afghanistan.

Bajrakharya, S.R. & Shrestha, B. (eds.) (2011). *The Status of Glaciers in the Hindukush Himalayas.* Kathmandu: International Centre for Integrated Mountain Development.

Bayani, N., Estrella, M., Franklin, K., Hassany, M.S., Knuerr, A., & Scanlon, A. (2016). Mountain Partners: *Applying Ecosystem-based Disaster Risk Reduction (Eco-DRR) for Sustainable and Resilient Development Planning in the Koh-e Baba Mountains, Afghanistan.* Geneva: UN Environment. Available at: http://www.unep.org/disastersandconflicts/mountain-partners-applying-ecosystem-based-disaster-risk-reduction-eco-drr-sustainable-and-resilient

Blood, P.R. (ed.). (2001). *Afghanistan: A Country Study*. Washington, DC: GPO for the Library of Congress.

Breckle, S.W. & Rafiqpoor, M.D. (2010). *Field Guide Afghanistan: Flora and Vegetation.* Bonn: Scientia Bonnensis.

Brown, O. & Blankenship, E. (2013). *Natural Resource Management and Peacebuilding in Afghanistan*. Kabul: UN Environment. Available at: http://postconflict.unep.ch/publications/Afghanistan/UNEP_Afghanistan_NRM.pdf

CBD. (n.d.). *Climate Change and Biodiversity*, available (December 2016) at: https://www.cbd.int/climate

Davis, P.H. (Ed). (1971). *Plant Life of South-West Asia*. Edinburgh: Royal Botanic Garden.

Doosti, A.A. & Sherzad, M.H. (2015). *Climate Change and Governance in Afghanistan.* Kabul: National Environmental Protection Agency and UN Environment. Available at: http://postconflict.unep.ch/publications/Afghanistan/Report_CC_Governance_Afghanistan_EN_v2.pdf

FAO. (2010a). *Forests and Climate Change in the Asia-Pacific Region*: Forests and Climate Change Working Paper 7. Rome: Food and Agriculture Organization of the United Nations.

FAO. (2010b). *Global Forest Resources Assessment 2010: Country Reports, Afghanistan.* Rome: Food and Agriculture Organization of the United Nations.

FAO. (2014). *Global Forest Resources Assessment 2015: Country Report, Afghanistan.* Rome: Food and Agriculture Organization (FAO). Available at: http://www.fao.org/3/a-az145e.pdf.

Fitzherbert, A. (2014). *An Introductory Guide to Sources of Traditional Fodder and Forage and Usage.* Kabul: UN Environment. Available at: http://postconflict.unep.ch/publications/Afghanistan/Introductory_guide_sources_traditional_fodder_forage_usage_Afghanistan_2015.pdf

GEF. (n.d.). *Background Information on the NAPAs*. Available at: http://unfccc.int/adaptation/workstreams/national_adaptation_programmes_of_action/items/7572.php

Gouhari, S., Knuerr, A., & Snyman, D. (2017). *Gendering Resilience: Women, Natural Resources and Climate Change in Afghanistan*. Kabul: Afghanistan Resilience Consortium.

Grace, J. & Pain, A. (2004). *Rethinking Rural Livelihoods in Afghanistan*. Kabul: Afghanistan Research and Evaluation Unit.

Gurung, D.J., Giraj, A., Aung, K.S., Shrestha, B. & Kulkarni, A.V. (2011). *Snow Cover Mapping and Monitoring in the Hindukush Himalayas*. Kathmandu: International Centre for Integrated Mountain Development.

Hansen, J., Ruedy, R., Sato, M. & Lo, K. (2010). 'Global Surface Temperature Change.' *Review of Geophysics*, Vol 48, RG4004.

Ives, J., Shreshtha, R. & Mool, R. (2010). *Formation of Glacial Lakes in the Hindukush-Himalayas and GLOF Risk Assessment*. Kathmandu: International Centre for Integrated Mountain Development.

Jensen, D. & Halle, S. (2013). *Women and Natural Resources: Unlocking the Peacebuilding Potential.* Geneva: United Nations Environment Programme (UNEP), United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), United Nations Peacebuilding Support Office (PBSO), and United Nations Development Programme (UNDP). Available at: http://www.unep.org/disastersandconflicts/women-and-natural-resources-unlocking-peacebuilding-potential

Jones, C., Giorgi, F. & Asrar, G. (2011). 'The Coordinated Regional Downscaling Experiment: CORDEX–An International Downscaling Link to CMIP5.' CLIVAR Exchanges, No. 56, 16 (2), 34-40.

Kim, H. (2014). *Global Soil Wetness Project Phase 3 (GSWP3): Surface Meteorology 1*. Available at: http://hydro.iis.u-tokyo.ac.jp/GSWP3/exp1.html

Knuerr, A. & Samim, S. (2017a). *Hazard and Climate Vulnerability Assessment (HCVA) Toolkit: The Afghanistan Resilience Consortium's Guide to Assessing Community Resilience and Vulnerability to Natural Hazards and Climate Change in Afghanistan.* Kabul: Afghanistan Resilience Consortium.

Knuerr, A. & Samim, S. (2017b). *Community-based Disaster Preparedness (CBDP) Toolkit:: The Afghanistan Resilience Consortium's Guide to Enhancing Community Resilience to Natural Hazards and Climate Change in Afghanistan.* Kabul: Afghanistan Resilience Consortium.

Laudazi, M. Lambrou, Y, Shaw, J. & Monsieur, C. (2003). *Gender and Sustainable Development in Drylands: an Analysis of Field Experiences.* Rome: Food and Agriculture Organization of the United Nations.

Maplecroft. (2010). *Climate Change Vulnerability Index 2010*. Bath: Maplecroft.

Michaud, S. (2014). *After Action Review of DREF Operation # MDRAF002 – Afghanistan Floods and Landslide (2014)*. Canadian Red Cross.

Milbrandt, A. & Overend, R. (2011). *Assessment of Biomass Resources in Afghanistan, NREL/TP 6A20-49358*. Washington, DC: United States Department of Energy.

P.H. Davis (ed). (1971). *Plant Life of South-west Asia*. Edinburgh: Royal Botanic Garden.

UN-Habitat. (2015). *The State of Afghan Cities*. Kabul: UN-Habitat.

UNDP. (2015). *2015 Human Development Report of Afghanistan*. New York: United Nations Development Programme.

UN Environment. (2016). *Loss of Forest Cover in Eastern Forest Complex (Nangarhar, Kunar and Nuristan Provinces)* [unpublished]. Kabul: United Nations Environment.

UNESCO. (2015). *Afghanistan Country Profile 2015: Education*. Paris: United Nations Educational, Scientific and Cultural Organization.

USAID. (n.d.). *Afghanistan Energy Sector Overview; South Asian Regional Initiative for Energy Integration.* Available at: http://sari-energy.org/oldsite/PageFiles/Countries/Afghanistan_Energy_Overview.html

USEA. (1999). *USEA/USAID Handbook of Climate Change Mitigation Options for Developing Country Utilities and Regulatory Agencies*. Washington, DC: United States Energy Association.

WHO. (2015). *Trends in Maternal Mortality: 1990 to 2015: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division*. Geneva: World Health Organization.

World Bank. (n.d.). *Afghanistan Country Overview*, available (December 2017) at: *http://www.worldbank.org/en/country/afghanistan/overview*

World Bank. (1999). *What a Waste: Solid Waste Management in Asia*. Washington, D.C.: World Bank.

World Bank. (2011). *Afghanistan Economic Update*. Washington, D.C.: World Bank.

World Bank. (2017). *World Bank Open Data*, available (December 2017) at: https://data.worldbank.org/.

UNFCCC GUIDANCE AND IPCC GUIDELINES

IPCC. (1997). *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Bonn: United Nations Framework Convention on Climate Change.

IPCC. (2001). *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Hayama, Japan: IGES.

IPCC. (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories;* prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. & Tanabe K. (eds). Hayama, Japan: IGES.

IPCC. (2007). *Climate Change 2007, Mitigation of Climate Change: Working Group III Contribution to the Fourth Assessment Report of the IPCC*. Cambridge: Cambridge University Press.

UNFCCC. (2003a). *Report on the Conference of the Parties on its Eighth Session, Held at New Delhi from 23 October to 01 November 2002; FCCC/CP/2002/7/Add.2*. Bonn: United Nations Framework Convention on Climate Change.

UNFCCC. (2003b). *Reporting on Climate Change: User Manual for the Guidelines on National Communications from non-Annex 1 Parties.* Bonn: United Nations Framework Convention on Climate Change.

UNFCCC. (2006). *Training Handbook for Mitigation Assessment for Non Annex 1 Parties.*United Nations. (1992). *United Nations Framework Convention on Climate Change (UNFCCC*), FCCC/INFORMAL/84 GE.05-62220 (E) 200705. New York: UN.

UNFCCC. (2008a). *UNFCCC Resource Guide for Preparing the National Communications of Non-annex I Parties: Module 1: The Process of National Communications from Non-annex I Parties*. Bonn: United Nations Framework Convention on Climate Change.

UNFCCC. (2008b). *UNFCCC Resource Guide for Preparing the National Communications of Non-annex I Parties: Module 2 - Vulnerability and Adaptation to Climate Change.* Bonn: United Nations Framework Convention on Climate Change.

UNFCCC. (2008c). *UNFCCC Resource Guide for Preparing the National Communications of Non-annex I Parties: Module 3 - National Greenhouse Gas Inventories.* Bonn: United Nations Framework Convention on Climate Change.

United Nations. (2006). *Economic and Social Council, Committee of Experts on Public Administration, Fifth Session, Agenda Item 5: Compendium of Basic Terminology in Governance and Public Administration*, E/C.16/2006/4. New York: UN.

IPCC. (2013). Climate Change 2013: *The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Bonn: United Nations Framework Convention on Climate Change.

ANNEXES

ANNEX I : COMPOSITION OF NATIONAL CLIMATE CHANGE COMMITTEE

#	Name	Position	Organization
#	Name	Position	Organization
1	Ghulam Mohammad Malikyar	Technical Deputy Director General	National Environment Protection Agency
2	Abdul Wali Modaqiq	Policy and International Relations Deputy Director General	National Environment Protection Agency
3	Mohammad Dawood Qazizada	Deputy Minister	Ministry of Energy and Water
4	Nabila Musleh	Deputy Minister	Ministry of Women Affairs
5	Professor Abdul Tawab Balakarzai	Deputy Minister	Ministry of Higher Education
6	Sayeeda Mozhgan Mostafawi	Deputy Minister	Ministry of Information and Culture
7	Mohammad Qasem Haidari	Deputy Minister	Afghanistan National Disaster Management Authority
8	Mohammad Akbar Ahmadi	Deputy Minister	Ministry of Urban Development and Housing
9	Feda Mohammad Paikan	Deputy Minister	Ministry of Public Health
10	Fawzia Ehsani	Deputy Minister	Ministry of Trade Civil Aviation
11	Abdul Hakim Monib	Deputy Minister	Ministry of Haj and Religious Affairs
12	Najia Kharoti	Technical Advisor and Aide Minister and Deputy Minister	Ministry of Rural Rehabilitation and Development
13	Mohammad Rafi Qazizada	Director General of Natural Resources Management	Ministry of Agriculture, Irrigation and Livestock
14	Asad Ullah Mohaqiq Jahani	Deputy Minister	Ministry of Education
15	Mohammad Ismail Rahimi	Deputy Minister	Ministry of Economy
16	Sayed Dawran	Director of Development, Competition and Support of Consumers	Ministry of Commerce and Industries
17	Shah Wali Safi	Assistant Deputy Minister	Ministry of Interior
18	Mir Ahmad Javid Sadat	Deputy Minister	Ministry of Mining and Petroleum
19	Doctor Azimullah Niazi	Member of Kabul Provincial Council	Provincial Council of Kabul Province
20	Rahmatgul Ahmadi	Deputy of Natural Science	Afghanistan Academy of Science
21	Farzana Razmju	Lecturer at Agriculture Faculty	Kabul University
22	Mohammad Qasem Sediqi	Head of Water supply and Environmental Engineering Department	Kabul Polytechnic University
23	Hasibullah Moahed	Technical Deputy Director General	Central Statistics Organization
24	Abdulkhaliq Babar	Deputy Director General	Afghanistan National Standard Authority

ANNEX I : COMPOSITION OF NATIONAL CLIMATE CHANGE COMMITTEE

25	Timor Sharan	Deputy Director General	Independent Directorate Local Governance
26	Shafiqullah Atayee	Technical and Policy Deputy	Afghanistan Chamber of Commerce
27	Ghulam Hassan Amiri	Director of Climate Change and Adaptation Division	National Environmental Protection Agency
28	Abdul Ghias Safi	Dean of Geo Science Faculty	Kabul University
29	Nahid Sarabi	Deputy Minister	Ministry of Finance
30	Mohammad Dawood Shirzad	Lecturer	Faculty of Environmental Science- Kabul University

ANNEX II : COMPOSITION OF NATIONAL STUDY TEAMS

A. National Study Team on National Circumstances

#	Name	NST Role	Organization	Title
1	Ghulam Mohmmad Malikyar	Team Leader	National Environmental Protection Agency	DDG-Technical
2	Abdul Wali Modaqiq	Team Leader – climate change mitigation	National Environmental Protection Agency	DDG- Policy and International Relations
3	Ghulam Mohammad Malikyar	Team Leader- GHG Inventory	National Environmental Protection Agency	DDG-Technical
4	Mohmmad Aman Amanyar	Assessment Group Leader	Ministry of Agriculture, Irrigation and Livestock	Director of Forestry Division
5	Shah Aqa Jalat	Research and Systematic Observation	Afghanistan Meteorological Authority	General Manager of Meteorology
6	Mohammad Iqbal Hamdard	Public Awareness Group Leaders	National Environmental Protection Agency	Communication and Public Awareness Officer
7	Mohammad Solaiman Bakhshi	Technical Officer	National Environmental Protection Agency	Climate Finance Expert

B. National Study Team on Vulnerability Assessment and Adaptation

#	Name	NST Role	Organization	Title
1	Mohammad Aman Amanyar	Team Leader	Ministry of Agriculture, Irrigation and Livestock	Director of Forestry Division
2	Abdul Gheyas Safi	Water Expert	Kabul University	Director of Meteorology Department
3	Mohammad Reza Amiri	DRR Expert	Afghanistan Disaster Management Authority	Policy Extension and Programme Expert
4	Abdul Basir Ahzam	Science Expert	Academy of Sciences	Member of Chemistry, Biology and Agriculture Centre
5	Hedayatullah Arian	Glacier Expert	Kabul University	Professor
6	Atiullah Ehsanzada	Technical Officer	National Environmental Protection Agency	Water and Glacier Sector Expert

C. National Study Team on Greenhouse Gas Inventory

#	Name	NST Role	Organization	Title
1	Ghulam Mohammad Malikyar	Team Leader	National Environmental Protection Agency	DDG-Technical
2	Ahmad Shah Tahiri	Energy Expert	Ministry of Trade and Industry	Deputy Director of International Trade Division
3	Nesar Ahmad Kohistani	Forest Management Expert	Kabul University	Professor

ANNEX II : COMPOSITION OF NATIONAL STUDY TEAMS

4	Abdul Sami Sakhi	Forest Management Expert	Ministry of Agriculture, Irrigation and Livestock	General Manager of Environmental Conventions
5	Eng. Naik Mohammad	Waste Management Expert	National Environmental Protection Agency	Environmental Inspection Director
6	Mohammad Qasim Sediqi	GHG Expert	Polytechnic University	Professor
7	Eng. Naqibullah Sediqi	Toxic Gases Expert	National Environmental Protection Agency	Greenhouse Gases Mitigation Officer
8	Noor Ahmad Akhundzada	Industrial Processes Expert	Kabul University	Dean of Environmental Sciences Faculty
9	Ghulam Abas Leyaqat	Technical Officer	National Environmental Protection Agency	General Manager of Reporting to UNFCCC

D. National Study Team on Climate Change Mitigation

#	Name	NST Role	Organization	Title
1	Abdul Wali Modaqiq	Team Leader	National Environmental Protection Agency	DDG- Policy and International Relation
2	Mohammad Shafiq Hamidi	Energy Expert	Ministry of Energy and Water	Energy Expert
3	Ghulam Naqshbandi Naseri	Forestry Expert	Kabul University	Professor
4	Kauja Asadullah	Research Expert	Ministry of Agriculture, Irrigation and Livestock	Forestry Expert
5	Masjeedi Khan Ranjbar	Industrial Expert	Ministry of Commerce and Industries	Industrial Engineer
6	Haji Abdul Qayom	Transport Management Expert	General Traffic Directorate	Deputy Administration
7	Mohammad Jawad Mohammadi	Urban Environment Expert	Ministry of Mining and Petroleum	Environment Officer
8	Zabiullah Paiman	Water Resources Engineer	Polytechnic University	Professor
9	Aria Neyaesh	Technical Officer	National Environmental Protection Agency	Climate Change Mitigation Officer

ANNEX II : COMPOSITION OF NATIONAL CLIMATE CHANGE COMMITTEE

E. National Study Team on Research, Systematic Development, and Technology Transfer

#	Name	NST Role	Organization	Title
1	Shah Aqa Jalat	Team Leader	Afghanistan Meteorological Authority	General Manager of Meteorology
2	Abdul Basir Ahzam	Scientist	Academy of Sciences	Head Researcher
3	Mohammad Afzal Safi	Industrial Technology Expert	Ministry of Rural Rehabilitation and Development	National Water Supply and Irrigation Advisor
4	Abdul Gheyas Safi	Meteorologist	Kabul University	Head of Meteorology Department
5	Ahmad Fatey Yusufi	Clean Technology Expert	National Environmental Protection Agency	Clean Technology Officer
6	Mohammad Qasim Salehi	Urban Environment Expert	Ministry of Urban Development and Housing	Acting Head of Water Supply and Environmental Services Directorate
7	Mohammad Shafiq Hamidi	Energy Expert	Ministry of Energy and Water	Energy and Environment Affairs Expert
8	Ghulam Naqshbandi Naseri	Forest Expert	Kabul University	Head of Forestry and Natural Resources Department
9	Sediqullah Reshtin	Hydrologist	Kabul University	Professor
10	Naqibullah Sediqi	Policy Expert	National Environmental Protection Agency	Greenhouse Gases Mitigation Officer
11	Abdul Basir Rashidi	Technical Officer	Afghanistan Meteorological Authority	Observation Network Officer

F. National Study Team on Education, Training, Public Awareness, and Capacity Needs

#	Name	NST Role	Organization	Title
1	Mohammad Iqbal Hamdard	Team Leader	National Environmental Protection Agency	Communication and Public Awareness Officer
2	Habibullah Sherwani	Education	Ministry of Education	General Manager of Compilation
3	Jalal Noorani	Information and Culture	Ministry of Information and Culture	Head of Printing House
4	Shakillah Yusufi	Women Affairs	Ministry of Women Affairs	Cultural and Social Affairs Officer
5	Abdul Jabar Waziri	Technical Officer	National Environmental Protection Agency	Technical DDG Secretary

ANNEX III : SECOND NATIONAL COMMUNICATION PROJECT INCEPTION WORKSHOP PARTICIPANTS

#	Name	Organization	Title
1	Najmudin Tareen	AAS	Asst. of Technical and Natural Science
2	Hazratnoor	Kabul Municipality	Environmental Officer
3	Abdul Ghias Safi	Kabul University	Lecturer of Hydrometeorology
4	G.N. Naseri	Kabul University	Head of Forestry and NRM Department
5	Abdul Qauim Payanda	MAIL	National Parks Management Officer
6	Ahmad Shah Tahiry	MCI	Officer
8	Rohullah	MEW	Water Management officer
9	Habibullah Sheerwani	MoEd	Head of Scientific Research
10	Abdul Qauim	MoI, Traffic Division	Assistant of Traffic Division
11	Din Mohammad Hajizada	MoMP	Social Environmental Officer
12	Shakila Yousufi	MoWA	Analysis Officer
13	Mohammad Afzal Safi	MRRD	Consultant of Sanitation and Environmental
14	Abdul Wali Modaqiq	NEPA	Deputy Director General
15	Aria Niaysh	NEPA	Head of Climate Change Impact Reduction
16	Ghulam Mohammad Malikyar	NEPA	Deputy Director General
17	Gull Aqa	NEPA	Industrial Impact Assessment officer
18	Jalal Noorani	NEPA	Director of Public Awareness Division
19	Jalaludin Naseri	NEPA	Director of Natural Heritage Division
20	Naqibullah Sediqi	NEPA	Head of GHGs
21	Noor Mohammad Fazli	NEPA	Director of Sustainable Division
22	Sharifah	NEPA	Journalist
23	Abdul Azim Doosti	UNEP	Environmental Policies Coordinator
24	Alec Knuerr	UNEP	Deputy Country Programme Manager
25	Andrew Scanlon	UNEP	Country Programme Manager
26	Chris Aikins	UNEP	Environmental Education Advisor

ANNEX IV : SECOND NATIONAL COMMUNICATION VALIDATION WORKSHOP PARTICIPANTS

#	Name	Organization	Title
1	Schah-Zaman Maiwandi	NEPA	Director General
2	Mohammad Afzal Safi	MRRD	National Program Advisor
3	Abdul Qayoom	General Traffic Directorate	Assistant of Traffic Division
4	Mohammad Aman Amanyar	MAIL	Forestry Director
5	Mohammad Reza Amiri	ANDMA	Plan and Policy Expert
6	Abdul Basir Azam	AAS	Member of the Academy of Science
7	Mohammad Qasim Sediqi	KPU	Professor
8	Ghulam Abbas Leyaqat	NEPA	Reporting Manager to UNFCCC
9	Khan Mohammad	NEPA	Agriculture Sector Expert
10	Dirk Snyman	UNEP	Climate Change Specialist
11	Mohammad Shafiq Hamidi	MEW	Environment Expert
12	Zolfaqar Karimi Baloch	NEPA	Director of International Relation Division
13	Alec Knuer	UNEP	Deputy Country Programme Manager
14	Haris Sherzad	UNEP	MAPS Unit Coordinator
15	Fazulkarim	MAIL	Agriculture Research Expert
16	Ahmad Shah Khan	MoCI	Advisor to the Minister
17	Mohammad Solaiman Bakhshi	NEPA	Climate Finance Expert
18	Nesar Ahmad Kohestani	KU	Agriculture Faculty Professor
19	Abdul Wali Modaqiq	NEPA	Deputy Director General
20	Ghulam Mohammad Malikyar	NEPA	Deputy Director General
21	Abdul Jabar Waziri	NEPA	Secretary of the DDG
22	Mohammad Wahid jalal	NEPA	Director of Public Awareness Division
23	Nooruddin	NEPA	General Manager of Public Awareness
2	Bashir Ahmad Rashidi	AMD	Head of Observation Network
25	Abdul Ghias Safi	KU	Dean of Geo Science Faculty
26	Sharifa Sultan	NEPA	Journalist
27	Ghulam Hassan Amiri	NEPA	Director of Climate Change and Adaptation Division
28	Raihana Osmani	UNEP	KMU Assistant
29	Saeeda Gouhari	UNEP	MEA Unit Coordinator
30	Mohammad Monib Noori	UNEP	MEA Unit Assistant
31	Ghulam Sakhi Sakha	NEPA	Head of Information
32	Zahra Khodadadi	UNEP	KMU Assistant
33	Ahmad Samim Hoshmand	NEPA	National Ozone Officer
34	Toryalai Tanin	MoEc	Director of Agriculture and Rural Development Directorate
35	Shakila Yousufi	MoWA	General Manager of Reporting
36	Ahmad Shakib Ahmadi	UNEP	Operation Assistant

REFERENCES

[1] ADB. (n.d.). Economy: Afghanistan.
[2] CSO. (2016b). *Afghanistan Statistical Yearbook 2015-2016*.
[3] CSO (2017a). *Afghanistan Statistical Yearbook 2016–2017*. Kabul: Central Statistics Organization.
[4] UNESCO. (2015). *Afghanistan Country Profile 2015*: Education.
[5] UNESCO. (2015). *Afghanistan Country Profile 2015*: Education.
[6] CSO (2017b). *Estimated Population by sex and age group 2017-18*. Kabul: Central Statistics Organization
[7] MoPH. (2014). *Afghanistan Health Indicators Fact Sheet*.
[8] CSO. (2016a). *Afghanistan Living Conditions Survey 2013-14: National Risk and Vulnerability Assessment*.
[9] CSO, MoPH, & ICF International. (2016). *Afghanistan Demographic and Health Survey 2015: Key Indicators*, p. 15.
[10] CSO, MoPH, & ICF International. (2016). *Afghanistan Demographic and Health Survey 2015: Key Indicators.*, p. 15.
[11] CSO, MoPH & ICF International. (2017). *Afghanistan Demographic and Health Survey 2015*. Kabul: Central Statistics Organization.
[12] CSO. (2016a). *Afghanistan Living Conditions Survey 2013-14: National Risk and Vulnerability Assessment*, p.134.
[13] CSO. (2016a). *Afghanistan Living Conditions Survey 2013-14*: National Risk and Vulnerability Assessment, p.138.
[14] CSO. (2016a). *Afghanistan Living Conditions Survey 2013-14: National Risk and Vulnerability Assessment,* p.134.
[15] Afghanistan. (2014b). *National Biodiversity Strategy and Action Plan*. Kabul, p. 14.
[16] CBD. (n.d.). *Climate Change and Biodiversity.*
[17] NEPA & UNEP. (2008b). *Biodiversity Profile of Afghanistan: An Output of the National Capacity Needs Self-Assessment for Global Environmental Management (NCSA) for Afghanistan.*
[18] UNEP. (2003). *Post-conflict Environmental Assessment: Afghanistan.*
[19] Delattre, E. & Rahmani, H. (n.d.). *A Preliminary Assessment of Forest Cover and Change in the Eastern Forest Complex of Afghanistan: Report Submitted to WCS Afghanistan and USAID [unpublished]*; Groninger, J.W. (2012). 'Reforestation Strategies Amid Social Instability: Lessons from Afghanistan.' *Environmental Management*, Vol. 49: 4, 833–845; and Groninger, J.W. (2006). 'Forestry and Forestry Education in Afghanistan.' Journal of Forestry, Vol. 104, 426–430.
[20] Delattre, E. & Rahmani, H. (n.d.). *A Preliminary Assessment of Forest Cover and Change in the Eastern Forest Complex of Afghanistan: Report Submitted to WCS Afghanistan and USAID [unpublished]*; Freitag, H. (1971a). 'Studies in the Natural Vegetation of Afghanistan.'
[21] Breckle, S.W. & Rafiqpoor, M.D. (2010). *Field Guide Afghanistan: Flora and Vegetation.*
[22] UN Environment. (2016). *Loss of Forest Cover in Eastern Forest Complex (Nangarhar, Kunar and Nuristan Provinces)* [unpublished].
[23] Adger, N. (2000). 'Social and Ecological Resilience: Are They Related?'; and FAO. (2010a). *Forests and Climate Change in the Asia-Pacific Region: Forests and Climate Change Working Paper 7.*
[24] FAO. (2010b). *Global Forest Resources Assessment 2010: Country Reports, Afghanistan*; Delattre, E. & Rahmani, H. (n.d.). *A Preliminary Assessment of Forest Cover and Change in the Eastern Forest Complex of Afghanistan: Report Submitted to WCS Afghanistan and USAID* [unpublished]; Groninger, J.W. (2012). 'Reforestation Strategies Amid Social

Instability: Lessons from Afghanistan'; Shroder, J. (2012). 'Afghanistan: Rich Resource Base and Existing Environmental Despoliation'; UNEP. (2003). *Post-Conflict Environmental Assessment: Afghanistan; and NEPA & UNEP. (2008a). Afghanistan's Environment.*

[25] MAIL. (2009). *National Agriculture Development Framework*, p. 23.

[26] NEPA & UNEP. (2008a). *Afghanistan's Environment*.

[27] Doosti, A.A. & Sherzad, M.H. (2015). *Climate Change and Governance in Afghanistan*.

[28] CPHD. (2011). *Afghanistan National Human Development Report - The Forgotten Front: Water Security and the Crisis in Sanitation.*

[29] CPHD. (2011). *Afghanistan National Human Development Report - The Forgotten Front: Water Security and the Crisis in Sanitation*, p. 50.

[30] UNDP. (2017). *Human Development Index 2016: Work for Human Development*.

[31] CPHD. (2011). *Afghanistan National Human Development Report - The Forgotten Front: Water Security and the Crisis in Sanitation*. Kabul: Centre for Policy and Human Development, Kabul University.

[32] CPHD. (2011). *Afghanistan National Human Development Report - The Forgotten Front: Water Security and the Crisis in Sanitation.*

[33] UNDP. (2016). *Human Development Index 2015: Work for Human Development*.

[34] Aich, V. and Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives.*

[35] Afghanistan. (2012a). *Initial National Communication under the UNFCCC.*

[36] CSO (2017a). *Afghanistan Statistical Yearbook 2016–2017.* Kabul: Central Statistics Organization.

[37] Afghanistan. (2012a). *Initial National Communication under the UNFCCC.*

[38] CSO (2017a). *Afghanistan Statistical Yearbook 2016–2017.* Kabul: Central Statistics Organization.

[39] NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA).*

[40] USAID. (n.d.). *Afghanistan Energy Sector Overview*; South Asian Regional Initiative for Energy Integration.

[41] DABS. (2013). *Energy Sector Overview*.

[42] DABS. (2013). *Energy Sector Overview.*

[43] Afghanistan. (2008b). *Energy Sector Strategy*.

[44] Addison, M.W. (2007). *Energy Sector Strategy of Islamic Republic of Afghanistan for the Afghanistan National Development Strategy.*

[45] CSO. (2015a). *Afghanistan Trade Statistics 2014-2015*, p 95-99.

[46] CSO. (2016b). *Afghanistan Statistical Yearbook 2015-2016*, p 191.

[47] MEW. (2014f). *Renewable Energy Magazine.*

[48] MEW. (2014e). *Afghanistan Wind Resource Potential Map.*

[49] MEW. (2014b). *Afghanistan Hydro Resource Map: Including Mini and Micro Hydro Power Plants.*

[50] MEW. (2014g). *Renewable Energy Projects Status Chart.*

[51] MEW. (2014g). *Renewable Energy Projects Status Chart.* Kabul: Ministry of Energy and Water. Available at: http://red-mew.gov.af

[52] MEW. (2014d). *Afghanistan Wind Resource Potential Map*.

[53] MEW. (2014d). *Afghanistan Wind Resource Potential Map.*

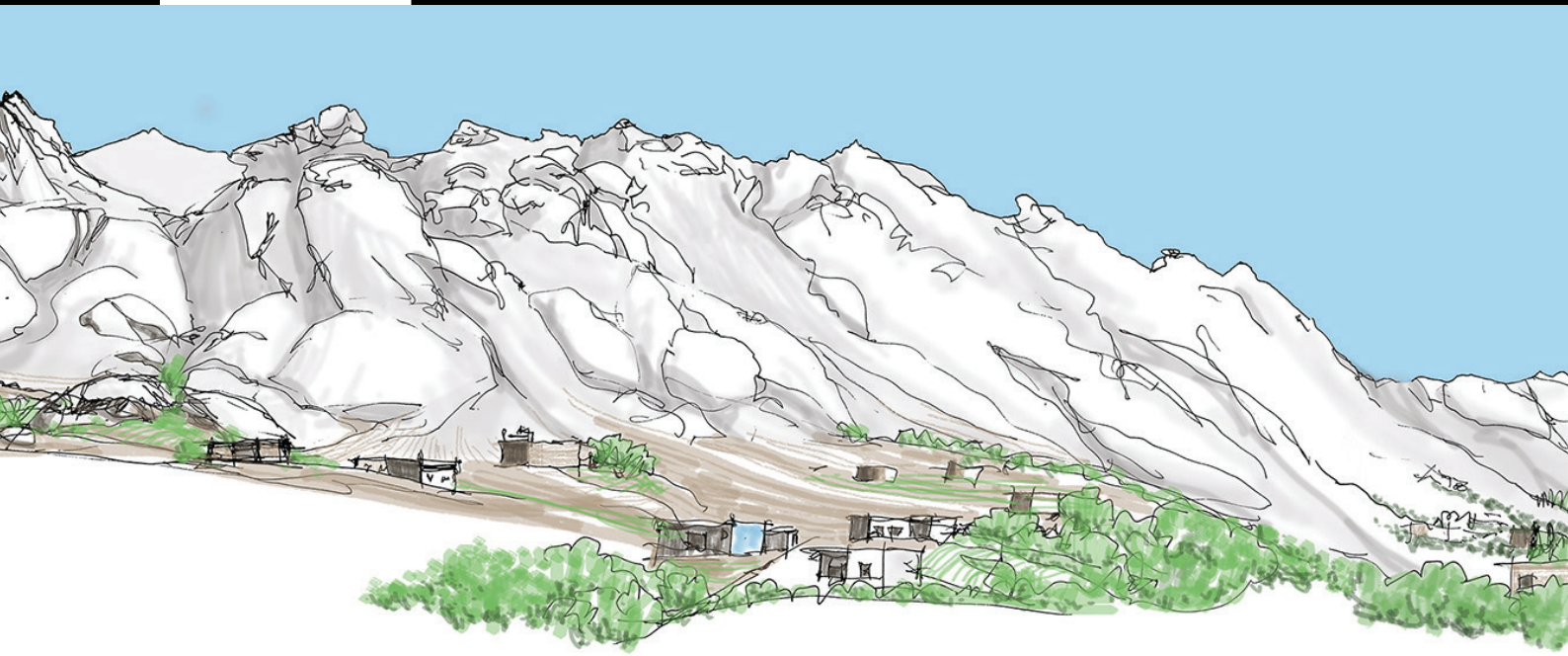
[55] MEW. (2014g). *Renewable Energy Projects Status Chart*.

[56] MEW. (2014d). *Afghanistan Solar Resource Potential Map*.

[57] MEW. (2014d). *Afghanistan Solar Resource Potential Map.*

[57] MEW. (2014a). *Afghanistan Biomass Resource Potential Map*.
[58] Peters, S.G., King, V.V.T., Mack, T.J., & Chornack, M.P. (eds.). (2011). *Summaries of Important Areas for Mineral Investment and Production Opportunities of Nonfuel Minerals in Afghanistan*.
[59] World Bank. (n.d.). *Afghanistan Country Overview*.
[60] ADB. (2018). *Asian Development Outlook (ADO)*.
[61] CSO. (2016c). *Afghanistan Statistical Yearbook 2015-2016: At a Glance*.
[62] CSO. (2017a). *Afghanistan Statistical Yearbook 2016-2017: At a Glance*.
[63] CSO. (2017a). *Afghanistan Statistical Yearbook 2016-2017: At a Glance*.
[64] World Bank. (n.d.). *Afghanistan Country Overview*.
[65] Afghanistan. (2012a). *Initial National Communication under the UNFCCC*.
[66] CSO. (2016b). *Afghanistan Statistical Yearbook 2015-2016,* p. 220.
[67] CSO. (2006). *Afghanistan Statistical Yearbook 2005-2006*, p. 112.
[68] CSO. (2011). *Afghanistan Statistical Yearbook 2010-2011*, p. 117.
[69] CSO. (2016b). *Afghanistan Statistical Yearbook 2015-2016*, p. 213-220.
[70] CSO (2017a). *Afghanistan Statistical Yearbook 2016–2017*. Kabul: Central Statistics Organization.
[71] UN-Habitat. (2015). *The State of Afghan Cities*.
[72] Afghanistan. (2008a). *Afghanistan National Development Strategy (ANDS) 2008-2013*.
[73] Afghanistan. (2004). *Constitution of the Islamic Republic of Afghanistan*.
[74] Afghanistan. (2004). *Constitution of the Islamic Republic of Afghanistan*, Art. 140.
[75] Afghanistan. (2004). *Constitution of the Islamic Republic of Afghanistan*, Art. 141.
[76] UNEP. (2007). *A Guide to Afghanistan's 2007 Environment Law*, p. 3.
[77] NEPA & UNEP. (2015). *Climate Change and Governance in Afghanistan*, p 24-26.
[78] United Nations. (1992). *United Nations Framework Convention on Climate Change*. FCCC/INFORMAL/84
[79] Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives*, p. 7.
[80] Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives*, p. 8.
[81] Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives*, p. 9.
[82] Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives*, p. 11.
[83] Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives*, p. 11.
[84] Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives*, p. 12.
[85] Aich, V. & Khoshbeen, A.J. (2016). *Afghanistan: Climate Change Science Perspectives*, p. 12.
[86] Doosti, A.A. & Sherzad, M.H. (2015). *Climate Change and Governance in Afghanistan*, p. 4.
[87] Savage, M., Dougherty, B., Hamza, M., Butterfield, R., & Bharwani, S. (2009). *Socio-economic Impacts of Climate Change in Afghanistan*.
[88] Aich, V. & Khoshbeen, A.J. (2016). Afghanistan: *Climate Change Science Perspectives*, p. 18.
[89] Aich, V. & Khoshbeen, A.J. (2016). Afghanistan: *Climate Change Science Perspectives*, p. 19.
[90] Aich, V. & Khoshbeen, A.J. (2016). Afghanistan: *Climate Change Science Perspectives*, p. 20.
[91] Aich, V. & Khoshbeen, A.J. (2016). Afghanistan: *Climate Change Science Perspectives*, p. 21.
[92] ANDMA. (2011). *Afghanistan Strategic National Action Plan (SNAP) for Disaster Risk Reduction: Towards Peace and Stable Development*.
[93] ANDMA. (2011). *Afghanistan Strategic National Action Plan (SNAP) for Disaster Risk Reduction: Towards Peace and Stable Development*.
[94] Afghanistan. (2012a). *Initial National Communication under the UNFCCC*.
[95] NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA)*, p. 70.
[96] NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental*

Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA), p. 73.
[97] NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA)*, p. 74.
[98] Singh, S.P., Bassignana-Khadka, I., Karky, B.S., & Sharma, E. (2011). *Climate Change on Hindukush-Himalayas: The State of Current Knowledge*, p. 4.
[99] Doosti, A.A. & Sherzad, M.H. (2015). *Climate Change and Governance in Afghanistan.*
[100] Singh, S.P., Bassignana-Khadka, I., Karky, B.S., & Sharma, E. (2011). *Climate Change on Hindukush-Himalayas: The State of Current Knowledge.*
[101] MAIL. (2009). *National Agriculture Development Framework*, p. 77; and NEPA, UN Environment & WFP. (2016). *Climate Change in Afghanistan: What Does it Mean for Rural Livelihoods and Food Security?*
[102] MAIL. (2009). *National Agriculture Development Framework*, p. 23.
[103] NEPA & UNEP. (2008a). *Afghanistan's Environment*.
[104] Doosti, A.A. & Sherzad, M.H. (2015). *Climate Change and Governance in Afghanistan*, p. 31.
[105] Doosti, A.A. & Sherzad, M.H. (2015). *Climate Change and Governance in Afghanistan*, p. 31.
[106] CBD. (n.d.). *Climate Change and Biodiversity.*
[107] Afghanistan. (2014b). *National Biodiversity Strategy and Action Plan*, p. 14.
[108] Afghanistan. (2008b). *Energy Sector Strategy*.
[109] Afghanistan. (2015a). *Intended Nationally Determined Contribution (INDC)*, p 1.
[110] Afghanistan. (2015a). *Intended Nationally Determined Contribution (INDC)*, p. 2.
[111] NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA)*, p. 76.
[112] NEPA & UNEP. (2009). *National Capacity Needs Self-assessment for Global Environmental Management (NCSA) and National Adaptation Programme of Action for Climate Change (NAPA)*, p. 76.
[113] Afghanistan. (2016). *Afghanistan National Peace and Development Framework (ANPDF) 2017-2021*, p. 18, 41.
[114] Afghanistan. (2016). *Afghanistan National Peace and Development Framework (ANPDF) 2017-2021,* p. 24.
[115] MAIL. (2009). *National Agriculture Development Framework.*
[116] Afghanistan. (2012a). *Initial National Communication under the UNFCCC.*
[117] GEF. (n.d.). *Background Information on the NAPAs.*
[118] Afghanistan. (2015a). *Intended Nationally Determined Contribution (INDC)*, p. 5-6.
[119] Afghanistan. (2015a). *Intended Nationally Determined Contribution (INDC)*, p. 8.



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