REPUBLIC OF THE SUDAN

First Nationally Determined Contribution under the Paris Agreement

Updated October 2021

Republic of Sudan
The Higher Council for the Environment and Natural Resources

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List of acronyms

BAU	Business-as-usual
BUR	Biennial Update Report
CH4	methane
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CO_2eq	carbon dioxide equivalent
COVID-19	Corona virus disease, 2019
EbA	Ecosystem Based Adaptation
FREL	Forest Reference Emission Level
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse
GoS	Government of Sudan
GWh	gigawatt-hours (billion watt-hours)
GWP	Global Warming Potential
HCENR	Higher Council for Environment and Natural Resources
INDC	Intended Nationally Determined contribution
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
M&E	Monitoring and evaluation
M^3	cubic meters
MAL	Miscellaneous Amendments Law
MoU	Memoranda of Understanding
MRV	Monitoring , Reporting, and Verification
MSW	municipal solid waste
N2O	nitrous oxide
NAP	National Adaptation Plan
NAPA	National Adaptation Plan of Action
NDC	Nationally Determined contribution
NSF	National Solar Fund
PA	Paris Agreement
PV	photovoltaic
REDD+	Reduce Emissions from Deforestation and forest Degradation
STP	Solar Transformation Programme
TJ	terajoules (trillion joules)
TNC	Third National Communication
UNDP	United Nations Development Programme
UNDP	United Nations Environment Programme
UNFCCC	United Nations Convention on Climate Change
USD	US dollar

1. Introduction

Sudan remains highly committed to the climate change Convention and the Paris Agreement (PA). Therefore, Sudan welcomes the opportunity to submit an update to its first Nationally Determined contribution (NDC) as required under the Paris Agreement, hereby meeting its obligation under Article 4.9. This update to Sudan's first NDC is consistent with Decision 4/CMA.1 of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA). It is also consistent with Articles 3, 4 and 7 of the PA in its descriptions of mitigation and adaptation contributions that are drawn from national strategies, plans and options for low carbon and climate-resilient development. The update also reflects the results of a national process to periodically update NDCs to reflect CMA decisions, strengthen institutional arrangements/capacity, and transform NDCs into a strategic action planning framework.

There are several key elements in this update to Sudan's first NDC. Adaptation is addressed through the identification of high-priority adaptation and resilient building interventions targeting the most vulnerable sectors and disaster-prone areas. Greenhouse (GHG) mitigation is addressed through the setting of fair and ambitious GHG emission reduction targets for the period 2021-2030 in key sectors to ensure reductions from the current business-as-usual BAU) emissions trajectory harmonized with national development planning processes, objectives, priorities and circumstances.

This NDC update has also benefitted from several notable developments since the INDC submission of 2015. Thanks to support for the preparation of Sudan's Third National Communication (TNC) and first Biennial Update Report (BUR), new processes are now in place for data collection, data sharing and coordination across key institutions. In addition, several quantitative assessments have been prepared on GHG inventories, GHG mitigation analysis, forest inventories, and vulnerability assessment. Moreover, strategic directions have been developed thanks to Sudan's ongoing participation in the initiative to reduce emissions from deforestation and forest degradation in developing countries (REDD+).

2. National Circumstances

This NDC update comes at a critical time for Sudan. The historic revolution of December 2019 thrust the country onto a transitional path to real democracy and the rule of law. However, this event has aggravated difficult economic conditions stemming from the secession of South Sudan in 2011, which led to adverse economic impacts due to the loss of revenue from South Sudan oil fields and contributed to economic hardship, including markedly less economic growth, double-digit consumer price inflation, increased fuel prices etc.

The December 2019 revolution also presented new political reform challenges and opportunities. A transitional government is now in place with a mandate to carry out sweeping reforms to reverse decades of economic, social, and political decline. In this regard, the Government of Sudan (GoS) has taken bold steps towards resolving long-standing internal conflicts, unwinding economic distortions, renewing the social contract, and re-engaging with the international community. As a result, Sudan's integration with the world economy has improved in recent years. Comprehensive U.S. sanctions on Sudan, levied in 1997 and expanded in 2006, were effectively lifted in 2020, allowing previously

banned financial and trade transactions between global entities and their Sudanese counterparts.

However, the combination of the global economic crisis and domestic limitations triggered by COVID-19 has led to a decline in GDP in recent years. The crisis has also significantly lowered government revenues while increasing costs for healthcare, leading to steeper deficits and resulting higher inflation. The country has also been afflicted with devastating flooding in July-September of 2020 that led to at least 100 fatalities and the destruction of 100,000 homes affecting over 500,000 people, prompting a declaration of a state of emergency.

Sudan is already experiencing the impacts of climate change. Over the past three decades, climate changes have led to crop failures in traditional rain-fed faming, the backbone of the Sudanese economy. It has also led to severe impacts to pastoralist activities such as the deterioration of natural rangelands, an increase in seasonal fires, overgrazing in communal lands, and livestock deaths. Such impacts are deepening already profound poverty levels across rural communities in Sudan.

About two-thirds of Sudan's primary energy supply consists of renewable resources - biomass and hydro. Its electric system is largely hydro-dependent, making up over 50% of annual electricity generation. While there is a substantial stock of fossil fuel infrastructure in the energy sector, it is oil-based – there are high carbon intensity fuels like petroleum coke used in the country. Sudan has substantial renewable energy resources such as solar, hydro, wind, geothermal, and biomass. At present, except for large hydro and biomass, renewable resources remain largely untapped. To take advantage of the increasingly favorable economics of renewable energy technology in a transition to low carbon development, climate financing and other forms of support will be needed as specified in Articles 9, 10 and 11 of the PA in reference to support needed by developing countries.

The update of Sudan's first NDC reflect several developments in national priorities and circumstances. First, the awareness of climate change among policymakers has shifted from a topic mostly associated with future risk to a present-day threats involving enormous social and economic stakes. This was never more evident than by the record flooding experienced in consecutive years, 2020 and 2021 that affected seventeen of Sudan's eighteen states. Second, there are improvements in the information available on the costs of policies and measures to mitigate future growth of GHGs in priority sectors as well as the costs of adaptation in key vulnerable sectors and systems. Third, Sudan is intent on taking advantage of green growth opportunities that decouple economic growth from GHG emissions. This will tap Sudan's rich renewable resource endowment that is so essential for low carbon and climate-resilient development while at the same time promote investment and the creation of new jobs.

Since the submission of its INDC in 2015, Sudan has made progress in implementing its response to climate change within the context of addressing the country's pressing development challenges. On the GHG mitigation front, energy, forestry, and waste continue to be key areas for achieving future GHG reductions and sustainable development objectives. Key circumstances are briefly summarized in the bullets below:

- *Energy:* A Solar Transformation Programme (STP) was launched in 2020 to take advantage of opportunities around decentralized renewable energy solutions to provide

cost-effective, rapidly deployable, and reliable alternatives for expanding electricity access to rural communities in Sudan. Based on GoS resolution 58/2017, all solar powered irrigation equipment is exempted from customs and other fees. Moreover, the Ministry of Finance has extended the tax and duty exemptions to all components of solar pumping systems for drinking water.

- *Forestry:* The forestry sector accounts for about 12% of GDP, provides 15% of the jobs in rural areas, support rural economy with a variety of non-wood forest products (Sudan is largest producer of Gum Arabic), comprises 30% of the feed source for livestock, and contributes more than 60% to primary energy supply. Nevertheless, there has been sustained deforestation over the last two decades at the rate of about 1.75 thousand km^2/year, caused mainly by agricultural expansion, overgrazing and unsustainable wood extraction for energy purposes. In response, Sudan submitted its first sub-national Forest Reference Emission Level (FREL) to the UNFCCC in 2020 as part of its national REDD+ Strategy implementation process. In that FREL, forests accounted for net emissions of about 0.94 million tonnes of CO_2eq, 1.22 million from deforestation and removals of 0.29 million from enhancement of forest carbon stocks.

- *Waste:* Little progress can be reported regarding waste management in Sudan. It remains among the most pressing environmental problems facing the country, given the increasing quantity of municipal solid waste (MSW) and its effects on public health and the economy. In 2017, 11.8 million tonnes of MSW was generated with only 13% disposed of at managed waste disposal sites. Most of the rest (44%) is directed to unmanaged waste disposal sites and a considerable amount (15%) is openly burned which causes local air pollution and public health impacts. While some recycling occurs, it is ad hoc and not subject to regulation. Wastewater management is similarly problematic with most of the approximately 50.6 thousand m^3/day generated mainly by industrial activities either dumped in shallow, unmanaged landfills or disposed in nearby areas.

Regarding adaptation to climate change, water, agriculture, public health, and coastal zones continue to be priority sectors and systems for building resilience to climatic risks. Key circumstances are briefly summarized in the bullets below

- *Water:* Half of Sudan's population lives on about 15% of the land, mostly near the River Nile. Hence, water resources are extremely important to Sudan's continued economic development and social cohesion. Sudan's National Adaptation Plan (NAP) of 2016 identified actions to protect water resources and reduce vulnerability to climate change in all 18 states of Sudan. The major proposed adaptation measures included water harvesting, efficiency irrigation technology, and improving water management practices. The range of water-related adaptation options was determined through systematic and bottom-up consultative processes at the state level which had the accompanying benefit of raising awareness and integrating adaptation concerns into community dialogues.

- *Agriculture:* In Sudan, the link between climate and livelihoods is very strong, as rain-fed crop production accounts for nearly 90% of the cultivated area and about two thirds of the population depend on rain-fed agriculture. The dependence on rainfall in the context of increasing erratic rainfall patterns is an inherent vulnerability and a key factor in Sudan's future economy, livelihoods, and food security. While the country enjoys an abundance of arable lands and favorable soil characteristics which have allowed the

country to grow a wide variety of perennial crops in different regions, agricultural productivity has declined precipitously. Since the secession of South Sudan in July of 2011, agriculture has declined to less than 40% of its post July 2011 levels. Livestock-raising is a risk hedging strategy among farmers but deteriorating rangeland productivity due to overgrazing of communal pastures poses a chronic challenge.

- *Public health:* Health risks are increasing in Sudan due to climate change, particularly in relation to water and vector borne diseases. Flash floods have led to contamination of water supplies and increased cases of diarrhea and cholera. Vector breeding zones have expanded in terms of coverage and intensity due to changes in precipitation and exposure-time linked to changes in seasonal patterns. In combination with water collecting in debris left after flood events, vector borne diseases such as malaria, dengue and chikungunya have increased. With communities increasingly exposed to risks, Sudan is considered a high burden and high-risk country for vector borne disease, particularly malaria. Despite the NAP's recommendation that climate risks and related health impacts need to be integrated into health planning and budgeting to inform the necessary adaptation measures current health policies and strategies do not fully consider potential climate change impacts.
- *Coastal zones:* Sudan's coastal zones along the Red Sea extend for about 800 km and are locations of rich marine biodiversity. These areas are facing a range of climate change threats associated with a rising ocean temperatures which can harm corals; increased concentrations of carbon dioxide in the sea surface which can lead to Red Sea acidification, and rising sea levels which can force inland migration of mangroves and adversely impact coastal communities, especially fisherfolk who depend on the Red Sea for about 8,000 tonnes per year of a wide variety of commercial fish species.

3. Mitigation component of the updated NDC

In addition to the discussion in the subsections below, specific details on Sudan's updated GHG reduction targets for 2030 are provided in Table 3-3 below, in accordance with the guidance specified in Annex I of decision 4/CMA.1.

3.1. Approach to establishing GHG emission reductions

Sudan intends to pursue implementing low carbon development interventions in three sectors - energy, forestry and waste, The measures chosen to achieve GHG emission reductions are consistent with Sudan's national development priorities, objectives and circumstances.

Sudan's approach to updating its NDC emission reduction target accounts for its status as a Least Developed Country (LDC) as considered in Art.4.6 of the PA. Nevertheless, Sudan considers these updated emission reduction targets to reflect the highest possible ambition in the light of national circumstances and as a fair contribution to the long-term global mitigation goal. The updated targets have been established based on the assumption that support will be provided to Sudan as set out in the Paris Agreement's Articles 9, 10, 11 and 13 for achieving the targets.

3.2. Methodological basis

The coverage and scope of the mitigation targets in this updated NDC are the same as for the INDC (2015), namely energy, forestry, and waste. The basis for estimating GHG emissions to inform Sudan's updated NDC emission reduction targets is based on the national GHG inventories prepared for the years 2012 through 2017 using the 2006 IPCC Guidelines, which will be submitted as part of Sudan third National Communications and the first BUR. The current inventory uses Global Warming Potential (GWP) values from the IPCC's 5th Assessment Report.

The methodological basis for projecting emissions under a BAU scenario for the period beyond 2017 is based on the use of national emission inventories for 2012-2017 in combination with the latest national development plans for the energy, forestry and waste sectors to estimate total emissions in each of these sectors in the year 2030. Additional detail is provided in the table below on "information to facilitate clarity, transparency and understanding" (Table 3-3).

3.3. Emission reduction targets for 2030

An overview of Sudan's updated projected total emissions and projected emission reduction targets is provided in Table 3-1 below, with the detailed mitigation contributions in Table 3-2 provided as information to facilitate transparency, clarity and understanding as specified in Annex I to decision 4/CMA.1 in table 3-3. The term "GHG emissions" in Tables 3-1 and 3-2 is defined on a net basis that accounts for removals by sinks in the forestry sector.

Table 3-1: Summary of Sudan's updated NDC mitigation targets

Sector	Projected GHG emissions in 2030 without mitigation actions (tonnes CO2e)	GHG emission reductions in 2030 (tonnes CO2e)	Projected GHG emissions in 2030 with mitigation actions (tonnes CO2e)	Percent reduction (%)
Energy (non-biomass)	33,181,563	12,458,008	20,723,555	38%
Forestry & Energy (biomass)	29,450,936	13,384,246	16,066,690	45%
Waste	6,394,907	1,278,822	5,116,085	20%

Table 3-2: Details underlying Sudan's updated NDC mitigation targets

Sector	#	Measure	BAU emissions in 2030	Impact	Units	Emission reductions in 2030 (tonnes CO2e)	Cost (million USD)
Energy (non-biomass)	1	Utility scale grid connected Solar and wind power plants		5,056	GWh of fossil-fired electricity displaced	3,574,580	1,872
	2	Stand alone and mini-Grid for residential, agricultural, and industrial sectors		1,529	GWh of BAU grid electricity displaced	1,086,360	846
	3	Hydro-generation plant rehabilitation		37		26,221	6
	4	reduction of electric transmission and distribution losses		1,213		857,506	210
	5	Energy efficient appliances in residential sector		2,295		463,759	5

Sector	#	Measure	BAU emissions in 2030	Impact	Units	Emission reductions in 2030 (tonnes CO2e)	Cost (million USD)
	6	Transport initiatives (mode switching - cars to buses in Khartoum, river transport and trucks to rail; use of biofuels (10%); light duty vehicle fuel economy improvements)		88,909	TJ of diesel and gasoline displaced	6,449,582	1,000
		subtotal	33,181,563			12,458,008	3,939
Energy (biomass)	7	Biomass savings through improved cookstoves for over 300,000 rural households (REDD+ ERP)		338,686	m^3 of firewood saved	699,139	5
	8	LPG as substitute for biomass/charcoal in 10% of urban population		55,100		113,741	11
	9	Improved cookstoves as replacement for traditional inefficient wood stoves for 20% of rural population		941,728		1,943,979	41
Forestry	10	Restoration and sustainable management of degraded forest reserve and Gum Arabic belt; Afforestation and restoration of degraded lands in 10% of rainfed areas and 5% of irrigated agriculture scheme areas; Restoration/conservation of mangrove forests in Red Sea State		1.7	million hectares	8,164,805	120
	11	Implementation of the National REDD+ Strategy in Blue Nile, Gadarif and Sinnar States		0.51	million hectares	2,462,582	37
		subtotal	29,450,936			13,384,246	214
Waste	12	Composting 60% of organic and recycling 15%, of the total waste		4,761,065	tonnes of solid waste avoided	323,752	240
	13	Establishment of landfills in all large urban areas of Sudan		5,665,667		453,253	
	14	Integrated solid waste management		6,243,796		437,066	
	15	Waste water treatment, sludge to biogas for electricity generation		1,295,010	tonnes of wastewater avoided	64,750	
		subtotal	6,394,907			1,278,822	240

Table 3-3: Information to facilitate clarity, transparency and understanding of NDCs

Provisions and sub-provisions of Annex I to decision 4/CMA.1	Information provided in the updated Sudan NDC
1. Quantified information on the reference point, (including, as appropriate, a base year)	
a. Reference year(s), base year(s), reference period(s) or other starting point(s)	Reference: Business-as-Usual (BAU) estimated projected emissions in 2030
b. Quantifiable information on the reference indicators, their values in the reference year(s), base year(s), reference period(s) or other starting point(s), and, as applicable, in the target year	BAU estimated projected emissions in 2030: • Energy (non-biomass): 33,181,563 tCO2e • Forestry & Energy (biomass): 29,450,936 tCO2e • Waste: 6,394,907 tCO2e
c. For strategies, plans and actions referred to in Article 4, paragraph 6, of the Paris Agreement, or polices and measures as components of NDCs where paragraph 1(b) above is not applicable, Parties to provide other relevant information	All contributions are based on national strategies and plans
d. Target relative to the reference indicator, expressed numerically, for example in percentage or amount of reduction	The updated Sudan NDC defines mitigation targets as fixed level GHG emission reductions in 2030 relative to the BAU level in that year, as summarized below: • Energy: 12,458,008 tCO2e • Forestry: 13,384,246 tCO2e • Waste: 1,278,822 tCO2e
e. Information on sources of data used in quantifying the reference point(s)	• GHG mitigation analysis for the TNC (prepared by HCENR) • GHG inventory for the TNC/BUR (prepared by HCENR) • Renewable Energy Master Plan 2020 (prepared by Ministry of Energy) • Electricity Strategy 2019 -2035 (prepared by Ministry of Energy) • Sudan-Forest Emission Reference level. 2020 (prepared by Forest National Corporation) • National REDD Strategy 2021 (prepared by Forest National Corporation) • National forest inventory 2020 (prepared by Forest National Corporation) • Waste management policy 2020 (prepared by Khartoum State Environment Council)
f. Information on the circumstances under which the Party may update the values of the reference indicators	Improvements in national data collection protocols and GHG mitigation analysis methods and tools during 2021-2030
2. Time frames and/or periods for implementation	
a. Time frame and/or period for implementation, including start and end date, consistent with any further relevant decision adopted by the CMA;	Time frame for implementation is 2021 - 2030. Due consideration will be given to any further decisions adopted by the CMA
b. Whether it is a single-year or multi-year target, as applicable.	Single year

Provisions and sub-provisions of Annex I to decision 4/CMA.1	Information provided in the updated Sudan NDC
3. Scope and coverage	
a. General description of the target;	The contributions cover the key sectors in Sudan, the targets are planned to ensure deviation from the current BAU trajectory in the development of the targeted sectors
b. Sectors, gases, categories and pools covered by the nationally determined contribution, including, as applicable, consistent with IPCC guidelines;	• Energy: (i) Electricity production: {1.A.1.a}, gases covered; CO_2, CH_4, N_2O (ii) Transport CO_2, CH_4, N_2O • Forestry: Forestland and Croplands ; gases covered CO_2, • Waste: Municipal solid and liquid waste ; gases covered CH_4, CO_2
c. How the Party has taken into consideration paragraphs 31(c) and (d) of decision 1/CP.21;	Sectors which were not included are because of reasons relating to national circumstances, such as lack of need good quality data
d. Mitigation co-benefits resulting from Parties' adaptation actions and/or economic diversification plans, including description of specific projects, measures and initiatives of Parties' adaptation actions and/or economic diversification plans.	Adaptation actions with likely mitigation co-benefits are described in the adaption component of this NDC document, however, not quantified, thought in some priority adaptation may be significant
4. Planning process	
a. Information on the planning processes that the Party undertook to prepare its NDC and, if available, on the Party's implementation plans, including, as appropriate:	The mitigation contribution was prepared as part of the national climate change programme, with participation of all climate related stakeholders, sectors and institutions at the national and sub-national levels, with more than 40% women participation. The process for preparing the NDC involved: • High-level national climate change committee with membership from over 20 institutions including government, Research, Academia, CSOs • Technical committee consist of membership of the same above-mentioned institutions in addition to private sector, (including working groups) • Consultation workshops including inception, mitigation, adaptation, and validation. • Training and capacity building on planning and project preparation • Team of national consultants • Government (Cabinet) endorsement • Work is ongoing on planning, implementation strategy, MRV, training, etc
i. Domestic institutional arrangements, public participation and engagement with local communities and indigenous peoples, in a gender-responsive manner;	Covered above
ii. Contextual matters, including, inter alia, as appropriate:	
a. National circumstances, such as geography, climate, economy, sustainable development and poverty eradication;	The contributions are defined in the context of national development priorities, objectives and circumstances. They cover all regions of Sudan, various stakeholder

Provisions and sub-provisions of Annex I to decision 4/CMA.1	Information provided in the updated Sudan NDC
	groups , including poor vulnerable communities, private sector, etc. Sudan's updated NDC is in line with Art 4.6 of the Paris Agreement, which stipulates that LDCs may prepare and communicate strategies, plans and actions for low greenhouse gas emission development. Most of the contributions presented in this updated NDC are drawn from national plans and strategies
b. Best practices and experience related to the preparation of the nationally determined contribution;	Ownership, the technical committee, national consultants, national plans and strategies, consultations, technical studies and reports produced during the updating process, including • Adaptation priorities • Mitigation priorities • Involvement of Private sector • Gender, environmental and social considerations
c. Other contextual aspirations and priorities acknowledged when joining the Paris Agreement;	Not applicable
b. Specific information applicable to Parties, including regional economic integration organizations and their member States, that have reached an agreement to act jointly under Article 4, paragraph 2, of the Paris Agreement, including the Parties that agreed to act jointly and the terms of the agreement, in accordance with Article 4, paragraphs 16–18, of the Paris Agreement;	Not applicable
c. How the Party's preparation of its NDC has been informed by the outcomes of the global stocktake, in accordance with Article 4, paragraph 9, of the Paris Agreement;	Not applicable
d. Each Party with an NDC under Article 4 of the Paris Agreement that consists of adaptation action and/or economic diversification plans resulting in mitigation co-benefits consistent with Article 4, paragraph 7, of the Paris Agreement to submit information on:	Not applicable
i. How the economic and social consequences of response measures have been considered in developing the NDC;	Not applicable
ii. Specific projects, measures and activities to be implemented to contribute to mitigation co-benefits, including information on adaptation plans that also yield mitigation co-benefits, which may cover, but are not limited to, key sectors, such as energy, resources, water resources, coastal resources, human settlements and urban planning, agriculture	Not applicable

Provisions and sub-provisions of Annex I to decision 4/CMA.1	Information provided in the updated Sudan NDC
and forestry; and economic diversification actions, which may cover, but are not limited to, sectors such as manufacturing and industry, energy and mining, transport and communication, construction, tourism, real estate, agriculture and fisheries.	
5. Assumptions and methodological approaches, including those for estimating and accounting for anthropogenic greenhouse gas emissions and, as appropriate, removals:	
a. Assumptions and methodological approaches used for accounting for anthropogenic greenhouse gas emissions and removals corresponding to the Party's NDC, consistent with decision 1/CP.21, paragraph 31, and accounting guidance adopted by the CMA;	Methodology: 2006 IPCC Guidelines Common metrics: IPCC Fifth Assessment Report
b. Assumptions and methodological approaches used for accounting for the implementation of policies and measures or strategies in the NDC;	Not applicable to Sudan's updated NDC as the targets are expressed in GHG emission reduction terms rather than in terms of policy goals.
c. If applicable, information on how the Party will take into account existing methods and guidance under the Convention to account for anthropogenic emissions and removals, in accordance with Article 4, paragraph 14, of the Paris Agreement, as appropriate;	2006 IPCC guidelines and IPCC Fifth Assessment Report
d. IPCC methodologies and metrics used for estimating anthropogenic greenhouse gas emissions and removals;	2006 IPCC guidelines and IPCC Fifth Assessment Report
e. Sector-, category- or activity-specific assumptions, methodologies and approaches consistent with IPCC guidance, as appropriate, including, as applicable:	
i. Approach to addressing emissions and subsequent removals from natural disturbances on managed lands;	Not significant, 2006 IPCC guidelines will be used, when needed
ii. Approach used to account for emissions and removals from harvested wood products;	Not applicable, no national data are available in the near future on HWPs
iii. Approach used to address the effects of age-class structure in forests;	Not applicable, no national data are available in the near future on effect of age-class structure
f. Other assumptions and methodological approaches used for understanding the NDC and, if applicable, estimating corresponding emissions and removals, including:	
i. How the reference indicators, baseline(s) and/or reference level(s),	Data availability was a major limiting factor I the estimation of BAU 2030, Therefore a

Provisions and sub-provisions of Annex I to decision 4/CMA.1	Information provided in the updated Sudan NDC
including, where applicable, sector-, category- or activity-specific reference levels, are constructed, including, for example, key parameters, assumptions, definitions, methodologies, data sources and models used;	series of steps have been undertaken including: 1. Collecting available data: • Gathering all the information available from official reports and government entities; • Consolidating (excel sheet) and cross-checking information extracted including through external sources, this process reveal number of inconsistencies between data sources; and • The INDC, the Second national communication (SNC), the Technology Needs Assessment and report and studies prepared in the context pf preparation of Sudan's third national communication found to contain the best available data to date in terms of GHG inventory and mitigation options considered. However, the data from SNC was affect by secession of Sudan into South Sudan and Sudan in 2011. There is no disaggregated data available for targeted sectors and sub-sectors 2. Review of definition of national sectors and sub-sectors in the context of 2006 IPCC guidelines, based on the national inventory data 3. Based on the data obtained, CO2 equivalents (CO2e) were aggregated and calculated using the IPCC Fifth Assessment Report's global warming potentials (2014) 4. Extrapolations (mostly but not exclusively linear) were run in order to build a business-as-usual (BAU) baseline for the 2022-2030. 5. Electricity production : fuel consumption data for thermal power generation or transportation , emission calculation based on tier 1 of IPCC, While the year of the most recent data varies per sources, most sources have 2015 as their most recent data point. Emissions for the 2016-2030 period were then linearly extrapolated from existing data for electricity generation and manufacturing segments. 6. Transportation : While the most recent data varies per sources, most sources have 2013 or 2015 as their most recently data point. Emissions for 2016-2030 were then linearly extrapolated from existing data. 7. Waste: Quantity and fractional distribution generated per capita as per official document. While the most recent data varies per sources, most sources have 2015 as their most recently data point. Emissions for 2016-2030 were then linearly extrapolated from existing data. 8. Forest: For forestry sector, linear extrapolation did not seem appropriate to forecast baseline emissions for 2022-2030 period, instead population growth in Sudan was

Provisions and sub-provisions of Annex I to decision 4/CMA.1	Information provided in the updated Sudan NDC
	used as leading indicator to forecast emissions change from deforestation. Sub-national FRL is constructed following the agreed UNFCCC REDD+ guidance and has been technically assessed by the UNFCCC.
ii. For Parties with NDCs that contain non-greenhouse-gas components, information on assumptions and methodological approaches used in relation to those components, as applicable;	Not applicable
iii. For climate forcers included in NDCs not covered by IPCC guidelines, information on how the climate forcers are estimated;	Not applicable
iv. Further technical information, as necessary;	Not applicable
g. The intention to use voluntary cooperation under Article 6 of the Paris Agreement, if applicable.	Sudan does not exclude the use of voluntary cooperation under Art. 6 the Paris agreement
6. How the Party considers that its NDC is fair and ambitious in light of its national circumstances	
a. How the Party considers that its NDC is fair and ambitious in the light of its national circumstances;	Sudan's updated mitigation contributions are considered fair and ambitious given its obligations under the UNFCCC and PA, in particular Art 4.6 of the Paris Agreement. The updated contributions are also ambition compared to the 2015 INDC and are in line with the development in the national development objectives, priorities and circumstance
b. Fairness considerations, including reflecting on equity;	
c. How the Party has addressed Article 4, paragraph 3, of the Paris Agreement;	
d. How the Party has addressed Article 4, paragraph 4, of the Paris Agreement;	
e. How the Party has addressed Article 4, paragraph 6, of the Paris Agreement.	
7. How the NDC contributes towards achieving the objectives of the Convention as set out in its Article 2	
a. How the NDC contributes towards achieving the objective of the Convention as set out in its Article 2;	The updated NDC include targets and priorities on emission reduction, avoidance of emissions and carbon removal that area consistent with Art.2 and 4.1 of the Paris Agreement.
b. How the NDC contributes towards Article 2, paragraph 1(a), and Article 4, paragraph 1, of the Paris Agreement.	

4. Adaptation component of the updated NDC

This adaptation communication is submitted by Sudan as the component of its NDC and is consistent with Article 7, paragraph 11 of the PA. It is also aligned with the Elements for an adaptation communication described in the Annex to decision 9/CMA.1.

4.1. National circumstances, institutional arrangements and legal frameworks

Climate change represents significant threat to food security and sustainable development in Sudan, with more than 70% of the population dependent on sectors and systems that are highly vulnerable to climate change. National vulnerability assessments have identified water, agriculture, coastal zones and public health as the most vulnerable sectors. Since the completion of its National Adaptation Plan of Action (NAPA) in 2007, Sudan has consistently prioritized building climate resilience into these sectors and mainstreaming adaptation actions within development plans and strategies.

The adoption of the National Adaptation Plan in 2016 by the Sudanese government was an important milestone in establishing a clear and actionable framework for adaptive, flexible and decisive action to reduce climate change risks. It called for businesses to undertake wide-ranging adaptation investments linking successful operations with risk reduction practices and emergency management arrangements. It also introduced a framework for developing new land use arrangements, decentralized management systems, and legislative initiatives to reduce exposure to gathering risks from climate change. Finally, the NAP outlined the needs for new partnerships ranging from state governments to international donors; from the household sector to the private sector; and from one end of the national institutional spectrum to the other.

The passing of the Miscellaneous Amendments Law (MAL) in 2020 is another important milestone for strengthening institutional coordination to meet climate change and other pressing environmental challenges. The MAL replaces the 2001 Environmental Law and unified the disparate Environment Councils operating in Sudan. The MAL established the Higher Council for Environment and Natural Resources (HCENR) as the sole Environmental Council, which is chaired by the country's Prime Minister. In addition to its previous role for protection of the environment and natural resources, the HCENR has now assumed responsibilities previously associated with the National Council to Combat Desertification and the National Biosafety Council. The amended law represents a good opportunity for mainstreaming climate change considerations into national plans and strategies.

Since the submission of its INDC in 2015, Sudan has identified and been implementing adaptation measures across the 18 states of the country to build resilience in vulnerable sectors. This adaptation component has been informed by these activities as well as the ongoing NAP Readiness project (2021-2022) that emphasizes capacity building, institutional coordination, and enhancing climate change data/information systems for supporting mid-/long-term adaptation planning. This adaptation component is also informed by the recently completed vulnerability assessment of crop production and livestock to climate change for the TNC.

Sudan's adaptation component is informed by and premised on Article 3, 7, 9, 10, 11 and 13 of the PA. The national adaptation priorities, support needs, plans and actions identified in Table 4-1 below identifies 12 adaptation priority initiatives across water, agriculture, public

health and coastal zone that will, if implemented at a cost of roughly 3.85 billion USD, enhance adaptive capacity, strengthen resilience, reduce vulnerability to climate change, and contribute to climate-resilient, sustainable development. Information on other elements of the adaptation communication as required under Decision 9/CMA.1 is provided in the subsections that follow.

4.2. Impacts, risks and vulnerabilities

Climatic trends of increased rainfall variability, lower annual rainfall amounts, steadily increasing temperatures and more frequent extreme events such as flooding and drought are evident across all of Sudan's 18 states. The major physical impacts of these trends is briefly outlined in the bullets below.

- *Reduction in ecosystem integrity and resilience, and a decline in biodiversity.* There has been degradation of rangelands because of Sahel's drought with permanent losses of pasture species, both woody and herbaceous. Moreover, almost all states report that the species composition of natural vegetation has changed; some tree and grass species have become either extinct or seriously endangered; and there has been a sharp decrease in the extent of gum-yielding trees (*Acacia Senegal* and *Acacia seyal*).
- *Decline in crop suitability.* Given the dominance of rainfed agricultural practices, rainfall variability/reduction trends have had severe adverse impacts on both crop suitability and yields. Some crop varieties (i.e., sorghum, millet), in successful cultivation since the 1960s, are no longer viable. For example, in Gedarif state, native sorghum species (*Mugut*) are unable to develop under conditions of reduced rainfall and have been entirely replaced with another local sorghum species (*Geshaish, Arfagadmk-8*). In many states practicing horticulture, there has been a reduction in fruit production due to increase of flowers abortion due to temperature increases.
- *Decline in crop and gum yields.* Shorter rainy seasons have increased risks for long-cycle crops to run out of growing time, leading to increased incidence of total crop failure. Modeling studies confirm this trend will continue for major crops (i.e., sorghum, millet, wheat, sesame, faba bean) as well as a reduction in gum Arabic belt in Kordofan over the 2030-2060 period. Subsequent studies have found many downstream issues that are associated with reduced yields associated with lower rainfall and drought-induced degradation of natural environments. These issues include a decrease of farmers income; more women-headed households as men abandon agriculture for income-earning opportunities in urban centers; an increase of agricultural pests and diseases; and a decrease of forest cover and the disappearance of some tree species altogether (e.g. Tamarind, Ebony).
- *Impacts on livestock production.* Major trends observed across all states is a progressive deterioration of livestock viability due to increasing temperature trends. Heat stress decreases forage intake, milk production, efficiency of feed conversion and performance, and reduces reproductive efficiency, with increases in extreme temperature trends by 1 to 5 degrees Celsius leading to increased mortality risk in grazing animals. As a coping strategy, many sheep and cattle farmers in Kordofan, Darfur and Gadarif states have adopted night grazing during the dry season to avoid high heat loads on their animals during the day. Data collected on the number of disease cases

brought to veterinary hospitals in East Darfur State during the period 2012-2017 indicated an upward trend in livestock disease incidence.

Table 4-1: Sudan's adaptation priorities

Vulnerable sector	Adaptation acti on #	Adaptation priority	Goal(s)	Relevance to national context	Main Outputs	Responsible institution(s)	Mitigation co-benefits	Cost (million USD)
Water	1	Enhancing rural water supply	Achieve access and sustainable utilization of water resources, increased water resilience of households in vulnerable rural areas, through supply of water (for both human and livestock) to all vulnerable states/localities in Sudan, including schools and health facilities.	• Water Resources 2021-2031 Strategy (Water Supply Transformation Strategic Plan); • National Policy on Drinking Water, Sanitation and Hygiene, 2011 (draft) and updated draft 2018; and • Sudan Country Strategy on Integrated Water Resources Management, 2007. NAP, NAPA	• Reach 100 % access to water supply in vulnerable rural, farmers and pastoralist areas. • Development and rehabilitation of water infrastructure: Water yards: 7765 - Mini water yards: 4,360 - Hand pumps, protected wells: 10,825 - Haffir/dam w/ treatment: 548 - Household or compound networks: 3,107513= 15,537,565 people • Strengthening relevant institutions and stakeholders at the national and sub-national levels	Ministry of Irrigation and Water Resources (MoIWR) relevant institutions and states	Reduced emissions associated with water access & transportation and emissions related to water extraction & pumping using solar energy	2,100
	2	Building resilience against floods	Build resilience, reduce risks, prevent loss of lives and assets, improve access irrigation facilities and reduce poverty in floods prone areas in vulnerable States in Sudan	• Water Resources 2021-2031 Strategy (Water Supply Transformation Strategic Plan); • National Policy on Drinking Water, Sanitation and Hygiene, 2011 (draft) and updated draft 2018; and • Sudan Country Strategy on Integrated Water Resources Management, 2007. NAP, NAPA	• Risk assessment and mapping of areas vulnerable to risks of floods; • Strengthening preparedness and early warning system; • Enable forecasting of extreme weather events including through: ➢ Installation and operation of automatic water level instruments with satellite-based transmission technology; ➢ Implementation and installation of Telemetry monitoring on key stations; ➢ Implementation and Installation of automatic loggers and management of key locations in Sudan; and ➢ Improved water harvesting and water management practices introduced in an estimated total of 500,000 Ha, taking stock of successful pilot interventions such as those in Wadi El KU in Darfur and the Gash Basin in Kassala.	MoIWR and relevant institutions and states	None	100
	3	Sustainable water management	Introduce good quality water data, including data management, sharing and use, for climate sensitive ground and surface water resources in Sudan	• Water Resources 2021-2031 Strategy (Water Supply Transformation Strategic Plan); • National Policy on Drinking Water, Sanitation and Hygiene, 2011 (draft) and updated	• Institutional Capacity building and Development, Program Management, and Enabling Environment; • Sector reform, including policy, legal aspects such as laws and proclamations for water supply, Preparation of applicable guidelines, manuals; • Smart IT used in the Nile and upscaled to all major catchments; • National Map for potential water resource use and	MoIWR and relevant institutions and states	None	20

Vulnerable sector	Adaptation acti on #	Adaptation priority	Goal(s)	Relevance to national context	Main Outputs	Responsible institution(s)	Mitigation co-benefits	Cost (million USD)
				draft 2018; and • Sudan Country Strategy on Integrated Water Resources Management, 2007. NAP, NAPA	recharge; • Monitoring station for seasonal rivers (non-Nile); • Treatment plant/compact units Household or compound networks; • Good quality water data that is better managed, shared and applied; • Risk analysis incorporated in MoIWR regulatory strategy; and • Communities programme to reduce water consumption			
	4	Resilient small scale pump irrigation	Introduce smart irrigation technologies (solar pumps, precision irrigation) to improve water management in targeting area of vulnerable farmers, livestock.	• Water Resources 2021-2031 Strategy (Water Supply Transformation Strategic Plan); • National Policy on Drinking Water, Sanitation and Hygiene, 2011 (draft) and updated draft 2018; and • Sudan Country Strategy on Integrated Water Resources Management, 2007. NAP, NAPA	• Structure and develop sustainable water services, in order to improve people's living conditions; • Introduction of modern, climate friendly, sustainable irrigation systems; • Create some 25,000 employment opportunities for Sudanese people; • Provision of affordable and reliable irrigation supplies to support livelihood security of farmers and pastoralists; and • Improve equitable access to irrigation facilities through expansion of groundwater use for small scale irrigation, particularly in areas distant from Nile River.	MoIWR and relevant institutions and states	None	150
Agriculture	5	Building resilience of crop production	Increase resilience of vulnerable main crop production systems to climate change, to improve socio-economic conditions, reduce poverty and contribute to achieving SDGs.	• Ministry of Agriculture's and forestry 2021-2023 Programme for Stability and Economic Development; • Sudan Comprehensive Africa Agriculture Development Programme (CAADP) 2016-2020 (updated 2020-2023)	• Adoption of improved adaptation technology e.g., drought and heat tolerant seeds and soil conservation and efficient tillage practices; • Improved crop management practices through post-harvest and value addition practices; • Water harvesting and integrated solutions in place in the traditional rain subsector; • Sustainable solution and technologies, such as solar systems, in place in the irrigated subsector	Ministry of Agriculture and forests (MoAF) and relevant state governments	Conservation of soil carbon, reduced emissions through use of solar technology instead of diesel	100
	6	Climate resilient agriculture	Build enabling environment for climate resilient development in the agriculture and related sectors	• Ministry of Agriculture's and forestry 2021-2023 Programme for Stability and Economic Development; • Sudan Comprehensive Africa Agriculture Development	• Adoption and implementation of climate change related policies; • Strengthened climate monitoring and early warning systems; • Introduction of weather-indexed crop insurance; • Provision of national and on-farm reserves storage of grains during good harvests ; • Provision of agricultural and rural finance;	MoAF and relevant state governments	None	80

Vulnerable sector	Adaptation acti on #	Adaptation priority	Goal(s)	Relevance to national context	Main Outputs	Responsible institution(s)	Mitigation co-benefits	Cost (million USD)
				Programme (CAADP) 2016-2020 (updated 2020-2023)	• Establishment of Farmers' social groups and networks; • Diffusion of adaptation technologies (extension services outreach); • Promotion of actor differentiated awareness of climate change ; • Support of research and development on crop varieties and cultural practices; • Women empowerment and promotion of gender mainstreaming approach in all interventions.; and • Convening of women groups to take advantage of income and food security opportunities (e.g., household gardens, diversified livelihood income sources).			
	7	Climate resilient irrigated cropping systems	Strengthen the preparedness of irrigated cropping systems (e.g., wheat and faba beans) to build their resilience to projected climate change impacts particularly the projected increase in temperature	• Ministry of Agriculture's and forestry 2021-2023 Programme for Stability and Economic Development; • Sudan Comprehensive Africa Agriculture Development Programme (CAADP) 2016-2020 (updated 2020-2023)	• Develop and release a number of climate resilient varieties combining high yield potential and heat tolerance; • Adoption of early maturing crop varieties and proper sowing date to avoid the hazards of elevated temperature and manipulation of sowing time ; • Installation of renewable (e.g. solar) powered irrigation systems; • Improvement of water productivity in the irrigated sector; • Women empowerment and promotion of gender mainstreaming approach in all interventions; and • Convening of women groups to take advantage of income and food security opportunities (e.g., household gardens, diversified livelihood income sources).	MoAF and relevant state governments	None	150
	8	Resilient livestock production systems	• Build resilience of livestock production systems to reduce the vulnerability of the livelihood systems of the pastoral communities; and • Improve livestock production and livestock feeding systems	• NAP(2016) and NAPA (2007) • Sudan Livestock Policy 2018	• Integration of livestock into farming systems and efficient utilization of crop residues in the big irrigated schemes (Gezera Suki, Rahad and New Halfa schemes) to improve nutritive value and animal feeding system and enhancing animal health services; • increasing animal resilience against climate related epidemic diseases including through vaccination of animals against epidemic diseases provision of well-equipped mobile clinics and provision of animal drugs such as anthelmintic, antibiotics to reduce disease and parasites infestation during rainy season; • improving rangeland productivity and grazing management practices;	MoAF and relevant state governments	Conservation and increasing soil carbon content, carbon sequestration in vegetation	200

Vulnerable sector	Adaptation acti on #	Adaptation priority	Goal(s)	Relevance to national context	Main Outputs	Responsible institution(s)	Mitigation co-benefits	Cost (million USD)
					• Ley farming systems (protected areas, close to settlements be reserved and planted with tree seedlings and forage legumes and grazing with sheep during the dry season); • Strategic supplementary feeding technologies to desert sheep; • Capacity building and training of related stakeholders in various aspects of the above activities, disease preventive measures, rural dairy processing and hygiene in handling animal and dairy products, and bookkeeping			
	9	Building resilience of rangelands	Rehabilitate, restore and improve productivity of degraded rangelands to reduce vulnerability and build resilience of vast rural communities their livelihood systems depend on them	• NAP(2016) and NAPA (2007) • Sudan Livestock Policy 2018	• Rehabilitation of livestock water points, including shallow wells, hafirs, water yards, etc.; • Establishment of shelterbelt programmes; • Introduction of water harvesting and integrated solutions in the traditional rainfed agriculture sector; • Capacity building on improvement of soil, pasture and rangeland management; and • Women empowerment and promotion of gender mainstreaming approach in all interventions.	MoAF and relevant state governments	Carbon removal through planting of shelterbelts	150
	10	Building resilience of livestock production systems	Enhanced preparedness of livestock sector to increase its resilience to projected climate change impacts on animal breeds	• NAP(2016) and NAPA (2007) • Sudan Livestock Policy 2018	• Improving rangelands through introducing forage legumes and perennials rather than annual grasses; • Establishing breed association for the endangered livestock breeds (Kenana and Butana cattle, desert sheep); • Replacement of non-productive animals from cattle herds and sheep flocks and keeping only productive ones; • Awareness raising and capacity building in support of required behavioral changes; • Development of alternative livelihood programs/ livelihood transformation programs, and vocational training for pastoral communities; • Development of forecast-based finance instruments to minimize potential losses to productive systems; and • Design of combinations of appropriate risk finance tools and instruments appropriate to local contexts	MoAF and relevant state governments	Conservation and increasing soil carbon content, carbon sequestration in vegetation	150
Public health	11	Building resilience in the health	• Build a healthy, resilient, low emission recovery	• Sudan's Water, Sanitation and Hygiene Sector 2019-2030	• Introduction of early diagnosis and treatment programmes for malaria, chikungunya, rift valley fever, yellow fever, dengue hemorrhagic fevers, lieshmaniasis,	Ministry of Health	None	500

Vulnerable sector	Adaptation acti on #	Adaptation priority	Goal(s)	Relevance to national context	Main Outputs	Responsible institution(s)	Mitigation co-benefits	Cost (million USD)
		sector Aim is to:	from COVID-19 that prevents future threats and unlocks inclusive, sustainable growth; and • Enhance resilience through integrating climate-resilient development and/or risk management strategies into water and sanitation and hygiene sector plans and vectors related diseases	Sustainable Development Goal Six (SDG6) Plan • Sudan's National Health Policy 2017-2030 • NAP(2016) and NAPA (2007)	onchocerciasis, schistosomiasis, diseases, and leishmaniasis; • Raising awareness of communities in vulnerable areas to climate change related diseases in order to increase their adaptive capacities; • Increasing health resilience to climate change related diseases and reducing the associated mortality by supporting health programmes; • Control of endemic and epidemic diseases induced by climate change through combating vectors and insects borne diseases, controlling of diseases shared between humans and animals; • Improvement of community sanitation and medical services, including capacities for diagnosis and treatment; • Solar for health to provide basic services to communities in remote areas without access to electricity services ; • Capacity building of health cadres and improvement of health services to meet the evolving and increasing challenges of climate change; and • Improvement of medical services including capacities of diagnoses and treatment			
Coastal zones	12	Building resilience in coastal zones	Reduce vulnerability of coastal communities to climate change impacts on their livelihoods	• NAP (2016) • Coastal zone 2022/2030 Strategic Plan	• Mangroves restoration and management for building resilience of dependent local communities especially in marine subsistence and commercial fisheries and through addressing multiple stresses using approaches based on science and participation; • Provisions for alternative livelihoods for mangrove-dependent communities; • Integration of adaptation options into coastal zone management planning; • Strengthening coastal communities to use Ecosystem Based Management approaches to improve fisheries management and achieve other marine resource benefits; • Protection of coral reef and, sea grass beds and restoration of degraded areas and areas especially sensitive to climate related risks; • Increased resilience of islands against climate impacts; • Mapping, demarcation of coastal hazard lines subjected to sea level rise and over flooding.	HCENR and Red Sea State government	Increased carbon sequestration by blue carbon systems	150

4.3. National adaptation priorities, strategies, policies, plans, goals and actions

Sudan's NAP (2016)[1] has emerged as the central policy framework for proposing needed action by the government in reshaping its current programmes and protocols to ensure that adaptation and climate risk management are integrated into the wider Sudanese sustainable development planning process. As a result, adaptation to climate change has begun to be rooted in the overall Sudanese development context. For example, climate-change related impacts on rangelands discussed above have led to the deepening of resource-based conflicts among pastoral, transhumant and farmer communities. The NAP provides a framework, now operationalized at the project level underway throughout the country, to take this dynamic into account to promote equitable, advocacy-based interventions that incorporate new technology, better practices and conflict resolution strategies.

Moreover, the NAP emphasizes the critical role of state-level governments as key stakeholder in the adaptation process. More frequent droughts have increased food insecurity in different ways among rural communities, this can only be effectively addressed through the kinds of state-specific adaptation interventions that are developed relative to specific state circumstances. Hence, the NAP calls for the development of state-level enabling environments that accounts for regional and state-level differences. Building local technical capacity is a core recommendation that will help support adaptation decision-making at the state and community levels, while promoting federal-state institutional coordination arrangements.

4.4. Implementation and support needs of developing country Parties

Sudan has been doubly vulnerable to climate change. On the one hand, it has been confronting climate change impacts as an LDC with very limited internal resources to implement adaptive measures to reduce acute water stress, deepening food insecurity, expansion of vector-borne diseases, and biodiversity loss. On the other hand, due to long-lasting economic and political sanctions - only recently lifted after the 2019 revolution - access to climate finance has been largely restricted to multilateral institutions like GEF and GCF, leaving Sudan even more vulnerable to the devastating consequences of climate change impacts on its people and natural systems.

Sudan is currently implementing some key urgent and immediate adaptation initiatives as identified based in the NAPA in four vulnerable states, based on resources from the Least Developed Countries Fund (LDCF), participating states, and the national government. Recently, Sudan has received financial support from the Green Climate Fund (GCF) for a project to enhance adaptive capacity of local communities and restore carbon sink potential of the Gum Arabic belt (10 million USD) and another project that implements resilience-building measures in rainfed crop and livestock systems in nine states (25.6 million USD). Important as they are, these projects are only a start in reducing the gap between the magnitude of climate change impacts and the need for effective adaptive responses.

With the HCENR as lead institution, Sudan is currently working on developing a strategy for NDC implementation that is focused on strengthening institutional cooperative and data

[1] https://www4.unfccc.int/sites/NAPC/Documents%20NAP/National%20Reports/Sudan%20NAP.pdf

sharing arrangements as well as building technical capacities on adaptation project planning and implementation. Sudan is also in the process of revising its GCF country programme in a way that reflects this updated NDC and developing a much-needed national fund-raising to support the financing of the 12 projects described in Table 4-1 that will build resilience in water resource management, agricultural production, public health supply chains and coastal zone ecosystem and infrastructure.

4.5. Implementation of adaptation actions and plans

The implementation of systematic adaptation planning action began in 2007 with the completion of the NAPA, which identified and characterized the highest priority adaptation needs to confront then-current impacts of climate change. This plan was followed by the completion of the NAP in 2016, a comprehensive, country-wide adaptation planning document whose objective was to assess future vulnerability to climate change in priority sectors (i.e., agriculture, water, health and coastal zones) and identify vulnerable hotspots and outline a set of adaptation strategies, including policies, technologies, systematic observation programmes, climate proofing needs, and required investment.

The implementation of the highest priority adaptation action began in 2010 in direct response to the 2007 NAPA, with financial and technical support from GEF, the LDC Fund and the UNDP. The projects aimed to enhance food and water security for agro-pastoralists. Projects activities were started in the states where the NAPA process itself took place. Specific measure implemented include micro-fencing to reduce desert encroachment on productive areas, rangeland rehabilitation, creation of village-level nurseries to support rangeland rehabilitation, and construction of water harvesting facilities were some of the most important practices for increasing the community resilience, with high involvement of community members, particularly women. Major results achieved across the states in which these interventions were implemented include:

- Reduction in unsustainable biomass harvesting through shifting from a total dependence on firewood to butane gas units for cooking. This reduced tree cutting and has helped to stabilize surrounding land against sand dune movement.
- Improved water security through expansion of water supply for agricultural and domestic use by well-drilling and sustainable groundwater use. This helped to increase cultivated areas and establish community managed horticulture and enhanced household food security and income potential.
- Improved water supply efficiency through the introduction water harvesting techniques to mitigate the adverse impact of increasing rainfall variability. This helped to increase crop yields in hard hit states.
- Improved agricultural productivity through the introduction of drought resistant and early maturing vanities of crops and vegetables seeds. This helped to temper the impact of shorter growing seasons and recurrent drought.
- Improved livestock health through the introduction of vaccination campaigns against epidemics, strategic supplementary feeding and the introduction of more suitable sheep and cattle species. This helped to stabilize an important source of annual income for agro-pastoralist households.

The effectiveness of the above measures has been recognized within the adaptation planning community in Sudan. They are now being integrated into development planning of these sectors. Donor-funded projects continue to be built upon and expanded based on this ongoing project-level experience. Indeed, the implementation of high priority adaptation action intensified after the completion of the NAP. Below is an overview of two of the most promising ongoing interventions whose designs were based on the outcome of the NAP.

- *Ecosystem-based adaptation.* The White Nile State Ecosystem Based Adaptation (EbA) project (GEF/UNEP supported) aims to mainstream EbA approaches into policies, planning and budgets and to develop capacities at national, state and local (community) level. It applies alternative, proactive EbA approaches to increase the productivity of farmers and pastoralists. It includes measures such as rangeland regeneration, afforestation, rainwater harvesting and introduction of drought-tolerant agriculture. The project support women in their ambition to develop alternative livelihoods (e.g., household vegetable gardening) to increase their resilience to climate shocks and provides for knowledge management on successful EbA measures.
- *Agro-pastoralist adaptation.* The GCF/UNDP supported project agro-pastoralist resilience project aims is to promote a paradigm shift in dryland pastoral and farming systems through an integrated set of adaptation-focused measures that increases the resilience of food production systems, improves availability/access to water sources; and strengthens capacities of institutions/communities relevant to building climate resilience. Specific interventions include drought-resistant, early maturing seeds, establishment of integrated women-led sustainable farms, rehabilitation of communal rangelands, development of multi-purpose tree nurseries, establishment of shelterbelts to shield cultivatable plots from dust storms, and increases in water availability

Sudan plans to implement all the remaining priority adaptation projects that were identified in the NAPA and NAP processes. Clearly, the cost for implementing adequate set of adaptation measures is well beyond the national resources at the disposal of the Sudanese government. Therefore, it is i imperative that Sudan succeeds in accessing international financial, technical, and capacity building support to meet the costs of the identified adaptation measures.

Having started the NAP process well before the NAP technical guidelines were developed by the UNFCCC, Sudan's NAP process recognized the need to address several gaps and limitations going forward. A GCF readiness support titled "Strengthening adaptation planning processes and capacity for implementation of adaptation actions in agricultural and water sectors in Sudan" is currently being implemented (2020-2022), building on NAP 2016 and aiming towards addressing most of the identified gaps, including:

- *Capacity building:* The NAP institutional arrangements need to be further strengthened and recognized at the state level. Technical and institutional capacities of the state institutions need to be further strengthened to enable coordinating the implementation and integration of the NAP into national and state-level development planning. Capacity building is further required to review and update Sudan's NAP in the future, as NAPs are a continuous and iterative process of adaptation planning and implementation.
- *Methods and tools:* There is a need to continue building technical capacity and knowledge about methods and tools such as on impact models for periodically assessing

future impacts of climate change and for assessing future vulnerability of the water, agriculture and food security and health sectors and their implication on national development.

- *Regional climate scenarios:* The vulnerability and adaptation assessments conducted during the NAP process followed the NAPA approach which is a participatory and consultative process but focuses only on the short-term climate impacts to address urgent and immediate adaptation needs. Therefore, further development of climate scenarios is necessary to cover all the states of Sudan to identify mid- and long-term adaptation needs based on a sound scientific approach, taking into account the needs and circumstances of different stakeholders, including women and men. Also, further follow up work on introducing impact models and their know-how is vital to use climate scenarios in order to better understand future vulnerabilities of the development sectors in Sudan. This will be addressed in outcome 1.
- *Planning and financing:* The adaptation measures identified by the NAP process have not been further analyzed and developed into informative, good quality project concepts to enable fund raising. Therefore, there is a need to take these programme and project ideas one step further and develop them into fundable concept notes and project/programme proposals. There is a need to improve adaptation planning and integration in development planning at the state level, including the policies, programmes and the skills for the preparation of good quality adaptation projects for financing through the available funding opportunities. This also includes costing adaptation interventions to enable stakeholders and decision-makers to prioritize adaptation interventions, thereby using the analysis of adaptation financial flows and adaptation costing for adaptation projects and initiatives.
- *Enabling environments:* Because of funding limitations, the NAP process could not move to do further work beyond scoping on the six specific recommendations for creating an enabling environment for effective adaptation responses. However, because these are very important elements of the NAP process and the integration of adaptation into development processes, Sudan decided to include them as ongoing programmes, hoping to raise further funding to continue developing them. These include, regional climate scenario development, improved observation network, enhanced national research for climate adaptation, vulnerability hotspot mapping, adaptation investment and financial flows, and climate proofing of ongoing development projects.
- *Monitoring and evaluation (M&E):* A Strong and well-functioning M&E system is key for adaptation planning and implementation of adaptation priorities, and to understand the impacts of climate change and opportunities for different stakeholders, including women and men. Sudan's NAP did not aim to establish such a system and has now been identified as a high-priority need. This will need to involve capacity building of state-level institutions on M&E, establishing the data collection and reporting systems, developing modalities to engage affected communities, as well as sharing of knowledge and experience on implementation and integration.
- *Awareness-raising:* There is a need to continuously improve awareness and knowledge about climate risks and adaptation responses. The stakeholders for awareness-raising campaigns span policymakers, analysts, planner, community leaders, households, and many others. A better understanding of the implications of climate change on people's

livelihoods will be needed at state and local levels to avoid maladaptive practices and exploit development opportunities.

- *National-state coordination:* Improving Sudan's initial NAP process should further elaborate and improve modalities for NAP implementation and integration into development planning at both national and state level to share information and good practices to communicate adaptation priorities and needs from the state to the national level and to make the best use of resources.

5. Support needed to implement mitigation and adaptation contributions

Sudan is currently implementing some key urgent and immediate adaptation initiatives as identified based on the NAPA and NAP, as well as GHG mitigation actions as identified in energy visioning processes, based on resources from the GEF, GCF, multilateral institutions, bi-lateral aid agencies, as well as participating states and the national government. This financial support has been very useful for Sudan to engage national institutions, build experience, knowledge, integrate climate change and maintain its ability to implement climate actions . However, in contrast to the funding levels outlined in Table 5-1, a continuation of past funding trends is clearly not commensurate with the 8.23 billion USD needed over the next 10 years to build climate resilience and honor a commitment to the international community to transition to low-carbon development pathways.

Table 5-1: Summary of Sudan's financial support needs for its mitigation and adaptation contributions

Focus	Measure or sector	Needed amount (million USD)
GHG mitigation	Renewable energy	2,724
	Energy efficiency	215
	Transport measures	1,000
	Carbon sequestration	214
	Waste management	240
	Sub-total	*4,393*
Adaptation	Water	2,370
	Agriculture	830
	Public health	500
	Coastal zone	150
	Sub-total	*3,850*
Total		**8,243**

Given the difficult economic circumstances Sudan is currently facing , the government will strive to cover 15% of the estimated cost of NDC implementation. This will include resources from the national and state-level governments to be mobilized through the regular and development budgets. In addition, the government is expecting important contribution and resources from national private sector engagement. Further development and elaboration of contributions and assessment of associated costs and required investment for implementing the updated NDC will continue to be elaborated and improved in the planning process for NDC implementation.

6. MRV systems in place to track mitigation and adaptation contributions

The HCENR, as the focal point of climate change activities, has formalized institutional arrangements with relevant institutions in support of Monitoring, Reporting and Verification (MRV) activities. These institutional arrangements have been codified in Memoranda of Understanding (MoU) established between the HCENR and 10 federal entities and 18 state-level environment institutions and ministries of agriculture. These MoUs are designed to clarify institutional responsibilities and improve institutional capacity to meet Sudan's MRV and transparency obligations (see Table 5-2).

Institutional coordination arrangements in support of MRV activities have involved several research and academic institutions, enlisted to support a range of actions including data development; capacity building; tool development; GHG inventories, GHG mitigation analysis; NDC development; adaptation actions; QA/QC procedures, and data archiving. The Ministry of Finance, Central Bureau of Statistics, and Council of Ministers all play key role in supporting MRV activities including management of financial resources, data supply, sectoral expertise; endorsement of resulting national reports. Finally, civil society organizations also contribute to MRV actions through participation and consultations to climate change planning, transparency and reporting; data provision, training and awareness events; and development of social and environmental safeguards.

The adequacy of MRV systems in Sudan to track mitigation and adaptation contributions will also benefit from the upcoming project on building transparency. The project, expected to start implementation in January 2022, aims to enhance Sudan's human and institutional capacities in the area of transparency, according to the Paris Agreement on Climate Change, in particular the provisions under Article 13. The project will be particularly focused on developing the national transparency system based on the modalities, procedures and guidelines (MPGs) for the transparency framework for action and support included in decision (18/CMA.1). This will be achieved through a) strengthening of national institutions for transparency related activities; b) provision of tools, systems, trainings and assistance in line with the transparency provisions established under the Enhanced Transparency Framework of the Paris Agreement; and c) development of a long-term institutional coordination strategy to improve transparency over time.