Terms of Reference (TOR)

For

***Activity 1.2.2 Climate* security assessment of the nexus of climate impacts with current displacement trends**

&

Activity 2.3.1: Climate security risk assessment analyzing the role of climate change in generating long-term resource scarcity in areas of protracted crisis, exacerbating situations of conflict and displacement in the region, with particular focus on risks to women

on

Climate Change Disasters, Flood Impacts, and Risk Management in the MENA Region:

The Case of Sudan and its Implications for Regional Flood Responses

Background

According to the United Nations International Strategy for Disaster Reduction (UNISDR), losses due to floods and heavy rains are increasing at a faster pace than other weather hazards, particularly since 1990 (UNISDR, 2009). This is primarily due to their frequency and often to their high intensity. Between 1970 and 2010, the average population exposed to floods every year rose by 114% worldwide, whereas the world's population increased by 87%, rising from 3.7 billion to 6.9 billion. In addition, according to the data available to the World Meteorological Organization (WMO), floods were the most frequently experienced extreme event of the decade 2001-2010.

The Arab region emerges as one of the hotspots for worsening extreme heat, drought, and floods. Many countries, such as Sudan, have experienced severe floods during the last two decades (2000 – 2020). These floods have led to a loss of life and livelihoods, damage of properties, lack of basic services such as drinking water, sanitation, and health, as well as shortages of food. Sudan is a member state of the League of Arab States. It occupies an area of about 1.866 million km² and is considered the 16th largest country in the world. Heavy rains usually fall in Sudan from June to October, and the country faces severe flooding almost every year. In September 2020, profuse and continuous rainfall caused a devastating flood across at least 16 Sudanese states with the Blue Nile River reaching water levels not seen in nearly a century. The event ranks among the most severe floods recorded in the region. A state of emergency was declared in the country, and teams have worked to prevent/abate damages to human safety, livelihoods, properties, and households. It is reported that the flood affected more than 3 million people, left 102 people dead and destroyed more than 100,000 homes.

According to several authors, a natural disaster is never solely "natural". It is always associated with a body of risks concerning not only nature, but also the social and economic processes flowing from the complex relationship communities have with the natural environment – for example, with regard to soil use, the water cycle, land use planning, canalizations, housing, etc. In other words, the problem of natural disasters and their impact is closely linked to the socio-economic context as well as, in this connection, processes particular to development (Correa, 2011). This, in turn, has an influence on communities' resilience to disasters, which is viewed as a key aspect of both sustainable development and of climate

change adaptation strategies (UNISDR, 2011). By way of example, a flood's impact on a community used to frequent flooding events is not at all the same as its impact on a community not familiar with this type of event.

In view of the serious situation in Sudan this year (2020), their negative effects on the implementation of the 2030 Agenda for Sustainable Development, and the threat they pose to the country's stability, it is timely to study and research recent flooding incidents. As Sudan has witnessed successive floods every year during the past two decades, it is proposed to conduct a case study assessing disasters, impacts, and risk management related to the country's recent flooding incidents. The assessment will include and form the basis for recommendations and identified risk management options for building resilience of community/local authorities to cope with floods in Sudan. The case of Sudan has relevance for several countries across the Arab region that are ill prepared for, and struggle with, an increased frequency of floods. Therefore, an integrated approach to studying floods, which includes the development of complex indicators sets, will help shed light on the complex impact chains climate change effects are heaving in the reason. Understanding how natural events, exposure, social vulnerability, and adaptive capacity are interlinked will help advance more nuanced and integrated mitigation and adaptation strategies to climate change effects across the region. The best practice manual and methodology proposed by this study have the potential to inform flood responses across the entire MENA region.

Objective

Focused on the nexus between climate action and human security, the SDG Climate Facility project seeks to enhance the capacity of regional and national institutions to effectively take climate action in a way that brings benefits across SDGs and for crisis prevention/recovery efforts, including support to scale-up climate finance for innovative local solutions.

Through joint actions, the program would address two main priorities in the region that have been identified during the formulation process - to promote more integrated solutions for climate action that brings benefits across SDGs and for crisis prevention/recovery goals, and to scale up local partnerships and finance to this end. Through a combination of regional dialogues and technical assistance at the regional level, and innovation grants at the country level, the program would generate three key outcomes:

- Outcome 1: Increased awareness and understanding at the regional level of the benefits of a nexus approach to climate action for achieving benefits across the SDGs and for crisis prevention/recovery goals
- Outcome 2: Enhanced access to analysis, tools and strategies at regional level to support nexus approach to advancing climate action across the SDGs and for crisis prevention/recovery goals
- Outcome 3: Strengthened national and local capacities to effectively integrate climate change considerations into development and crisis prevention/recovery policies and to scale-up climate finance.

With this regard and as part of the AWC activities under the SDG CF Project, AWC is to prepare this study under ***activity 1.2.2 climate*** **security assessment of the nexus of climate impacts with current displacement trends to determine i) sensitivity to climate variability; ii) forecasts of future climate displacement risks; and iii) recommendations for regional strategies to prevent the role of climate change as an exacerbating force.** ***The study will also link to activity 2.3.1: Climate security risk***

assessment analyzing the role of climate change in generating long-term resource scarcity in areas of protracted crisis, exacerbating situations of conflict and displacement in the region, with particular focus on risks to women" conducted in collaboration with UN-Women in Sudan. The proposed study will focus on assessing floods in Sudan in terms of disaster impacts and risk management as a case study from the region.

This study aims at:

- Addressing the complex interaction of socioeconomic factors in the environment which increase the vulnerability of people and ecosystems, resulting in impacts on natural resources and large numbers of people becoming more vulnerable, which intensifies migration patterns.
- Enhancing the understanding of climate change impacts as key drivers for social vulnerability, and as key factors of migration, human mobility, and displacement in Sudan.
- Assessing the magnitudes and impacts of extreme events (with a special focus on floods) in Sudan, in correlation with SDGs 1, 2 and 6, through studying hotspots of climate change exposure and vulnerability in the country.
- Studying the interconnection between climate change and floods.
- Investigating the country's vulnerability and adaptability to deal with flood risk management.
- Documenting best practices of managing flood risk and recommend the appropriate ones to match the local conditions in Sudan.
- Identify possible strategies, guidelines, or frameworks of best flood risk management with the purpose of raising affected communities' resilience and to support the Republic of Sudan in implementing the Sustainable Development Goals by 2030.

Scope of Work

1. Undertaking a comprehensive overview of the nature and effects of floods in Sudan, while assessing impacts and lessons learned from other flood affected areas of the MENA region;
2. Determining the impact of climate change on the fluctuations in flood levels and the increasing rates of floods in Sudan;
3. Correlating the relationship between floods and changes in land cover and land use in Sudan;
4. Assessing the population's social vulnerability and human mobility in relationship to floods.
5. Documenting best practices for flood risk management under Sudan's conditions and outlining how such practices may be able to inform flood responses across the MENA region; and
6. Developing a strategy or guidelines for building resilience and manage flood risks in the MENA region, based on the example from Sudan, to ensure the stability of rural, pastoral, and urban communities.

Methodology

This study or consultancy assignment focuses on analyzing the nature of Sudan's floods, assessing the impact of climate change, and studying in how far human activities may exacerbate flooding. Based on case study research, the assignment also includes studying the impact of flooding events on the living

standards and population stability in Sudan. The study has the potential to make important contributions to the development of plans, strategies, and guidelines to build community resilience in managing floods risk in the country, and across the region.

Task 1: Selection of Hotspots

Sudan is composed of 18 states, almost half of which are located along the Nile and its tributaries. The latter includes the White Nile, Blue Nile, Atbara, Rahad, and Dinder Rivers. The states of Kassala and the Red Sea are home to two seasonal streams, the Gash, and the Baraka, in the eastern part of the country. Five states will be selected for closer investigation, as they represent the country's flooding hotspots. These include Khartoum, River Nile, Blue Nile, or the White Nile, Kassala and West Kordofan states. However, an overview of land use/land cover and flood impact for the remaining states will be included. Figure 1 shows the selected states, which hereafter will be referred to as the **study area**.

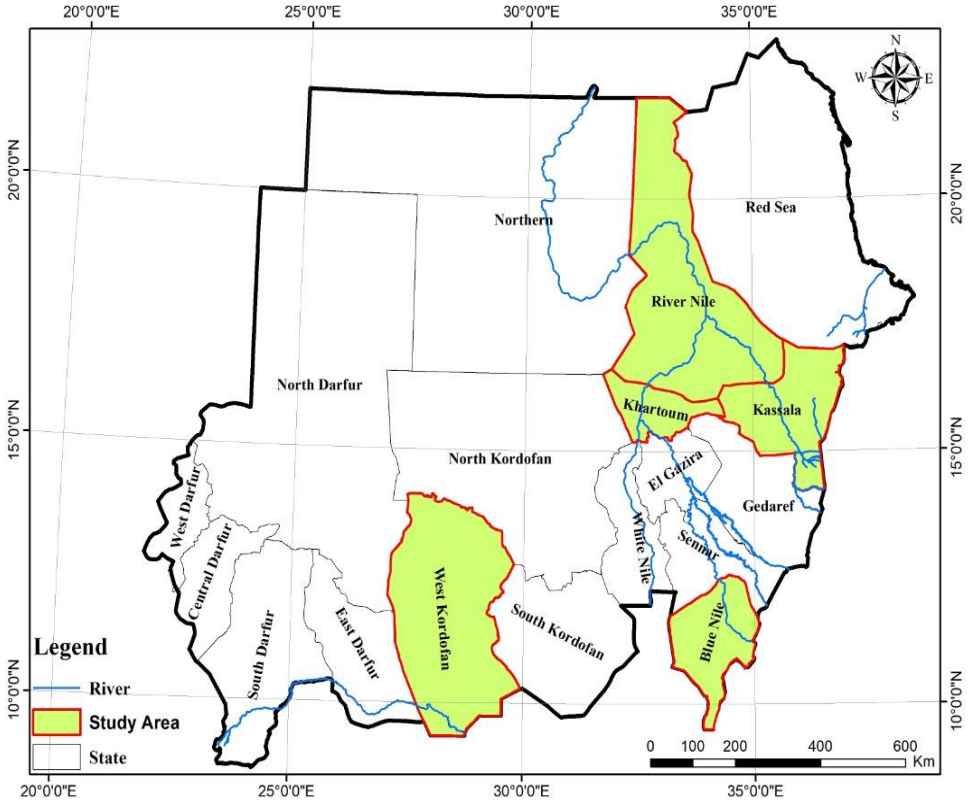

Figure 1: Flood Hotspot States in Sudan

Task 2: Analytical Framework

Considering the scope of the study the followings describe the methodology to conduct each of the elements/tasks.

- ***A comprehensive overview of the nature and effects of floods in Sudan***

To achieve this, the impacts of flash flood events of 2013, 2019 and 2020 in the study area will be assessed using an integrated, cross-sectoral approach. The steps of this integrated approaches are as follows:

- Document analysis of affected people and houses,
- Observational fieldwork in the worst flood-affected areas,
- Assessment of people's perception of causes and mitigation measures through household interviews,
- Insight into reports on drinking water quality, water-related diseases, food security, and food safety issues in the affected areas,
- Quantification of flood impact and loss pertaining to lives, livelihoods, and property.
- Social vulnerability risk assessment.
- View statistics on the volume and directions of flight, displacement and migration caused by recent flood events in Sudan to identify vulnerable groups particularly affected by displacement.

Wherever possible and available, data disaggregated by sex, age, ethnic background, and income group will be sought to enable a more nuanced assessment of flood impact on vulnerable groups.

- ***Determine impact of climate change on the fluctuations with the increasing rates of floods in Sudan***

The most common meteorological process leading to river flooding in Sudan is heavy rainfall, which can greatly increase the water level in rivers and seasonal streams, and cause water to overflow into surrounding areas. Although the magnitude of a flood is often described using the peak water level or peak river flow rate during the flood, this is only a partial indicator of flood severity. The severity of inundation by floodwaters also depends on the volume of floodwater during the portion of the event when inundation takes place. The following steps will be considered to determine the relationship between climate change and flooding:

- Review of methods to estimate changes in extreme rainfall, estimated changes in flood flows, and estimated changes in flood inundation,
- Time series rainfall data analysis,
- Watershed delineation in the hotspot states,
- Estimates of flood peaks and volumes for different return periods (5, 20, 25, 50 and 100 years).

Task 3: Determining the relationship between floods and changes in land cover and land use in Sudan

Land use / land cover is an important component of understanding the interactions of the human activities with the environment and necessary to simulate changes. Land use / land cover (LULC) changes play a major role in the study of global change where LULC and human / natural modifications have resulted in deforestation, biodiversity loss, global warming and increase of natural disaster-flooding (Mas et al, 2004). LULC alterations are generally caused by a mismanagement of agricultural, urban, range and forest lands, which can lead to severe environmental problems such as landslides, floods.

The overall objective of this task of the study is to investigate the evolution of land cover and land use in Sudan and their correlation/relationship with flood occurrences in the country. The specific objectives are:

- Identification of change in land use / land cover (LULC) in the study areas (five states) during the time period of 2000 to 2020 (pasture area, rain-fed agriculture, irrigated agriculture, dune areas, settlement, etc.). Maps will be generated for five-year periods with the year 2000 as the base year.
- Generation of flood maps in correlation with land cover and land use changes.

To analyze the land use / land cover patterns in the study area, the following method will be followed:

- Obtain subsets of multi-temporal and spectral imagery of Landsat images for the years 2000, 2005, 2010, 2015 and 2020. In case this is difficult to obtain or time consuming, available processed data will be collected from the relevant institutions,
- Use of secondary data such as topographical maps of the five states,
- Use of metrological data, and
- Use of Software packages such as ArcGIS, Afri-cover, etc. for image processing, geo-rectification, digitizing, mapping, evaluating, and analyzing of land use / land cover changes and flood evolution.

Task 4: Assessment of population vulnerability and human mobility to climate change, in relationship to floods.

Many different methods and approaches have been developed and applied to quantitatively assess vulnerability at different scales. While not without their constraints, these approaches are practical in decision-making processes since they provide a clear picture of the geographical locations of the most vulnerable populations and allow for the implementation of measures for their protection, including appropriate flood adaptation policies.

Acknowledging that the vulnerability of a certain area or system has an exogenous, biophysical dimension, as well as an internal, socio-economic dimension, it was determined to construct a vulnerability index based on the IPCC's definition of vulnerability using the indicators approach to assess socio-economic and biophysical factors contributing to vulnerability. According to IPCC's definition of vulnerability, vulnerability to climate change and variability is represented by three elements: exposure, sensitivity, and adaptive capacity. The study will view populations of rural municipalities as a vulnerable system, and climate change and climate variability as stressors. The study is based on the assumption that the largest number of rural households in the Sudanese hotspot states are dependent on agriculture, either as a main source of income or as a significant part of their livelihoods. Agriculture is highly sensitive to variations in climate, which is expected to further increase as a result of climate change.

A commonly used quantitative approach to assess vulnerability is the construction of a vulnerability index based on specific sets or combinations of indicators, which serve as proxies. Indicators to be used are as follows:

Component	Indicator
Exposure	Changes in average annual temperatures between reference periods (2000 – 2020)
	Changes in average annual precipitation between reference periods (2000 – 2020).
	Frequency of extreme months in the vegetation period (both dry and wet) in the analyzed period (2000–2020),
	Flood risk assessment for the housing sector
Sensitivity	Percentage of agricultural land
	Percentage of households engaged in agricultural production
	Percentage of rural population
	Arable land per capita
	Population density
Adaptive Capacity	Unemployment rate
	GDP per capita
	Dependency ratio
	Literacy rate
	Percentage of population with higher education
	Schools per 1000 population
	Average yield for major crops (based on the yields of sorghum, sesame, p and main fruits and vegetables)

Task 5: Documentation of best practices appropriate for flood risk management under Sudan's conditions, and assessment of its relevance for the MENA region

The methodology aims at fulfilling this task is as follows:

- Documentation of the current practices used to manage floods in Sudan, while taking into accounts some examples of flood management practices from other countries in the MENA region,
- Literature review of the best practices available, including lessons learnt from across the MENA region, and
- Recommendations of the appropriate practices to be used in Sudan,
- Extended set of recommendations and lessons learnt for flood risk management across the MENA region in the form of a short report and policy brief.

Task 6: Development of a strategy or guidelines for building resilience and to manage flood risks, ensuring the stability of rural, pastoral, and urban communities

Resilience is a concept that has emerged as a way to understand how systems prepare for, respond to, and recover from shocks (Zhou et al. 2010). Many practitioners consider increasing or building resilience an important objective in flood risk management, and resilience is often described as a desirable attribute of communities, particularly in the context of climate change (Godschalk 2003).

To be 'flood resilient', countries should have sufficient capacity to resist, the capacity to absorb and recover, and the capacity to transform and adapt. The methodology to be used in this study will be based on international comparative research to enhance Sudan's 'flood resilience' and to help decision-makers in Sudan and across the region to secure the necessary capacities to implement state-of-the-art flood management. Thus, the methodology for developing policy guidelines consists of the following steps:

- Quantify challenges and/or constraints that affect efficient flood risk management,
- Review the country's policy on emergency management, in particular floods,
- Develop a strategy or guidelines for flood management resilience, actors, and roles of actors.

Study Limitations

The study will cover the last two decades, that is the period 2000 – 2020. The study will shed light on the land use / land cover of all Sudanese states, whereas a detailed study on land use/ cover and impact on flooding will be conducted. The regional scale will be considered in regards to lessons learnt from flood prone countries in the MENA region, and in developing a methodology and best practice manual that is scalable and replicable across the region.

Activities and Responsibilities of the Consultant

The consultant shall be responsible for the accomplishment of the following duties and responsibilities:

- Drafting the study's concept note.
- Determining the scope of baseline information and refining the study's methodology.
- Conducting analysis using collected data, for a selected pilot area as a case study.
- Developing complex and multi-sectoral indicator sets that allow for a nuanced study of flood impacts and responses, and that can inform regional methodologies used in flood research, flood response mechanisms, and flood risk management.
- Conceptualizing and developing knowledge products and materials.
- Reviewing and mapping collected data, regional and national coordination mechanisms, relevant studies & literature, including lessons learnt from other parts of the region.
- Preparing and drafting the final report of results, including conclusions & recommendations.
- Any other relevant tasks that may be required to fulfil this assignment.

Deliverables and Timeline

- Portfolio of publicly available datasets and results of previous studies carried out across the region necessary to inform this study and recommendations on interventions to address data gaps.
  Due Date:
- Report on the review of flood causes and impacts in Sudan covering the last two decades that includes relevant maps.
  Due Date:
- Assessment report on floods risk and flood management in the country.
  Due Date:
- Strategy/Guidelines on best practices to effectively manage floods in Sudan, with lessons learnt and recommendations relevant to the MENA region.
  Due Date:
- Draft final report on findings and recommendations.
  Due Date:
- Discussion of findings and recommendations in a stakeholder consultation workshop.

Due Date:

- Final report
  Due Date:
- Facilitation of all technical aspects, preparation, and presentation of reports
  Due Date: Ongoing throughout the assignment
- Participation in relevant planning and coordination meetings and regular progress updates provided by email
  Due Date: Ongoing throughout the assignment

Qualifications and Experience

The consultant should have the following qualifications and working experience in the relevant field:

1. A Master's Degree or Ph.D. in a field related to climate change, risk assessment, economics and social sciences
2. A minimum of 10 years of work experience in performing environmental analysis, socioeconomic analysis, risk assessments and climate change analysis.
3. Previous experience in climate change & risk assessments or analysis at a national or a regional level in the MENA region,
4. Previous research experience on climate hazards, aid/development, experience in quantitative and qualitative data collection and analysis,
5. Excellent written and oral communication skills in English,
6. Ability to work independently and respond to feedback in a timely and professional manner,
7. Excellent organizational skills, attention to detail, and ability to contribute to a team.

Duration

The duration for completing the activities listed in this TOR is 6 months from March 2021 until August 2021.

Terms of Payment

Payment will be made based on the satisfactory submission of deliverables as follows:

- 10% upon signing of contract
- 40% upon submission of draft report
- 50 % upon submission of final report