

# SUDAN

## Gums for Adaptation and Mitigation in Sudan (GAMS):

Enhancing adaptive capacity of local communities and restoring carbon sink potential of the Gum Arabic belt, expanding Africa's Great Green Wall

Prefeasibility Study

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## ABBREVIATIONS AND ACRONYMS

<b>AAD</b>	Action Against Desertification (EU-funded FAO restoration project in 6 Sahelian countries)
<b>AFD</b>	French Development Agency (« Agence française de Développement »)
<b>AGB</b>	Above Ground Biomass
<b>AWPB</b>	Annual Work Plan and Budget
<b>BGB</b>	Below Ground Biomass
<b>CAP</b>	Cluster Adaptation Plans
<b>CC</b>	Climate Change
<b>CDC</b>	Community Development Committee
<b>CRVCP</b>	Climate Resilient Village Cluster Plans (synonymous with VCLAP)
<b>ER</b>	Emissions Reductions (of Greenhouse Gases)
<b>ESMP</b>	Environmental and Social Management Plan
<b>FFS</b>	Farmer Field Schools
<b>FMO</b>	Forestry Management Officer
<b>FNC</b>	Forestry National Corporation
<b>GA</b>	Gum Arabic
<b>GAB</b>	Gum Arabic Board (Multi-stakeholder Body)
<b>GALS</b>	Gender Action Learning System
<b>GAPA</b>	Smallholder Gum Arabic Producer Association
<b>GCF</b>	Green Climate Fund
<b>GDP</b>	Gross Domestic Product
<b>GGW</b>	Great Green Wall of the Sahara and the Sahel Initiative
<b>GHGs</b>	Green House Gases
<b>GoS</b>	Government of Sudan
<b>GRM</b>	Grievance Redress Mechanism
<b>Ha</b>	Hectare
<b>HCE</b>	Higher Council of Environment
<b>HH</b>	Households
<b>INDC</b>	Intended Nationally Determined Contribution (to the Paris Climate Agreement)
<b>IWRM</b>	Integrated Water Resources Management
<b>LER</b>	Land Equivalency Ratio
<b>LPC</b>	Local Procurement Committee
<b>LPD</b>	Land productivity dynamic
<b>LT</b>	Locality Teams (led by FNC field supervisor)
<b>LMRP</b>	Livestock Marketing and Resilience Programme (IFAD)
<b>M&amp;E</b>	Monitoring and Evaluation
<b>MARFW</b>	Ministry of Animal Resources Fisheries and Wildlife
<b>MFI</b>	Microfinance Institutions
<b>MoAF</b>	Ministry of Agriculture and Forestry
<b>NA</b>	Native Administration
<b>NAPA</b>	National Adaptation Programme of Action
<b>NDA</b>	Nationally Designated Authority for Green Climate Fund
<b>NDCs</b>	Nationally Determined Contributions
<b>NDVI</b>	Normalised difference vegetation index
<b>NR</b>	Natural Resources
<b>NRM</b>	Natural Resources Management
<b>PMU</b>	Project Management Unit (for GAMS at FNC HQ, Khartoum)
<b>PSC</b>	Project Steering Committee
<b>PIM</b>	Project Implementation Manual
<b>PMF</b>	Performance Measurement Framework (of the GCF)

<b>RoS</b>	Republic of Sudan
<b>RPA</b>	Range and Pasture Administration (at State level)
<b>RP GD</b>	Range and Pasture General Directorate (at Federal level)
<b>SC</b>	State Coordinator (of GAMS project)
<b>SCU</b>	State Coordination Unit (at FNC State offices in North, South and West Kordofan)
<b>SDG</b>	Sudanese Pounds
<b>SGAS</b>	Structuring the Gum Arabic Sector project (FNC/AFD)
<b>SR</b>	Stock Routes (also called Livestock corridors)
<b>SSNRMP</b>	Sudan Sustainable Natural resources Management Project (IFAD)
<b>TA</b>	Technical Assistance
<b>TFP</b>	Technical and Financial Partners
<b>UNEP</b>	United Nations Environment Programme
<b>VCLAP</b>	Village Cluster Level Adaptation Plan (synonymous with CRVCP)
<b>VDC</b>	Village Development Committee
<b>VSCG</b>	Village Savings and Credit Groups
<b>WSRMP</b>	Western Sudan Resources Management Programme (IFAD)

## DEFINITIONS AND KEY CONCEPTS (INCLUDING THEIR RELEVANCE TO CLIMATE CHANGE)

**Adaptation:** According to IPCC, in human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.

**Agroforestry:** World Agroforestry (ICRAF), a Research Centre of the Consultative Group on International Agricultural Research (CGIAR), redefined agroforestry in 1996 as “a collective name for land use systems and practices in which woody perennials are deliberately integrated with crops and/or animals on the same land management unit. The integration can be either in a spatial mixture or in temporal sequence. There are normally both ecological and economic interactions between the woody and non-woody components in agroforestry.”

(See <http://www.worldagroforestry.org/publication/definition-agroforestry-revisited>). Woody perennials include a variety of trees, shrubs, palms and bamboos. Agroforestry systems are multifunctional systems that can provide a wide range of economic, sociocultural, and environmental benefits. Trees integrated in crop fields, apart from providing non-timber forest products (e.g. **gum arabic**, see definition below), significantly improve soils through contributing soil organic matter and, in the case of Leguminous species, nitrogen fertilization. They also generate important climate change adaptation benefits as they reduce crop evapotranspiration by providing shade and reducing wind speed and by increasing water infiltration. There are three main types of agroforestry systems: (i) agrisilvicultural systems are a combination of crops and trees; (ii) silvopastoral systems combine forestry and grazing of domesticated animals on pastures, rangelands or on-farm; and (iii) agrosilvopastoral systems combining the three elements, namely trees, animals and crops. Agroforestry is especially important for smallholder farmers as it reduces the need for external inputs such as inorganic nitrogen fertilizer, which they often cannot afford, and diversifies and sustains production for increased social, economic and environmental benefits.

**Adaptive capacity/Readiness** The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.

**Anthropogenic:** Resulting from or produced by human beings.

**Baseline/reference:** The baseline (or reference) is the state against which change is measured. It might be a ‘current baseline,’ in which case it represents observable, present-day conditions. It might also be a ‘future baseline,’ which is a projected future set of conditions excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines.

**Biomass:** Biomass is defined as mass of live or dead organic matter. Changes in time of vegetation biomass per unit area (biomass density) can be used as an essential climate variable, because they are a direct measure of sequestration or release of carbon between terrestrial ecosystems and the atmosphere. <http://www.fao.org/3/i1238e/i1238e00.pdf>

**Browse (or browsing):** type of behaviour for which herbivorous animals feed on leaves, soft shoots, or fruits of high-growing, generally woody plants such as shrubs. This is contrasted with grazing, usually associated with animals feeding on grass or other low vegetation. Browsers glean leaves, bark, and green stems from plants, while grazers clip vegetation at or near ground level. See also **Fodder** below.



**Climate change:** According to IPCC, a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

**Climate-Smart Agriculture (CSA):** As defined by FAO at the 2010 The Hague Conference on Agriculture, Food Security and Climate Change, CSA is composed of three main pillars: 1. sustainably increasing agricultural productivity and incomes; 2. adapting and building resilience to climate change; 3. reducing and/or removing Greenhouse Gases (GHG) emissions, where possible. More specifically, CSA aims to achieve food security, climate change adaptation and mitigation, providing the means to help stakeholders from local to national and international levels identify agricultural strategies suitable to their local conditions, taking into consideration the social, economic and environmental context where it will be applied. Hence, CSA relates to both on- and off-farm actions.

(see <http://www.fao.org/3/CA3204EN/ca3204en.pdf>)

**Climate projection:** According to IPCC, a projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the emission/concentration/radiative-forcing scenario used, which are based on assumptions concerning, e.g., future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty.

**Climate scenario:** A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as about the observed current climate.

**Exposure:** The presence of people; animals, livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected.

**Fodder:** Fodder or animal feed is any agricultural foodstuff used specifically to feed domesticated livestock, such as cattle, goats, sheep, horses, chickens. Fodder crops are crops that are cultivated primarily for animal feed. By extension, natural grasslands and pastures are included whether they are cultivated or not. Fodder crops may be classified as either temporary or permanent crops. The former are cultivated and harvested like any other crop. In the project area, annual plants only grow for about five-six months a year, so livestock relies on tree browse, and on moving South towards wetter areas where pasture lasts longer, for part of the year.

**GAPAs: Gum Arabic Producer Associations** supported by the project. See under **Smallholder producer organizations**.

**Gum Arabic:** The Codex Alimentarius defines gum arabic as “a dried exudate obtained from the stems and branches of *Acacia senegal* (L.) Willdenow or *Acacia seyal* (fam. Leguminosae). Gum arabic consists mainly of high-molecular weight polysaccharides and their calcium, magnesium and potassium salts, which on hydrolysis yield arabinose, galactose, rhamnose and glucuronic acid. Items of commerce may contain extraneous materials such as sand and pieces of bark, which must be removed before use in food.”

See [http://www.fao.org/fileadmin/user\\_upload/jecfa\\_additives/docs/Monograph1/Additive-219.pdf](http://www.fao.org/fileadmin/user_upload/jecfa_additives/docs/Monograph1/Additive-219.pdf) (The Codex Alimentarius, supported by FAO and WHO, is a body of international food standards, guidelines and codes of practice that aims to contribute to the safety, quality and fairness of the international food trade, see <http://www.fao.org/fao-who-codexalimentarius/about-codex/en/>). In the project area, both kinds of gum arabic are produced: “hashab” gum from the *Acacia senegal* tree on the sandy soils dominating North and West Kordofan and “talha” gum from the *Acacia seyal* tree growing on clay soils covering part of South Kordofan. The large majority of the gum produced in the project area is hashab. Sudan accounts for over 60% of raw gum Arabic exports worldwide, worth more than USD 100 million annually. Up to 37% of cash income of smallholder farmers in the project area is made up of gum sales and the gum trees, which are grown scattered in crop fields, also play an important role in protecting crops against climate extremes (see also **Agroforestry** definition above).

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

**Land use and land use change:** According to IPCC, land use refers to the total of arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions, including actions related to temporary access and use of land allowing different users such as breeders, hunters, collectors or gatherers to find their own resources to find their own resources). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface albedo, evapotranspiration, sources and sinks of greenhouse gases, or other properties of the climate system and may thus have radiative forcing and/or other impacts on climate, locally or globally.

**Livestock:** includes all animals<sup>1</sup> kept by humans. In the GAMS project area, these are mainly ruminants: cows, sheep, goats and camels.

**Livestock corridors** or **transhumance corridors**, also called “**Stock routes**” in Sudan, are well-established pathways allowing for the seasonal movement of livestock in search of pasture and water and/or to access market. Many livestock corridors in Sudan have been interrupted in recent years, mainly due to conflict leading to internal displacement of rural communities, and to land-grabbing for large-scale mechanized rainfed farming. The resulting reduction in **livestock mobility** (see definition) has made **pastoralists** (see definition) more vulnerable to the impacts of climate change, caused damage to gum Arabic stands where livestock has been concentrated, and has led to increased conflict between pastoralists and farmers. Reopening livestock corridors through facilitating negotiations between farmers and pastoralists is thus essential for both climate change adaptation – facilitating livestock mobility – and climate change mitigation – restoring degraded gum stands in the project area. Experience with re-establishing livestock corridors in Sudan, under both IFAD and FAO supported projects, has been very positive. Best practice includes equipping the corridors with watering points at regular intervals and setting up local management institutions to ensure their sustainability, as well as demarcating conflict hotspots with concrete markers to reduce the potential for confusion and conflict. The delineation and protection of transhumance corridors are also critical to maintaining livestock mobility in agropastoral areas by allowing passage through areas of increasing cropping

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<sup>1</sup> Livestock kept in Sudan also includes chickens, however these do not feature in the project.

pressure. Understanding the local politics surrounding the mapping and protection of transhumance corridors is important for policy formulation.

**Livestock emissions:** greenhouse gas (GHG) emissions due to livestock, consisting of methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>). While livestock raising in semi-arid Africa has been traditionally considered to give rise to high GHG emissions per litre of milk or kg of meat produced, a broader, ecosystem-wide assessment carried out by CIRAD in Senegal demonstrates that overall, pastoralist livestock keeping sequesters rather than emits GHG.<sup>2</sup>

**Livestock mobility:** Mobility is one of the most defining features of pastoralism. Pastoralists move with their livestock herds in search of water and pasture. These movements may be within national territories or cross country borders; they may adhere to fixed predictable routes or follow flexible patterns that respond to local conditions. Strategic mobility allows pastoralists to adapt to variable weather conditions and produce food in constrained rangeland ecosystems. In semi-arid climates where rain-fed livestock raising dominates, the movement of pastoralists (see definition) with all or part of their livestock in relation to the availability of fodder and water. Livestock mobility is a key adaptation to both climate variability and climate change, see also **Livestock corridors** above. Pastoral mobility is shaped not only by tenure rights but by a whole host of factors including livestock wealth, labour availability, herding contracts, social insecurity, social networks, and access to market. The seasonal movements, called transhumance, allow pastoralists to make use of predictable variations in pasture quality and availability. Mobility thereby optimizes use of a resource base that varies in space and time, with demonstrated benefits to livestock productivity and rangelands. Mobility of livestock transhumance plays a key role in the face of climate change and for the conservation of biodiversity, without further degrading natural resources and improving soil fertility; conserving biodiversity and reducing greenhouse gas emissions.

**Native Administration:** Formerly, the Native Administration (NA) had the administrative authority and judicial powers over land allocation, providing a measure of control, regulation and conservation of land and related natural resources. Subsequently, this authority was vested first in the local government officers and later in the State governments, but these were unable to exert the intended level of control. In most rural areas, despite its lack of formal powers, the NA is still influential in land use decisions – and will therefore be closely involved in the activities of the project, especially in the rehabilitation of the livestock corridors.

**ND-GAIN index:** the Notre Dame Global Adaptation Initiative (ND-GAIN) index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. It aims to help governments, businesses and communities better prioritize investments for a more efficient response to the immediate global challenges ahead. See <https://gain.nd.edu/our-work/country-index/>

**Non-wood forest products:** FAO defines Non-wood forest products (NWFP) as being “goods of biological origin other than wood derived from forests, other wooded land and trees outside forests”. Different terms like secondary, minor or non-timber forest products (NTFP) are also being used in the literature. See the FAO 1999 Unasylva article “Towards a harmonized definition of non-wood forest products” at <http://www.fao.org/3/x2450e/x2450e0d.htm#fao%20forestry>

**Pastoralism and pastoral production systems:** Numerous economic definitions of pastoralism exist. Most refer to Swift (1988), defining pastoral production systems as those “in which at least 50% of the gross incomes of households (i.e. the value of market production and the estimated value of

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<sup>2</sup> CIRAD 2019. Territoires d'élevage pastoral au Sahel : un bilan carbone avec un potentiel inattendu d'atténuation du changement climatique. Perspective 52, novembre 2019. Paris

subsistence production consumed by households) come from pastoralism or its related activities, or else, where more than 15% of households' food energy consumption involves the milk or dairy products they produce". A biophysical definition of pastoralism is "a system made up of three distinct components that interact with each other to drive and sustain the livestock system: human resources, animal resources and natural resources (water and pasture)" (Hatfield and Davies, 2006). In rain-fed, semi-arid Africa, pastoralism has been demonstrated to be a more efficient land use strategy in the face of climate variability than sedentary ranching. Pastoralism is also considered to be more resilient in the face of climate change. **Pastoralists** are people "whose livelihoods depend mainly or exclusively on the keeping of **livestock**. They inhabit those parts of the world where the potential for crop cultivation is limited due to lack of rainfall, steep terrain or extreme temperatures. They often have mobile lifestyles, in order to optimally exploit the meagre and seasonally variable resources of their environment, and to provide feed and water for their animals" (Hatfield and Davies, 2006). In the GAMS project area, there are both mobile pastoralists, who move through the area in search of water and pasture, often along well-established **livestock corridors** (see definition) and sedentary agro-pastoralists, consisting of crop farmers who have diversified into livestock keeping and mobile pastoralists that have become sedentarized following previous droughts. Mobile pastoralists are sometimes divided into nomadic pastoralists, who are mobile year-round, and transhumant pastoralists, who have more permanent wet and/or dry season home bases that they move between.

**Rangeland:** areas of pasture. In the project area, these include both open rangeland and "hema" rangeland reserves that are the property of sedentary agro-pastoralists.

**Rangeland restoration:** the rehabilitation of degraded rangelands through revegetation, preferably using local species or otherwise proven adapted species and varieties. Many rangelands in the project area are degraded. This degradation can often be reversed by low-cost measures such as direct seeding, sometimes assisted by mechanical or manual soil preparation. Restored rangelands not only provide better fodder (see definition) to livestock but also store more carbon, thus playing an important role in climate change mitigation.

**Smallholder farmer:** are defined in Sudan as family farmers that have less than 5 ha of land per household to farm. Smallholder farmers dominate agricultural production in Sudan – and even more in the Kordofan states.

**Smallholder producer organization:** Organization made up of smallholder farmers, or pastoralists, who conduct part of their operations (often marketing of produce, input acquisition) together to benefit from economies of scale. The GAMS project helps build the capacity of smallholder gum producer organizations called GAPAs (Gum Arabic Producer Associations) to produce clean, dry gum and sell it in larger quantities and at higher prices. While this helps smallholder farmers to adapt to climate change – gum harvests being less sensitive to drought than those of annual crops – it also provides them with a major incentive for restoring and expanding gum agroforestry systems (see definition), thus generating climate change mitigation benefits at the same time.

**Stock routes** – see Livestock corridors.

**Taungya system:** The term "taungya" derives from the Burmese words for hill ("taung") and cultivation ("ya"). The taungya system originated in the British colonies in Asia in the 19<sup>th</sup> Century as an inexpensive means of establishing timber plantations, where the labourers hired to establish tree plantations on government land were permitted to raise agricultural crops in between the trees until the tree canopy closed over – after 1-3 years in the humid tropics, or 3-5 years in the dry tropics. A large variety of crops and trees, depending on the soil and climatic conditions, has been grown in

taungya plantations in Asia and Africa.<sup>3</sup> Under classical taungya, the people that plant the trees have no right to anything but the agricultural crops they grow, but in Sudan, the taungya system has been modified to allow for sharing the proceeds of the trees with the local communities that planted or seeded them. In the case of “hashab” (*Acacia senegal*) plantations in Sudan, FNC shares the gum proceeds 50/50 with the local communities. This tends to be very popular with poor farmers including women, especially those who are landless. In Sudan, most taungya plantations are established through direct seeding of crops and trees simultaneously, rather than through planting of tree seedlings.

**Vulnerability:** The propensity or predisposition of being exposed, sensitive, adversely affected and little reactive to a shocks, hazards or constraints.

**Wood Fuels or Fuelwood:** Wood fuels are defined as all types of biofuels originating from woody biomass, where the original composition of the wood is preserved and unaltered from its original form.

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<sup>3</sup> <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=106175> accessed 14 April 2020.

## CURRENCY AND CONVERSION FACTORS

Feddan	0.42 hectare
Hectare	10,000 m <sup>2</sup>
Kantar <sup>4</sup>	100 lbs (about 45.4 kilograms)
Lbs	0.454 kilograms
SDG	Sudanese pound (1 USD = 47.1 SDG)

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<sup>4</sup> Unit of weight used in gum and other crop markets in Sudan

## CHAPTER 1 PROJECT SUMMARY

### ABSTRACT

1. The GAMS project will enhance the resilience to climate change impacts of the livelihoods of 53,000 rural smallholder farm households and 13,338 smallholder pastoralist households<sup>5</sup> in 11 Localities in the States of North, West and South Kordofan. These three States are among the most vulnerable to climate change in Sudan, and the smallholder farmers and pastoralists are among the most vulnerable people (RoS, 2003). The project will do this by improving the sustainability of their rain-fed cropping systems through climate-smart agroforestry, through the transformation of their relationships with markets and formal financial services, through enhanced livestock mobility and rangeland restoration and through improved institutional arrangements for cross-sectoral, climate responsive land use planning.

2. The project will invest in a major scaling up – from one to eleven Localities – of fair and equitable contract farming arrangements between gum producer groups and private sector gum buyers piloted under an FNC project funded by AFD (2014-2018). These community-company partnerships will be a key element of the project's exit strategy – as their continued functioning does not depend on project support beyond the initial investment in capacity building of smallholder producer groups and brokering of relations with responsible gum buyers.

3. The project will also invest in rehabilitating livestock corridors (see Definitions and key concepts above) in South Kordofan, both as a direct climate change adaptation investment in increasing livestock mobility and thereby improving resilience of smallholder pastoralist households, and as an investment in protecting the results of the gum agroforestry and reforestation investments made by the GAMS project against the overgrazing that has resulted from reduced livestock mobility in the project area.<sup>6</sup>

4. The project uses a relatively modest GCF grant of USD 9.975 million to leverage USD 14.7 million of mobilized private sector financing from the Ebda'a Microfinance Bank (USD 1.2 million) and the Elemats gum exporting company (USD 13.5 million), who will invest directly in the smallholder gum producer groups participating in the project. Other gum companies and Micro-Finance Institutions are expected to partner during project implementation.

5. Restoring agroforestry systems with drought-resistant gum trees will make dryland farming more resilient in the face of expected increases in moisture stress due to climate change, with crops benefiting from ecosystem services provided by gum trees, such as reduced evapotranspiration (due to lower wind speed and temperature), increased water infiltration and soil moisture retention (through an increase in soil organic carbon and N<sub>2</sub> fixation). The use of more drought-tolerant gum tree varieties and introduction of better gum tapping tools will enhance the trees' life span and carbon sequestration. The enhanced capacity of, and increased prices obtained by, smallholder gum producer organizations will create a strong incentive for them to continue to invest in restoration and management of such climate-smart agroforestry systems – also after the end of the project implementation period. Furthermore, the establishment of "clean, dry hashab gum" as a new market standard and getting micro-finance institutions to accept gum purchase guarantees as collateral for smallholder group credit will empower the people that are most vulnerable to climate change and will benefit the livelihood resilience and land management decisions of millions of people. These fundamental transformations

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<sup>5</sup> At 5.5 members per farm household on average, and at 6 members per pastoral household on average (FAO 2017b), this translates to a total of 371,528 direct beneficiaries.

<sup>6</sup> The livestock corridors that will be rehabilitated by the GAMS project in South Kordofan are contiguous with the corridors being rehabilitated in North and West Kordofan under the ongoing IFAD-funded Livestock Marketing and Resilience Project. The GAMS investment will also benefit from the lessons learned from the experience of the IFAD-funded Western Sudan Resource Management Project that closed in 2016.

will continue to have an impact long after the project ends.

## ALIGNMENT WITH NATIONAL CLIMATE CHANGE PRIORITIES

6. The following key adaption actions proposed in the NDCs have been integrated in the GAMS project proposal:

- diversification of income generating activities in order to increase adaptive capacity of vulnerable farmers' communities in order to achieve food security/reduce poverty;
- establishment of markets in vulnerable areas, awareness and access to information by vulnerable groups/communities etc.;
- Introduction of agroforestry in areas vulnerable to climate change to enhance agriculture production, as well as empower vulnerable communities through their involvement in community forests activities/products;
- establishment of women cooperative societies in order to empower them and increase their resilience;
- enhancing the participation of women and youth in activities related to adaptation and environmental conservation in order to empower them and enhance their adaptive capacity including through establishment rural women development programme;
- planting shelterbelts, introduction of high economic value trees and rehabilitation of the Gum Arabic gardens to increase the resilience of vulnerable communities through engagement in a range of forestry activities;
- joint management of the natural resources for comprehensive consideration of climate change impacts;
- management of the grazing areas and rangelands in a sustainable manner.

7. The NDCs also recognizes that many of the above-mentioned climate change adaptation actions have mitigation co-benefits, thus providing a strong justification for the cross-cutting nature of the GAMS project.

## PROJECT BENEFITS

8. The project benefits include those related to climate change mitigation, climate change adaptation and other expected co-benefits, the latter unrelated to climate change. They are summarized below. The climate change benefits are described in more detail in Chapter 2 (adaptation) and Chapter 9 (mitigation) below.

### Climate change mitigation benefits

9. The climate change mitigation benefits were quantified using the Ex-ACT tool, as described in Chapter 9 of this prefeasibility study. The GAMS project envisages the generation of greenhouse gas emissions reductions and removals through three major activities: (i) restoration of 75,000 ha degraded agroforestry systems (6.59 million tCO<sub>2</sub>e; (ii) reforestation of 50,000 ha of degraded land (1.05 million tCO<sub>2</sub>e) and (iii) restoration of 151,000 ha of degraded rangelands (1.59 million tCO<sub>2</sub>e). The total GHG emissions reductions and removals that GAMS will generate over the 20-year lifetime of the investment<sup>7</sup> is estimated at 9.23 million tCO<sub>2</sub>e. Applying even a modest price of USD 8/tCO<sub>2</sub>e, the Economic and Financial Analysis (EFA, see Annex 8 of Full Proposal, para. 22) found that this significantly increases overall project benefits, and increases the Economic Internal Rate of Return (EIRR) considerably, from 21% (only just above the 18% discount rate) to 23%, even at current low market

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<sup>7</sup> 20 Years corresponds to one full land use cycle, including 15 years of gum agroforestry mixed with annual crops, followed by 5 years of gum tree fallow to regenerate the land, see also FP Annex 8, Economic and Financial Analysis.



prices for GHG emissions reductions and removals, which are significantly below the social value of carbon.

### Climate change adaptation benefits

10. Investments in the restoration of gum arabic agroforestry systems will result in a significant increase not only in carbon sequestration but also the delivery of other ecosystem services, the latter contributing directly to climate change adaptation. Ecosystem services derived from restoration investments include reduced wind speed, increased shading, improved water infiltration, reduced surface run-off, and subsequently reduced evapotranspiration, increased biomass, increased soil nutrient content, increased moisture retention through increased organic matter and increased crop yields (for a detailed description of these benefits, see Chapter 2 below). The EFA shows that, as a result of these enhanced ecosystem services, revenues and income after labour appear steady after 20 years, despite the inclusion in the model of climate change impacts such as declining crop yields (using IFAD's CARD tool), and the occurrence of extreme weather events (with good, moderate and bad years). This suggests that the project investments are able to successfully counter forecast declines in yields, revenues and earnings as a result of climatic changes.

11. Investment in the negotiation and equipment of livestock corridors increases livestock mobility, enabling pastoralists to deal with climate change and variability more effectively. Finally, the participatory elaboration of Village Cluster Adaptation Plans increases the capacity of local communities to organize themselves to invest in climate change adaptation.

### Other Expected Co-Benefits

12. Apart from climate change mitigation and adaptation, the GAMS project will generate significant economic (SDGs 1 and 12), social and gender (SDGs 5 and 11), and environmental (SDGs 12, 13 and 15) benefits. Quantified benefits from restoration of agroforestry systems and reforestation of degraded lands include increased gum and crop production. Quantified benefits from rangeland restoration include improved livestock nutrition, especially for cows, which leads to productivity increases.<sup>8</sup> Other benefits resulting from improved vegetation cover, such as reduced damage to cropland and infrastructure due to reduced surface run-off and soil erosion, and enhanced biodiversity, have not been quantified.

13. Building the capacity of smallholder gum producer groups, helping them to restore degraded agroforestry systems and mainstreaming "clean, dry gum arabic" as a new market standard will have many economic and social benefits. Better integration into crop markets under more favourable conditions (as witnessed by the doubling of the gum producer price under the pilot project that will be scaled up) will increase smallholder revenues and investment in more sustainable and diversified agricultural, livestock and forestry production – with favourable macro-economic impacts as well as positive effects on food security and poverty reduction. Improving the position and the revenues of women – through supporting both mixed and women-only producer groups – will have a number of social co-benefits, including improvements in children's health and education.

14. Finally, the increased capacity and resulting improvement in revenues will make the smallholder groups – few of whom currently have access to formal financial services – bankable, and therefore more able to invest in sustainable land management and other climate change adaptation priorities.

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<sup>8</sup> Improving the nutrition status of poorly fed livestock also tends to lower greenhouse gas emissions, as it reduces methane exhaust, however this has not been quantified.

## Complementarity and synergies with other GCF and donor investments in Sudan

15. UNDP has prepared a project entitled “Building resilience in the face of climate change within traditional rain fed agricultural and pastoral systems in Sudan”. The project, which will also be submitted to the GCF Board in 2020, will be executed by the Higher Council for Environment and Natural Resources, Ministry of Agriculture and Natural Resources, and targets nine States: West Darfur Central Darfur, South Kordofan, West Kordofan, Kassala, Red Sea, Northern and Khartoum State. It focuses on climate change adaptation efforts among subsistence agro-pastoralists and nomadic pastoralist communities in dryland zones across nine States, including two States in which GAMS will also operate, South and West Kordofan. The UNDP project’s proposed investments in increasing the availability of water resources through the construction and rehabilitation of “hafirs” (dugout enlargements where surface water runoff collects during the rainy season, water yards (i.e. water extraction and distribution facility which includes borehole, storage tank, animal watering basins and tap stands) as well as sand water storage dams (rainwater harvesting structures) are highly complementary to the GAMS project investments in livestock mobility (through rehabilitation and demarcation of stock routes) and in climate change mitigation, through gum agroforestry restoration and reforestation of degraded lands. A further synergy will be created by UNDP’s emphasis on building the technical and organizational capacities of women, who are currently underrepresented in the smallholder Gum Arabic Producer Associations (GAPAs) that are a priority target group for GAMS’ capacity building efforts.

16. UNEP has also prepared a project for submission to GCF, which focuses on improving Sudan’s climate change science and policy development capacities, at national and State level. There are likely to be important synergies with the GAMS project, as the newly developed science and policy development capacity can help to further scale up and mainstream the approaches developed by GAMS.

17. FAO, in close collaboration with the NDA, has prepared the GCF NAP-Readiness ‘Strengthening adaptation planning processes and capacity for implementation of adaptation actions in agricultural and water sectors in the Sudan’, which has been endorsed by GCF in November 2019. This project will upscale the capacity of the Sudan to generate and analyze climate change data. In addition, the capacity of the Sudan to further climate change adaptation planning and implementation will be strengthened by *inter alia* re-activating the State-level Technical Committees in all the 18 States of the Sudan.

18. The GAMS project aims to scale up the results of two projects that have closed recently, the Structuring the Gum Arabic Sector project implemented by the Forestry National Corporation (FNC) funded by AFD – which pioneered GAPA capacity building and gum value chain facilitation efforts – and the Western Sudan Resources Management Project funded by IFAD, which rehabilitated and demarcated livestock corridors in the Kordofan States. These two projects, and the lessons learned from them that have been incorporated in the GAMS project design, are described in detail in Chapter 3. The livestock corridors that the GAMS project aims to rehabilitate and demarcate in South Kordofan are contiguous with the livestock corridors in North and West Kordofan that are being rehabilitated by the IFAD-funded Livestock Marketing and Resilience Project (LRMP) – another major synergy.

## PROJECT DEVELOPMENT METHODOLOGY AND APPROACH

### Project Initiation and national ownership

19. The GAMS project idea was first mooted at a regional FAO meeting, between the NDA, the Forest National Corporation (FNC) and the FAO specialists. The gum agroforestry component is an upscaling of a successful pilot project that FNC implemented with support from the French Development Agency (AFD) in 2014-2018. FNC played a lead role in project preparation, collecting information on smallholder gum producer groups in the project States, convening stakeholder consultations and helping to oversee thematic studies commissioned jointly with FAO.

### FAO/FNC Multi-stakeholder consultations timeline

20. Since January 2017, FNC and FAO have engaged stakeholders in project preparation in a number of ways: (i) January 2017 multi-stakeholder workshop to discuss scope of project<sup>9</sup>; (ii) July 2017 workshop with government and non-government stakeholders from all the 13 gum belt states, to agree on criteria for selecting the project area, focusing on climate change considerations and environmental and socio-economic co-benefits<sup>10</sup>; (iii) September 2017 – September 2018 FNC/FAO field visits and stakeholder discussions in seven gum belt States, including North, South and West Kordofan; (iv) November 2017 – September 2018 FNC participatory assessment of the capacity of smallholder gum producer groups (GAPAs) to engage in the project; (v) January 2018 multi-stakeholder workshop to discuss initial findings of project preparation team; (vi) May 2018 workshop to consult with private sector gum buyers and micro-finance institutions; (vii) September 2018 project preparation team meetings with local stakeholders in North Kordofan. A final validation workshop will be organized after GCF feedback on the proposal has been received.

### Commissioning of specific project preparation studies

21. As part of project preparation, FAO and FNC commissioned five studies.<sup>11</sup> These were intended to validate approaches used in the pilot projects to be scaled up, or to fill information gaps. The five studies, which are referenced throughout the prefeasibility study, are:

- Abakar, A.M. and A.H. Ibrahim 2017. Marketing and contract farming feasibility of gum arabic in Sudan. Khartoum: FAO/FNC unpublished project preparation report.
- Ballal, M.E.B, A.M. Sharief, S.K.E. Abdel Rahim, A.M.F. Mohammed and A.R.A. Khatir 2018. Large-scale restoration of degraded lands for enhancing carbon stocks and increasing production of quality gum and other forest and agricultural products. Khartoum: FAO/FNC unpublished project preparation report, May 2018.
- Mahmoud, T.E. and S.M. Elhassan 2018. Assessment Summary Report: Description, Analysis and Verification of GAPAs in the Selected States of the GAMS Project. Khartoum: FAO/FNC unpublished project preparation report, October 2018.
- Mofadel, H. I. A. 2018. Contract Farming Agreements between Gum Arabic Producer Associations (GAPAs) and Private sector in Sudan: Cases and Experiences. Khartoum: FAO/FNC unpublished project preparation report.
- Siddig, E.A. 2018. Sudan: Gum Arabic policy and institutional reform. Khartoum: FAO/FNC unpublished project preparation report.

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<sup>9</sup> Scoping workshop recommendations and participant's list are available in project files.

<sup>10</sup> Workshop participants' list and site selection report are available in project files.

<sup>11</sup> All five studies are available in the project file.

## CHAPTER 2 CLIMATE CHANGE, VULNERABILITY and RESILIENCE in SMALLHOLDER PRODUCTION SYSTEMS

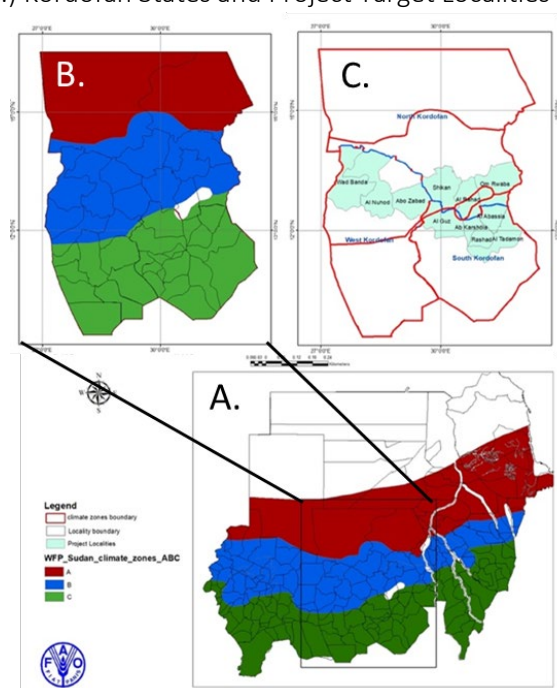
### CLIMATE CHANGE

22. Situated in Northeast Africa, Sudan anchors the eastern edge of the Saharan desert along the Red Sea and is bisected through its north-south axis by the Nile River Basin. Arid in the north, with less than 25 mm of annual rainfall along the Egyptian border, the country's climate becomes increasingly moist towards the south, with areas receiving just over 800 mm in the extreme south (RoS, 2014). Characteristic of the region, the onset of the single rainy season is driven by the northward movements of the InterTropical Convergence Zone (ITCZ) drawing moisture laden air into the arid interior. Annual mean temperatures are high, ranging from 26 °C to 32 °C, with annual average maximal temperatures rising to 33°C to 39°C (World Bank, 2020; SMA, 2018). In an environment characterized by high temperatures, low and variable rainfall, the seriousness of future changes to the climate, in terms of potential impacts on agricultural productivity and human welfare, is not to be underestimated. The remainder of this section examines the historical trends in precipitation and temperature, future projections and greenhouse gas emissions using reliable data and recent analysis from various sources. In particular, the Sudan Meteorological Authority (SMA) provided FAO with daily weather records from its network of 29 stations for the period 1981-2018 which were analyzed to identify the existence of climate trends and are presented here.

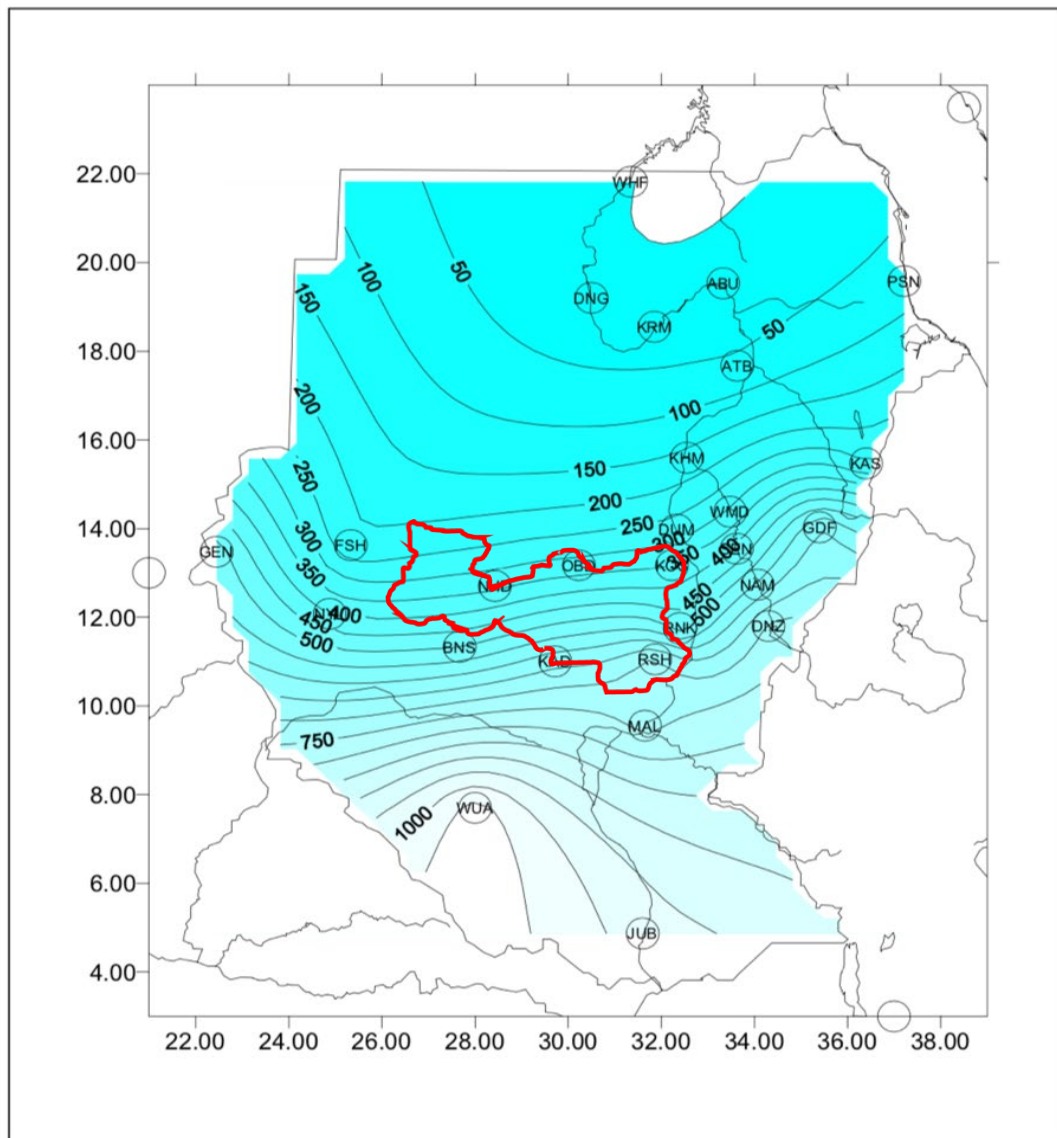
### Climate baseline

23. Sudan lies between 8°N and 23°N. The 11 target Localities of the project lie within the three Kordofan States (North, South & West) highlighted in blue in the top right portion (C) of Figure 1.

**Figure 1.** Climate zones of Sudan: A.) Livelihood Zones (WFP, 2016); B.) Livelihood Zones and Kordofan States; C.) Kordofan States and Project Target Localities (light blue).



**Figure 2.** Rainfall Isohyets, Sudan (RoS, 2003), with overlay of target localities in red.

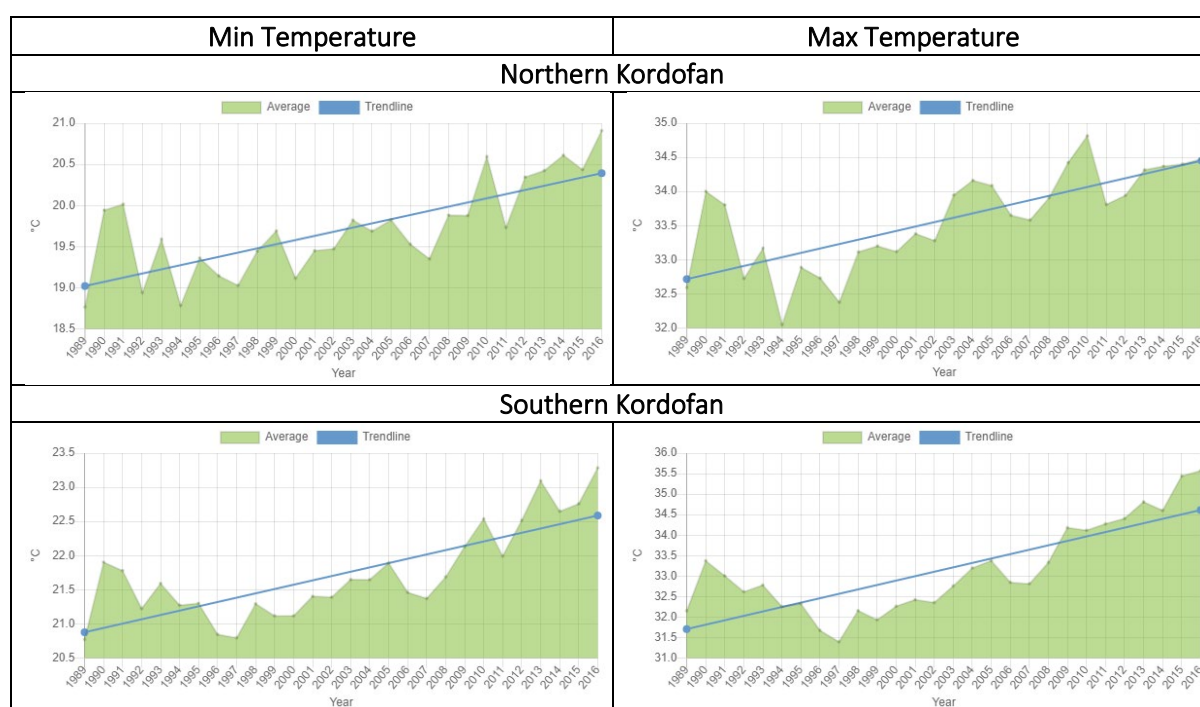


24. Historically the Kordofan states have received between 350 - 850mm of rainfall on average annually (RoS, 2003 Vol. II) (see Figure 2). Depending on latitude, rainfall occurs during a single rainy season beginning in May/June, lasting until October/November, with the peak occurring during July – August (ibid). Rainfall in the Kordofan states is highly variable with the coefficient of variability (CV) ranging from 65 in the north to 15 in the south, with an average CV of 25 from reporting met stations within the project target areas (ibid). Drought is also endemic with particularly severe, national-scale droughts occurring in 1967-1973, 1980-1984, 2012 and 2015 (World Bank Knowledge Portal; IFAD 2019), and more localized droughts, affecting portions of the country occurring in 1987, 1989, 1990, 1991, 1993, 2000, 2011. The Kordofan and Darfur states are noted in Sudan’s first communication under the UNFCCC as being the most heavily drought affected<sup>12</sup> areas within the country (RoS, 2003, Vol I).

<sup>12</sup> No specific figures are given, rather RoS 2003 (Vol. 1) makes a summary statement regarding the relative drought affectedness of different areas of the country.

### Historical temperature trends

25. The latest report of the IPCC (2019) shows that globally, mean land surface temperatures have risen 1.53 °C since the pre-industrial era (1895-1900 to 2006-2015), with temperatures rising much more rapidly since 1980. Figure 3 shows the trend of temperature increase in Northern and Southern Kordofan<sup>13</sup> over the period 1989 – 2016, with annual minimum temperature increasing by 1.4 °C in Northern Kordofan and 1.7 °C in Southern Kordofan, and maximal temperatures rising by 1.8 °C in Northern Kordofan and 2.9 °C in Southern Kordofan. These trends show that the combined mean temperature increase in Northern and Southern Kordofan over the period has been more than twice as fast as the global average – 1.95 °C vs 0.89 °C (NOAA, 2020). This rate of temperature increase translates into a 12.8 percent rise in potential evapotranspiration for North and South Kordofan, capable of removing an additional 97 mm of soil moisture annually.<sup>14</sup>



**Figure 3.** Evolution of Annual Min and Max temperatures over the period 1989-2016 in Northern and Southern Kordofan (Source: The European Centre for Medium-Range Weather Forecasts ECMWF, Earth Map)

### Historical precipitation trends

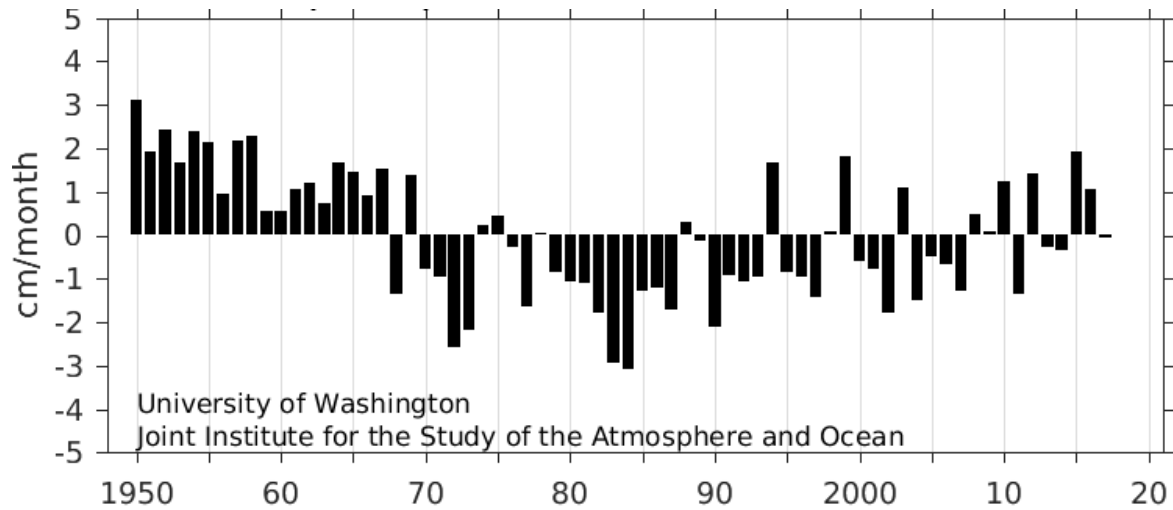
26. Situated within the Sahelian zone, Sudan was equally impacted by the continent-wide 20-25 percent downturn in precipitation that affected the Sahel in the latter half of the 20th century (Giannini, 2016) (Figure 4). As a result of this sustained period of decreased rainfall the desert boundary in Sudan pushed up to 200 km further southwards (IFAD, 2019). The recent “partial recovery” of annual rainfall has been characterized in some locations of the Sahel by an increase in the mean intensity of daily rainfall, with little increase in the number of rainy days (Lebel et al., 2003). The trend analysis of daily met station data conducted by FAO within the project target area (1981-2018) shows: (A) a modest increase in total precipitation within the agricultural season; (B) no observable change in the average

<sup>13</sup> For longer-term climate statistics, the labels Northern and Southern Kordofan are used rather than North, South and West Kordofan States, since the State of West Kordofan was abolished in 2005 (with its territory divided between North and South Kordofan) and recreated in 2013.

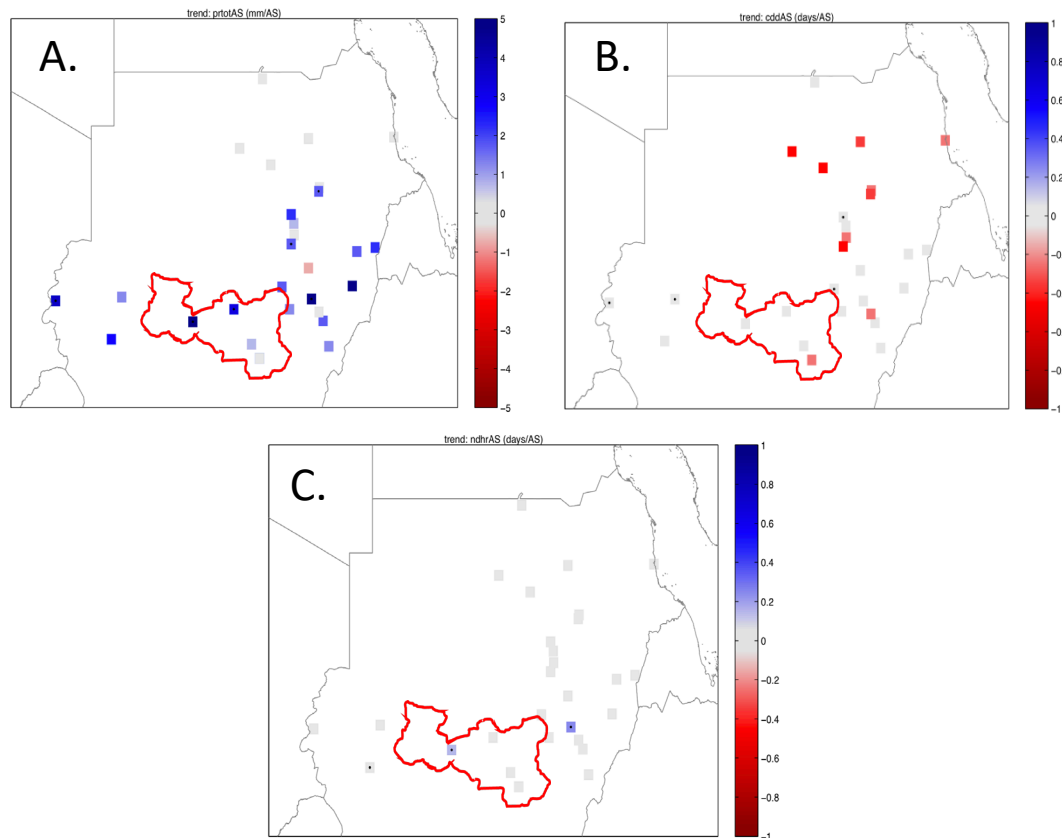
<sup>14</sup> Calculations of the potential evapotranspiration were performed using Thornthwaite's equation; commonly used when meteorological parameters other than temperature and latitude are unknown. The equation is known to under-estimate the actual rate of evapotranspiration.



gap between rainy days within the season; and (C) a slight seasonal increase in the number of high rainfall days in some locations within the project target area (Figure 5). Combined, a modest increase in annual precipitation and the absence of change in the gap between rainy days supports the general trend observed elsewhere in the Sahel of a rise in average rainfall intensity. This increase, and the observed slight rise in the number of high rainfall events, indicates the potential of more rainfall being lost through runoff resulting in a decrease in water actually available to support crop growth.

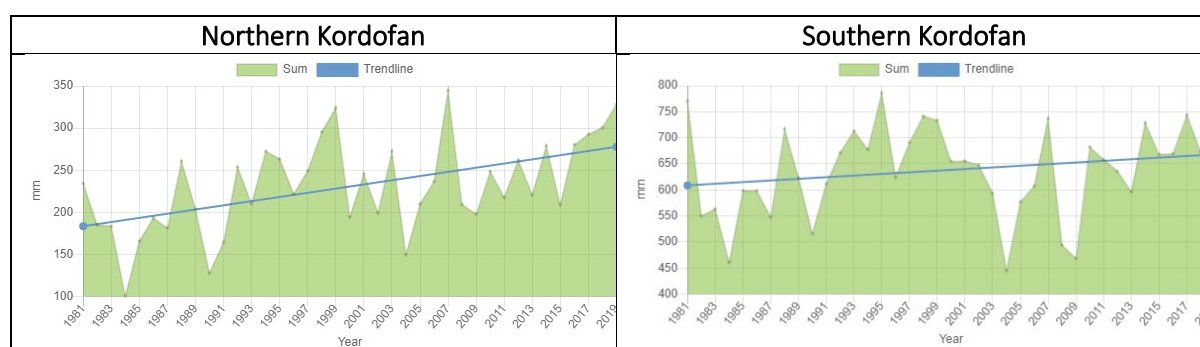


**Figure 4.** Sahelian rainfall anomalies 1950-2017 (June - October averages over 20-10° N, 20° W -10° E)(Source: University of Washington, Joint Institute for the Study of Atmosphere and Oceans; [http://research.jisao.washington.edu/data\\_sets/sahel/#analyses](http://research.jisao.washington.edu/data_sets/sahel/#analyses))



**Figure 5.** Trends in precipitation (1981-2018) within the agricultural season: A.) mean annual precipitation, B.) number of rainy days within the season, C.) number of high rainfall (>30 mm) days (Source: data provided by the Sudan Meteorological Agency, analysis by FAO).

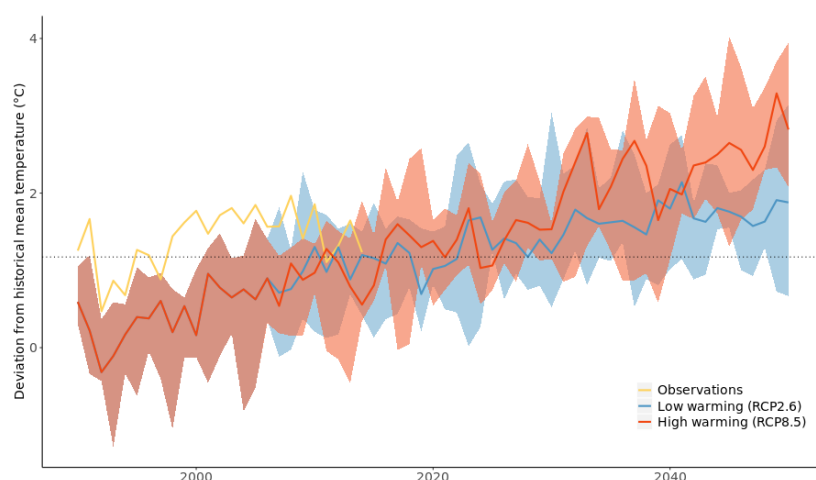
27. The general trends in annual rainfall volumes across the Kordofan states over the 1981-2019 period show a modest but clear increasing trend (Figure 6), with an equally clear continuation of the high degree of variability in annual precipitation. It should be noted, however, that the observed increase over the past three decades of nearly 60 mm of annual rainfall in South Kordofan and 95 mm in North Kordofan, shown in Figure 6, were more than offset by the rise in potential evapotranspiration that occurred over the same period, which removed approximately 136 mm of additional moisture – thus resulting in a net decline in soil moisture availability.



**Figure 6.** Evolution of Annual precipitation over the period 1981-2019 in Northern and Southern Kordofan (Source: CHIRPS, Earth Map)

#### Projected future trends

28. The projections of climate change for Sudan indicate a continued warming trend under both the low (RCP 2.6) and high emission (RCP 8.5) scenarios (Baarsch et al., 2020). As shown in Figure 7, below, the expected mean annual temperature rises under RCP 8.5 by 2050 is 2.8°C, raising average annual temperatures in the Kordofan states to 30.8°C. An annual average temperature equal to those currently experienced in Mecca, Saudi Arabia, the reputed hottest inhabited city in the world (30.7°C) (Burt, 2014). More importantly, in the absence of appropriate adaptation action, these higher temperatures will greatly intensify soil moisture loss through increased potential evapotranspiration, resulting in the removal of an additional 291 mm from the soil annually.



**Figure 7.** Deviation from the historical mean temperature (1951-1980) under low warming and high warming scenarios for Sudan. (Source: [https://explorer.et0.co/en/ee110\\_en/](https://explorer.et0.co/en/ee110_en/), based on Baarsch et al., 2020)

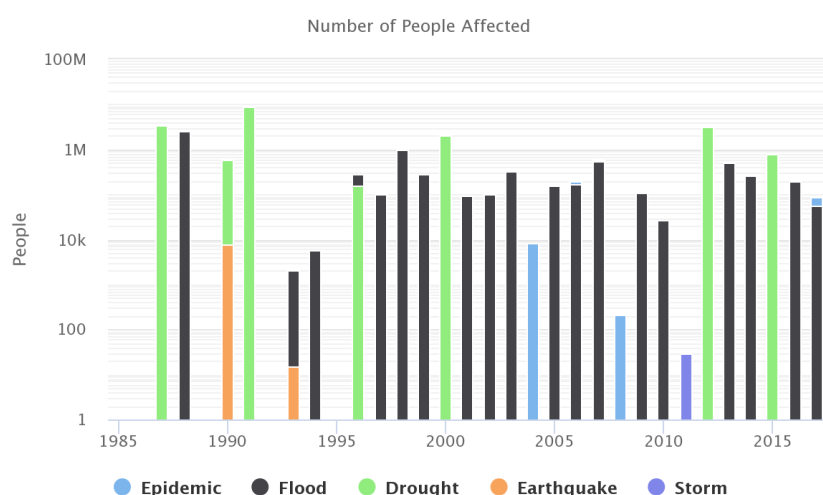


29. Forecast changes in precipitation for Sudan are more uncertain than temperature with various models predicting possible wetter or drier future conditions. Model projections for northern Sudan are less consistent with respect to changes in rainfall, while there is higher confidence in southern Sudan of an increase in the current trend toward more intense precipitation events (World Bank Climate Change Knowledge Portal). Considering the entire country under the high emission scenario RCP 8.5 the projection is for a slight increase in mean annual precipitation of 5.8mm by 2050 (equivalent to 1-2 percent in the project area) (CHIMP5 data; Ibid). This slight increase in precipitation is more than offset by the expected 34 percent increase in the potential evapotranspiration rate due to rising average annual temperatures over this same period, as detailed in paragraph 25.

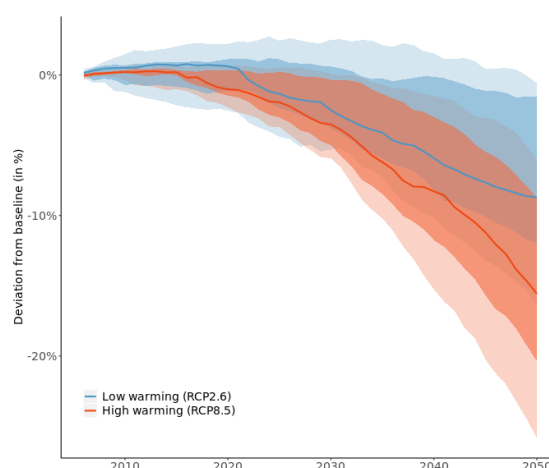
## VULNERABILITY

### Vulnerability at national and household level

30. In addition to the growing seriousness of moisture stress due to the slow onset of rising temperatures, over the past three decades Sudan has faced a range of acute environmental hazards, particularly weather related extreme events – droughts and floods – with individual events affecting up to one million people (see Figure 8). Projections for 2050 show that the economic impact of climate stressors, as illustrated in Figure 9, could reduce Sudan’s per capita GDP by about -15.6 percent (median), with a maximum loss up to -28.6 percent in the high warming scenario (RCP8.5) (Baarsch et al. 2020). Much of this decrease is related to losses in the agricultural sector.



**Figure 8.** Key Natural Hazard Statistics for 1985-2018 (Source: World Bank Climate Change Knowledge Portal)



**Figure 9.** Consequence of climate change on GDP per capita in Sudan (Source: [https://explorer.et0.co/en/ee110\\_en/](https://explorer.et0.co/en/ee110_en/), based Baarsch et al. 2020)

31. The ND-GAIN vulnerability index<sup>15</sup>, which measures overall vulnerability by considering food, water, health, ecosystem service, human habitat, and infrastructure, currently ranks Sudan the 6th most vulnerable country in the world (175th of 181 countries – the 181st is most vulnerable). The ND-GAIN index uses the framework of the IPCC's 4th assessment report (IPCC, 2007) in assessing vulnerability, where: Vulnerability = (exposure x sensitivity) – adaptive capacity. Sudan ranks among the most exposed (177th of 192 countries – the 192nd is most exposed), most sensitive countries (167th of 171 countries – the 171st is most sensitive) and lowest in adaptive capacity (164th of 180 countries – the 180th has the least adaptive capacity).

32. In terms of food security, national averages of caloric supply and protein have shown a slight improvement since 2011, while the percentage of individuals undernourished has declined from 23.5 percent in 2011-2013 to 20 percent in 2016-2018 (FAOSTAT). At the household level, food security and household income are closely linked, with 60 percent to 75 percent of rural households' annual net food buyers (WFP, 2018). The higher poverty rates in the rural areas, 58 percent versus 27 percent in urban areas, combine with the extreme variability in rainfed agricultural production in defining the food insecurity experienced by the majority of households. In the Kordofan States between 78 percent and 89 percent of households spend over 65 percent of their household income on food (WFP, 2018). Not surprisingly, the poorest 20 percent of households are the most food insecure, with 65 percent reporting moderate to severe levels of food insecurity (ibid). Poorer households, female-headed household and those with highest levels of food insecurity, are all more dependent on agricultural activities than the wealthier and more food secure households (ibid). Across most major metrics, households in the Kordofan States follow those in Darfur in their dependence on crop agriculture and livestock, poverty and food insecurity (ibid). Survey data from households in North Kordofan show that earnings from the collection and sale of gum Arabic provide up to 38 percent of household income (AFD, 2017), and across the Gum Belt constitutes the major source of income during the dry season (FNC, 2016). With the majority of rural households being annual net food buyers, especially the poorest, this underscores the importance of gum Arabic income to food security in the project area.

#### Impacts on agriculture in the three Kordofan States

33. Despite the importance of Sudan's agricultural production to the national economy, productivity and area harvested is low and determined largely by annual rainfall, with an overall trend of declining yields masked by annual production conditions. Nationally, yields for sorghum and millet are 80 percent and 57 percent respectively of those obtained elsewhere in Africa (Osman, 2017). The co-efficient of variation in yields over a 40-year period (1970-2009) in North Kordofan for sorghum, millet and groundnuts were 80, 66 and 60 percent respectively (Osman, 2017). Over this same period, millet yields showed the greatest rate of decline at 7 kg/ha/yr (ibid).

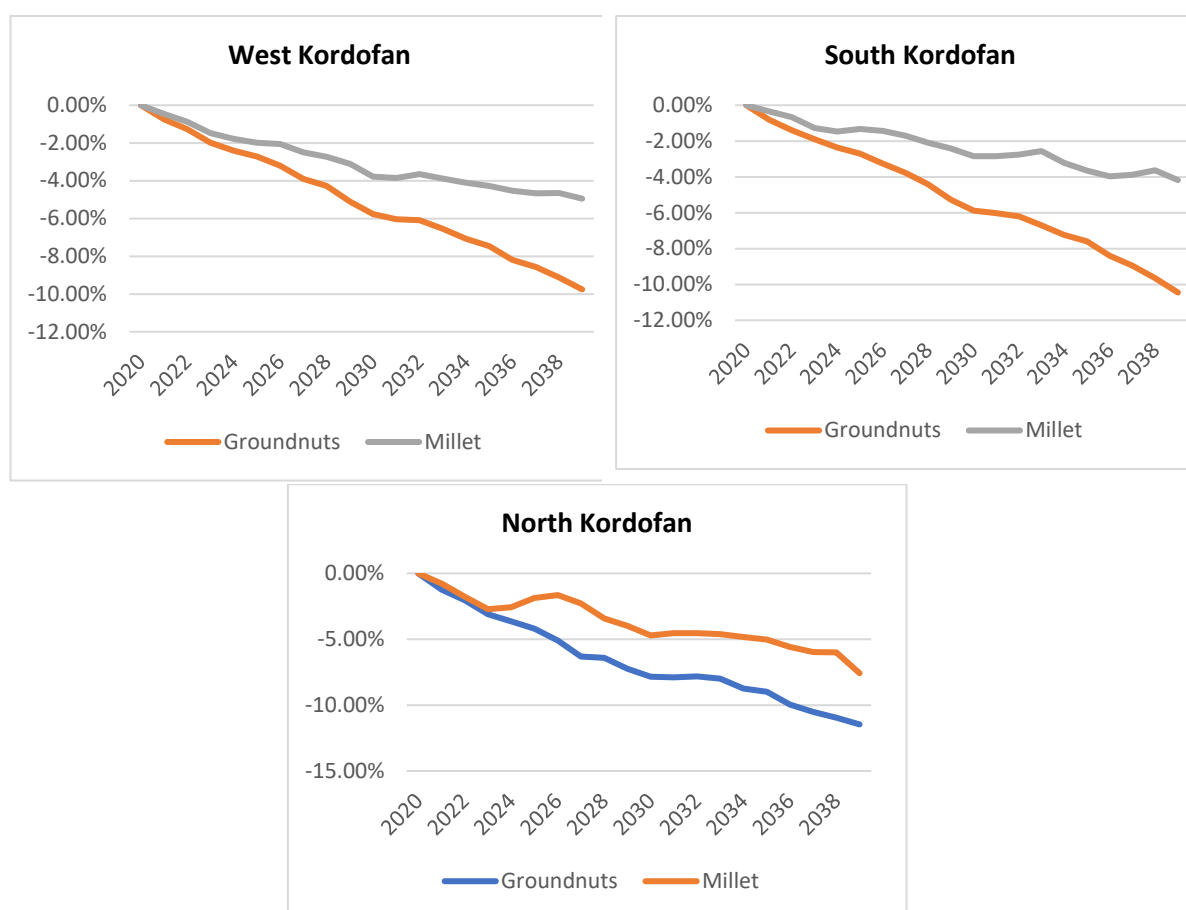
34. A number of studies have examined the climate change impacts on agriculture in Sudan. Similar to the findings of FAO's own analysis carried out in preparing this proposal, the World Food Programme and the UK Met Office showed in their nationwide vulnerability assessment that the potential, slight increase in future precipitation is likely to be dwarfed by the impact of higher temperatures on evaporation, exacerbated by increased surface run-off due to land degradation from inappropriate farming practices and overgrazing (WFP, 2016). Sudan's National Adaptation Plan of Action has forecast that the humid agro-climatic zones are likely to continue shifting southward, rendering areas of the north increasingly unsuitable for agriculture, which in turn will contribute to increasing resource

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<sup>15</sup> <https://gain.nd.edu/our-work/country-index/rankings/> (accessed 07/02/2020)

scarcity (RoS, 2007). Sudan's Second Communication under the UNFCCC found that the areas suitable for agriculture are expected to decrease in size with negative impacts for both local incomes and food security (RoS, 2013a). The adverse impacts of climate change may impact some areas indirectly as agriculture in the drier parts of Sudan become less productive, leading to an exodus of inhabitants, elevating the risk of conflict over resources further south (RoS, 2016). As part of the growing body of evidence on the relationship between climate change and social tensions and violence, studies carried out elsewhere in the Sahel have found that resource scarcity and migration of ethnic groups have in some cases triggered latent conflicts and lead to the emergence of new outbursts of violence over natural resources (Benjaminsen et al., 2012; Homer-Dixon, 1994; 1999).

35. The direct climate change impacts on crop production will be significant. Figure 10, below, shows the projected climate change impact on the yields of select rainfed crops in the Kordofan states for the high emission scenario RCP 8.5 as projected by the IFAD CARD tool<sup>16</sup> for the period of 2020-2039. The results show a decrease in the yields of between 4 percent to 7 percent for millet, and 10 percent to 12 percent for ground nuts by 2039.



**Figure 10.** Impact of CC on yields in the Kordofan states in the RCP 8.5 Scenario (2020- 2039)(CARD; <http://www.ifad.org/card>)

36. Sudan's First National Communication under the UNFCCC (RoS, 2003 Vol. 2) carried out a detailed assessment of the climate change impacts on millet, sorghum and Gum Arabic production in the Kordofan's states. The twenty simulations conducted for five locations, four of which fall within the project target areas, projected declines in millet yield by 2030 of between 15 percent and 58 percent,

<sup>16</sup> The Climate Adaptation in Rural Development (CARD) assessment tool enables easy access to peer-reviewed modelling results for crop yields under climate change. It uses data from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) and the greenhouse gas emission scenarios. <http://www.ifad.org/card>

and by 2060 of between 24 percent and 62 percent (ibid). Projected declines in sorghum yields by 2030 were between 44 percent and 69 percent, and by 2060 of between 49 percent and 71 percent (ibid). For Gum Arabic, the projected yields losses were roughly half those for cereal crops, with an estimated loss of between 25 percent to 30 percent by 2030 and 2060 respectively (ibid). The more tolerant characteristics of Gum species were identified as offering an important adaptive option for the region.

## GHG EMISSIONS and EMISSION TRENDS

37. Sudan's total GHG emissions have shown a clear rising trend, increasing by 36 percent from 1990 to 2016 (CAIT Country Greenhouse Gas Emissions Data, see Figure 11).<sup>17</sup>

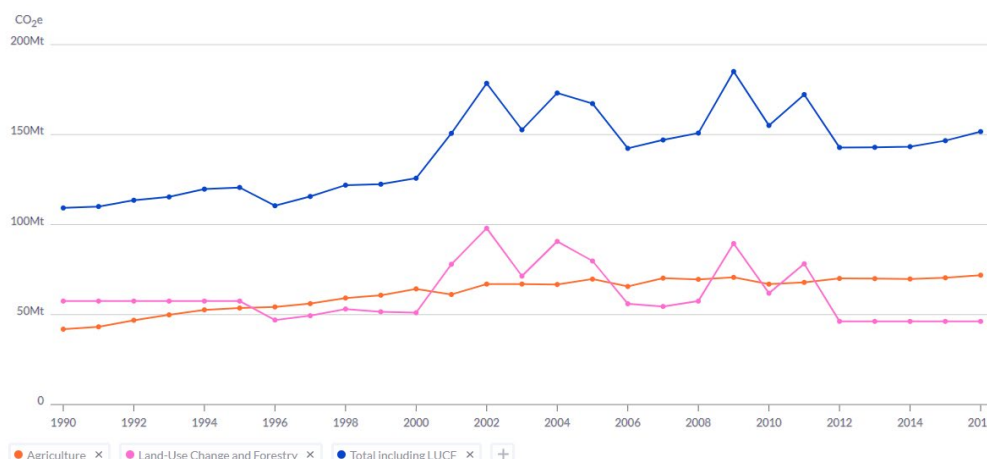


Figure 11. Sudan Greenhouse Gas Emissions Data (1990-2016) (Source: CAIT)

## Agriculture, Forestry and Other Land uses

38. Together, agriculture and land-use change and forestry (LUCF) account for nearly 80% of overall emissions. The GHG emissions from the agricultural sector increased by 71 percent, while LUCF decreased by 24 percent over the same period (CAIT Country Greenhouse Gas Emissions Data). The increase in emissions from agriculture is primarily due to an increase in livestock populations with approximately 74 percent of all CO<sub>2</sub>e emissions associated with enteric fermentation and manure management. The decrease in emissions from LUCF is a result of reductions in forest and grassland conversion, coupled with the expansion in reforested areas and managed forested lands (RoS, 2013a). The spikes in LUCF emissions between 2001 and 2006, and again between 2006 and 2012, align closely with periods of conflicts within the country which disrupted traditional and formal tenure systems and lead to the displacement of several million individuals who relied on forest resources for their survival.

## Sudan's Climate Change Mitigation and Adaptation Targets: INDC, NAP and REDD+

39. While Sudan's Intended Nationally Determined Contributions (INDC) under the Paris Agreement of the UNFCCC (RoS, 2015) does not set specific emission reduction targets, a target is set for achieving a national forest cover of 25 percent by 2030 through reforestation and afforestation efforts if international assistance is provided. The adaptation component within the INDC (RoS, 2015) is based on the National Adaptation Plan (NAP)(RoS, 2014) priorities, with additional intended actions articulated under the mitigation component. Specifically, the INDC (and NAP) proposes the following key adaption actions with which this proposal is aligned:

- diversification of income generating activities in order to increase adaptive capacity of vulnerable farmers' communities in order to achieve food security/reduce poverty;

<sup>17</sup> <http://cait.wri.org/historical/>

- establishment of markets in vulnerable areas, awareness and access to information by vulnerable groups/communities etc.;
- Introduction of agroforestry in areas vulnerable to climate change to enhance agriculture production, as well as empower vulnerable communities through their involvement in community forests activities/products;
- establishment of women cooperative societies in order to empower them and increase their resilience;
- enhancing the participation of women and youth in activities related to adaptation and environmental conservation in order to empower them and enhance their adaptive capacity including through establishment rural women development programme;
- planting shelterbelts, introduction of high economic value trees and rehabilitation of the Gum Arabic gardens to increase the resilience of vulnerable communities through engagement in a range of forestry activities;
- joint management of the natural resources for comprehensive consideration of climate change impacts;
- management of the grazing areas and rangelands in a sustainable manner.

40. These INDC priorities are also reiterated in the national REDD+ strategy, which is to be published in 2020. The REDD+ strategy notes the potential for scaling up gum restoration and value chain interventions in twelve States: Gadaref, Blue Nile, Sinnar, White Nile, East, Central, South, West and North Darfur, as well as North, West and South Kordofan. In the framework of the REDD+ process, the FAO is supporting the Government in conducting a national forest inventory, the elaboration of a national forest reference level (to be reviewed by UNFCCC in June 2020) and the establishment of a national Measurement, Reporting and Verification system for the country's forest carbon stocks. The FAO is also assisting the Sudanese National Meteorological Authority in strengthening its weather data collection, analysis and reporting systems through a GCF NAP Readiness project, which has been endorsed by GCF in November 2019.

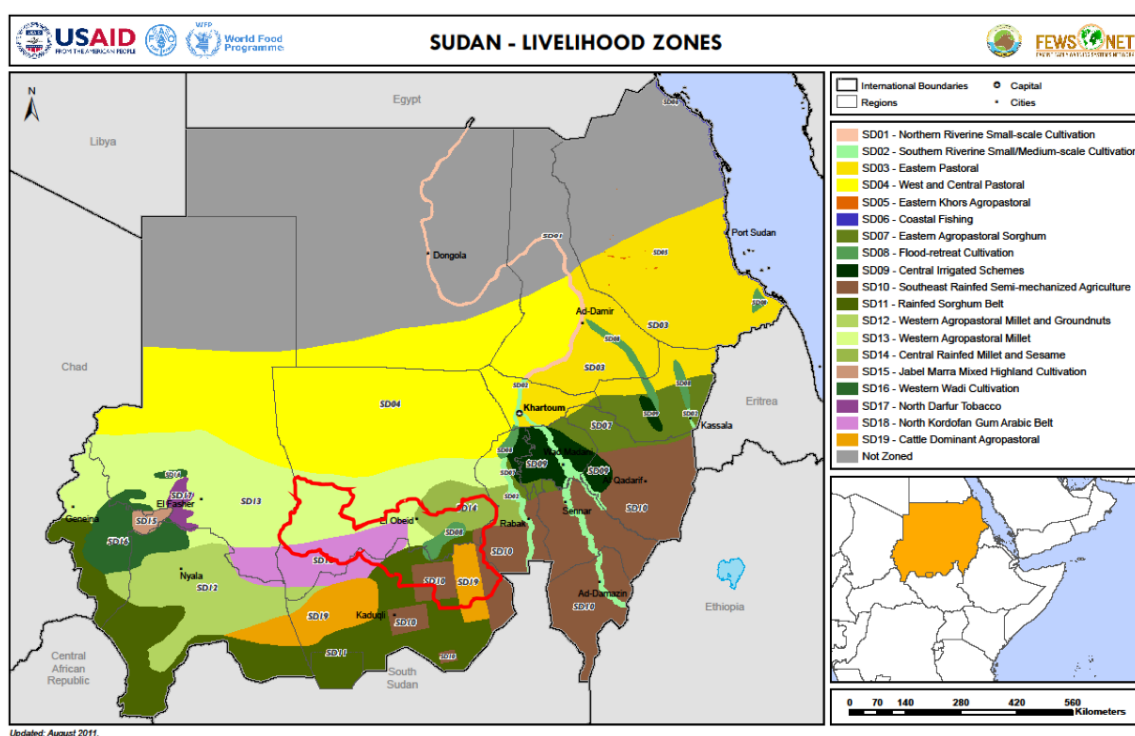
## CHAPTER 3 LAND USE SYSTEMS, ADAPTATION OPTIONS AND INSTITUTIONAL ISSUES

### Introduction: The Agricultural Sector in Sudan

41. Sudan is the third largest country in the African continent with a land base of nearly 1.9 million km<sup>2</sup>. The population is estimated at around 43 million (2020), two-thirds (66.8 percent) of which is thought to be rural (FAO, 2017a). The rural population is further subdivided between sedentary households (87 percent) and nomadic (13 percent) (ibid). Among rural households 95 percent are assumed to be involved in small-scale agriculture, predominantly rainfed, and pastoralism (ibid). Both groups are involved in gum production.

42. Historically, agriculture has served as the structural backbone of the Sudanese economy. After a period of decline in the early 2000s, where agricultural value-added GDP dropped from over 40 percent to a low of 23 percent just prior to the secession of South Sudan in 2011, agricultural GDP has risen and remained at over 30 percent in the years since (World Bank, 2020). Data from 2013-2014 within the sector shows that livestock production is the major contributor to agricultural GDP at 60 percent, followed by large-scale irrigated agriculture, 26 percent, rainfed farming, 11 percent, forest products, 2 percent, and semi-mechanized farming, 1 percent (FAO, 2017a).

Figure 12. Sudan Livelihood Zones with the project area marked in red



43. After livestock and sesame, gum arabic is the third leading contributor to agricultural export earnings (FAOSTAT; UNCTAD, 2018). Cumulatively, across these subsectors, the major share (73 percent) of agricultural GDP is generated by small-holder producers, those cultivating less than 4.2 hectares of land (ten feddans) (FAO, 2017a). There is little to suggest that these relative proportions have changed since then.

Agricultural production remains sharply divided between irrigated and semi-mechanized production systems and the extensive traditional rainfed systems, including livestock (see descriptions of these sub-sectors below). This general distribution reflects the country's natural resource endowments and pattern of past investment policies within the sector. Sudan has a reported 19.8 million hectares of arable land, roughly 10 percent of the total land area of the country, with an additional 48 million hectares in permanent pasture (FAOSTAT).

44. Geographically the country can be divided into proximate thirds, where the northern portion of the country is desert, the middle third, semi-arid grasslands with scattered trees, and southern third mixed woodland characterized into various agricultural systems (see Figure 12 above). The population density and agricultural crop production are increasingly concentrated in the middle and southern tiers. The gum arabic belt is located in the southern portion of the grassland dominated middle third, and the northern portions of the southern zone.

45. Roughly seventy percent of the total cropping area is sown to four food crops – sorghum, millet, groundnuts and sesame – of which virtually all is produced under rainfed conditions (FAO, 2017a). In terms of volume, the major crops produced, in descending order of importance, are sugarcane, sorghum, fruits, vegetables, groundnuts, onions and millet (FAOSTAT). Sudan ranks 6th globally in the production of sorghum and millet, and 5th for groundnuts (ibid), and is the world's leading producer of gum Arabic (UNCTAD, 2018). Sudan is also a major global producer of cattle (10th), small ruminants (goats 7th and sheep 6th) and camels (2nd), with the number of head, or all types, increasing steadily (FAOSTAT). The livestock herds are seasonally concentrated during the rainy season in the grasslands of the middle tier, with annual sojourns southwards in search of pasture and water during the dry season and times of drought. Ninety percent of the livestock production is thought to come from pastoralists and smallholder producers (FAO, 2017a).

46. Despite the importance of Sudan's agricultural production to the national economy, productivity and area harvested in the rainfed cropping systems is low and determined largely by annual rainfall, with an overall decreasing trend in yields masked by annual production conditions. Nationally, yields for sorghum and millet are 80 percent and 57 percent respectively of those obtained elsewhere in Africa.

### Farming systems in Sudan and in the three Kordofan States

47. Farming systems in Sudan are commonly placed into three categories – irrigated, semi-mechanized and traditional rainfed.

48. The irrigated system occupies 1.68 million hectares of land, roughly nine percent of the total agricultural lands, and is dominated (75 percent) by large state-owned perimeters (FAO, 2017b). Most schemes are situated along the Nile River and its tributaries, with additional seasonal spate systems found elsewhere and small- to medium-scale pump irrigation perimeters northward along the river (see SD09, SD02 and SD01, Fig. 1). These schemes produce a range of crops, including sugarcane, cotton, vegetables, fruits and fodder, as well as 100 percent of the wheat, 23 percent of sorghum and 1 percent of millet (FAO, 2017b; Osman, 2017). Yields, while the highest nationally, are well below world averages, due to lack of maintenance, problems with siltation in canals and poor agricultural practices (FAO, 2017b).

49. The semi-mechanized farming system is found in a large swath (6.7 million hectares; WFP, 2018), decreasing in width from East to West, situated south of the line receiving approximately 500 mm of annual precipitation (see SD10, Fig. 12). As indicated by name, not all activities in this system are fully mechanized. Typically, after mechanical land preparation and seeding, which can be undertaken on parcels of up to 50,000 hectares, other management activities are carried out by hand



(FAO, 2016). Although this system supplies on average 38 percent of the sorghum and 5 percent of millet, yields are extremely low (61 percent of average African yields) (Osman, 2017). The low yields are reflective of the opportunistic nature of the system, where operations are carried out with as few inputs as possible, with rainfall being the principal determining factor of yield (FAO, 2017b). In years with poor rain, the standing crop may be sold to pastoralists for grazing rather than harvested (ibid).

50. The traditional rainfed system occupies just under half of the total cropland (9 million hectares). Farm households, managing from 2 to 50 hectares of land, produce 39 percent of the sorghum and 94 percent of the millet grown in the country (FAO, 2017b; Osman, 2017). While this system is equally exposed to variations in rainfall as the semi-mechanized system, and in fact often occupies drier locations, average sorghum yields in the traditional rainfed system are over 40 percent higher (Osman, 2017), due to the greater management efforts applied by smallholder producers. The major share of gum Arabic harvest is produced by farmers within this system (particularly in the Kordofan States), and by pastoralists who overlap in this range (especially the Darfur States).

51. The three Kordofan States (North, South and West) where the project area is located contain over half of Sudan's rainfed cropping area (54 percent), including both the traditional and semi-mechanized systems (FAO, 2017a). The States produce nearly half (47 percent) of the national cereal production (FAO, 2017a), which in 2003 included 40 percent of the national millet harvest, 15 percent of the sorghum, 25 percent of the groundnut and 30 percent of sesame (RoS, 2003). A millet-based production system dominates on the sandy soils in the center and north, while a sorghum-based system is found on the heavier clay soils to the south and east. Both systems incorporate gum trees (*Acacia senegal* dominates on sandy soils and *A. seyal* on heavier soils) in the crop rotations, which in addition to a cereal crop include other annual crops – sesame, watermelon, cowpeas and others. The Kordofan States are home to 75 percent of the Gum Arabic production nationwide (RoS, 2003). They are also considered the centre for livestock production (ibid).

52. The Kordofan States harbour 21%, 24%, 22% and 22% of the national herds of cattle, camels, sheep and goats, respectively (Egemi 2017). Total number of grazing animals is about 38 million and the total rangeland area is over 20 million hectares, roughly half of which is in North Kordofan, and a quarter each in South and West Kordofan. Rangelands occupy 45, 40 and 34% of the total area of North, West and South Kordofan, respectively (ibid.). Despite their important role in the economy, transhumant pastoralists have become increasingly marginalized in recent decades due to the shrinking of customary rangelands and the blocking of traditional livestock migration corridors by spreading cultivation and by heavy capital investments, especially in the semi-mechanized farming sector (ibid).

### Climate change adaptation options for cropping systems

53. In the three Kordofan States, where opportunities for promoting irrigation are extremely limited, the key climate change adaptation option for agriculture that is accessible to smallholder farmers, is the promotion of agroforestry, as foreseen by Sudan's NAP and INDC. Under agroforestry<sup>18</sup> systems, trees are mixed into the crop fields in order to protect crops from moisture stress, which is projected to increase significantly under future climate change scenarios (see Chapter 2).

#### Why trees?

54. It is now generally accepted that tree-based production systems such as agroforestry have enormous potential to reduce vulnerability and increase the resilience of households living in dryland regions of Sub-Saharan Africa.

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<sup>18</sup> For a formal definition and a more extensive discussion of the concept of agroforestry, see the section Definitions and Key Concepts, above.



**Table 1. Agroforestry impacts on annual crop yields and ecosystem services**

Issue	Evidence	Reference
No benefit, or competition, between crops and <i>A. senegal</i> trees when agroforestry system first established.	No significant yield difference (increase or decrease) in sorghum or sesame when trees planted 5m x 5m and 10m x 10m; from year of planting to 4 years	Raddad and Luukkanen, 2007
Decrease in crop yields when <i>A. senegal</i> trees are planted closely together.	Significant decline in crop yields for groundnut (53%), sesame (6%) and roselle (14%) with 15 year-old trees at densities of 500 trees/ha (LER <sup>19</sup> still >1.00)	Fadl and Gebauer, 2004
	Significant decline in crop yields for groundnut, sesame and roselle (LER>1.00)	Fadl and Sheikh, 2010
Significant increase in crop yields when planted in agroforestry association with <i>A. senegal</i>	At 4 x 8 tree spacing crop yields were significantly higher for sorghum (34-119%), sesame and groundnut	Ahmed et al., 2012
	Sorghum (19-23%)	Mohamed, 2005
	Sorghum (14%), sesame (24%), roselle (21%)	Fadl, 2012
	Sorghum (138-223%), sesame (25-75%), groundnut (96-54%)	Elzulali, 2009
Crop yield increase due to combination of following benefits associated with agroforestry generally and <i>A. senegal</i> agroforestry associations in particular: significant increase in soil fertility, potential infiltration, reduction in runoff, moisture retention in soil, reduced erosion, reduction in temperatures	N, P, K, soil carbon,	Muchane et al., 2020; Fadi, 2012; Elzulali, 2009; Mohamed, 2005
	Reduction of Runoff	Muchane et al., 2020
	Erosion (decreased by 50%)	Muchane et al., 2020
	Temperature	Omar and Muhammed, 2015; Fadl, 2012 V&W;
	Water retention (reflected by reduced bulk density of soil; increased soil organic carbon (21%); increased soil organic matter)	Elzulali, 2009; Muchane et al., 2020

55. Trees provide food, fodder (especially during the dry season, when there is no grass), fuel and fibre, soil enhancement (through litter fall and nitrogen fixation) and with their deep rooting systems, offer some production even in drier years. They are therefore a good buffer against climatic risk and a critical element in rural livelihood diversification strategies. Production of the most important dryland crops is typically associated with dispersed trees in the farm fields, a form of land use often referred to as “agroforestry parklands” (World Bank 2016).

56. Trees on farms will become even more important in the future, as they mitigate the impact of increased moisture stress, through promoting greater water infiltration, reducing temperature

<sup>19</sup> LER stands for Land Equivalency Ratio. An LER greater than 1 indicates that the agroforestry system outperforms annual cropping without trees.

(through shade) and wind speed, and thereby reducing evaporation. They also contribute to increased resilience indirectly, through their impact on reducing soil erosion, trapping of wind-blown dust, increasing soil fertility, and therefore to improved soil moisture holding capacity. Table 1 summarizes agroforestry impacts on crop yields and other ecosystem services, with a special emphasis on the benefits provided by *Acacia senegal*, the “hashab” variety of gum arabic that is grown most widely in the project area, to a variety of annual crops.

57. Although trees provide valuable environmental services, these functions are not generally the primary reason why farmers plant, manage and retain them. Rather, the impetus for tree cultivation is the value of the other products trees can provide, such as timber, woodfuels and non-wood forest products (food, medicines etc.), with immediate and clear benefits to farmers’ livelihoods (van Noordwijk et al. 2011).

58. About 150 non-wood forest products (NWFP) are regularly harvested and used in Sudan. At least six of these NWFPs are regularly exported: gum arabic (*Acacia senegal* and *Acacia seyal*)<sup>20</sup>, gum loban (*Boswellia papyrifera*, known in English as frankincense), as well as aradeib fruit (*Tamarindus indica*), baobab fruit (*Adansonia digitata*), senna leaves (*Cassia senna*) and henna leaves (*Lawsonia inermis*). The total value of NWFP export trade, excluding gum arabic, amounts to around USD 7 million annually. This sum is dwarfed by the value of gum arabic exports, which reached USD134.2 million in 2013 (Mahmoud 2016).

59. Apart from gum arabic, local uses of NWFP – including direct household consumption as well as sale in local markets – are more important than production for export. The results of key informant interviews carried out in North and West Kordofan States (inside the project area) and Blue Nile and Sennar States for a major FAO study on NWFP in Sudan (Mahmoud, 2016) provided strong evidence of the significant contribution NWFPs make to local communities, including food, fodder, medicinal materials, and other uses. The use of NWFPs as fodder – obtained from many different species – ranked first (45 percent), followed by food (29 percent), medicinal materials (21 percent) and other uses (5 percent). The distribution of gross income from collecting the three top NWFPs in North and West Kordofan states revealed that the highest income was obtained from collecting gum arabic (58 percent), followed by baobab (27%) and tamarind fruit (15%), according to the NWFP collectors interviewed.

### Why gum arabic agroforestry?

60. During project preparation, a number of potential agroforestry species that could be promoted by the GAMS project were reviewed. As can be seen from Table 2 below, the two gum Arabic species, *Acacia senegal* and *Acacia seyal* are the most suitable tree species for integration in agroforestry systems in the project area. This is not only because of their large and growing export market potential (as discussed in the previous section), but also because of their nitrogen fixation capabilities and their suitability for being grown in a mix with annual crops, providing them with protection against heat and drying winds but not unduly competing with them.

61. The principal reason *Acacia Senegal* was selected as the main species for agroforestry restoration and reforestation is its extreme tolerance to dry conditions.<sup>21</sup> The species’ range extends far to the North, where the annual rainfall is only 100-150 mm, as compared to a minimum of 200-300 mm rainfall per year in the most northerly part of the GAMS project area. By introducing seed from such Northern, highly resilient provenances into the project area, the GAMS project will mitigate the

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<sup>20</sup> Other *Acacia* gums, such as the gums of *Acacia papyrifera* and *A. polyacantha*, are also exported in smaller quantities (10s to 100s of tonnes rather than over 60,000 tonnes such as GA) from Sudan, however their growing areas are restricted to Blue Nile, Sennar and South Darfur States.

<sup>21</sup> According to Ong et al. 2015, *Acacia senegal* has a documented root depth of 32 m, about 4-5 times the tree height!

expected impact of increased moisture stress on future gum yields.

**Table 2.** Comparison of selected NWFP species for suitability in agroforestry systems in Kordofan<sup>22</sup>

Latin name	Local name	Market potential	Suitability for agroforestry	Fodder quality	Observations
<i>Acacia senegal</i>	hashab	+++	+++	+++	Produces “hard” variety of gum arabic. Nitrogen fixer. Grows best on sandy soils but also found on clay soils.
<i>Acacia seyal</i>	talha	+++	+++	+++	Produces “friable” variety of gum arabic. Nitrogen fixer. Grows only on clay soils, fodder quality marginally better than hashab
<i>Adansonia digitata</i>	Baobab (known as tabaldi locally)	+(+)	+	++	Fruit (called “gongleiz”) rich in vitamin C, used in food. Tree too large for easy integration in agroforestry, mainly local market potential.
<i>Balanites aegyptiaca</i>	heglig	+(+)	+	+	Fruit (called “laloub”) can be processed into high-quality oil. Casts dense shade so not suitable for agroforestry. Mainly local market potential.
<i>Boswellia papyrifera</i>	Gum loban	+(+)	++	+	Tree yields high-value gum-resin called frankincense in English. Suitable for mixing with crops but not a nitrogen fixer. Rare in project area, mainly local market potential.
<i>Tamarindus indica</i>	Tamarind (known locally as aradeib)	+(+)	+	++	Fruit (“tamarind” in English) used for seasoning food. Nitrogen fixer, but large spreading crown less suitable for agroforestry. Mainly local market potential.
<i>Ziziphus spina-christi</i>	nabag	+	++	++	Small tree suitable for mixing with crops, not a nitrogen fixer. Fruit is made into flour, local market potential only.

Legend: + = low; ++ = medium; +++ = high

62. *Acacia senegal*<sup>23</sup> has been cultivated for centuries in the gum belt of Sudan, formerly in rotational bush fallow systems, but from the late 20th century onwards increasingly in more permanent mixes with annual dryland crops. When consecutive government policy interventions – including a government monopoly on the export of gum – reduced the producer price of gum to around 10% of the world market price in the early 2000’s, however, many farmers dis-adopted gum production (Rahim

<sup>22</sup> Based on Mahmoud 2016 and discussions held with FNC and local stakeholders during project preparation.

<sup>23</sup> Taxonomists have recently changed the name of the species *Acacia senegal* to *Senegalia senegal* and the name of *Acacia seyal* to *Vachellia seyal* (Kull and Rangan 2015, Kyalangalilwa et al 2013), but since these names are not generally accepted in the agroforestry literature or in Sudan, they are not used in this project document.

et al. 2008), with a clear negative effect on the natural resource base as many trees were felled and turned into charcoal (Mahmoud et al. 2017). Since the government monopoly on gum exports was abolished, however, producer prices increased to about 20-25% of world market prices. Smallholder gum producers who are engaged in contract farming arrangements facilitated by the AFD pilot project that the GAMS project proposes to scale up (see next section) receive about 45-50% of world market prices.

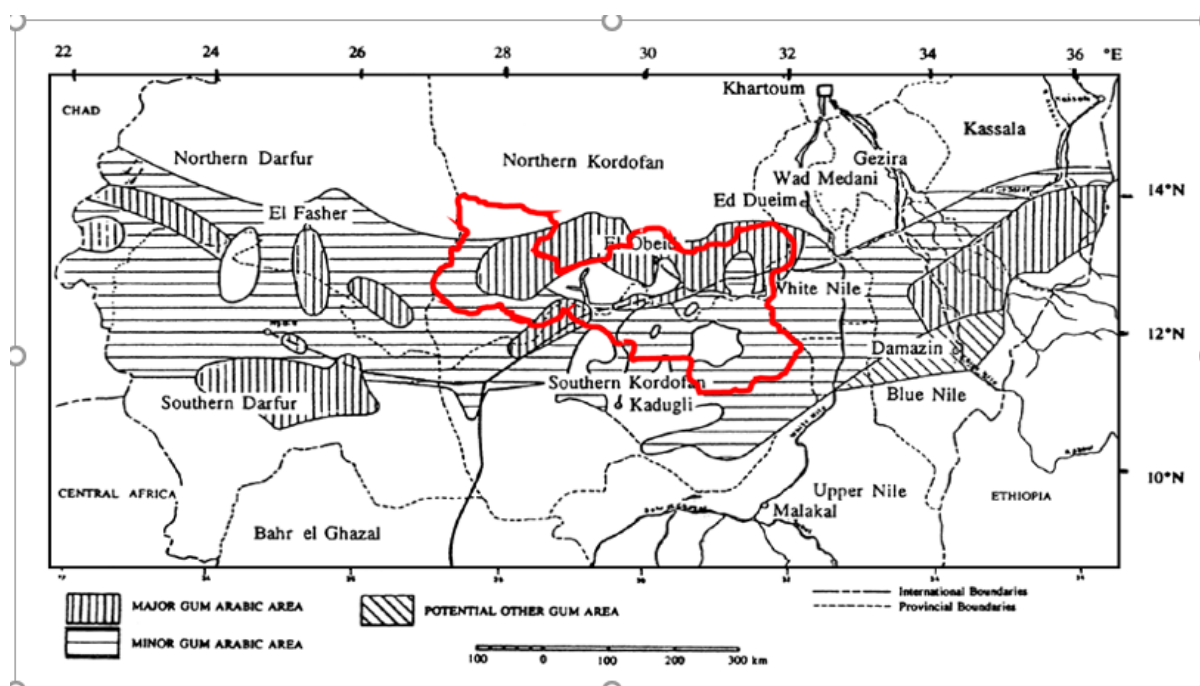
63. Acacia trees represent more than 70% of forests in Sudan. More than 30 species are present, 4 of which produce marketable gum. Two of these are officially recognized as “gum Arabic” by the Codex Alimentarius and are mostly exported on international markets: Acacia senegal gum (hashab) and Acacia seyal gum (talha). Hashab grows better on the sandy soils covering North and West Kordofan, whereas Talha grows better on clay soils, which cover part of the project area in South Kordofan. Therefore, Talha trees will be deployed for about 20% of the reforestation activities in South Kordofan, but Hashab trees will be used for 100% of the agroforestry activities in North and West Kordofan

64. The gum Arabic belt (figure 13, below) is an area of 520,000 square kilometres situated between latitude 10° and 14°, covering 11 States. In the project area, gum arabic is mostly produced by smallholder producers in agroforestry systems, mixing gum trees with annual crops. The trees start to produce gum 5 to 7 years after their establishment for an average period of 20 years. Acacia gum tapping starts in October, just before the sorghum harvest, the period characterized by lowest food and cash reserves in the households – thus making an important contribution to household food security (Kinomé 2012).

65. Gum arabic is the most commercially important plant-based gum worldwide. It is a complex branched polysaccharide composed of galactopyranose units and small quantities of glycoprotein, which give it its emulsifying properties. Plants (either wild or domesticated) are the only sources of gum arabic, which has never been synthesized successfully because of its complex composition and multiple biochemical properties (Sacande and Parfondry 2018). Gum arabic is in high demand in international markets for use as an emulsifier in a variety of foods and beverages and as a neutral carrier in the pharmaceutical and cosmetics industry, among others.

66. The value of raw gum exports from producer countries averaged USD 148,479,000 in 2014-2016, with Sudan accounting for over two thirds of this value, or USD 105,993,000. Gum prices have remained remarkably strong, despite a steady increase in worldwide gum supply from just over 30,000 tonnes in 1992 to 110,000 tons in 2016 (UNCTAD 2018). In conclusion, gum arabic agroforestry is a robust and low-risk climate change adaptation option, especially for the rural smallholder farmers and livestock producers in the three Kordofan States, who are considered to be particularly vulnerable to climate change impacts. Other key elements included under the NAP agroforestry options, such as market information and women’s cooperatives, are also covered under the GAMS project activities and outputs (see Chapter 5).

**Figure 13.** The gum Arabic belt in Sudan, with the project area marked in red



### SGAS pilot project to be scaled up by the GAMS project

67. Neither of the two projects to be scaled up by the GAMS project, the AFD-funded Support in Structuring the Gum Arabic Sector in Sudan (SGAS) project in North Kordofan, and the IFAD-funded Western Sudan Resources Management Project (WSRMP) in North, South and West Kordofan, have been the subject of a formal end-of-project evaluation.<sup>24</sup> Both projects, however, were included in a thorough, multi-stakeholder lessons learned exercise on natural resource management and climate change in Sudan, which was conducted by UNEP under the ADAPT project from 2016 to 2018 (see UNEP 2018a and UNEP 2018b).

### Description of SGAS project

68. The Support in Structuring the Gum Arabic Sector in Sudan (SGAS) project was funded through a grant from the Agence Française de Développement (AFD) signed in 2013, initially for a period of three years. Implementation started in 2014, with the Forest National Corporation as the implementing agency. The overall objective of the project was to contribute to poverty reduction and environmental protection by strengthening the gum arabic value chain in Sudan and by developing new market opportunities for gum in national and international market. The project, which aimed to support 30 smallholder gum producer associations (GAPAs), had three components: (i) Market Development and Market Information System; (ii) Gum Arabic Production and Quality Management; and (iii) Support Access to Microfinance.

69. The SGAS project's main pathway for repositioning the GAPAs in the gum markets was to build their capacity to organize themselves to produce sizable quantities of clean and dry<sup>25</sup> gum Arabic (following the international market standard, AIPG 2014) and to facilitate contract farming

<sup>24</sup> The Mid-Term review report of the AFD-funded project, however, was used in the preparation of the GAMS project.

<sup>25</sup> The training was provided by the Institute for Gum Arabic Research and Desertification at the University of North Kordofan (IGARD). Prescriptions for gum producers include direct collection and storage in suitable containers (jute sacks, woven plastic bags or baskets) and avoidance of any contamination with foreign matter including earth and other farm produce and plants (AIPG 2014).

arrangements with large gum buyers (exporters) willing to pay premium price for high quality gum. The project developed improved “sonki” or “sunki” gum tapping tools, enabling farmers to remove small strips of bark without unnecessarily damaging the wood – thus extending the useful life of the trees. In addition, “sonki” increase the productivity of gum tappers and are easier for women to use than the traditional axe employed in most of Sudan for gum tapping, as well as reducing injuries caused by the long, sharp spines of the Acacia gum trees (Hamad et al. 2018). As part of the contract farming arrangements, gum buyers agreed to pre-finance the gum tapping operations, and provided key inputs in-kind such as sonki, plastic sheets to avoid contact between harvested gum and the soil, and jute sacks (which are five times the price of standard plastic bags) to store the gum and allow it to dry properly. In addition, COMATS/Elemats, one of the companies participating in the project, provided SDG 750,000 (then equivalent to about USD 75,000) of cash pre-financing to 14 GAPAs. In return for obtaining a much higher quality gum, buyers agreed to pay a premium price, the El Obeid auction market price plus 10% (COMATS/Elemats) or 5% (Yousif Habeebi) premium. Since GAPAs were used to selling their gum to village traders at very low, “sheil”<sup>26</sup> prices of about 35-50%<sup>27</sup> of El Obeid auction prices, this effectively more than doubled the gum producer price.

70. As part of project preparation, FAO commissioned a study on the experience of the GAPAs engaged in contract farming arrangements with the Elemats and Habeebi companies (Mofadel 2018). The study demonstrated that the initial experience was highly successful, with 95 and 90% of the contracted quantities of clean, dry gum being delivered by the GAPAs. A sample of 6 GAPAs assessed in detail by IGARD showed significant increases in gum area tapped<sup>28</sup> (from 57 to 186 ha) and gum harvested (between 68 and 84%)(ibid.). This high success rate is quite unusual for contract farming arrangements, especially at the initial stages, which are normally characterized by a lack of trust between the companies and the producer groups, and high levels of side-selling by the latter. In recent years, contract farming arrangements have been interrupted by the civil unrest and the resulting inability of the gum companies to mobilize large amounts of pre-finance in cash. Nevertheless, three years after the AFD financing was terminated, 14 GAPAs are still engaged in gum contract farming, and a new company has become involved in 2018, the Almotahida exporting company. This demonstrates the robustness of the gum contract farming model piloted by the SGAS project that will be scaled-up under the GAMS investment.

## Lessons learned and barriers to be addressed in scaling up the SGAS project

71. Many important lessons were learned from the SGAS project experience, including: (i) the importance of building trust among value chain actors, who are generally unfamiliar with the constraints facing other actors within the chain; (ii) the importance of building the capacity of GAPAs to empower smallholders, increase their gum revenue, and creating incentives for adopting improved land use practices; (iii) the attractiveness of the gum contract farming model, both to smallholder producers and gum exporting companies, and the resulting increase in gum area tapped, gum harvested and smallholder revenues; (iv) the robustness of the contract farming model, and the ability of FNC to lead project implementation, with assistance from the Institute of Gum Arabic Research and Desertification (IGARD) of the University of North Kordofan for the gum production quality training; (v) the need for introducing specific “rules of the game” to prevent GAPA members (especially women) from being treated inequitably by their leaders<sup>29</sup>; and (vi) the immediate impact on smallholder

<sup>26</sup> “Sheil” refers to a system where village traders provide smallholder agricultural producers with pre-financing in return for an agreement to buy the crop at a fraction of the market price.

<sup>27</sup> The feasibility study for the SGAS project (Kinomé trees and life, 2012) cited a market sales price of 300 SDG/kantar against a “sheil” price of 100 SDG/kantar and noted that the smallholder gum producers’ highest priority was to find alternatives for “sheil” pre-financing.

<sup>28</sup> Many gum areas formerly remained untapped, because of the low “sheil” prices received by producers.

<sup>29</sup> E.g. some GAPAs leaders did not share out the pre-financing they received from the companies for all their members. In response, the companies developed obligatory “farmer declarations”, see Chapter 7, Implementation arrangements.

farmers' land use practices, in terms of extending the areas devoted to gum arabic agroforestry, principally through seeding trees mixed with crops seeds such as sesame. All of these lessons have been integrated in the GAMS project design.

72. While the project was successful in building GAPA capacity and facilitating contract farming agreements, five key constraints will need to be addressed in the scaling-up to take place under the GCF-funded GAMS project.

73. First, the number of GAPAs assisted through capacity building for producing high-quality gum was quite small: 30 GAPAs initially, of which 14 are still engaged in contract farming two years after the end of the project. Increasing this number by more than an order of magnitude to 500 will require not only significant investment (Outputs 1.2.1 and 1.2.2) but also adjustments in the contract farming model. The transaction costs of dealing with 100-150 GAPAs may be prohibitive for the gum exporters, and it might not be possible for them to generate all the required pre-financing. So, a direct link with micro-finance institutions (MFI) and/or banks, as foreseen under Output 1.2.4, will be established, by developing new lending instruments that are more adapted to the need of smallholder farmers, and by facilitation activities with the MFIs.

74. Second, and directly following on from the previous point, the SGAS project has not been able to draw MFIs and Banks into the contract farming relationships as it aimed to do. While some five GAPAs (out of 30) had reported receiving bank credit, this was for an average amount of SDG 1,070 (equivalent to USD 100), or about two percent of the average cash pre-financing – not counting inputs provided in-kind – granted to GAPAs by the gum company COMATS/Elemats under the project.<sup>30</sup> This is in part because of the risk-averseness of Sudanese financing institutions (who are subject to stringent financial rules due to the economic sanctions still weighing on the country) and their unfamiliarity with lending to smallholder producer groups, and in part because their standard financial products, such as “Bai alsalam”, are not acceptable to smallholders.<sup>31</sup> This is why FAO and FNC have conducted a dialogue with EBDA'A microfinance bank, which has committed mobilized private sector financing to the project<sup>32</sup>, and why technical assistance and dialogue for developing new financial products is included under Output 1.2.4.

75. Third, the dialogue the SGAS project held with the main crop auction market in El Obeid did not led to the creation of a distinct “clean and dry gum” market grade, to be sold separately in the auction market. One of the barriers appears to be that entrepreneurs associated with the market gain high profits from purchasing inferior gum, which is then cleaned, dried and resold. These entrepreneurs have blocked the introduction of a new quality standard that would effectively deliver higher purchase prices to any GAPA able to bring gum that conforms to these standards to market, as it would impact their exploitative business model. To achieve Output 1.2.3, the GCF GAMS project will work directly with the El Obeid auction market in addressing this barrier as it is essential for scaling up the opportunities for smallholder gum producers to fully benefit from the climate-resilient income they could gain from increased gum volumes and prices in the medium to long term. Creating such a distinct product category for high-quality gum – which is considered a priority by the new leadership of the national Gum Arabic Board – aligns with the government's new national gum Arabic strategy, which aims to increase advanced local processing (spray-drying for industry-quality powder) of gum in Sudan.<sup>33</sup>

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<sup>30</sup> AFD 2016 and Mofadel op. cit. 2018.

<sup>31</sup> Bai alsalam, like the sheil system practised by village traders, imposes a pre-fixed, low gum price on the producers and requires loans to be reimbursed in-kind, through delivery of gum. Unlike the sheil system, however, if the gum price goes up significantly, there is some limited profit-sharing with the producers. Mofadel op. cit. 2018

<sup>32</sup> See signed co-financing letter in Annex 5 of the full proposal.

<sup>33</sup> Tarig Elsheikh Mahmoud, Secretary General of the Gum Arabic Board, pers. comm. 2020.

76. Fourth, the GCF project will need to develop and apply specific women GAPAs support packages, adjusted to their organizational potential (higher than men) and marketing options (fewer than men).<sup>34</sup> This barrier will be addressed by gender-specific brokering and facilitation activities, especially under Output 1.2.4, as detailed in Chapter 5.

77. Fifth, the need to make the market information system (daily SMS to farmers providing sales prices and volumes in three nearby gum markets) established by the SGAS project financially and institutionally sustainable, as foreseen under Output 1.2.3. Finally, the SGAS project did not support smallholder gum producers directly in agroforestry restoration and reforestation activities, as it focused on improving the smallholder gum value chain. For these restoration and reforestation activities, therefore, the GAMS project builds on the lessons learned from the Action Against Desertification (AAD) Project that was implemented by FAO in six Sahelian countries, including the importance of involving local communities in the choice of tree, shrub and grass species to be used in restoration and the need to combine manual and mechanic soil preparation in the more degraded areas. The lessons learned from AAD have been published recently in the form of a manual for large-scale restoration.<sup>35</sup>

### Livestock production systems

78. For animal husbandry in highly variable and risk-prone ecologies, where the location of natural feed (pasture and tree browse) and water are uncertain and changing, the ability to constantly move animals to where feed and water can be found, while avoiding areas of conflict, disease, pests and degradation, is fundamental. This is also recognized in the new (draft) national Livestock policy, which counts protection and rehabilitation of stock routes, and dispute resolution to reduce conflict between mobile pastoralists and sedentary farmers, among its priorities.<sup>36</sup>

79. In fact, the extent of mobility is a key defining characteristic among livestock management systems. In Sudan it is useful to differentiate between four main traditional livestock systems – nomadic, transhumant pastoralism, semi-sedentary agropastoral and sedentary. Most of these systems constitute true livelihood systems, wherein the essential capabilities, assets and activities support a way of life (Chambers and Conway, 1991), providing food security, possibility of asset accumulation and serves as a central point in social relations. While continual change and innovation have progressively blurred the lines between the different systems, it is still useful to reflect on a basic typology when considering livestock systems and their varying reliance on mobility.

80. A 2017 FAO report on small-scale production systems in Sudan (FAO, 2017), distinguishes between four major patterns of livestock production systems, with livestock movement ranging from: (i) pure nomadism, with no fixed [home] location; to (ii) different forms of transhumance, with seasonal migration along migratory corridors, also called stock routes; to (iii) varying levels of agro-pastoralism where crop-livestock production is practiced, often with some short-range stock movement; to (iv) completely sedentary ranching – the latter being rare to non-existent with smallholders.

81. In terms of livestock species and herd composition, nomadic systems are typically dominated by camel herds, with some cattle herders, and are generally found in the driest environments, with little to no integration with sedentary agriculture.

82. Transhumant pastoralists rely on cattle herding, along with small ruminants, especially sheep, making seasonal migrations between traditional grazing areas in alternative dry and wet seasons.

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<sup>34</sup> UNEP 2018a in press. Lessons learned and good practices in NRM: support to smallholder Gum Arabic farmers. Khartoum: UNEP ADAPT! Project.

<sup>35</sup> See Sacande et al. 2020, accessible through <http://www.fao.org/documents/card/en/c/ca6932en/>

<sup>36</sup> See pp. 36-39 in RoS 2018a Livestock policies in Sudan. Ministry of Animal Resources, Khartoum.



Transhumant pastoralists typically have established residence, permanent or seasonally shifting, where portions of the family group reside, while other members migrate with their herds. Herd composition and size varies, and may include mixtures of camels, cattle and small ruminants. Large herds may be broken in smaller management groups, sometimes organized by species, gender and age. Group mobility varies from those ranging over large areas, akin to the nomadic groups, in the search of grazing areas and water, to those following more established patterns of seasonal movement along migratory corridors used to gain access to known grazing areas and watering points. Agricultural crops are commonly grown in the herders' residential base locations, which are increasingly located in or associated with agricultural communities.

83. Agro-pastoralists constitute an extension of transhumant pastoralism, where much greater emphasis is placed on crop production. Agro-pastoralists are often comprised of pastoral groups that, for one reason or another, have become increasingly sedentary in their lifestyles. Group movements tend to follow shorter migratory arcs, making regular use of stock routes to access pasture and water. Depending on location, small ruminant herds can dominate, especially sheep, and herders may be much more closely integrated with livestock markets for the sale of live heads, as well as milk and meat. In addition to their own stock, these herders may manage the livestock of nearby agriculturalists.

84. Sedentary livestock production, as the name implies, defines a system where herds occupy residential areas and typically do not move further than a day or two distance to access pasture. Due to their proximity to permanent settlements locating secure watering points away from the village is less of a concern. Small ruminants, especially goats, are common in such systems. The herds themselves often represent investments as opposed to constituting a way of life for their owners.

85. All four livestock systems are found in the Kordofan states. To varying degrees, the first three systems are well-adapted to climate shocks by allowing herders and their animals to use their mobility in responding to the spatial and temporal variations in pasture and water availability within and between years. Over the past several decades, however, a number of external forces have intervened that have eroded pastoralists' ability to maintain the traditional levels of mobility. Civil conflict in the Nuba Mountains and in the years leading up to the secession of South Sudan in 2011, led to a major disruption in traditional pastoral movements. In addition, expansion of urban areas and agriculture, both semi-mechanized (involving large-scale "land grabbing") and traditional rain-fed farming, have further reduced pastoral peoples' ability to move their herds as needed. The reduced mobility of pastoral herds has led to considerable degradation to both pastures and gum stands, throwing herders and farmers into more frequent conflict. A recent ranking of the relative importance of drivers of deforestation and forest/range degradation carried out in preparation for the national REDD+ strategy showed that local communities consider overgrazing to be the third most important driver, after expansion of agriculture and fuelwood consumption, and ahead of fires, drought and urban expansion.<sup>37</sup>

### Climate change adaptation options for livestock systems

86. The direct and indirect effects of climate change have the capacity to intensify the noted levels of environment stress, while potentially augmenting incidence of scarcity in the resources upon which herders most depend. The projected rise in future temperatures will not only increase livestock need for water intake as they struggle to cool themselves, but will also serve to more rapidly evaporate the surface water reserves upon which they rely. The noted high coefficient of variability in annual rainfall (up to 65 percent in the North) and in crop yields (60 – 80 percent), can be taken as proxies for the degree of year-to-year variability in surface water availability and pasture productivity. Imbedded within the figures are equally high levels of intra-annual variability. Although not well captured in the

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<sup>37</sup> RoS 2018b. In-depth analysis of drivers of deforestation and forest/range degradation. Khartoum: RoS REDD+ Programme.

data available for this analysis, the dominant source of rainfall in the Sahel is from line-squalls, known for their high degree of spatial and temporal variability in precipitation as each storm passes over the landscape (Nicholson, 1982; Farmer and Wigley, 1985). The result of such rainfall patterns is a seasonally evolving patchwork of vegetative growth as evidence of the storms' path.

87. One obvious key in helping livestock herders adapt to the increasing variability of fodder and surface water resources associated with climate change, as well as reducing further natural resource degradation and conflicts between herders and farmers, and is through restoring the ability of livestock herds to move as needed. Apart from renegotiating livestock corridors with other land users, as is foreseen under the GAMS project, this will also require provision of water points and restoration of rangelands along the stock routes (151,000 ha under GAMS) to increase fodder availability – as highlighted in the NAP and INDC and more recently in the above-mentioned draft national livestock policy.

### WSRMP pilot project to be scaled up by the project

#### Description of WSRMP pilot project experience

88. The Western Sudan Resources Management Programme (WSRMP) was implemented in the three Kordofan States from 2005-2017.<sup>38</sup> One of its five components focused on natural resource management. In 2015-2016, WSRMP successfully demarcated, or re-demarcated, 4,970 km of stock routes. The project also made substantial achievements in demarcation and mapping of traditional rangelands along the stock routes. The Livestock Marketing and Resilience Project, also funded by IFAD, has continued the WSRMP's work on the Stock Routes in North and West Kordofan States since 2014, but not in South Kordofan State, which was left out of the project. GAMS will focus on the demarcation of stock routes in South Kordofan.

89. During WSRMP implementation it became evident that it was difficult to effectively manage the demarcated stock routes by the staff from the Range and Pasture Department and the WSRMP extension team without stronger involvement of pastoral and sedentary communities along and nearby the stock routes. As a response, a co-management strategy was formally introduced and implemented from 2015. Two stock routes were selected, one in the East (in North Kordofan) and one in the West (in West Kordofan).

90. Mobile Extension Teams (METs), now often called mobile stock route co-management teams, were an important innovation of the project, an attempt to break through sector barriers. They consist of seven members representing different technical departments of relevant rural development ministries (not the Forest National Corporation) as well as representatives from local farming communities and pastoralists groups. Through an App Group, the members of the three METs communicate on a regular basis to clarify, share and comment.

91. The approach to stock route demarcation in WSRMP included the following series of eleven steps, which will be adopted by the GAMS project:

1. Preparation and sharing of key concepts and approaches of co-management in workshops, meetings and seminars;
2. Data collection and analysis for natural resources adjacent to stock routes;
3. Survey of Eastern and Western stock routes;
4. Tracking of major resource-based conflicts;
5. Capacity building of Mobile Extension Team (MET) members;
6. Preparation of guidelines;
7. Development of a manual for co-management implementation;

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<sup>38</sup> The following section is based on the IFAD WSRMP project documentation and on UNEP 2018b in press.

8. Formation of start-up teams;
9. Building capacity of communities (Community Development Committees) along the stock routes;
10. Facilitating meetings;
11. Launching awareness raising campaigns and follow up visits and meetings; and supervising the METs.

92. The Range and Pasture Administration (RPA) does a major part of the work. A wide selection of guidelines and other supporting materials are presently available in Arabic and will be used by GAMS, in addition to the experience gained by FAO with a similar stock route project implemented in 2018-2019 in the Darfur States.

### Lessons learned and barriers to be addressed in scaling-up the WSRMP project

93. The livestock corridor and rangeland management activities of WSRMP and other similar interventions generated a number of important lessons for addressing key barriers, including:

1. Livestock corridor interventions are not only about livestock mobility, they also need to take into account the pastoral resources along the corridors, including rangeland and pasture rehabilitation, and resting areas including water supplies, among others. In line with this lesson, the GAMS project will invest in the restoration of 151,000 ha of rangelands, including the installation of watering points at strategic locations;
2. The sustainability of previous livestock route investments has sometimes been a challenge. The management of corridors and associated resources requires developing effective institutions that interact between Government and customary institutions, and that are representative, accountable, and efficient. The GAMS project will reconvene and empower mobile stock route co-management teams to achieve this. The fact that the co-management teams are rooted in existing institutions (RPA, CDC and NA) is an important guarantee for long-term sustainability;
3. For the maintenance of each of the watering points along the livestock corridors, WSRMP developed a tripartite agreement between the local water management committee (which consists of community representatives), the State Ministry of Water and the Locality Administration. This agreement establishes the collection of a service fee from all water users by the local management committee, which is distributed as follows: 20% to the State Water Ministry, 20% to the Locality Administration and 60% to the local management committee, which is in charge of day-to-day replacement of any spare parts for the watering point, and for the rehabilitation of the "hafir" as needed. In return for receiving their 20% shares, the Water Ministry and the Locality Administration accept responsibility for taking care of more occasional, larger-scale maintenance activities that the local committee cannot execute. This approach is so successful that it has since been made mandatory by State-level regulations adopted in the three Kordofan States.
4. Cost reduction is key for sustainability, as it ensures that project investments can be maintained from modest government budgets, once the project ends. For example, there is no need to mark the whole of the livestock route with concrete markers, just the conflict hotspots will suffice (only 15% of total length in the case of GAMS). In many cases, rangeland restoration can be done quite low cost, by transhumant pastoralists scattering grass seed in seasonal pastures once they are ready to move on. In order to further reduce costs and increase transparency with stakeholders, innovative but easy-to-use technologies will be used, such as GPS, rapid mapping tools and smartphones, along with strengthening the needed stakeholder capacities to use them. Such investments will help all involved in resource negotiations, and avoid incidents of 'land grabbing' possible through asymmetries in information. FAO has gained experience with GPS and rapid, participatory mapping tools in its livestock corridor project in Darfur that will be helpful in implementing the GAMS project;

5. Including marginalized constituencies, such as youth and women, in the building of institutions, policy dialogue, dispute resolution and technological innovation is absolutely essential for achieving the project's objectives – livelihoods of women and youth being the most vulnerable to climate change – and for long-term sustainability of the corridors. FAO will deploy the Gender Action Learning System (GALS) in order to achieve this.

## The need for improved cross-sectoral coordination and land use governance

### Cross-sectoral coordination

94. According to Sudan's First Communication to the UNFCCC in 2003, "sustainable land use management – which is essential for both climate change adaptation and mitigation – faces great challenges mainly due to poor policy coordination across sectors (i.e., forestry, agriculture, range and protected lands).<sup>39</sup> The basic feature of Sudanese legislation pertaining to environmental issues is that it is purely sector-based. The greatest proportion falls in the agriculture, forestry, fisheries, public health and animal resources sectors. The following sector-based legislation that influenced land use has been issued over the years: The Crop Control Act 1972, Food Protection Act 1973, Pesticides Act 1974, Environmental Health Act 1975, Wildlife and National Reserves Conservation Act 1986, Forestry Act 1989, Seeds Act 1990 and the Land Disposition and Construction-Planning Act 1994. A Forests and Renewable Natural Resources Act was introduced in 2002, but this was never implemented. One notable absence among these sectoral laws is the pasture and range departmental sector. There has been no central legislation regulating the use of pasture, although recently, state legislations and local government orders have been issued to define demarcation of stock routes and fire lines (Mahmoud 2016).

95. After the launching of the federal system of government, environmental matters and concerns at the state level became divided between the portfolios of the state ministries for agriculture and animal resources, health and engineering affairs. The Agriculture Ministry has responsibility for agriculture, forests, and the environment and animal resources. The mandate of the Engineering Affairs Ministry includes overseeing land and surveys, construction and housing, roads and public waters, transportation and communication, water resources and energy and electricity. The Health Ministry is responsible for preventive and curative medicine. But there is no coordination or interactive mechanism that brings these bodies together over a joint issue and common concern (Mahmoud 2016).

96. This land use context has led to problems such as overgrazing, over cultivation and reduced land productivity which in turn have led to rural poverty, and rural-urban migration patterns that cannot be sustained in the long-term. This lack of policy coordination is still a problem and has no doubt played a role in the issuance of mechanized farming concessions where livestock corridors had been established earlier – reducing livestock mobility and causing damage to agroforestry systems managed by the prospective GAMS project beneficiaries. This state of affairs poses a real risk to the long-term sustainability of the stock routes to be established and equipped by the project to restore livestock mobility, and to the mitigation and adaptation results of reforestation and gum agroforestry activities, which could be reduced or wiped out by overconcentration of livestock in areas restored with support from the project.

97. During the preparation of the GAMS project, the NDA explained that the highest priority was for improved cross-sectoral coordination at State and Locality levels, and requested that project partners FNC and FAO focus there rather than at National level. Therefore, (policy) dialogue among sectoral institutions at State level has been prioritized under Component 2. At local level, cross-sectoral

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<sup>39</sup> Some effective cross-sectoral coordination mechanisms do exist at State level, for example for fire and tree locust control (see Annex 7, Risk assessment and management), demonstrating that it is possible to achieve such coordination in practice.

coordination will be improved through the participation of the different government sector agencies in the mobile stock co-management teams (see Chapter 5, Detailed project description).

98. Apart from the lack of cross-sectoral coordination, there is nothing in the various sector policy frameworks that poses any particular constraint to the achievement of GAMS project results. The new Gum Arabic Strategy – currently available only in Arabic – builds very much on the results of the FNC pilot project that GAMS aims to scale up, and is therefore highly supportive of the project approach, with a strong emphasis on capacity building of smallholder gum producer groups (GAPA) and restoration of gum agroforestry systems. The main strategy chosen by FNC for the afforestation activities on state forest land, the modified taungya system (see Definition Section), where local communities establish the gum plantations in return for the right to grow annual crops until the tree canopy closes, allows for gum benefit sharing with local communities. This has turned out to be very attractive to local people, especially those that are landless. The new Livestock Policy<sup>40</sup>, albeit still in draft, is also highly supportive of the GAMS investments in livestock mobility.

#### Land use governance

99. The land use governance situation in Sudan is marked by a strong contrast between the formal, legal framework and the reality on the ground. The Land Settlement and Registration Act, issued in 1925, provided for individual rights and interests over land, including cultivation, pasture, woodcutting and holding. In 1970, the government promulgated the Unregistered Land Act that bestowed ownership of any wasteland, forest or unregistered land on government. Private ownership of land is limited to rights registered before the Unregistered Land Act of April 1970 came into force. Almost 95 percent of the land area in Sudan is unregistered. Although the government has formal ownership of unregistered land, it has not been able to exercise effective control over land allocation and use. The land allocation and judicial powers, which provided a certain measure of control, regulation and conservation, were taken from the Native Administration (NA)<sup>41</sup> and vested in the local government officers and later in the State governments. Neither level of government has the knowledge of the traditional use of land, nor the means to plan and control land use. This has resulted in an uncontrolled expansion of mechanized farming, which has wreaked havoc on the country's natural resources. At present, Sudan has no national land use policy, nor is there legislation that deals with land use in an integrated manner (Mahmoud, 2016).

100. In most rural areas, despite its lack of formal powers, the NA is still influential in land use decisions. This means that any effort trying to improve land use management – such as the livestock corridors the GAMS project aims to rehabilitate – needs to work both with the NA and the local government at State and Locality level. Women in the project area are legally entitled to own land and other productive assets, but do not always fully control the land they legally own.<sup>42</sup>

#### Key Sudanese institutions involved in GAMS project preparation and implementation Higher Council for Environment and Natural Resources (HCENR)

101. The Higher Council for Environment and Natural Resources (HCENR) is the Government body responsible for coordination among all national institutions on issues related to environmental protection and conservation of natural resources. HCENR was first established by law in 1992. Under the new law on environmental protection issued in 2001, the Council was put under the supervision of the President of the Republic, and headed by the Minister in charge of Environmental Affairs. HCENR has a membership that consists of all related government, research, academia, private sector, civil

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<sup>40</sup> Republic of Sudan 2018a. Livestock policies in Sudan. Ministry of Animal Resources, Khartoum.

<sup>41</sup> See Section definitions and key concepts

<sup>42</sup> See analysis of gender aspects of land tenure in Annex 4, Gender Analysis and Action Plan.

society institutions, including State-level institutions (State environment council). Most of the federal ministries and institutions have environmental units that work in coordination with the General Secretariat of the Council.

102. HCENR coordinates policies, legislation and strategic planning in relation to environmental and natural resources conservation and management and is the government coordinating body concerned with integration of environment into national development. Further, HCENR is the focal point of many Multilateral Environmental Agreements, including the Rio conventions, and works in close collaboration with all government institutions at both the federal and State-level. The HCENR coordinates all climate change (CC) related activities in Sudan, including the NDC, UNFCCC National Communication, development of the NAP 2016, NAPA, Technology Needs Assessment, GHGs mitigation assessment and planning and the implementation of many CC projects and related research activities. As the NDA, the role of the HCENR has been catalytic in coordinating the dialogue across the many potential partners around project development opportunities for CC resilience-building in vulnerable communities. The NDA was closely involved in developing the initial GAMS project idea and participated actively in stakeholder consultation meetings organized by FAO and FNC. In addition, the HCENR (NDA) has been consulted regularly during the GAMS project preparation process.<sup>43</sup>

#### Forests National Corporation (FNC)

103. The Forests National Corporation (FNC) was established by the Forest National Corporation Act in 1989. The FNC Act established the Board of Directors, General Manager and Secretariat and set out the functions and purpose of the FNC: (i) to lay down the general policies (on forests); (ii) to make the rules and methods which secure the good utilization and development of forests; (iii) to achieve full protection of the environment; (iv) to propose laws which achieve the implementation of the approved policies for the development of forests; (v) to supervise technically all forests of the country; (vi) to disseminate awareness about forests; (vii) to conduct studies and forest planning; (viii) to increase the reserved forest areas up to a minimum of 20% of the area of the country; (ix) to intensify tree plantation and supply seedlings; (x) to develop Gum Arabic and other minor forest products; and (xi) coordinate with other bodies to implement forest policies particularly projects combating desertification.

104. The establishment of FNC represented a major change for the forestry administration, from a government department to a parastatal, service-oriented and independent body corporate. As a self-financing entity, it has much more functional freedom and flexible procedures in retaining revenue to meet its recurring expenses, namely wages, salaries, operation and maintenance. FNC is obliged to transfer any surplus revenue to the Treasury on a monthly basis and has developed significant accounting capabilities to fulfil this obligation. It has also gained experience with the implementation of large projects funded by multilateral donors, including IFAD and the World Bank. FNC is accountable to the Federal Minister of Agriculture and Forestry (FMAF) who has the right to issue directives that he deems in the public interest to the Board of Directors of the corporation.

105. FNC has about 3,500 staff, 500 of whom are professional foresters while 150 are accountants and financial managers. It has a HQ in Khartoum and offices at State, Working Circle (corresponding to Locality) and Section level. FNC HQ is responsible for the coordination and integration of all the activities performed in the States and the formulation of national forest plans and programmes in close coordination with the States. FNC has offices in all 18 States. The State Offices oversee the Working Circles, whose boundaries coincide with Locality boundaries in most cases. The Working Circle is the basic administrative entity that is entrusted with technical and administrative authority over the sections. The Section Level is the basic operational unit. It is generally established according to technical criteria and geographically located for the management of specific forest resources.

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<sup>43</sup> For further information on HCENR, please see [http://www.hcenr.gov.sd/invc\\_en/?p=81](http://www.hcenr.gov.sd/invc_en/?p=81)



106. FNC has been closely involved in the preparation of the project since the process started in 2017. It mobilized its staff in all 13 gum belt States for the initial prioritization of the project area and carried out a major data gathering exercise on the smallholder Gum Arabic Producer Associations (GAPAs) in North, South and West Kordofan. It also participated in many field visits and provided essential information and lessons learned from the AFD-funded GAPA capacity building pilot project it has implemented in Sheikan Locality, North Kordofan, which the GAMS project aims to scale up. FNC will be one of two Executing Entities for the GAMS project, the other being FAO.<sup>44</sup>

#### Range and Pasture General Directorate (RPGD)

107. The Range and Pasture General Directorate (RPGD) of the Ministry of Animal Resources assures the technical supervision of 18 State Range and Pasture Administration offices (RPAs). The RPAs take the lead in ensuring sustained livelihood conditions for pastoralists, through sustainable management and utilization of the range resources. RPGD is charged with ensuring that rangelands make a significant contribution to the national income and GDP through the use of appropriate technologies that ensure perpetuation of the natural resources in order to achieve sustainable maximum production. Specifically, RPGD is mandated to: (i) formulate policies, strategies and regulations capable of protecting rangelands and improving the management of range resources; (ii) monitor and evaluate the impacts of environmental changes on the range resources; (iii) conserving the genetic resources of the natural forage plants; (iv) monitor, evaluate and supervise national range management and improvement programmes and projects; (v) promote the synergies, coordination and cooperation needed for protection and improvement of the natural resources and development of the pastoral sector; and (vi) manage climate-related risks that have led to rangeland deterioration.

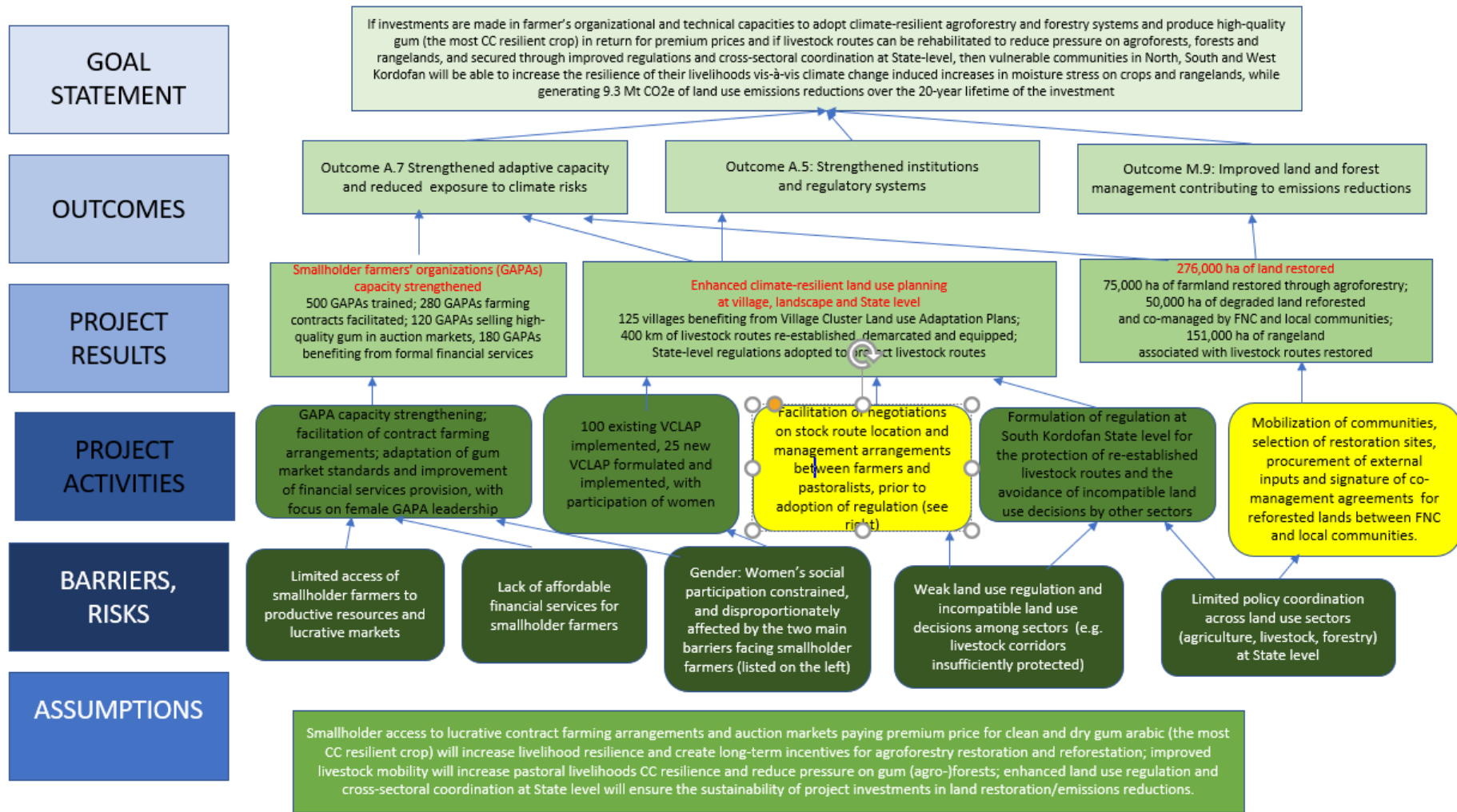
108. At State level, RPAs are administratively affiliated to the State Ministry of Production and mandated for in situ and ex-situ conservation and management of the rangelands, and for monitoring their use. RPAs also work with non-governmental organizations and projects involved in the development of natural resources in the States. RPGD was engaged in project preparation through its contribution to the project preparation study on large-scale restoration<sup>45</sup> and through its active participation in stakeholder consultation meetings. RPGD will second rangeland development specialists and extension officers to the GAMS project for the implementation of the rangeland restoration activities.

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<sup>44</sup> For more information on FNC's role in project implementation, see Chapter 5, Detailed description of project outputs and activities, and Chapter 6, Implementation arrangements.

<sup>45</sup> Ballal et al. 2018. Large-scale restoration of degraded lands for enhancing carbon stocks and increasing production of quality gum and other forest and agricultural products. Unpublished project preparation study. FNC/FAO: Khartoum.

## Chapter 4 The Theory of Change





A Theory of Change (ToC) is a description and illustration (see figure above) of a proposed pathway to transition from a business as usual (BAU) development model to a “sustainable scenario”. Under the BAU scenario, smallholder farmers’ and pastoralists’ livelihoods in North, South and West Kordofan will increasingly suffer from climate change induced moisture stress (see PFS paras 22-36) while at the same time, greenhouse gas emissions due to land and forest degradation (see PFS paras 37-40) would continue unabated.

The Sudan GAMS ToC is based on the transformation of poorly organized and under-capitalized smallholder farmers in Kordofan, with cropping systems that are extremely vulnerable to climate change, into well-organized, sustainable agroforestry producers, benefiting from access to formal financial services and to remunerative markets for high-quality gum arabic – the crop that is most resilient to climate change. Gum trees also protect annual crops grown in agroforestry systems against moisture stress, providing a key contribution to climate change adaptation (see paras 60-66).

Due to the long-term gum contract farming arrangements that the project will facilitate and through adopting a new, internationally accepted standard to distinguish clean, dry gum arabic in the main auction markets, allowing local gum producers to create value-added in line with the Sudanese government’s new National Gum Arabic Strategy, the members of the smallholder Gum Arabic Producer Associations (GAPAs) will have strong economic incentives to maintain the agroforestry systems and gum tree stands restored with assistance from the project after it ends, generating 9.3 Mt CO<sub>2</sub>e of land use emissions reductions over the 20-year lifetime of the investment. The project includes many activities to strengthen the position of women in the GAPAs, and to promote their social participation and active involvement in implementing project activities.

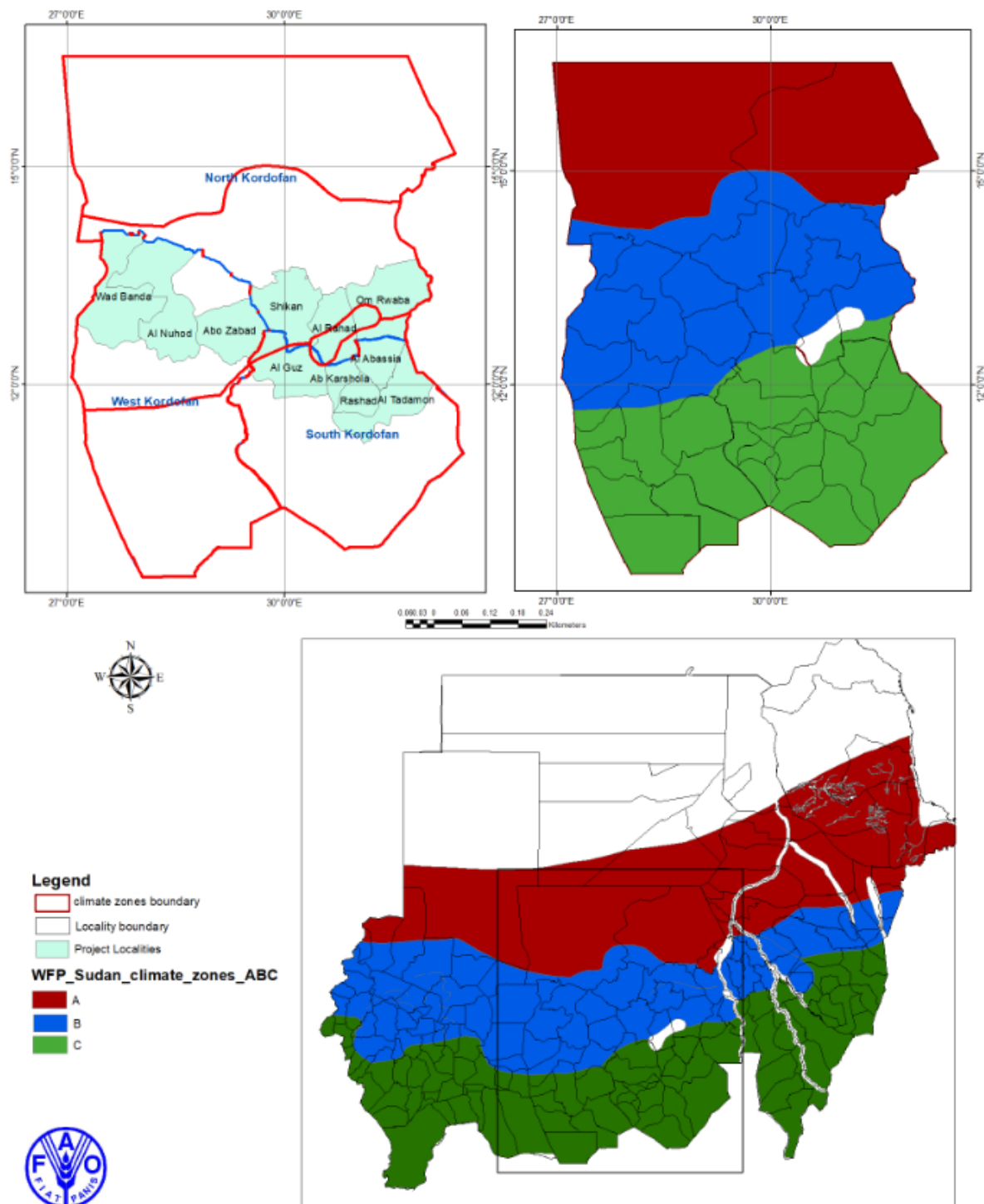
Sustainability of project results will be further enhanced through investments in livestock corridors for transhumant pastoralists and strengthening of management arrangements for the corridors, thus enhancing the adaptive capacity of the pastoralists to climate change while minimizing livestock damage to the gum trees and reducing conflict with farming communities.

## Chapter 5 Detailed description of project activities and outputs

### Project area and beneficiaries:

109. The project will target farming communities and transhumant pastoralists in 11 Localities in the States of North, South and West Kordofan in Sudan (see Figure 14).

**Figure 14.** GAMS project localities (top left), the Kordofan States (top right) and the Sudan, all overlaid with the three major climate zones South of the Sahara Desert in Sudan (based on WFP 2016).



110. Table 3 presents expected beneficiaries per component. The project will ensure women's participation (minimum 50 %) and their share among the beneficiaries (50 %, and 100% for selected activities, see Annex 4, Gender Analysis and Action Plan).

**Table 3:** Project Beneficiaries by component: direct, indirect and as a % of national population

	Target Areas	Direct Beneficiaries	Indirect Beneficiaries	Women / Men %	Total Ben as % of Sudan population
<i>Component 1</i>	N/S/W Kordofan	291,500	1,100,000	50%	3.1%
<i>Component 2</i>	N/S/W Kordofan	80,028	110,000	50%	0.4%
<i>Total</i>	N/S/W Kordofan	371,528	1.210,000	50%	3.5%

#### Beneficiaries of component 1

111. The direct beneficiaries of component 1, "Restoration of smallholder gum agroforestry systems and improvement of gum value chain", are 53,000 agroforestry farm households involved in the gum arabic value chain. They are organized in smallholder gum producer associations (GAPAs), which have been pre-identified through a survey of existing GAPAs carried out by FNC during project preparation.<sup>46</sup> The number of direct beneficiaries of component 1 is 291,500, with an average of 5.5 persons per farm household. Indirect beneficiaries of component 1 are the gum producers who will be able to sell their produce directly at the auction market at premium prices, once the new gum market grades and standards will have been adopted (Output 1.2.3). These indirect beneficiaries will also include smallholder gum producers outside the 11 Project Localities and even outside the Project States, e.g. many gum producers in Darfur sell their gum in the auction markets the project will work with in North and West Kordofan. The data gathered on the GAPAs through this survey are summarized in Table 4 below.

**Table 4:** Membership of GAPAs in the selected States of the GAMS project

State	GAPA gender status					Gender status of GAPA members (excl. GAPAs without membership data)		
	Women only GAPAs	Men only GAPAs	Mixed GAPAs	GAPAs with no membership data	Total number of GAPAs	Female members	Male members	Total members
North Kordofan	0	0	204	54	258	3 577	24 946	28 523
West Kordofan	19	0	170	0	189	3 749	10 656	14 405

<sup>46</sup> T.E.Mahmoud and S.M. Elhassan 2018. Assessment Summary Report: Description, Analysis and Verification of GAPAs in the Selected States of the GAMS Project, FAO/FNC unpublished project preparation report, October 2018.

South Kordofan	3	7	24	541	575	643	1 995	2 638
Total	22	7	398	595	1022	7 969	37 597	45 566

112. There are 1,022 registered GAPAs in the three Kordofan States, more than twice the number that will be supported by the project, 500. Membership data, which is available for 42% of the GAPAs surveyed, shows that the average GAPA has 106 smallholder producer members, implying that the total number of smallholder gum producers who are members of registered GAPAs in the three Kordofan States is around 108,300. The total number of smallholder gum producers in these three States is thought to be around 600,000, demonstrating the potential for further scaling up of project results.

113. The GAPA survey data also shows that membership is heavily skewed towards men, who account for over 80% of the known members, and that there are currently just 22 women-only GAPAs, around 5% of the GAPAs for whom membership data exists. This is despite the fact that women are known to play an important role in gum arabic production throughout the project area, and that women's groups tend to be better organized than men's in Sudan. The project will thus promote increased membership of women in mixed-gender GAPAs, and the creation of additional women-only GAPAs in villages where women prefer this option over joining mixed-gender GAPAs – as well as specific capacity-building activities focusing on women, including literacy and numeracy. Under the agroforestry and reforestation activities of component 1, the project will also create opportunities for women and women's groups to get involved in the collection of high-quality tree seed and in production of tree seedlings in household/village nurseries.<sup>47</sup>

114. Strengthening the GAPAs is an essential part of the strategy for component 1 of the project. It is the only way for smallholder producers to produce sufficient quantities of gum to interest gum buyers willing to pay premium price for high-quality gum, or alternatively, to access the auction markets – which do not permit entry to gum lots below 1 tonne – directly.

## Beneficiaries of component 2

115. Direct beneficiaries of component 2, "Climate change adaptation at landscape level through establishment of livestock routes, restoration of rangelands and enhancement of policy/institutional enabling environment", are 13,338 transhumant pastoralist households<sup>48</sup> who move their animals along livestock corridors (also called stock routes in Sudan) that will be established and equipped with watering points by the project. The number of direct beneficiaries of component 2 is 80,028, with an average of 6 persons per pastoralist household. The total number of indirect beneficiaries of component 2 has been estimated at 20,000 farm households that live in the "sphere of influence" of the livestock corridor. At 5.5 members each, they amount to a total of 110,000 people, benefiting from reduced livestock damage to their crops and gum trees and reduced conflict with transhumant pastoralists, due to improved livestock mobility facilitated by the stock route.

## Total number of direct and indirect beneficiaries

116. The total number of direct beneficiaries quantified for the purpose of the project is 371,528, the sum of the 291,500 direct beneficiaries for component 1, and 80,028 direct beneficiaries for component 2. Indirect beneficiaries of component 1 are the gum producers who will be able to sell their produce directly at the auction market at premium prices, once the new gum market grades and standards will have been adopted (Output 1.2.3). The total number of indirect beneficiaries of component 1 has been estimated as follows: 200,000 farm households (out of an estimated total of 2 million gum producing farm households in Sudan) with 5.5 members each, or 1.1 million people.

<sup>47</sup> For more details, see Annex 4 of the Full Proposal, Gender Analysis and Gender Action Plan.

<sup>48</sup> Based on estimates from the IFAD WSRMP project.

Indirect beneficiaries of component 2 are the farming communities around the livestock corridors, who will benefit from reduced livestock damage to their crops and trees, and reduced conflict with pastoralists. The total number of indirect beneficiaries of component 2 has been estimated at 20,000 farm households with 5.5 members each, or a total of 110,000 people. The total number of indirect beneficiaries is therefore 1,210,000 (1.1 million for component 1 and 110,000 for component 2). The total number of direct and indirect beneficiaries is 1,581,528, consisting of 371,528 direct beneficiaries and 1,210,000 indirect beneficiaries. These direct and indirect beneficiaries make up 3.5% of the population of Sudan.<sup>49</sup>

### Government in-kind contribution and mobilized private sector financing:

117. In the following, in-kind contributions from the Sudanese government and the mobilized financing from the private sector are described. For additional financial details please refer to Chapter 9, Project Cost and Financing, and to the detailed project budget in Annex 4 of the full proposal.

#### Government in-kind contribution

118. The Sudanese government will commit staff resources, from FNC, and to a lesser extent the Rangeland and Pasture Administration (RPA), worth USD 2,172,000 for the duration of the project for its implementation. These have not been counted as co-financing, as they are existing FNC and RPA staff. The Forestry National Corporation (FNC) will also provide office space for the Project Management Unit free of charge, which is worth about USD 60,000 for the duration of the project. However, since it is in-kind, it has not been counted as co-financing in the project budget. The total value of the in-kind contributions the Government of Sudan will provide for GAMS project implementation is USD 2,232,000, or about 22% of the GCF grant amount. The reason the Sudanese government is not able to contribute cash co-financing is the dire economic and financial situation the country is in, following years of civil strife, international sanctions and recent political upheaval, as explained in the full proposal document.

#### Leveraged private sector financing

119. The project will leverage private sector financing from private sector gum companies and micro-finance institutions, who will channel their contributions enable GAPAs to scale up production of clean, dry gum directly to the members of the smallholder. The gum companies will provide the smallholder gum producer associations (GAPAs) with gum purchase guarantees, pre-finance for the gum tapping and collecting operations (short-term loans), and some in-kind inputs, e.g. jute bags. Microfinance institutions will provide GAPAs with loans. Gum Arabic Producer Associations (GAPAs) that are the beneficiaries of component 1. So far, USD 14.72 million in private sector financing has been mobilized through signed letters (see 'co-financing' letters attached to proposal document), but additional financing is expected to be mobilized from the private sector during project implementation, as more gum companies and micro-finance institutions become project partners.

#### Description of outputs and activities

120. In the following, a detailed description is provided of project outputs and the associated activities. As for the project logframe (see Annex 2 of the main project document) and the project monitoring framework (see Chapter 7 of the present Pre-Feasibility Study), these descriptions follow the project component logic and numbering. However, since both project components 1 and 2 are cross-cutting, contributing to GCF adaptation as well as mitigation outcomes, the project monitoring framework (see chapter 7 of the present Pre-Feasibility Study) is organized according to GCF outcomes, to enable accurate reporting and aggregation of GCF adaptation and mitigation results.

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<sup>49</sup> The last population census in Sudan was taken in 2008, before South Sudan became an independent country. FAO projections from the 2008 census data yield a total population number for Sudan of 45.2 million in 2020.

## Component 1 outputs and activities

121. Component 1 is “Restoration of smallholder gum agroforestry systems, reforestation of degraded land and improvement of smallholder gum value chains”. This component has two outputs (1.1 and 1.2) that generate direct greenhouse gas mitigation benefits through gum agroforestry restoration and reforestation activities, and four outputs (1.3 to 1.6) that focus on adaptation. Under the adaptation outputs, the project will build the capacity of 500 smallholder gum Arabic producer groups (GAPAs) to produce sizable quantities of clean, dry gum – as gum trees are by far the most resilient crop with regards to tolerating increasing moisture stress in the project area – and reposition them in the value chain and link them up with financial services providers. The doubling of gum producer prices, achieved under the AFD-funded pilot project that GAMS will scale-up, not only immediately improves farm household resilience to climate change shocks, but also promotes longer-term adaptation as the promoted gum agroforestry systems are more resilient to the projected climate change stresses, and creates incentives for smallholders to maintain carbon sequestration (mitigation) results over time. The GAPAs to benefit from component 1 would be selected on the basis of the following two criteria: (i) Willingness to engage actively in gum agroforestry restoration (output 1.1) or reforestation (output 1.2) activities, which is essential as the GAPA members would need to devote significant labour (and farm land for output 1.1)<sup>50</sup>; and (ii) willingness to apply the accountability and transparency tools developed under the AFD-funded pilot project (see appendix c of Chapter 6 of Annex 13, PFS) that GAMS aims to scale up, in order to guarantee that benefits accruing to GAPAs are shared equitably with the GAPA members. This component has six outputs and 14 associated activities, as follows:

### *Output 1.1 and associated activities*

122. Output 1.1 is “75,000 hectares of gum agroforestry systems (40,000 ha in West Kordofan; 35,000 ha in North Kordofan) restored by local communities supported by the project”. While the restoration targets are large numbers, they will be achieved through bottom-up planning and a Community-Driven Development Approach, with site selection based on the preferences of the GAPA members making the land available for restoration. Based on FNC’s recent experience with different plantation establishment techniques in North and West Kordofan, direct seeding of tree seeds together with crop seeds will be the preferred technique.<sup>51</sup> This may be supported by mechanical soil preparation where necessary. To support these restoration activities, FNC will use hashab seed from its own stocks, or procure it locally from women’s groups and farmers. It may also obtain quality seed from the Forestry Research Centre (striking a balance between gum yield and resilience to moisture stress, and thus facilitating climate change adaptation). Where necessary, it may engage local machine operators in soil preparation. Where direct seeding is not feasible, FNC may procure seedlings from local women’s groups’ nurseries or use seedlings from its own nurseries.

123. The project will provide technical support for women to become tree seed/seedling suppliers in the restoration process based on their effective skills (household/village tree nursery production, production of seedlings, collection of improved seeds, transportation of seedlings, and providing technical support). The achievement of this output will be verified using data provided by Locality teams (LT) and state coordination units (SCU) including a georeferenced M&E Archive and reports. Changes in Land productivity dynamics (LPD) and Normalized difference vegetation index (NDVI) will be assessed against the baseline. Four activities are planned for this output: 1.1.1, 1.1.2, 1.1.3 and 1.1.4. In the generation of this output, a different implementation approach will be followed for those communities (referred to as “phase one”) that already have completed Village Cluster Level Adaptation Plans

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<sup>50</sup> All GAPAs are expected to want to engage in gum value chain activities generating direct monetary benefits, but not all GAPAs may be willing to engage in agroforestry restoration or reforestation as well. It is the link between these two categories of activities that is essential for the exit strategy of the project and the sustainability of project results.

<sup>51</sup> Direct seeding accounted for over 80% of hashab gum plantations established with FNC support in North Kordofan in 2015-2017. See also Ballal et al. 2018 for technical aspects of land restoration interventions.

(VCLAP), including restoration targets, and those that do not (“phase two communities”), as detailed below.

124. Activity 1.1.1 Stakeholder meetings at State (2) and Locality (7) levels. Stakeholder meetings at State and Locality levels will be essential for ensuring local authorities are supportive of the project objectives and planned agroforestry restoration activities, and representatives of smallholder producer organizations are aware of project activities and benefits to the targeted beneficiaries. The project will sign Letters of Agreement (LoA) with local NGOs to develop a communication strategy and facilitate meetings of the various actors involved in smallholder gum production.

125. Activity 1.1.2 Confirmation of preselected target communities and validation of their restoration plans. Around 80% of the local communities in the project area have already gone through a Village Cluster Level Adaptation Planning (VCLAP) exercise, facilitated by a previous IFAD-funded project, and have proposed gum agroforestry restoration investments, most of which have not yet been funded, as part of their adaptation plans. The project will hold validation workshops in the 7 project Localities in North and West Kordofan States and will conduct 120 Village Cluster Level meetings to verify the continued interest of target communities (referred to as phase one communities) to participate in restoration efforts and prioritize actions identified within their plans to be supported under the GAMS project. Of these, about 100 Village Clusters are expected to participate in restoration activities (conservative assumption).

126. Activity 1.1.3 Mobilization of communities (labour), provision of extension and procurement of restoration inputs by FNC (quality seed from Forestry Research Centre, seedlings from local nurseries and soil preparation). Once the agroforestry restoration plans of the Village Clusters have been validated (activity 1.1.2), FNC will mobilize the target communities for the execution of the restoration activities. Most of the restoration work will be done by the communities. FNC will procure external inputs, such as mechanical soil preparation on degraded lands, as necessary, and provide technical advice to local communities. The project will establish partnership agreements with the phase one communities involved to implement restoration programs for years 2 (8,000 ha), 3 (12,000 ha), 4 (20,000 ha) and 5 (20,000 ha). The project will also recruit a consultant for carrying out a livelihood and gender impact assessment at mid-term and end of project, which will also cover activities 1.1.4, 1.2.2 and 1.2.3 below.

127. Activity 1.1.4 Engage remaining 20% of target communities without existing gum restoration plans in participatory planning process and implement gum restoration plans. For the 20% of the local communities in the project area that have not yet gone through a Village Cluster Level Adaptation Planning (VCLAP) exercise, referred to as “phase two communities”, the project will conduct this planning exercise in a participatory manner, through the signing of an LoA with a competent local NGO. The planning exercise will involve repeated site visits to the 25 Village Clusters involved, to give the communities time to reflect on new information provided and set their own priorities for lands targeted with agroforestry plantings. Once restoration investments have been prioritized and agreed, FNC will conclude partnership agreements with the phase two communities involved to implement restoration programs for years 2 (2,000 ha), 3 (3,000 ha), 4 (5,000 ha) and 5 (5,000 ha). As with the phase one communities, most of the restoration work will be done by the communities themselves and FNC will provide technical assistance and procure external inputs, such as quality seed and mechanical soil preparation on degraded lands, as necessary.

#### *Output 1.2 and associated activities*

128. Output 1.2 is “50,000 hectares of degraded lands (40,000 ha in South Kordofan; 5,000 ha in North Kordofan; 5,000 ha in West Kordofan) reforested by local communities supported by the project”. 80% of the area targeted by GAMS for reforestation is in the State of South Kordofan. FNC has pre-

identified potential areas for reforestation in the four project Localities in that State: Alabasya, Rashad, Abu Karshola and Algoz. Areas pre-identified by FNC include sixteen Community Forests with a total area of 48,000 feddan of which 47,000 feddan (about 19,740 ha) are degraded, and 27 Government Forests with a total degraded area of 95,200 feddan (about 39,984 ha). In the latter, 7,993 households would be involved in taungya reforestation. Final site selection of degraded community forests and government forests to be reforested would be based on local community preferences and aspirations, but support for gum value chain activities of the concerned GAPAs would be conditional on their willingness to engage in reforestation, as highlighted in paragraph 2 above. Out of the total of nearly 60,000 ha of degraded forests pre-identified in the four project Localities in South Kordofan, 40,000 ha will be reforested with assistance from the GAMS project. The main species planted or seeded will be *Acacia senegal* (Hashab, on sandy soils and sandy clay soils) and *Acacia seyal* (talha, on clay soils). While the main product of the *Acacia* trees is hard gum (hashab) and soft gum (Talha), they are multi-purpose trees that are also suitable for livestock fodder and nitrogen fixation. In addition, stream buffers will be planted with a variety of suitable species yielding other NTFP, such as baobab and tamarind, identified in consultation with local communities. The decision of where to reforest and over what area will be taken in a participatory manner with the communities involved, at the start of the project.

129. Reforestation activities in Government Forests will be implemented using the “modified taungya” system, which is well-known and has produced good results in Sudan, e.g. in Nabaq Forest in South Kordofan State. Under the modified taungya system, local communities are allowed to plant crops in between the gum Arabic trees planted or seeded, until the tree canopy closes after 5-6 years. This benefit is highly valued by local communities, especially among landless farmers, many of whom are women. As for Output 1.1, direct seeding of tree seeds together with crop seeds will be the preferred technique. This may be supported by mechanical soil preparation where necessary. To support these restoration activities, FNC will use Hashab and Talha seed from its own stocks or procure it locally from women’s groups and farmers. It may also obtain quality seed from the Forestry Research Centre (striking a balance between gum yield and resilience to moisture stress, and thus facilitating climate change adaptation). Where necessary, it may engage local machine operators in soil preparation. Where direct seeding is not feasible, FNC may procure seedlings from local women’s groups’ nurseries or use seedlings from its own nurseries. A co-management agreement will be concluded between FNC and the communities to confirm benefit sharing arrangements for the gum production, which becomes important around five years after tree establishment. To generate this output, a slightly different approach will be followed for those communities that already collaborate with FNC on reforestation (30% of the reforestation target area) and those that don’t (70% of the reforestation target area). For the latter, an independent facilitator will be recruited to enhance trust building between local communities and FNC staff, as detailed below.

130. The achievement of this output will be verified using data provided by Locality teams (LT) and state coordination units (SCU) including a georeferenced M&E Archive and reports. Changes in Land productivity dynamics (LPD) and normalized difference vegetation index (NDVI) will be assessed against the baseline. Four activities are planned for this output: 1.2.1, 1.2.2, 1.2.3 and 1.2.4.

131. Activity 1.2.1 Confirmation of pre-identified deforested areas amenable to community reforestation. Stakeholder meetings at State and Locality levels will be essential for ensuring local authorities are supportive of the project objectives and planned reforestation activities, and representatives of village communities and smallholder producer organizations are aware of project activities, rights and responsibilities and distribution of benefits among the targeted beneficiaries. The project will sign Letters of Agreement (LoA) with local NGOs to develop a communication strategy and facilitate meetings of the various actors involved in reforestation in 11 project Localities in North, South and West Kordofan States.



132. Activity 1.2.2 Mobilization of community stakeholders for new reforestation areas (70% of acreage). The project will sign LoAs with local NGOs for facilitating the participatory planning process with 35 communities and conduct technical and leadership training for community members, including women. The project will conclude partnership agreements with the target communities, who will do most of the work involved, for the implementation of reforestation programs for year 2 (5,600 ha), 3 (8,400 ha), 4 (10,500 ha) and 5 (10,500 ha). As for the restoration activities under output 1.1, FNC will procure external inputs (seeds, seedlings, soil preparation) where necessary.

133. Activity 1.2.3 Mobilization of communities for scaling up of existing community forestry/co-management agreements through additional reforestation (30% of acreage). Since the communities involved in this activity are already collaborating with FNC, the project will include the conduct of the participatory planning process in the annual work plan and budget for FNC, who will facilitate a participatory planning process with 15 communities and conduct technical and leadership training for community members, including women. The project will conclude partnership agreements with the target communities, who will do most of the work involved, for the implementation of reforestation programs for years 2 (2,400 ha), 3 (3,600 ha), 4 (4,500 ha) and 5 (4,500 ha). As with the restoration output 1.1.1, direct seeding will be the preferred establishment technique. FNC will use hashab seed from its own stocks or procure it locally from women's groups and farmers. It may also obtain quality seed from the Forestry Research Centre (striking a balance between gum yield and resilience to moisture stress, and thus facilitating climate change adaptation). Where necessary, it may engage local machine operators in soil preparation. Where direct seeding is not feasible, FNC may procure seedlings from local women's groups' nurseries or use seedlings from its own nurseries.

134. Activity 1.2.4 Facilitate negotiations between communities and FNC on new co-management agreements for additional reforestation. For those communities that do not have ongoing co-management agreements with FNC, new agreements will need to be negotiated to agree on FNC's and the communities' rights and responsibilities and confirm benefit sharing arrangements for the gum produced. The project will sign LoAs with one or more experienced local NGOs to act as independent facilitator for the negotiation of these co-management agreements. The project will also recruit consultants to help implement the Environmental and Social Management Framework (ESMF) and operationalize the Grievance Redress Mechanism (GRM).

### *Output 1.3 and associated activities*

135. Output 1.3 is "Technical, organizational and commercial capacity strengthening program for value chain actors implemented". The main beneficiaries of this output are the 500 smallholder Gum Arabic Producer Associations (GAPAs) in North, South and West Kordofan targeted by the project, including mixed gender groups and women only groups. The targeting of 500 GAPAs, to be selected according to the criteria laid out in paragraph 128 above, across the three States represents a major scaling up vis-à-vis the FNC pilot project funded by AFD<sup>52</sup> that the GAMS project is replicating, which strengthened the capacity of 30 GAPAs in one Locality North Kordofan State only. Under this output, gender plan activities and targets at State Level will be validated to adjust the project gender mainstreaming activities. Through negotiating direct purchase agreements between buyers and the GAPAs, specifying terms of quality and delivery, the pilot project succeeded in doubling GAPA producer prices for gum arabic. Secondary beneficiaries include gum buyers and market authorities. Two activities are planned for this output: 1.3.1 and 1.3.2.

136. Activity 1.3.1 Organize meetings and exchange visits among GAPAs and gum buyers. At the start

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<sup>52</sup> The AFD-funded pilot project "Support in Structuring the Gum Arabic Sector in Sudan" was implemented by FNC in Sheikan Locality, North Kordofan State, from 2014 to 2018.

of the implementation of the AFD-funded pilot project, it became clear that there was such mistrust among smallholder gum producer groups (GAPAs) and gum buyers – because of a long history of exploitation – that sensitization meetings and exchange visits were needed to build trust between these actors. The project will use the basic management (including accounting) tools guaranteeing equity and transparency among all parties that were introduced by the AFD-funded pilot project implemented by FNC, in consultation with the gum companies.<sup>53</sup> Given FNC's ample experience with this task, the project will include facilitation of sensitization and roundtable meetings in its annual work programme and budget under the project. There will be 3 sensitization meetings, one per state, between GAPAs and gum buyers at State level, followed by 11 sensitization meetings at Locality level.

137. Activity 1.3.2 Build the technical organizational and commercial capacity of GAPAs to produce clean, dry gum according to the international IAPG standard. In order to design the GAPA capacity building programme, the project will recruit a national consultant for analysis of GAPA training needs and elaboration of training materials – building on those developed under the AFD-funded pilot project. The project will also recruit a Gender Action Learning System (GALS) consultant to ensure that structural gender issues are properly addressed and that the GAPA capacity building programme benefits women – one of the major challenges identified by the pilot project. Among other things, the project will provide literacy and numeracy training for women in order to address this. For the technical training, the project will procure the services of the Institute for Gum Arabic Research and Desertification of the University of North Kordofan (IGARD), who conducted GAPA training in clean dry gum production according to the international standard established by the International Association for the Production of Gum (IAPG) under the pilot project. The project will then conduct GAPA training, including GALS and literacy and numeracy for women GAPA members.

#### *Output 1.4 and associated activities*

138. Output 1.4 is “280 smallholder gum producer groups linked up with gum exporters paying premium price for clean, dry gum”. The main beneficiaries of this output are the smallholder Gum Arabic Producer Associations (GAPAs) in North, South and West Kordofan targeted by the project, including mixed gender groups and women only groups. The GAPAs will be paid a premium price (auction market price plus 10%) by the gum companies in return for delivering clean, dry gum Arabic compliant with the AIPG standard – as per the procedures successfully tested under the AFD-funded pilot project that GAMS will scale up. This is equivalent to about twice the price they currently get for the gum they produce. The compliance with the AIPG standard will be validated jointly by the gum company and the GAPA on delivery of the gum. It represents a major scaling up vis-à-vis the FNC pilot project funded by AFD that the GAMS project is replicating, which was successful in doubling smallholder gum producer prices under gum purchase agreements they facilitated for 30 GAPAs (around 14 of which are still operational) in North Kordofan State only. The GAPAs to benefit from this output would self-select from among the GAPAs whose technical and organizational capacity will have been built by the project under Output 1.3, but would also depend on the availability of a gum company willing to engage in contract farming with them. One activity is planned for this output: 1.4.1.

139. Activity 1.4.1 Facilitate contract farming relationships between GAPAs and gum buyers/exporters. The project will facilitate these contract farming relationships by organizing business brokering meetings between GAPAs and gum buyers at Locality and Village Cluster level. During these meetings, participants will be informed about the management tools for contract farming relationships<sup>54</sup> which were developed in collaboration between private gum buyers, GAPAs and FNC under the AFD-funded pilot project that GAMS aims to scale up, the use of which will be mandatory for all partnerships benefiting from GAMS support. For the implementation of this activity, the project will

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<sup>53</sup> These management tools are provided in Appendix c of Chapter 6, Implementation Arrangements.

<sup>54</sup> These management tools are described in detail in Chapter 6, Implementation arrangements, of the present Pre-Feasibility study.

recruit two national consultants: a Contract Farming Specialist familiar with the gum value chain and a GAPAs/Community Development Officer. Specific support will be provided to women to (i) tailor the contract farming purchase guarantee to be signed with gum exporters to fit with women's profiles, constraints and needs; and (ii) monitor the correct use of the GAPAs management tools (see Chapter 6 implementation arrangements) to ensure that women members of mixed GAPAs receive an equitable amount of pre-financing from the gum exporters.

#### *Output 1.5 and associated activities*

140. Output 1.5 is "120 smallholder gum producer groups selling clean, dry gum in standardized auction markets". The main beneficiaries of this output are the smallholder Gum Arabic Producer Associations (GAPAs) in North, South and West Kordofan targeted by the project, including mixed gender groups and women only groups. The GAPAs to benefit from this output would self-select from among the GAPAs whose technical and organizational capacity will have been built by the project under Output 1.3, but would also depend on the crop auction market establishing "clean, dry gum arabic" as a new market standard, one of the project's strategies to ensure that scaling up continues after the project ends. Establishing an open market gum quality standard represents a new departure vis-à-vis the FNC pilot project funded by AFD that the GAMS project is scaling-up and forms a key part of the project's exit strategy. Currently, gum markets in Sudan don't have a separate quality standard for clean, dry gum, which prevents smallholders from being rewarded for their best-quality gum and removes any incentive for producing more. Once auction markets in Sudan start formally recognizing clean, dry gum produced according to the AIPG standard as a distinct product, with a unique price, it will provide an important incentive for smallholder gum producers, organized in GAPAs, to improve the quality of their gum and increase the income they derive from it. The greater value derived from quality gum sales with further incentive farmers in investing and maintaining their gum gardens, and thus strengthen their climate change adaptation preparedness. Introducing gum quality standards in crop auction markets is also a key element of the Government of Sudan's new Gum Arabic Sector Strategy, which will be implemented over the next five years. The gum market auctions provide open access to any producer groups capable of meeting the specified quality standards, thus create the potential of greatly expanding project achievements in helping smallholder producers to enhance the adaption to climate change stressors. There are two activities associated with this Output: 1.5.1 and 1.5.2.

141. Activity 1.5.1 Facilitate dialogue with gum producers, gum buyers and State-level agricultural and trade authorities to promote recognition of "clean, dry gum" as a new market standard, starting with the El Obeid Crop Auction Market. The project will recruit a national consultant for the analysis of gum market standards and quality assurance protocols. Once this analysis has been completed, the report will be widely disseminated for feedback, and discussed at a gum stakeholder roundtable meeting, aiming to build support for the recognition of "clean, dry hashab gum" in auction markets, starting with the El Obeid Crop Auction Market, which is the main market for gum in the project area and nationally. This activity is completely in line with the new national Gum Arabic Strategy issued recently (in Arabic) by the Gum Arabic Board (GAB), so the project will work closely with GAB to disseminate the roundtable meeting report widely and conduct follow-up events to increase stakeholder buy-in for the new gum standards. Women gum producers are less able to travel to far-away auction markets than men, so they will need additional assistance to benefit from the new gum quality standards. Once "clean, dry gum" is recognized in auction markets, the project will recruit a service provider to facilitate exchange visits and workshops with women GAPAs and village/local market traders, followed by meetings to broker long-term supply contracts for the delivery of high-quality gum by women's GAPAs to village/local market traders, at higher prices.

142. Activity 1.5.2 Elaborate and conclude an agreement among gum buyers and market authorities to fund and maintain the gum market information system established by the AFD-funded pilot project. The GAMS project will establish a simple gum market information system, modelled on the AFD pilot

project, that provides text messages about gum prices, volumes traded in nearby markets and the new quality standards to anyone with a basic cell phone. An initial radio messaging campaign will help to generate interest among the beneficiaries for the information system. As became apparent from AFD project reports and from field visits conducted in North Kordofan for the preparation of the GAMS project, this system is highly appreciated by smallholder gum producers and other gum value chain actors. As part of its exit strategy, the GAMS project aims to make this system financially self-sufficient and independent of external project funding. The project will recruit a national consultant to draft a "white paper" on possible options for sustaining the gum market information system independent of donor financing. The project will disseminate the white paper widely among gum value chain stakeholders and solicit feedback on the proposed options. Subsequently, the project will recruit a facilitator and hold a multi-stakeholder roundtable meeting to build consensus on the preferred market information system option. Finally, the project will recruit an IT consultant to complete development of the market information system, including technical and administrative requirements and provisions for installation, maintenance and cost recovery. The project will also provide the necessary support to ensure that women have equitable access to the market information system.

#### *Output 1.6 and associated activities*

143. Output 1.6 is "180 smallholder gum producer groups linked up with micro-finance institutions (MFI)". The main beneficiaries of this output are the smallholder Gum Arabic Producer Associations (GAPAs) in North, South and West Kordofan targeted by the project, including mixed gender groups and women only groups. The GAPAs to benefit from this output would self-select from among the GAPAs whose technical and organizational capacity will have been built by the project under Output 1.3, but would also depend on the willingness of microfinance institutions (MFI) to provide the GAPAs with appropriate financial services. The latter may also depend on the availability of a gum company willing to engage in contract farming with the GAPAs, as the project aims to convince the MFIs to accept the gum purchase guarantees provided by the gum companies as collateral for GAPA loans. This represents another departure vis-à-vis the FNC pilot project funded by AFD that the GAMS project is scaling-up and forms a key part of the project's exit strategy. The AFD pilot project provided some financial literacy training but this did not lead to an increase in lending to GAPAs by MFI, mainly because the conditions imposed by the latter (collateral for loans, "sellam" loans based on undervalued gum prices) were not acceptable, or even possible, for the GAPAs. The involvement of MFI in pre-financing GAPAs is an essential part of the scaling-up strategy of the project. Without the MFIs, gum contract farming would remain small as gum exporters could not absorb the transaction costs of working directly with many GAPAs, and GAPAs wanting to sell directly into auction markets would also need MFI support. This Output is associated with one Activity: 1.6.1.

144. Activity 1.6.1 Design GAPA-friendly financial products and facilitate credit relationships between GAPAs and microfinance institutions. One of the main improvements needed in the MFI financing conditions to make them more GAPA-friendly is the acceptance of gum purchase guarantees provided to GAPAs by gum companies as collateral by MFIs. The project will recruit an international consultant for developing new lending modules, and to discuss these with micro finance institutions (MFI). The project will then hold sensitization events with MFIs and GAPAs at Locality level, followed by brokering events with MFIs and GAPAs at Locality level (including specific events for women GAPAs and MFIs). Finally, the project will conduct further follow-up meetings to facilitate further negotiations as needed and will support women's savings and credits groups in order to improve their chances of receiving MFI financing.

#### *Component 2 outputs and activities*

145. Component 2 is "Climate change adaptation at landscape level through establishment of livestock corridors, restoration of rangelands and improvement of the enabling policy and institutional environment. Restoration of livestock mobility through the establishment of livestock corridors

contributes directly to climate change adaptation of pastoralists' livelihoods, and by facilitating livestock movement, it also reduces the risk of livestock damage to the areas restored under Component 1. Restoration of rangelands has direct greenhouse gas mitigation benefits as well as adaptation benefits for pastoralists' livelihoods. Finally, this component also aims to improve cross-sectoral coordination among land use agencies at State and Locality level, in order to improve the enabling environment for the implementation of climate change adaptation strategies in the land use sector, and safeguard the results of the project. This outcome has four outputs (2.1 to 2.4) associated with 12 activities, as follows.

#### *Output 2.1 and associated activities*

146. Output 2.1. is "Climate Resilient Village Cluster Plans (CRVCP) completed and adaptation interventions (land restoration and revegetation, water conservation & management) prioritized and implemented in 125 village clusters". Village clusters, which consist of 2-3 villages on average, are used by many projects as the unit for local-level climate change adaptation planning. Many Village Clusters in the project area already have so-called Climate Resilient Village Cluster Plans (CRVCP) or Village Cluster Level Adaptation Plans (VCLAP), which were prepared in a participatory manner under the IFAD-funded Western Sudan Resources Management Project that closed in 2017, in North, South and West Kordofan, and under the ongoing IFAD-funded Livestock Marketing and Resilience Project (LMRP), in North and West Kordofan only. While some of the priorities of these CRVCP or VCLAP have been funded by IFAD, especially those related to the creation of water reservoirs ("hafir"), other priorities – including farm and rangeland restoration – have remained unfunded in many Village Clusters. The GAMS project will work with local communities in the 11 Project Localities to confirm land restoration priorities for 100 existing CRVCP and will facilitate preparation of 25 new CRVCP focusing on the areas around new stock routes, in a participatory manner. Village clusters to benefit from this output will be selected on the basis of the following criteria: (i) geographical vicinity to the livestock corridor to be re-negotiated, demarcated and equipped by the project; and (ii) the existence of previously established CRVCP/VCLAP with land restoration priorities (for 100 villages), or the willingness of village clusters (25) without existing CRVCP/VCLAP to engage in the climate change adaptation planning process and in rangeland restoration. The implementation of the land restoration investments prioritized under these 125 CRVCP is covered under the climate change mitigation outputs 1.1, 1.2 and 2.3. In South Kordofan State, the CRVCPs will provide a supportive matrix for the establishment of 400 km of livestock corridors, see Output 2.2 below. Output 2.1 will be realized through the implementation of three activities: 2.1.1, 2.1.2 and 2.1.3.

147. Activity 2.1.1 Provide training for community stakeholders on climate change adaptation (CCA) and natural resource management (NRM) To improve the quality of the Climate-Resilient Village Cluster Plans (CRVCP) to be formulated and prioritized under this output, it will be important to first provide basic training in Climate Change Adaptation/Natural Resource Management (CCA/NRM) to local communities. The project will recruit an international consultant to adapt and update the IFAD CCA/NRM training programme developed earlier and recruit a local NGO to train community stakeholders in CCA/NRM. This training will not only improve the quality of the CRVCP, but also generate other ideas with local communities on how they can adapt their livelihoods and natural resource use practices to better respond to climate change stressor.

148. Activity 2.1.2 Formulate Climate-resilient Village Cluster Plans (CRVCP) and help communities prioritize climate change adaptation investment options in 25 new Village Clusters. The project will conclude a LoA with a local NGO for facilitating elaboration of new CRVCP around stock routes to be established under Output 2.2.1. The NGO will assist 25 village clusters in elaborating their CRVCP.

149. Activity 2.1.3 Facilitate implementation of prioritized CRVCP climate change adaptation investments (100 existing CRVCP and 25 new CRVCP). Under this activity, the project will assist village clusters (VC) with the implementation of their prioritized Climate Change Adaptation (CCA) investments

other than land restoration (which will be implemented under the climate change mitigation outputs), with an average financial envelope of USD 6,000 per VC. The CCA investments will be executed in year 2 (25 VC), year 3 (30 VC), year 4 (50 VC) and year 5 (20 VC).

#### *Output 2.2 and associated activities*

150. Output 2.2 is “Four hundred (400) km of stock routes negotiated with local government, farming communities and pastoralists, demarcated on the ground and equipped (watering points), and arbitration mechanisms established to resolve conflicts among different user groups.” The stock routes, often called livestock corridors in the literature, are an essential tool for strengthening climate change adaptation in the project area, where livestock relies mobility to reach natural pasture and tree browse and where grass grows only 5-6 months a year.<sup>55</sup> Many stock routes have been blocked in recent decades, often due to land grabbing for large-scale rainfed mechanized farming and to internally displaced populations following the civil conflict. The resulting overconcentration of livestock in small areas has led to degradation of vegetation cover, including rangelands and gum arabic stands. The stock routes that will be established by GAMS in South Kordofan will link up with stock routes established under the IFAD-funded Livestock Marketing and Resilience Project in North and West Kordofan, thus facilitating climate change adaptation of transhumant pastoralists – and conflict prevention with sedentary farmers – over a much larger area. FAO has gained considerable experience with the participatory mapping and demarcation of livestock corridors, most recently in Darfur. This output will require the implementation of four activities: 2.2.1, 2.2.2, 2.2.3 and 2.2.4.

151. Activity 2.2.1 Participatory mapping, demarcation of conflict hotspots and validation with local stakeholders of stock routes. The project will recruit a service provider for the rapid assessment and validation of 400 km of proposed stock routes, and subsequently, for participatory mapping and validation of the definitive stock routes, including conflict hotspots. The project will then recruit a service provider to produce and install concrete markers for demarcation of conflict hotspots on the ground over an estimated 60 km.

152. Activity 2.2.2 Plan construction of watering points along livestock routes; agree on maintenance arrangements and cost recovery mechanism with farmers and pastoralists, and implement construction. The project will facilitate stakeholder discussions among farmers and pastoralists to reach agreement on location of watering points and on local institutions taking responsibility for maintenance and cost recovery, then construct them. Based on the lessons learned from the IFAD WSRMP (see PFS para 93), tripartite agreements for the establishment and management of watering points will be signed between State Water Ministry, Locality administration (local government) and community-level water management committee. The latter charges fees for water use, which are shared among the three parties to cover O&M costs.

153. Activity 2.2.3 Build capacity of rural communities and State and Locality level institutions to co-manage transhumant livestock corridors and establish arbitration mechanisms to reduce conflict between farmers and pastoralists along corridors through the gum belt. FAO will conclude an LoA with the Rangeland and Pasture General Directorate (RGPD), to mobilize government rangeland management specialists to implement this activity. FAO will also recruit an international consultant for developing stock route co-management training materials and training of trainers for stock route co-management. The project will then reconvene and empower 16 mobile stock route co-management teams to train change agents - including women – in farming and pastoralist communities along the stock routes and assist them in conflict reduction and management. Finally, the project will update stock route co-management training materials to cover new NRM regulations developed under Activity 2.3.1.2.

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<sup>55</sup> See Chapter 3 for a definition of the livestock corridor concept, and its importance for climate change adaptation.



154. Activity 2.2.4 Set up a geographic information system (GIS), and provide training sessions to the project partners on enhanced cross-sectoral coordination and geo-referencing, recording and monitoring in the GIS. The project will recruit an international consultant for setting up the GIS system for recording activities and for training FNC and Rangelands staff in using it, and for conducting refresher training.

#### *Output 2.3 and associated activities*

155. Output 2.3 is “151,000 ha of rangelands associated with stock routes restored by local and transhumant communities supported by the project” (121,000 ha in South Kordofan, 15,000 ha each in North and West Kordofan). The sites for the rangeland restoration activities will be selected on the basis of the community preferences and aspirations expressed in the Village Cluster Level Adaptation Plans (VCLAP) or Climate Resilient Village Cluster Plans (CRVCP) elaborated and validated under output 2.1 above.

156. The achievement of this output will be verified using data provided by Locality teams (LT) and State Coordination Units (SCU) including a georeferenced M&E Archive and reports. Changes in Land productivity Dynamics (LPD) and Normalised Difference Vegetation Index (NDVI) will be assessed against the baseline. FAO will sign a LoA with the Rangeland and Pasture General Directorate (RPGD) to make available two rangeland management specialists – one for South Kordofan and one to be shared between North and West Kordofan – to assist in the implementation of the three activities which are planned for this output: 2.3.1, 2.3.2 and 2.3.3.

157. Activity 2.3.1 Raise awareness regarding the importance of rangeland restoration with stakeholders at State and Locality levels. Stakeholder meetings at State and Locality levels will be essential for ensuring local authorities are supportive of the project objectives and planned rangeland restoration activities, and representatives of smallholder pastoralist and livestock producer organizations are aware of project activities and benefits to the targeted beneficiaries. The project will sign Letters of Agreement (LoA) with local NGOs to develop a communication strategy and facilitate meetings of the various actors involved in rangeland restoration, then organize three Kick-off meetings at State level and 11 Kick-off meetings at Locality level.

158. Activity 2.3.2 Facilitate participatory process with farming and pastoral communities to identify sites and species (trees, shrubs, grasses) for rangeland restoration and agree on division of labour among project and beneficiaries for implementing agreed plans. The mobile stock route co-management teams established by the project (see output 2.2 above) will conduct local-level stock route segment meetings (up to 16) to prioritize restoration sites and species (making sure to interview women, who often have different species preferences, separately) and agree on management arrangements. As for the other restoration activities, most of the work will be done by local communities, in this case including transhumant pastoralists, so it is essential that they are properly informed and consulted prior to the implementation of any restoration activity.

159. Activity 2.3.3 Implement 151,000 ha rangeland restoration program in South Kordofan (121,000 ha), North Kordofan (15,000 ha) and West Kordofan (15,000 ha). The project will conclude partnership agreements with agro-pastoralists’ and transhumant pastoralists’ communities to implement rangeland restoration programmes for years 2 (30,200 ha), 3 (45,300 ha), 4 (37,750 ha) and 5 (37,750 ha). As for other restoration activities, most of the work will be done by local communities. Where external inputs are necessary, (quality seed supply, mechanical soil preparation on the most degraded land), the project will recruit service providers, providing specific support to women as for the reforestation/agroforestry output. The project will also recruit a consultant for mid-term and final livelihood and gender impact assessment of this activity.

#### *Output 2.4 and associated activities*

160. Output 2.4 is “State-level cross-sectoral policy dialogue and adoption of climate-responsive natural resource management regulations (including protection of livestock corridors). The First Communication to the UNFCCC of Sudan in 2003 highlighted the lack of cross-sectoral coordination on land use policies and strategies as one of the major constraints in implementing climate change adaptation and mitigation programmes. This is still the case. Output 2.4 will improve cross-sectoral coordination at State and Locality level<sup>56</sup> and thus help to safeguard the long-term sustainability of adaptation and mitigation results generated by the project’s investments in land restoration. This output will require implementation of two activities: 2.4.1 and 2.4.2.

161. Activity 2.4.1 Facilitate policy dialogue to strengthen the enabling environment for climate change adaptation investments (NTFP value chains, land management and restoration). The project will recruit an international Climate Change Adaptation (CCA) policy consultant and a national Natural Resources Management (NRM) consultant to prepare and organize two stakeholder roundtable meetings on enabling policy environment for CCA/NRM investments, one on climate resilient Non-Timber Forest Product (NTFP) value chains and one on climate resilient land management and restoration practices – both involving the participation of women’s groups representatives.

162. Activity 2.4.2 Elaborate State level natural resource management regulations, including those needed to provide legal protection for livestock corridors and community forests - and their respective management arrangements - and disseminate these regulations amongst rural communities. The project will recruit a two-person consultant team consisting of an international specialist on the Voluntary Guidelines for the Governance of Tenure (VGGT) and a local land and natural resource tenure specialist to elaborate new climate change resilient Natural Resource Management (NRM) regulations for the protection of livestock corridors, community forests and other Climate change adaptation (CCA) priorities involving land and other resource utilization.

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<sup>56</sup> Following a request from the NDA, the GAMS project focuses on policies and regulations at sub-national level. Some of the planned results of the GAMS project, however, will also provide relevant inputs for the review of national-level policies and regulations.



## Chapter 6 Project Implementation Arrangements

163. **The Food and Agriculture Organization of the United Nations (FAO)**, serving as **Accredited Entity (AE)** to the **Green Climate Fund (GCF)**, will enter into an Operational Partnership Agreement (OPA) with the **Forests National Corporation (FNC)**, serving as the **Executing Entity (EE)** for the implementation of this project. **In addition to its role as the AE**, FAO will also serve as the second **GAMS Executing Entity**, providing quality assurance and technical assistance during project implementation. FNC and FAO will thus co-execute the GAMS project.

164. **The independence of the two roles of FAO** will be guaranteed by establishing two separate functions as follows:

A. **FAO as Accredited Entity.** The FAO's supervising role will be attributed to the FAO Regional Office for the Near East (RNE, located in Cairo) with support by the FAO Climate, Biodiversity, Land and Water Department (CB, located in Rome) and other technical divisions as required. In order to fulfil this function, a specific **project supervision team** will be established, including FAO staff from RNE, CB and other technical divisions. A Lead Technical Officer will be appointed in the regional office, coordinating the supervision functions. The separation from the role of executing entity will be ensured by the establishment of: (a) regular system of approval of Annual Work Plan and Budget – exercised by the Lead Technical Officer (belonging to RNE) and the members of the Project Task Force, composed of FAO technical staff; (b) regular independent supervisions of the project activities throughout the project intervention, ultimately to ensure that the project management takes corrective measures if and when required, and (c) through the evaluation functions carried out by the FAO Office of Independent Evaluation (in Rome) at mid-term and final stage. More specifically, the **FAO Lead Technical Officer (LTO)** will have overall technical responsibility for the implementation of the project. The role of the LTO is central to FAO's comparative advantage for projects and to separate the functions of FAO in its role as Accredited Entity and as Executing Entity. The LTO will oversee and carry out technical backstopping to the project implementation. The LTO will support the Budget Holder (BH) in the implementation and monitoring of the Annual Work Plan and Budget (AWPB), including work plan and budget revisions. The LTO is responsible and accountable for providing or obtaining technical clearance of technical inputs and services procured by the Organization. In addition, the LTO through supervision missions (she/he may call other experts to participate and advise) will provide technical backstopping to the Project Team to ensure the delivery of quality technical outputs. The LTO will coordinate the provision of appropriate technical support from the PTF to respond to requests from the PSC.

B. **FAO as Executing Entity.** The **FAO Representation in Sudan (FAO-SD)** will be in charge of the execution of selected activities and of the contractual agreements with the executing entity FNC (see below). A **project delivery team** will be set up in FAO-SD, comprising staff covering all functions relevant to the execution of the envisaged activities. More specifically, following the principle to ensure the highest level of ownership and sustainability of the project investment at country level (i.e., within local institutions), FAO-SD's role in GAMS will be **limited to the provision of quality assurance** throughout all project components, to enhance the success of the project and its potential replicability, **and to management of the activities that require recruitment and management of international consultants and local sub-contractors**.<sup>57</sup> Technical assistance will be provided by mobilizing FAO experts, or FAO supervised consultants and service providers. FAO's mandate as a global stakeholder in the field of agriculture, forests

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<sup>57</sup> FAO will take on this role because of FNC's relative inexperience with recruiting and managing international consultants and subcontractors, as recommended by the April 2019 micro assessment of FNC under the Harmonized Approach to Cash Transfer (HACT) framework.

and rangeland management, and climate change, and its related expertise represents a comparative advantage in providing technical assistance and quality assurance.

165. FAO as Accredited Entity to GCF will be responsible for the overall management of the project, including: (i) all aspects of project appraisal; (ii) administrative and financial oversight and supervision throughout project implementation; (iii) ensuring funds are effectively managed to deliver results and achieve objectives; (iv) ensuring the quality of project monitoring, as well as the timeliness and quality of reporting to the GCF; and (v) project closure and evaluation. FAO will assume these responsibilities in accordance with the detailed provisions outlined in the Accreditation Master Agreement (AMA) between FAO and GCF.

166. FAO, in its role as AE, will conclude a five-year Operational Partnership Agreement (OPA) with FNC, complemented by operational agreements for the implementation of annual work programmes and budgets. The OPA that FAO will conclude with FNC will also include a Risk Mitigation Plan<sup>58</sup> to address the weaknesses highlighted by the above-mentioned HACT assessment.<sup>59</sup>

### **Project execution:**

167. A dedicated **Project Management Unit (PMU)** will be established under this project and hosted by **FNC** in Khartoum. The PMU will be functional for the entire duration of the project, and will have State Coordination Units (SCUs) in North Kordofan, West Kordofan and South Kordofan.

168. The Project Management Unit (PMU) will be hosted by FNC and will be responsible for the day-to-day implementation of the project. The Forestry National Corporation (FNC) will provide office space for the Project Management Unit free of charge, an in-kind contribution valued at USD 60,000 for the duration of the project, but not included as co-financing in the project budget. The FNC will also commit significant staff resources to the implementation of the project – again these have not been counted as co-financing, as they are existing FNC staff. The PMU will include a Project Coordinator, Admin and Finance Officer and M&E Officer. Other support staff from FNC will be seconded to the PMU, this includes technical officers, procurement, IT, HR, Safeguards officer, M&E Assistant, accountant, legal advisor, documentation and media officer. The PMU will develop 3-month work plans and budgets and submit them to the Project Steering Committee (PSC) for endorsement. Similarly, the PMU will prepare quarterly progress reports, financial reports and procurement plans and submit them to the PSC for endorsement. Quarterly reports after endorsement by the PSC will be submitted to the FAO-GCF project supervision team for release of subsequent disbursement of funds.

169. In each of the three targeted states, a light **State Coordination Unit (SCU)** will be established to coordinate the project implementation at State and Locality levels. The unit will consist of a State Coordinator and seconded staff from FNC office at State level. The State Coordinator will report to the Project Coordinator at the PMU and will be also responsible for coordination of the project with all stakeholders at State and Locality levels. The SCUs will play an extremely important role in ensuring the correct sequencing of the participatory planning processes to be conducted at different levels – Locality, Village Cluster, Community – prior to implementation of the field activities of the project.

170. In each Locality, a **Locality Team (LT)** consisting of field supervisor, forests extension officers, range extension officers and agricultural engineers will be seconded from FNC and agriculture and livestock administrations based on the specific need in each locality. Locality teams will support the State Coordinators on implementation of the project activities at Locality level. The Locality Team will

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<sup>58</sup> See Appendix a.

<sup>59</sup> See Appendix b. for budget activity by Executing Entity - FAO and FNC.

be the front-line implementation team and will be responsible for day-to-day implementation of project activities at Locality level.

171. FAO, in its capacity as EE, will appoint a **Chief Technical Advisor (CTA)** to support the PMU. The CTA will be based in the PMU and work closely with the PMU staff. In the same (EE) capacity, FAO will take responsibility for the recruitment and management of international consultants and contracting of sub-partners in accordance with the quarterly procurement plans produced by the PMU. International consultants will sign contracts and local sub-contractors will sign Letters of Agreement (LoA) directly with FAO, in its role as EE. FAO will ensure coordination and collaboration between international consultants and national sub-partners on the one hand and the PMU and FNC on the other, by explicitly adding to their contracts an enforcement statement on collaboration with the PMU and the linkages between their deliverables and the PMU deliverables. This is necessary to ensure that the work of these consultants and sub-partners is fully coordinated with the other activities being implemented by the PMU at Federal, State and Locality levels.

#### **Flow of funds:**

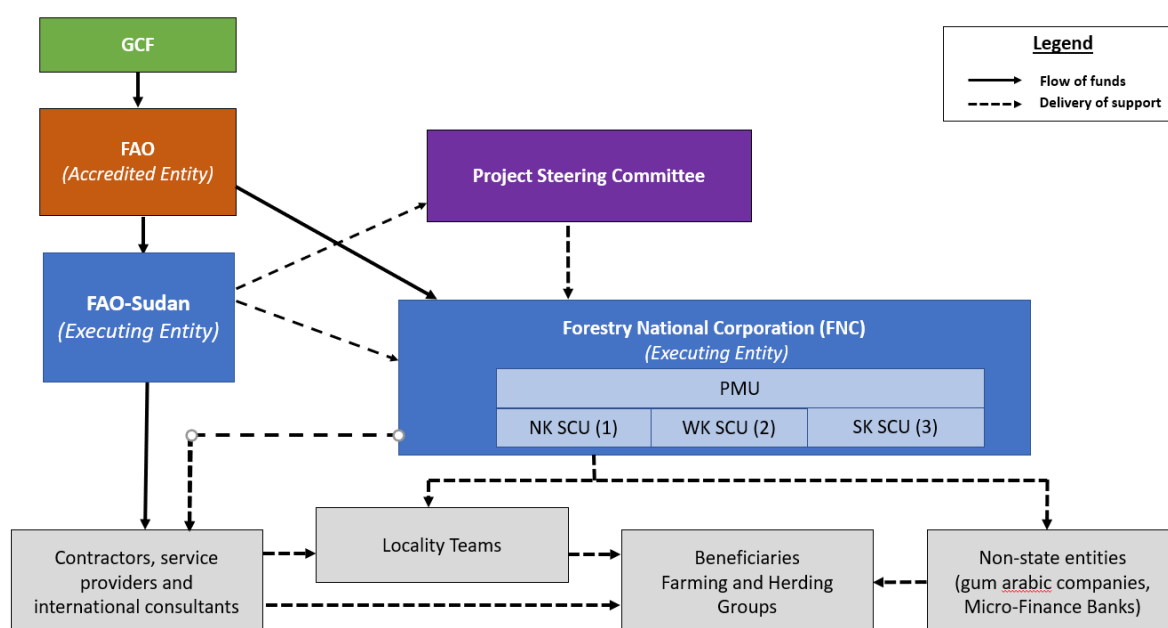
172. In line with the project execution arrangements outlined above, funds that FAO receives from GCF in its capacity as Accredited Entity would flow forward to the Executing Entity FAO-SD and the Executing Entity FNC for the implementation of project activities, in accordance with the respective responsibilities of FNC and FAO listed in Appendix 2b, logframe. No GCF funds will flow to the gum Arabic companies and microfinance institutions.

#### **Project Governance:**

173. A **Project Steering Committee (PSC)** will be established to provide strategic guidance for the project. The PSC will be chaired by the Director General of FNC. The Coordinator of the PMU for this project will act as Rapporteur to the PSC and FAO CTA will participate as resource person. The PSC, which will be composed of 15 primary stakeholders of this project including FNC, HCENR (GCF-NDA), FAO, ministries of agriculture, livestock, water resources, trade, finance, research corporation, gum producers and traders and microfinance banks. The role of the PSC will be to:

- Provide overall guidance and direction to the project, ensuring it remains within any specified constraints;
- Address project issues as raised by the project coordinator;
- Monitor project risks and the effectiveness of mitigation measures, and provide guidance on new project risks, and agree on possible countermeasures and management actions to address specific risks;
- Review the project progress, and provide direction and recommendations to ensure that the agreed deliverables are produced satisfactorily according to plans;
- Review and approve annual work plan and provide necessary strategic guidance for its implementation;
- Appraise the annual project implementation report, including the quality assessment rating report; make recommendations for subsequent workplans to build on achievements and address any shortcomings;
- Provide ad hoc direction and advice for exceptional situations when the project coordinator's tolerances are exceeded; and

**Figure 15. Project Organigramme**



### Project Partners from the Private Sector:

174. The project will work closely with a number of private sector partners, who, together with the Gum Arabic Producer Associations (GAPAs) whose capacity the project intends to build, will be a key element in the project's exit strategy and the sustainability of its results. First and foremost, among the private sector partners are the gum exporting companies that participated in the AFD-funded pilot project that the GAMS project intends to scale up: COMATS/Elemats, Habibi and Almotahida. Of these, COMATS/Elemats has already signed a letter committing to finance the GAPAs supported by the GAMS project and other companies are expected to follow in due course.<sup>60</sup>

175. The participating gum companies will be required to use the management tools developed under the AFD-funded pilot project (see Appendix c below), which aim to create equity and transparency in the dealings between the companies and the Gum Arabic Producer Associations (GAPAs), and between the GAPA leadership and its members. The tools provide for: (i) an assessment of the GAPA's production capacities and pre-financing needs; (ii) standard receipts for every transaction at GAPA level; (iii) producer gum supplies registration; (iv) GAPA gum supplies registration; (v) cash book; (vi) stock book; (vii) monitoring of pre-financed funds; and (viii) quality monitoring.

176. The other private sector partners who are essential for the GAMS project's success in scaling up the results of the AFD-funded project are in the financial sector. One Microfinance Institution (MFI), Ebda'a Bank<sup>61</sup>, has already signed a letter committing to finance the GAPAs supported by the GAMS project, and more are expected to follow. The project will help these partners develop innovative lending instruments, using gum purchase guarantees provided by the gum exporting companies as collateral for loans needed for pre-financing gum tapping and collecting operations.

177. In line with FAO's policy, a detailed due diligence exercise will be performed prior to any formal engagement with gum exporters or financial companies.

<sup>60</sup> See basic information on COMATS/Elemats in Appendix d.

<sup>61</sup> See basic information on Ebda'a Bank in Appendix e.

### **Project Coordination and Collaboration:**

178. The project will work closely with other projects in the Kordofan States, in particular the Livestock Marketing and Resilience Project of IFAD, which is currently establishing livestock corridors in North and West Kordofan that will link up with the livestock corridors to be established by the GAMS project in South Kordofan. In the implementation of the restoration/reforestation activities included in the Village Cluster Level Adaptation Plans developed in dialogue with local communities under the earlier IFAD-funded Western Sudan Resources Management Project (WSRMP), the GAMS project will coordinate closely with the recently approved IFAD Natural Resources Management Project in North and West Kordofan States, which will also build further on WSRMP plans, focusing on water infrastructure. The GAMS project will also coordinate with the UNDP-sponsored GCF project in South and West Kordofan.

## Appendix a. GAMS Implementation Arrangements: Risk Mitigation Plan<sup>62</sup>

Risks identified	Risk mitigation measures and agreed corrective actions	Expected completion Date	OP's responsible officer
<i>[Indicate the findings identified by the OP's Assessment Report]</i>	<b>[Indicate corrective actions that will be put in place by the OP as per recommendations of the OP Assessment Report]</b>	<i>[Indicate scheduled date of completion]</i>	<i>[Name and function]</i>
1) Waste or misuse of the project resources or assets due to lack of fraud prevention mechanism	<ul style="list-style-type: none"> <li>FNC will amend the anti-corruption policy to include fraud-reporting mechanism.</li> <li></li> </ul>		
2) Delays in the project implementation due to lack of risk management process	<ul style="list-style-type: none"> <li>FNC will develop a formal risk management mechanism.</li> <li>The project will train concerned staff from FNC on risk management.</li> <li></li> </ul>		
3) Challenges to monitoring project's accounting information from existing manual accounting system	<ul style="list-style-type: none"> <li>The project will provide computers and accounting software for recording of the project's financial transactions.</li> <li>The project will provide regular trainings for accounting/finance staff.</li> </ul>		
4) Improper payments or misallocation of payments to incorrect projects	<ul style="list-style-type: none"> <li>FNC should ensure that all invoices are stamped as "PAID" and marked with a donor</li> </ul>		

<sup>62</sup> This risk mitigation plan was formulated based on the recommendations of the OPIM Assessment of FNC.

	and/or project code, to prevent accidental duplicate payments or double funding. <ul style="list-style-type: none"> <li>• Close monitoring and follow up by Project Admin/ Finance officers.</li> </ul>		
5) Challenges to proper utilization of the project assets	<ul style="list-style-type: none"> <li>• FNC shall cover the project assets with insurance policy.</li> <li>• The project will provide computers and computerized inventory system.</li> <li>• Project assets will be classified and labelled with a coherent numbering system by FNC.</li> </ul>		
6) Inappropriate award of procurement contracts	<ul style="list-style-type: none"> <li>• FNC will develop conflict of interest procedure.</li> <li>• Close monitoring and follow up by Project officers.</li> </ul>		
7) Sub-partner management	<ul style="list-style-type: none"> <li>• AVOID.</li> <li>• FNC shall not sub-partner any of the project activities.</li> </ul>		

contracted

For all above risks, FAO, through contracted audit firm, will conduct minimum 2 spot-checks and 1 audit per year.

**For the Operational Partner: [Name of the Operational Partner]**

Name: [Name of the OP's Authorized Officer]    Signature:.....

Title: [Title of the OP's Authorized Officer]        Date:.....

**For the Food and Agriculture Organization of the United Nations**

Name: [Name of Project Formulator]    Signature:.....

Title: [Title of Project Formulator]        Date:.....



Appendix b. Budget activity by Executing Entity - FNC and FAO.

List the activities:	Inputs	Responsible
<b>OUTPUT 1.1.1</b>		
<b>Activity 1.1.1.1.</b> Stakeholder meetings at state and locality levels	<b>1.1.1.1.a. LoA with local NGOs to develop communication strategy and facilitate smallholder gum producers stakeholder meetings at State and Locality levels US\$ 48,700</b>	FAO
<b>Activity 1.1.1.2</b> Confirmation of preselected target communities of phase one and validation of their restoration plans (80% of communities with GAPAs supported by the project have already developed VCLAP. (160ha/GAPA))	<b>1.1.1.2.a. Validation workshops in project localities of N. &amp; W. Kordofan US\$ 28,000</b>	FNC
	<b>1.1.1.2.b. Village-level cluster meetings for verification to participate as a community (360/3 per cluster= 120 meetings) US\$90,000</b>	FNC
	<b>1.1.1.2.c. Operations costs for Restoration field supervisors (11) at Locality level US\$198,000</b>	FNC
	<b>1.1.1.2.d. Operations costs for Restoration field assistants (11) at Locality level US\$132,000</b>	FNC
	<b>1.1.1.2.e. State level Accountant US\$36,000</b>	FNC
	<b>1.1.1.2.f. Documentation Officer at State level US\$9,000</b>	FNC
	<b>1.1.1.2.g. Drivers at State level US\$18,000</b>	FNC
<b>Activity 1.1.1.3</b> Mobilization of communities (labour), extension and procurement of restoration inputs by FNC (quality seed from Forestry Research Centre, seedlings from local nurseries and soil preparation)	<b>1.1.1.3.a. Investments in agroforestry enrichment/restoration including FNC procurement of external inputs (private \$/ha + % of area est.) (\$/ha 80% of 75,000 equal to 60,000 ha US\$ 1,020,000</b>	FNC
	<b>1.1.1.3.b. Livelihood and Gender Impact Assessment (including end line survey) US\$ 20,000</b>	FAO
	<b>1.1.1.3.c. Supply of inputs and extension support for women-led nurseries US\$ 25,000</b>	FNC
<b>Activity 1.1.1.4</b> Engage remaining 20% of GAPAs without existing community-level gum restoration plans in participatory planning process and implement phase two of community-level gum restoration plans	<b>1.1.1.4.a. Participatory process for planning: Repeated site visits for each village cluster; (90/3=30 meetings x 3= 90 meetings). Repeated site visits for each village cluster; (90/3=30 meetings x 3= 90 meetings) US\$ 45,000</b>	FAO
	<b>1.1.1.4.b. Investments in agroforestry enrichment/restoration (\$/ha 20% of 75,000ha= 15,000 ha) US\$ 255,000</b>	FNC
<b>OUTPUT 1.1.2</b>		
<b>Activity 1.1.2.1.</b> Confirmation of deforested areas amenable to community reforestation through the modified taungya method (new /scaling-up of existing co-management agreements, 70/30 split)	<b>1.1.2.1.a. Validation workshops in project localities in North, West and South Kordofan US\$ 44,000</b>	FNC
<b>Activity 1.1.2.2</b> Mobilization of community stakeholders for new co-management agreements with FNC, involving reforestation through the modified taungya system.	<b>1.1.2.2.a.Independent facilitator for 35 communities US\$ 43,200</b>	FAO
	<b>1.1.2.2.b. Investments in agroforestry enrichment/restoration including FNC procurement of external inputs (35,000 ha) US\$ 875,000</b>	FNC

	<b>1.1.2.2.c. Technical, organizational trainings for women groups members and leaders US\$ 18,000</b>	<b>FNC</b>
	<b>1.1.2.2.d. Leadership and management trainings (including women leaders) US\$ 18,000</b>	<b>FAO</b>
	<b>1.1.2.2.e. Direct procurement of inputs and extension support for women-led nurseries US\$ 25,000</b>	<b>FNC</b>
<b>Activity 1.1.2.3</b> Mobilization of communities for scaling up of existing co-management agreements through additional reforestation, using the modified taungya system.	<b>1.1.2.3.a. Technical and leadership training for 15 communities US\$ 12,000</b>	<b>FNC</b>
	<b>1.1.2.3.b. Investments in agroforestry enrichment/restoration including FNC procurement of external inputs (15,000 ha) US\$ 375,000</b>	<b>FNC</b>
	<b>1.1.2.3.c. Vehicles (1) US\$ 50,000</b>	<b>FNC</b>
	<b>1.1.2.3.d. Motorbikes (30) US\$ 75,000</b>	<b>FNC</b>
<b>Activity 1.1.2.4</b> Facilitate negotiation between communities and FNC on co-management agreements, stipulating roles and responsibilities of both parties as well as the details of the gum benefit sharing arrangements.	<b>1.1.2.4.a. LoA for NGO to act as independent facilitator (2 days of negotiation at village cluster level) US\$ 23,600</b>	<b>FAO</b>
	<b>1.1.2.4.b. Venue and travel provision for participants US\$ 37,500</b>	<b>FNC</b>
	<b>1.1.2.4.c. Environmental and Social Management Framework (ESMF) and Grievance Redress Mechanism (GRM) Specialist – consultancy US\$ 28,800</b>	<b>FAO</b>
<b>OUTPUT 1.2.1</b>		
<b>Activity 1.2.1.1</b> Organize meetings and exchange visits among GAPAs and gum buyers.	<b>1.2.1.1.a. Sensitization meetings between GAPAs and buyers: 3 meetings at State level US\$ 9,000</b>	<b>FNC</b>
	<b>1.2.1.1.b. Sensitization meetings between GAPAs and buyers: 11 meetings at Locality level US\$ 16,500</b>	<b>FNC</b>
	<b>1.2.1.1.c. 1 buyer with around 20 GAPAs at roundtable meetings (total 450+50 GAPAs exchange visits) US\$ 125,000</b>	<b>FNC</b>
<b>Activity 1.2.1.2</b> Build the technical, organizational and commercial capacity of GAPAs and other interested smallholder producer groups to produce clean, dry gum according to the international Association for International Promotion of Gums (AIPG) standard.	<b>1.2.1.2.a. Chief Technical Advisor (CTA, VC Specialist) US\$ 600,000</b>	<b>FAO</b>

	1.2.1.2.d. IGARD - national trainer consultancy (I- Development of training program and material for GAPAs: technical training US\$ 84,000	FAO
	1.2.1.2.e. Training delivery (fees, venue, travel, logistics) US\$ 75,000	FNC
	1.2.1.2.f. Deploy training and capacity building program for GAPAs: technical, organizational and commercial US\$ 450,000	FNC
	1.2.1.2.g. Rapid assessment of post-training program (local consultant) US\$ 2,500	FAO
	1.2.1.2.h. Contract with NGO for Gender Action Learning System (GALS) training for beneficiary households (including FNC staff training of trainers US\$ 120,000	FAO
	1.2.1.2.i. Contract with NGO for functional literacy and numeracy (for women group members) US\$ 86,400	FAO
	1.2.1.2.j. Contract with NGO to validate gender action plan activities and targets at State level to adjust the project gender mainstreaming activities US\$ 20,000	FAO
	1.2.1.2.k. Operational costs for 11 Locality gum extension officers US\$ 132,000	FNC
<b>OUTPUT 1.2.2</b>		
<b>Activity 1.2.2.1</b> Facilitate contract farming relationships between GAPAs and gum exporters	1.2.2.1.a. Organize business brokering meetings between GAPAs and buyers at locality level (including travel cost) US\$ 11,000	FNC
	1.2.2.1.b. Organize Business brokering meetings between GAPAs and buyers at village cluster level US\$ 25,000	FNC
	1.2.2.1.c. Contract farming specialist familiar with gum value chain US\$ 67,200	FAO
	1.2.2.1.d. Operational costs for GAPA / Community Development Officer (FNC) US\$ 67,200	FNC
<b>OUTPUT 1.2.3</b>		
<b>Activity 1.2.3.1</b> Facilitate dialogue with gum producers, gum buyers and State-level agricultural and trade authorities to promote recognition of "clean, dry hashab gum" as a new market standard, starting with the El Obeid Crop Auction Market, to enable all GAPAs accessing the market to get premium price for the quality gum they produce.	1.2.3.1.a. Organize round table discussion on product standardization and market recognition of clean, dry hashab gum as well as agreement on ToR of a design study US\$ 5,000	FNC

<b>Activity 1.2.3.2</b> Elaboration and conclusion of an agreement among gum buyers and market authorities to fund and maintain the gum market information system established by the AFD-funded pilot project, which provides text messages with gum price and volume information to smallholder producers.	<b>1.2.3.2.a. Organize and facilitate round table discussion on market information needs and levy (price or volume based) on buyers for maintaining market information system, including preparation of a white paper (consultant) US\$ 9,500</b>	FAO
	<b>1.2.3.2.b. Develop technical and administrative requirements for procurement and maintenance of text messaging system (consultant) US\$ 10,000</b>	FAO
	<b>1.2.3.2.c. Complete development of market information system, including provision for installation, training, maintenance and cost recovery (consultant) US\$ 20,000</b>	FAO
<b>OUTPUT 1.2.4</b>		
<b>Activity 1.2.4.1</b> Help GAPAs build credit relationships with banks and microfinance institutions	<b>1.2.4.1.a. 11 Sensitization events for MFIs and GAPAs at locality level (including travel for GAPAs) US\$11,000</b>	FAO
	<b>1.2.4.1.b. Brokering meetings between GAPAs and MFIs at locality level US\$ 11,000</b>	FAO
	<b>1.2.4.1.c. Brokering meetings for women groups with MFIs at locality level US\$ 2,500</b>	FAO
	<b>1.2.4.1.d. Follow-up meetings US\$ 2,500</b>	FAO
	<b>1.2.4.1.e. International TA on lending modules (local consultant-economist) US\$ 22,500</b>	FAO
	<b>1.2.4.1.f. PIM chapter on component 1 operations including M&amp;E US\$ 11,500</b>	FAO
<b>OUTPUT 2.1.1</b>		
<b>Activity 2.1.1.1</b> Training for community stakeholders on climate change adaptation and natural resource management.	<b>2.1.1.1.a. Adaption of training program on Natural Resource Management (NRM) and Climate Change (CC) for Village Clusters (international consultant) US\$ 20,000</b>	FAO
	<b>2.1.1.1.b. LoA with local NGOs for Training to community stakeholders on climate change adaptation and natural resource management US\$ 42,200</b>	FAO
<b>Activity 2.1.1.2</b> Formulate Village Cluster Level Adaptation Plans (VCLAP) and prioritize climate change adaptation investment options in 25 village clusters.	<b>2.1.1.2.a. LoA with local NGOs for land use planning and mapping around livestock routes and facilitating local stakeholder discussions US\$ 18,100</b>	FAO
	<b>2.1.1.2.b. State level Coordinator US\$ 72,000</b>	FAO
<b>Activity 2.1.1.3</b> Facilitate implementation of Village Cluster Level Adaptation Plans (VCLAP) and climate change adaptation investments in 125 village clusters	<b>2.1.1.3.a. Facilitate investments in CRVCP priorities in North, West and South Kordofan (average envelope available for investments of each cluster) US\$ 750,000</b>	FAO

<b>OUTPUT 2.2.1</b>		
<b>Activity 2.2.1.1</b> Participatory mapping, demarcation or validation of stock routes in North, West and South Kordofan	<b>2.2.1.1.a. Service provider for rapid assessment, feedback and validation workshop of livestock corridors for North and West Kordofan states (cost per km of corridor) one per locality US\$ 7,000</b>	FAO
	<b>2.2.1.1.b. Service provider for mapping and demarcation of livestock routes for South Kordofan, including feedback and validation workshop US\$ 17,000</b>	FAO
	<b>2.2.1.1.c. Service provider for producing and installing concrete livestock routes markers US\$ 120,000</b>	FAO
<b>Activity 2.2.1.2</b> Plan construction of basic infrastructure (small watering points and veterinary service points) around livestock corridors; agree on maintenance arrangements and cost recovery with farming and pastoralist communities, and implement construction program	<b>2.2.1.2.a. Invest in stock routes infrastructure (watering points) US\$ 620,000</b>	FAO
	<b>2.2.1.2.b. Contract Infrastructure Engineer (one for North and West Kordofan and another one for South Kordofan) US\$ 45,000</b>	FAO
	<b>2.2.1.2.c. Community Development / Gender Specialist US\$ 45,600</b>	FAO
<b>Activity 2.2.1.3</b> Build capacity of rural communities and state and locality level institutions to co-manage transhumant livestock corridors and reduce conflict between farmers and pastoralists in the gum belt (including arbitration mechanisms).	<b>2.2.1.3.a. Operational costs for two Rangeland Management Specialists (seconded from Rangeland Department) US\$ 48,600</b>	FAO
	<b>2.2.1.3.b. Reconvene, and provide refresher training to (16) mobile stock route co-management teams US\$ 36,000</b>	FAO
	<b>2.2.1.3.c. International TA on NRM and rangeland development US\$ 47,500</b>	FAO
	<b>2.2.1.3.d. Develop and publish training material for stock route and rangeland co-management US\$ 7,500</b>	FAO
	<b>2.2.1.3.e. Master trainer for rangeland co-management Training of Trainers (ToT) for 16 village clusters by master trainer, plus refresher courses in mid-years - international consultant US\$ 30,000</b>	FAO
	<b>2.2.1.3.f. Training venues for Training of Trainers (ToT) US\$ 15,000</b>	FAO
	<b>2.2.1.3.g. Training of 80 change agents (two sessions) and village/recap events US\$ 16,000</b>	FAO
<b>Activity 2.2.1.4:</b> Set-up an information system, and provide training-sessions to the project partners on enhanced project / sectoral coordination, and geo-referencing, recording and monitoring in the GIS	<b>2.2.1.4.a. International consultancy for arranging agreement on product pricing verification system within relevant agency US\$ 15,000</b>	FAO
	<b>2.2.1.4.b. International TA for training FNC staff and installing geo-referencing, recording and monitoring GIS management system, ensuring high data quality US\$ 52,250</b>	FAO

<b>OUTPUT 2.2.2</b>		
<b>Activity 2.2.2.1</b> Raise awareness re importance of rangeland restoration with stakeholders at state and locality levels	<b>2.2.2.1.a. Kick-off meeting at state level (x3) US\$ 4,500</b>	<b>FAO</b>
	<b>2.2.2.1.b. Kick-off meeting at locality level (x11) US\$ 8,250</b>	<b>FAO</b>
	<b>2.2.2.1.c. Operational cost for Rangeland Management specialist US\$ 64,800</b>	<b>FAO</b>
	<b>2.2.2.1.d. Operational cost for Community Development Specialist US\$ 64,800</b>	<b>FAO</b>
	<b>2.2.2.1.e. NGO to Develop communication strategy, and design and publish communication material US\$ 20,000</b>	<b>FAO</b>
<b>Activity 2.2.2.2</b> Facilitate participatory process with farming and pastoral communities to identify sites and (tree, shrubs, grasses) species for rangeland restoration and agree on division of labour among project and beneficiaries.	<b>2.2.2.2.a. Two Rangeland Management Specialists (seconded from RGPD) US\$ 43,200</b>	<b>FAO</b>
	<b>2.2.2.2.b. LoA with NGO to organize local level meetings (32) to prioritize sites and species for restoration, and to agree on post-restoration management arrangements US\$ 96,000</b>	<b>FAO</b>
<b>Activity 2.2.2.3</b> Implement 151,000 ha rangeland restoration program	<b>2.2.2.3.a. Operational costs for two Rangeland Management Specialists (seconded from Rangeland Department) US\$ 86,400</b>	<b>FAO</b>
	<b>2.2.2.3.b. Operational costs for 11 Locality Rangeland Extension Officers US\$ 132,000</b>	<b>FAO</b>
	<b>2.2.2.3.c. Procurement of quality seed, machine rental for soil preparation as necessary US\$ 1,057,000</b>	<b>FAO</b>
	<b>2.2.2.3.d. Consultant for Livelihood and Gender Impact Assessment (including endline survey) US\$ 20,000</b>	<b>FAO</b>
	<b>2.2.2.3.e. Vehicles (1) US\$ 50,000</b>	<b>FAO</b>
	<b>2.2.2.3.f. Motorbikes (25) US\$ 62,500</b>	<b>FAO</b>
<b>OUTPUT 2.3.1</b>		
<b>Activity 2.3.1.1</b> Facilitate policy dialogue to strengthen the enabling environment for smallholder participation in non-timber forest product value chains and land management and restoration	<b>2.3.1.1.a. Roundtable discussion on enabling policy environment for smallholder producers inclusion in value chain US\$ 5,000</b>	<b>FNC</b>
	<b>2.3.1.1.b. International Natural Resource Management (NRM) Specialist (Policy and Institutional reform) Consultancy US\$ 30,000</b>	<b>FAO</b>
	<b>2.3.1.1.c. NRM Specialist (Policy and institutional reform) – consultancy US\$ 25,200</b>	<b>FAO</b>
	<b>2.3.1.1.d. Stakeholder review meetings US\$ 30,000</b>	<b>FNC</b>
<b>Activity 2.3.1.2.</b> Elaborate improved state-level natural resource management regulations, including those needed to provide legal protection for livestock corridors and community forests – and their respective management arrangements - and disseminate these regulations amongst rural communities	<b>2.3.1.2.a. Land tenure and Voluntary Guidelines on Governance and Tenure (VGGT) expert – international consultancy US\$ 38,000</b>	<b>FAO</b>
	<b>2.3.1.2.b. Land tenure expert - local consultancy US\$ 27,000</b>	<b>FAO</b>
	<b>2.3.1.2.c. PIM chapter on component 2 operations including M&amp;E US\$ 11,500</b>	<b>FAO</b>

179. The following set of eight tools has been developed under the AFD-funded Structuring the Gum Arabic Sector (SGAS) project implemented by FNC, which the GAMS project aims to scale up. Deployed together, the eight tools will guarantee equity and transparency in the contract farming arrangements between gum buyers and GAPAs, and in the commercial transactions between GAPA leaders and members. FNC and FAO will make the use of these tools mandatory for gum companies that agree to partner with the GAMS project, and for the GAPAs whose capacity will be strengthened by the GAMS project. Application of these tools will help to increase the capacity of the GAPAs supported by the GCF project to handle commercial transactions in a transparent and equitable way, thus contributing directly to GAMS project results. The use of these tools will also help FNC and FAO to reduce any potential grievances under Component 1.

Name of GAPA :  
Village :  
GAPA leader :  
Company that provided contract :

[illegible]

**Example :**

180. Each member commits himself to deliver a quantity of gum and will receive the amount of pre-financing based on the rule fixed with the company. This table is filled before the start of the season. Even when there is no foreseen pre-financing, a GAPA needs to know the amount of gum it can produce. Even if cases (like what happen with Yusef Habibi) when the amount pre-financed is not based on a quantity but on a price (the quantity to be delivered will be fixed at collection time depending on the market price + premium), it is important for a GAPA to be able to have an indication of the quantity of gum each member can deliver (and therefore an indication of the quantity of the gum available for trade).

Name of the producer	Quantity of gum to be provided	Need for prefinancing	Producer's signature
Faiza	2 Gintar	60 000 GNF	
Mohammed	1 Gintar	30 000 GNF	
Sunhair	1 gintar	30 000 GNF	
Omar	3 gintar	90 000 GNF	
Al Khatim	2 gintar	60 000 GNF	
<b>Total amount for the GAPA</b>	<b>9 Gintar</b>	<b>270 000 GNF</b>	



## Tool 2 : receipt

Name	
Village	
Receipt number	
Amount (GNF)	
Receipt from	
.....	
.....	
Amount :	
.....	
.....	
Subject :	
.....	
.....	
Made in ..... Date : .....	
Signature .....;	

181. A receipt should be signed every time there is a transaction at GAPA level: including delivery of gum from a member, purchase of tools and sales of gum.

182. After receipt signature, the cash book and stock books are updated and a copy of the receipt is kept. Using receipts is very easy but it creates a lot of different document to handle. For some of the transactions (for transactions with members of the GAPA or with a regular customer for example), it could be useful to replace it by an alternative document to register all the transaction with one actor. The reference is used to facilitate the link between receipt and cash book/stock books. Tool 3 and 4 show examples of these tools.

### Tool 3: Producer gum supplies registration

Date	product	Quality grade	buyer	unit	Unit price	quantity	amount	Producer signature	Gapa leader signature

183. With this tool, the producer does not have to keep one receipt for each transaction. After one transaction, the producer and the GAPA leader both sign the document and a copy is given to the producer at the end of the year.

### Tool 4: GAPA gum supplies registration

184. This tool is used in the same way than the previous one but with companies/buyers. One table is prepared for each regular buyer to register all the transaction with him during the year. The reference is used to facilitate the link between receipt and cash book/stock books.

Date	ref	product	Quality grade	buyer	unit	Unit price	quantity	amount	GAPA leader signature	Buyer signature

### Tool 5: Cash book

Date	ref	Details	In	Out	total

185. All the financial transaction made by the GAPA should appear in the cash book, either in the category “in” (for sales, pre-financed funds, subsidies, annual member fees...) or in the category “out” (purchases, transports, DSA for leaders...). The reference refers to the receipts (or the alternative document) to enable tracing the transaction. There should be regular checks made by the accountant of the GAPA that the amount appearing in the cash book is the same as the amount physically there at the cashier’s level. Cash books should be disseminated for all the value chain actors involved in economic activities: GAPAs, unions of GAPAs, local traders, traders... Companies probably already have accounting tools (as they deal with foreign company, government for taxes...) and do not need this kind of basic tools.

### Tool 6: Stock book

Date	ref	Details	In	Out	Stock available

186. The stock book is very similar to the cash book but for the real products owned by the GAPA. All the transactions involving flows of products should be registered, even if products are not stored by the GAPA. For example, if a GAPA collect gum from 5 producers and sell it to a buyer in the same day, the stock book (and the cash book) should show all the six transactions. The five first ones will appear in the category “in” and refer to all the individual receipts and the last one in the category “out” with a reference to the buyer receipt). There should be regular checks that the stock appearing in the book and the real physical stocks are the same.

187. If a GAPA buys and sell different products (for example if a GAPA also sells other products like sesame, but also if there are very different quality categories of gum) there should be a cash book per type of product.

### Tool 7: Monitoring of pre-financing provided by gum companies

188. When a company is providing pre-financing to the GAPAs for gum tapping and collection, each producer receiving funds should sign a receipt when s/he receive the funds and when the gum is sold. Having a tool that recapitulates the amount of the loan received and whether or not it has been repaid is a very useful tool for the GAPAs to be able to trace the transactions with individual members. It will also help the GAPAs supported by the GCF project to demonstrate their capacity to manage loans to MFIs they might want to partner with.

189. The same type of tool can be used to register pre-financed transactions between companies and GAPAs.

product	unit	Qty of gum to provide	Prefinanced amount	Date of funds reception	Producer signature	Gapa leader signature	Quantity of gum provided	Repayment of funds	Producer signature	Gapa leader signature


Tool 8: quality monitoring tool

Date	Producer's name	Quantity of gum provided	Gum is well dried	Gum is clean	Gum is in jute bag	Recommendation if quality is not sufficient	Signature of producer	Signature of controller

## Appendix d. Basic information on COMATS/Elemats

Comats DMCC is an international trading company in bulk commodities and materials, specialized in importing and exporting construction materials, petroleum products, particularly Fuel Oil and Crude Oil focusing on Midstream and Downstream along with Service & Supply to Upstream operations. The headquarters of Comats is located in Kuwait and provides a wide range of complete information to clients regarding the construction, petroleum industry, services and commodities in general. Also have a number of subsidiary companies working in Sudan, Chad and Mali

Comats MDCC owns the following companies:

- Elemats Investment & Services Co., LTD, Khartoum – Sudan
- Soundous Agro Business sarl, Bamako – Mali
- Elemats sarl, N'Djamena - Chad

Those companies which are fully owned by Comats MDCC are specializing in producing and marketing natural agricultural products such as Gum Arabic, Sesame, Ground nuts, Shea Butter and Watermelon seeds throughout the globe. The production and trade are done throughout supply chain and value chain approaches and practicing fair trade mechanism within the local communities (favouring contract farming approaches). These companies have introduced strict quality control methods throughout the supply chain including pre- and post-harvest cultural practices and methods. All specifications as well as Material Safety Data Sheets (MSDSs) are available for different grades and products.

### **Vision**

The vision of these companies is to be one of the first companies in exporting and marketing organic and natural crops and products chemical-free, high quality value products with minimal impurities.

### **Mission**

The mission is to be a developer of organic and natural products to be distributed in wide markets worldwide. Concerning for the environment and the fight against poverty through the stability of the rural population and increase their incomes through fair trade mechanisms (favouring contract farming approaches), value chain and new concepts such as the one village one product (OVOP) by developing such products.

### **Role in the GAMS project**

COMATS/Elemats has committed the equivalent of USD 13.5 million for investments in contract farming (pre-financing of gum tapping and collection, provision of essential inputs such as jute bags) with the smallholder gum producer associations (GAPAs) supported by the GAMS project. COMATS/Elemats will build on its positive experience gained with gum contract farming under the AFD-funded pilot project implemented by FNC in Sheikan Locality, North Kordofan State, which serves as a model for GAMS.

## Appendix e. Basic information about EBDAA Bank – Sudan

### About EBDAA bank:

EBDAA Bank is a microfinance institution that accepts deposits. It works in reducing poverty by providing sustainable financial and non-financial services, job creation, vocational training and skills development, targeting owners of small-scale businesses with special focus on women, unemployed people and people with disabilities.

EBDAA bank also works on promoting and disseminating the micro-finance culture among citizens and poor communities and provides technical support to microfinance projects. All that with goal of boosting economic growth and providing investment and employment opportunities for the targeted groups in urban and rural areas.

The bank was established in Sudan through partnership agreement between the Arab Gulf Programme for Development, the Islamic Development bank and private sector in Sudan and Arab countries in 2013, and become operationally active in 2014.

According to EBDAA Annual report 2018 the authorized capital equals to USD 5,000,000 and paid-up capital equals to USD 4,175,000.

EBDAA bank has a number of branches all over Sudan (in 11 states). Specifically, the bank has branches in Um Rawaba, Omdurman, Khartoum, East Nile, Al-Rashad, Um Kadada, Al-Kamlien, Libya, Al-Halfaya, Al-Kalakla, Abuzabad, Al-Nohoud, Shandi, Al-Khawi, Al-sant and Damazine localities. (Source: EBDAA Bank website <http://ebdaabanksd.net/en/index.php>, accessed on March 23, 2020).

The branches that EBDAA bank has within GAMS project areas are:

- (1) In North Kordofan: in Um Rawaba and El Rahad localities.
- (2) In West Kordofan: in Abu Zabad, Elsonott and Elfula localities.
- (3) In South Kordofan: in Eldibeibat and a sub branch (more like a unit) in Kazgeil localities.

### The Aim:

EBDAA Bank aims to contribute to the success of the national strategy to reduce poverty and unemployment by increasing the productivity of economically active small owners in Sudan, especially women, and improving their livelihoods by providing sustainable financial and non-financial services in a direct or indirect way that meets their needs.

### Some of EBDAA Bank Principles:

- EBDAA Bank asserts that its low-income customers are already experts in their fields, knowledgeable and know-how to optimize and benefit from the services given to them as customers and not just recipients of support or aid.
- EBDAA Bank based on the fact that there is no bad customer but there is bad financing services, therefore making sure that the financing is given at the right time, in the right amount and with close follow-up.
- EBDAA Bank focuses on women (80% of its customers) by giving them opportunities to start their own small businesses so that to be economically active and participate in the society.
- EBDAA Bank sees the contribution to the economic growth of the country requires the expansion of the productive work of the small holders and increasing the number of beneficiaries of services.
- EBDAA Bank design different financing products that meet the needs of the targeted groups in various sectors in line with its objectives and financing policies.

### Targeted groups:

EBDAA Bank targets economically active poor people with low income in rural and urban areas and those most in need, focusing on women, youth, pensioners and people with disabilities.

### Services and Products:

(Source: EBDAA Bank website <http://ebdaabanksd.net/en/index.php>, accessed on March 23, 2020)

#### ➤ Finance Services:

- (1) *EBDAA Product*: It is a product dedicated to small women's projects that need small capital. Amount of funding: 1000 - 3000 Sudanese pounds. Profit margin: 2%. Financing formula: contracting. Fees: 10 Sudanese pounds. Period of funding: 10 months. Guarantees: Group Guarantee.
- (2) *Morah Product*: It is a product dedicated to women's groups and young breeders and pastoralists to contribute to increased income and production. Target group: Women Groups, Youth in Pastoral Areas. Financing size: 4000 - 5000 SDG. Profit margin: 2%. Funding period 4-12 months. Guarantees: Group Guarantees.
- (3) *Solar Power Product*: Provide permanent lighting in homes in the countryside. Provide alternative energies, which helps in the operation of bolts in agricultural projects. Making use of solar energy in small investment projects. Reducing emigration and encouraging reverse migration by financing accompanying projects that help improve the standard of living.
- (4) *Youth Product*: targeting youth (18-35 years old) with interest in one of the following projects (all types of agriculture, vegetable and agricultural crops, fodder, breeding and fattening, poultry farms, salon and beauty salons, workshops Blacksmithing, maintenance of electronic equipment, training centers, kindergartens, pharmacies). Amount of funding: SDG 750 - 20.000. Profit margin: 1.5%. Fees: SDG 30. Period of funding: 15-18 months. Guarantees: Group Guarantee.
- (5) *Swaidna Product*: It is a product dedicated to the financing of small and medium projects that enjoy the independence of their owners. Target group: All low and low income persons with due consideration (The project age is not less than 6 months). Amount of funding: 4600 - 20000 Sudanese pounds. Profit margin: 15%. Period of funding: 15, 18, 24 months (by amount). Guarantees: group guarantee, salary guarantee, pension, maintenance / check guarantor, original warrantee (rent).
- (6) *Education Product*: Provide funding for families to register their children in educational institutions on time. Other advantages: Affordable conditions for students with special needs and outstanding students.

#### ➤ Saving services:

- (1) *Investment Securities*: The minimum deposit is 500 Sudanese pounds. The deposit shall be made at any time of the year after the signing of an absolute speculative contract with the Bank. No withdrawal shall take place after six months or after the end of the year. Earnings are set at 20% for the bank and 80% for the customer. Profit is paid in January of each year and renews the contract if the customer wishes. The deposit is used as collateral to grant funds representing 150% of its size. Targeted: Female heads of household - students - employees - farmers - workers.
- (2) *Algrsh Elabyed Savings*: The account is open for free. There is no minimum deposit amount. The customer is given savings book costing SDG 10. The credit is withdrawn and deposited at all times. Targeting housewives, students, children, employees, farmers and workers.
- (3) *Algrsh Elabyed (plus) Savings*: Is a savings account provided by the bank to customers to save their money and all options of withdrawal and deposit are the property of the customer. Open the account for free. Withdrawals and deposits are made at all times. The minimum amount deposited (SDG 50). The customer shall give a book

of savings its cost (SDG 10). The customer will compete in the best savings prize (to be withdrawn every three months). Targets: housewives, students, children, employees, farmers, workers.

- (4) *Child Money*: It is a product for children from the age of kindergarten to the age of 15 years. The aim of this product is to consolidate and build the culture of the brotherhood and to link the target to the financial institutions by encouraging children to save from their surplus daily expenses to take advantage of it during the vacations period.

➤ *Insurance Services:*

(1) *Health Insurance.*

(2) *Crop Insurance.*

### **General principles for granting finance:**

According to EBDAA Bank operational manual 2017, the following are the basic principles for granting finance from EBDAA Bank:

- (1) Granting finance only when a reliable credit base is available including the feasibility of the proposed project, information about the customer and a full understanding of the financing purposes and sources of repayment.
- (2) The funded economic sectors and targeted customers must be diversified to reduce the risks as much as possible.
- (3) Prefer to provide finance to groups and associations instead of individuals and rely on groups' guarantees.
- (4) The volume of a single financing must not be less than SDG 1,000 and not more than SDG 20,000.
- (5) The validity of the credit decision is vested in the bank's management represented by the general manager, the operations manager, or his representative, and according to the request of the loan specialist, the branch manager, and the credit committee in accordance with the powers of disbursement and financing ceilings.
- (6) Achieve maximum possible return on the bank funds invested in its operations and within limits risks by following the laws and public policies issued by the Central Bank of Sudan.

### **Eligibility conditions to grant fund:**

To be Sudanese with ID document, resident in the bank's work area, aged from 18 up to 65 years, not to have been convicted of an honour and trust crime, to be in good health (even if he/she with disability but able to work and produce), being able to carry out activity or having sufficient experience and a clear vision to manage it, good credit reputation and suitable fixed place for conducting the projects activities. (Source: EBDAA Bank Operational Manual 2017, Arabic version).

### **Accepted Guarantees:**

Group guarantee; Individual guarantee (check or salary); entitlement to a pension or an expense; mortgage of personal or the project assets; savings. (Source: EBDAA Bank Operational Manual 2017, Arabic version).

### **Enhanced guarantees:**

Receipt of money trust; Warranty documents;

### **EBDAA Bank financing cycle consists of the following steps:**



Promotion and announcements, reception of customers for more clarification, funding request, evaluating the funding request, funding decision, disbursement of financing, follow up on financing (recovery), close the financing, renewal of financing. (Source: EBDAA Bank Operational Manual 2017, Arabic version).

## CHAPTER 7. PLANNING, M&E AND LEARNING AND KNOWLEDGE MANAGEMENT

### PLANNING

190. The annual working plan and budget (AWPB) constitutes the main formal instrument to ensure ownership and participation of project stakeholders and beneficiaries. It represents the result of the national engagement process and the main planning tool of the project. To this end the PMU, via its M&E team, will secure constant dialogue with target communities and administrations and will ensure their participation in the AWPB formulation process. AWPB will be implemented through quarterly operational plans, an update of the AWPB could be considered at mid-year if needed.

191. The AWPB is composed of the main sections below:

- Georeferenced<sup>63</sup> Annual Report (after year 1);
- Georeferenced Annual Logframe matrix (LFM);
- Timeframe with annual milestones;
- Working Plan Rationale;
- Communication and knowledge management (KM) annual strategy;
- Budget;
- Procurement Plan.

192. *Georeferenced Annual Report.* Other than for the first AWPB, the PMU will present on a yearly base the annual report including the geographic coordinates of each executed activity. The report will describe activities executed and milestones reached against targets including data and analysis from the M&E team. The report will also include a detailed description of the expenditure of the past year and highlight issues encountered in procuring goods and services. In addition, the report will contain a section dedicated to media, publications, and other communication/awareness activities funded or participated in by the project. A detailed outline of the annual report will be developed with partners and PMU at project start-up.

193. *Georeferenced Annual LFM.* The AWPB will include a LFM reporting activities and expected contribution to project's targets. Proposed activities will have to clearly present geographical coordinates related to planned investments and soft activities.

194. *Timeframe with annual milestones.* The AWPB will also contain the annual timeframe for reporting deadlines, SC meetings and targets to be reached for the year. The timeframe will also report community engagement milestones as well as M&E targets for the year.

195. *Working Plan Rationale.* Each activity presented in the Sub-LFM will be clearly detailed including description of planned approaches and tools deployed to achieve annual goals, milestones and community engagement. Rationale will also include results of geospatial analysis performed on areas identified for the execution of activities.

196. *Communication and KM annual strategy.* The AWPB will also include clear description of project's communication and knowledge management strategies including, approaches, methodologies, target audiences and key stakeholders to be reached by the proposed set of actions, as well as the rationale for these choices.

197. *Budget.* The AWPB will contain a detailed budget that will contain all planned expenditures according to FAO rules and procedures or else according to covenants of the project financial agreement.

198. *Procurement Plan.* The procurement plan will be prepared according to FAO/state rules and procedures.

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<sup>63</sup> *Georeferencing* is the process of assigning a unique set of geographical coordinates to data, information, physical elements, areas, and any other point/action/activity/process related to the project including policy development and training

199. Planning and approval of the AWPB will be done at the end of each fiscal year and will require formal approval of both the Project Steering Committee (PSC) and FAO.

## MONITORING AND EVALUATION

200. The project will apply FAO's standard M&E procedures and will be compliant with the GCF performance measurement framework. FAO, in its capacity as the Accredited Entity, will manage and coordinate reporting to the GCF according to agreed standards and procedures. The project will follow an Evidence and Results Based Management (RBM) approach, which is intended to aid decision-making towards the explicit goal, outcomes and outputs identified as part of the Theory of Change. The Monitoring Plan is provided in Appendix at the end of this Chapter.

201. The project will be monitored using a combination of tools based on: (i) georeferencing, (ii) field data collection and (iii) geospatial analysis.

(i) *Georeferencing*: will ensure a unique relation between project's activities and geographical coordinates collected according to specific georeferencing procedures. This will allow the project and the Country to ensure clear identification of activities and beneficiaries. The use of georeferencing approach will not require special technologies, equipment or advanced IT skills. Basic software are available under license (i.e. ArcGis/ESRI) or in open source (i.e. QGIS) and most of the currently available smart phones/tables, regardless of their operative systems, can execute most of the processes required to ensure georeferencing and data management. Additionally, FAO will provide dedicated training to PMU, M&E team and project's partners/stakeholders at project start-up.

(ii) *Field data Collection*: field data will be collected by the Forest National Corporation and by the State-level M&E teams following a protocol including stakeholder participation. Data flow and quality assurance mechanisms must be defined at project start-up. The project has also planned for two households and institutions surveys at mid-term and project completion.

(iii) *Geospatial analysis*: the FNC - supported by FAO - will monitor field activities and their impacts with the help of freely available high-quality satellite imagery, using the FAO Earth Map tool for their interpretation and analysis. The training that FAO has provided to FNC staff under the ongoing National Forest Inventory project will be highly instrumental in this regard

202. Apart from enabling FNC to assess project impacts through the monitoring of changes in the Land Productivity Dynamics (LPD) and Normalized Difference Vegetation Index (NDVI), the FAO Earth Map tool will also allow the project to factor in climate change variables as well as socio-economic and environmental data into the planning and decision-making process. The integration of 'geo-spatial' elements will allow stakeholders to overlay different classes of data such as climate trends, hydrography, erosion, flood risks, land cover, land use, distribution of population and livelihoods in order to inform an evidence based decision making process. Finally, the dissemination and use of the FAO Earth Map tool will contribute in enhancing national and regional data collection activities that will support the understanding of Climate Change impacts at local level.

203. The combination of georeferencing, ground-truthing, participatory monitoring involving farming and pastoral communities and remote sensing analysis will enable stakeholders, including the GCF and the general public, to access a verifiable assessment of the project's effectiveness and efficiency. Apart from generating information for the annual reports, the described approach will also enable the PMU and SCU to take real-time corrective measures to improve project management as necessary.

## M&E Team Composition and Functions

204. The overall M&E process will be under the responsibility of the PMU. Within the PMU, the M&E officer will be

responsible for coordinating all M&E activities. He will also coordinate the project M&E team composed of him/herself, one M&E assistant (with GIS profile) seconded to the PMU from FNC, and the State coordinators and field supervisors acting as M&E focal points respectively at State and Locality level. He will provide support to Locality teams, implementing partners/service providers and FNC agents for data collection at field level. The M&E Officer will work under the direct supervision of the Project Coordinator. The M&E team will work closely with project technical specialists on activities planning, data consolidation and analysis and reporting activities.

205. During project implementation, the M&E team will perform 3 main functions:

206. *Monitoring of Execution Performances:* the M&E team will be responsible for: (a) collecting and consolidating data from local, state and national levels and (b) submitting progress reports on approved targets on a quarterly basis to the Project Coordinator. The M&E team will ensure correct and efficient filing of collected GPS coordinates. Once coordinates will start populating the M&E database, activities will be shared by the PMU via thematic project's maps and will be monitored via consolidated remote sensing practices (geospatial analysis). This aspect of the process is paramount to ensure knowledge building within the PMU and among stakeholders and in evaluating direct and indirect impacts of project's activities. Showing activities in their exact location - visualizing relations with the context - will allow a more objective evaluation of project impacts and will provide decision makers with an objective, transparent and evidence based support to inform national and State-level policies and strategies. Data, collected via reports prepared by service providers/partners/locality teams and verified with beneficiaries, will also be disaggregated by gender. Data will be stored in a database accessible to the PSC as well as to FAO. Functions of local M&E focal points also include verification and respect of the social and environmental safeguards.

207. *Community Monitoring and Ground Truthing:* The project will also apply a monitoring approach that ensures the participation of target beneficiaries and stakeholders into the process. Given the importance and relevance attributed by the theory of change to community's participation in restoration of degraded gum agroforestry systems and rangelands and in reforestation, the M&E team will ensure annual consultations in target areas so to support planning and monitor execution of activities. Thanks to the described georeferencing process, communities will participate directly both in planning and in ground-truthing the results obtained via FAO spatial analysis tools and methodologies. This particular aspect of the M&E strategy will also allow for enhanced and evidence-based knowledge sharing with local communities and their administrations as well as for mainstreaming climate change among key stakeholders.

208. *Strategic Advice:* annual results and related analysis, jointly reviewed by FAO and the PMU, will form the base for each annual planning exercise via the AWPB. These will be presented to the PSC in order to support its strategic role and to secure transparency and evidence-based strategy development.

## Project Baseline

209. In order to quantify the impact of the project's land restoration and reforestation activities under Outcome 1, it will be essential to establish the ex-ante status of the areas where these activities will take place. This will be done by FNC staff using the above-mentioned FAO Earth Map tool, focusing on the Land Productivity Dynamics (LPD) and Normalized Difference Vegetation Index (NDVI) variables. Since the FAO Earth Map tool provides access to complete sets of satellite imagery going back many years, these baselines can be assessed at any time. Under the project, LPD and NDVI baselines will be assessed once restoration and reforestation areas have been agreed with local communities and authorities.<sup>64</sup> The baseline assessments will also serve as a refresher course for FNC staff training in satellite imagery interpretation and analysis under the ongoing National Forest Inventory project supported by FAO.

210. As for the capacity building and gum value chain facilitation activities with the Gum Arabic Producer Associations (GAPAs) under Outcome 2, the baseline data were provided by the AFD project and by the survey of GAPAs in the project

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<sup>64</sup> The area indicator baselines in the project logframe are zero because the restoration and reforestation activities are all new and additional.

area carried out by FNC during project preparation.

### Description of Selected Indicators

211. The project identified a series of indicators deriving from GCF core performance indicators and project-specific interventions. Selected indicators have been discussed and agreed with the implementation partners.

212. Selected means of verification (MoV – see table 4 below), will allow the project to secure and enhance data collection and to guarantee data analysis and processing. MoV will include data collected by the project, independent surveys, and existing systems (FAO Earth Map, National Forest Inventory, national statistics, Government reports and publications of regulations in Official Journal, etc.).

**Table 5: Indicators and Means of Verification**

Expected Result	Indicator	Means of Verification (MoV)
<b>Fund-level impacts</b>		
<i>A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions</i>	GCF A1.2 Number of males and females benefiting from the adoption of diversified, climate-resilient livelihood options	Records of gum producer groups (GAPAs) and of participating gum buyers; Completed Climate-Resilient Village Cluster Plans; Agreed Livestock Route maps and published State-level regulations protecting Livestock Routes; Annual, mid-term and final project reports;  <b>Measurement Unit: Number, differentiated by gender</b>
<i>A4.0 Improved resilience of ecosystems and ecosystem services</i>	GCF A4.1 Extent of ecosystems and ecosystem services restored, protected, or made more resilient to reduce negative impacts of climate change	Georeferenced M&E Archive and reports will provide the project with necessary data. Changes in Land productivity dynamics (LPD) and Normalised difference vegetation index (NDVI) will be assessed against the baseline using the FAO Earth Map tool. Results will be presented at Mid Term and Project's Completion.  <b>Measurement Unit: hectares</b>
<i>M4.0 Reduced emissions from land use, reforestation, reduced deforestation, and through sustainable forest management and conservation and enhancement of forest carbon stocks</i>	GCF M4.1 Tonnes of carbon dioxide equivalent (t CO <sub>2</sub> eq) emissions reduced or avoided and/or GHG removal by sinks from forestry and land use activities.	Tonnes of carbon dioxide equivalent (tCO <sub>2</sub> eq) emissions reduced or avoided and/or GHG removal by sinks from forestry will be monitored with FAO EX-ACT methodology and tools. Results will be disaggregated per State, Locality and type of investment (agroforestry restoration, reforestation and rangeland restoration); and will be presented annually to the Fund.  <b>Measurement Unit: tCO<sub>2</sub>eq</b>
<b>Outcome M9.0 Improved management of land or forest areas contributing to emissions reductions</b>		
Georeferenced M&E Archive and reports will provide the project with data on the total hectares of agroforestry systems and rangelands restored and degraded lands reforested leading to reduced GHG emissions and/or enhancement of carbon stocks respecting environmental and social safeguards.		

Expected Result	Indicator	Means of Verification (MoV)
Changes in Land productivity dynamics (LPD) and Normalised difference vegetation index (NDVI) will be assessed against the baseline.		
<b>Outcome A7.0 Strengthened adaptive capacity and reduced exposure to climate risks</b>		
Annual, mid-term and final project reports; Project impact assessments; Records of gum producer groups (GAPAs) and of participating gum buyers; Completed Climate-Resilient Village Cluster Plans; Agreed Livestock Route maps and mobile stock route management team reports will provide data on the use by vulnerable households, communities, businesses and public-sector services of Fund-supported tools, instruments, strategies and activities to respond to climate change and variability		
<b>Outcome A5.0 Strengthened institutional and regulatory systems for climate-responsive planning and development</b>		
South, North and West Kordofan State records (published regulations in Official Journal) and Water Ministry records (for tripartite agreements on watering points) and accounts (for sharing of water fees); Official stock route adoption texts published. Annual, mid-term and final project reports;		
<b>Outcome M9.0 – Output level results</b>		
<b>Output 1.1</b> 75,000 ha of gum agroforestry systems restored (40,000 ha in West Kordofan; 35,000 ha in North Kordofan)	<i>Hectares of agroforestry systems restored.</i>	Data provided by Locality teams (LT) and state coordination units (SCU) will be consolidated in the project M&E database including georeferenced M&E Archive and reports. Changes in Land productivity dynamics (LPD) and Normalised difference vegetation index (NDVI) will be assessed against the baseline.  <b>Measurement Unit: Ha</b>
<b>Output 1.2.</b> 50,000 ha of degraded lands reforested (40,000 ha in South Kordofan, 5,000 ha in North Kordofan, 5,000 ha in West Kordofan)	<i>Hectares of land reforested</i>	Data provided by Locality teams (LT) and state coordination units (SCU) will be consolidated in the project M&E database including georeferenced M&E Archive and reports. Improvements on Land productivity dynamics (LPD) and Normalised difference vegetation index (NDVI) will be assessed against the baseline.  <b>Measurement Unit: Ha</b>
<b>Output 2.3</b> 151,000 ha of rangelands associated with stock routes restored by local and transhumant communities supported by the project (121,000 ha in SK, 15,000 ha each in NK and WK)	<i>Hectares of rangeland restored</i>	Data provided by Locality teams (LT) and state coordination units (SCU) will be consolidated in the project M&E database including georeferenced M&E Archive and reports. Improvements on Land productivity dynamics (LPD) and Normalised difference vegetation index (NDVI) will be assessed against the baseline.  <b>Measurement Unit: Ha</b>

Expected Result	Indicator	Means of Verification (MoV)
<b>Outcome A7.0 – Output level results</b>		
<b>Output 1.3</b> Technical, organizational and commercial capacity strengthening program for value chain actors implemented (500 smallholder gum producer groups will be targeted, detailing number of mixed groups and women only groups, total membership male and female – plus buyers, market authorities )	<i>Number of smallholder gum producer groups (GAPAs) that have benefited from capacity strengthening activities</i>	Periodic progress reports and project M&E database  <b>Measurement Unit: #</b>
<b>Output 1.4</b> 280 Smallholder gum producer groups linked up with gum exporters paying premium price for clean dry gum	<i>Number of smallholder gum producer groups (GAPAs) benefiting from contract farming arrangements at premium prices</i>	Project M&E database by consolidating data from Smallholder gum producer groups' (GAPA) records; Gum exporters' records and project assessments  <b>Measurement Unit: #</b>
<b>Output 1.5</b> 120 Smallholder gum producer groups selling clean dry gum in standardized auction markets	<i>Number of smallholder gum producer groups (GAPAs) benefiting from premium prices in auction markets</i>	Project M&E database by consolidating data from Smallholder gum producer groups' (GAPA) records and Auction market records; Project impact assessments  <b>Measurement Unit: #</b>
<b>Output 1.6</b> 180 Smallholder gum producer groups linked up with micro-finance banks	<i>Number of smallholder gum producer groups (GAPAs) benefiting from formal financial services</i>	Project M&E database by consolidating data from GAPA Records and Microfinance banks' records; Project impact assessments  <b>Measurement Unit: #</b>
<b>Output 2.1</b> Climate Resilient Village Cluster Plans	<i>Number of new CRVCPs formulated</i>	Periodic progress reports and project M&E database  <b>Measurement Unit: #</b>

Expected Result	Indicator	Means of Verification (MoV)
(CRVCP) completed and adaptation interventions (land restoration and revegetation, water conservation & management) prioritized and implemented in 125 village clusters	<i>Number of CRVCPs prioritized and implemented</i>	Periodic progress reports and project M&E database <b>Measurement Unit: #</b>
<b>Output 2.2</b> Four hundred (400) km of stock routes negotiated with local government, farming communities and pastoralists, demarcated on the ground and equipped (watering points and veterinary services), and arbitration mechanisms established to resolve conflicts among different user groups	<i>Km of livestock routes negotiated, formally adopted, demarcated and co-managed by resource users and local governments</i>	Monthly reports of mobile stock route co-management teams; Periodic progress reports and project M&E database <b>Measurement Unit: Km</b>
<b>Outcome A5.0 – Output level results</b>		
<b>Output 2.4</b> State-level cross-sectoral policy dialogue and adoption of climate-responsive natural resource management regulations (including protection of livestock corridors) will guarantee long-term sustainability of results generated	<i>Number of state-level regulations providing formal status for project innovations (e.g. protection of livestock routes, regulations promoting transparency in gum auction markets)</i>	Published State-level regulations (Official Journal) <b>Measurement Unit: #</b>



Expected Result	Indicator	Means of Verification (MoV)
under Outcomes 1 and 2		

### Contribution to SDG Indicators

213. In addition to the described indicators, the project will also contribute to several SDGs Indicators. The M&E team will ensure data collection and description of each of the selected indicators in addition to those reported in the logframe matrix.

**Table 6: GAMS Project's contributions to SDGs**

GAMS PROJECT'S CONTRIBUTIONS TO SDGs				
SDG #	SDG	Targets	Indicators	Project's Contributions
1	End poverty in all its forms everywhere	1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	1.5.2 direct economic loss attributed to disasters in relation to global gross domestic product (GDP)	GAMS will make the income of vulnerable smallholder farmers and pastoralists more resilient to moisture stress and drought.
5	Achieve gender equality and empower all women and girls	5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	5.5.2 Proportion of women in managerial positions	GAMS project will empower women in Gum Arabic Producer Associations through focused capacity building and additional value chain facilitation activities
13	Climate Action: Take urgent action to combat climate change and its impacts	13.2 Integrate climate measures into national policies, strategies and planning	13.2.1 Number of countries with nationally determined contributions, long-term strategies, national adaptation plans, strategies as reported in adaptation communications and national communications	GAMS project can inform target setting by Government of Sudan for land use GHG mitigation for the next iteration of its NDC

GAMS PROJECT'S CONTRIBUTIONS TO SDGs				
SDG #	SDG	Targets	Indicators	Project's Contributions
			13.2.2 Total greenhouse gas emissions per year	GAMS project will contribute to 9.23 million tCO <sub>2</sub> e of GHG emission reductions and removals over its 20-year lifespan.
15	Life on Land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area	GAMS will help reforest 50,000 ha of denuded areas
		15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management	GAMS will help reforest 50,000 ha of denuded areas
		15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	15.3.1 Proportion of land that is degraded over total land area	GAMS will assist local communities to restore 75,000 ha of degraded agroforestry systems and 151,000 ha of degraded rangelands
		15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	15.A.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems	Evidence on effectiveness and cost-efficiency of land restoration and on capacity to mobilize private sector financing in

GAMS PROJECT'S CONTRIBUTIONS TO SDGs				
SDG #	SDG	Targets	Indicators	Project's Contributions
				smallholder land use systems generated by GAMS will leverage additional finance.

### Monitoring Strategy

214. Data will be collected by the M&E team according to the means of verifications described in the previous sections. Data will originate from described sources and will be organized in a georeferenced M&E database. Data will be presented annually according to milestones fixed by each approved AWPB. Specific wrap section will be organized and supported by FAO at mid-term and completion so to secure data availability to external evaluators.

215. Within the set of activities planned in the AWPB and approved by the AE, the PMU will ensure that each no objection requests related to project's expenditures contains clear maps reporting investments' coordinates as well as georeferenced cadaster maps (if available) describing the areas of intervention. Absence of coordinates and maps will negatively affect the process denying automatically the authorization to proceed with expenditures. Project's data and information will be georeferenced and provided in ArcGIS or equivalent compatible formats, such as the open-source Q-GIS. Each dataset and information, including maps attached to the no objection process, will be also reported as KML file for uploading and sharing via Google Earth Pro. Produced datasets will be uploaded in Earth Map where geospatial algorithms are already available and fine-tuned for Sudan in order to perform a large spectrum of remote sensing analyses. Analysis via Earth Map will support analysis of achievements and impacts in target areas.

216. Coordinates will be taken in a unique and known reference system, which by preference should be the geographic coordinate system (datum WGS84 and unit in decimal degrees). The full set of coordinates and KMZ files will represent the geographical location and distribution of the interventions in the project areas and will be included in the "Project's Atlas". Produced maps will be provided in digital format (ArcGIS or equivalent) with all the metadata and sources of information. Maps shall be reported as well as in KML/KMZ format.

217. Involved institution and stakeholders (including the Steering Committee) will be involved both directly and indirectly via dedicated communication and training processes. The PMU will ensure communication via the annual reporting processes, national ownership workshops and via the project atlas. Communication documents will be constantly updated at the disposal of stakeholders, AE as well as donors. FAO will provide stakeholders with trainings to secure full mastering and ownership of the promoted process.

### Reporting, Supervision and Evaluation

218. Project's reporting will consist of four elements:

219. *Technical Reports (TRs) prepared by Partners/Service Providers/LT.* TRs will describe executed activities and involved beneficiaries according to M&E indicators and means of verification as reported in the previous paragraphs. Partners and service providers will ensure Georeferencing of each executed field activity and will present TRs on a monthly base to the M&E Team.

220. *Quarterly reports (QRs) prepared by the M&E team.* QR will present the work and achievements of activities presented in the AWPB. QR are prepared by the M&E team in close collaboration with technical specialists and will contribute to the annual report.

221. *Annual reports (ARs) prepared by the M&E team for the SC and FAO.* ARs will present the work and achievements for relevant year and will include implementation and fiduciary chapters. ARs will include findings and recommendations of FAO supervision reports (SRs) as well as comments and information from beneficiaries and other involved stakeholders. It will also include the independent annual audit reports (AARs) - commissioned by FAO to an independent firm according to FAO covenants, rules and standards - and the “Project’s Implementation Atlas” presenting the maps and charts obtained thanks to the georeferencing of project activities. Both will be presented as annexes of the AR. ARs are prepared by the M&E Team and validated by the Project Coordinator. FAO as accredited entity of the project will ensure annual reporting to the GCF.

222. *Evaluation Reports* are commissioned by FAO to an external and independent entity according to FAO covenants, rules and standards. ERs are shared with the Steering Committee and the PMU for comments and after finalization sent to the GCF at mid-term (MTE) and within six (6) months of project closure (FE).

223. In accordance with the FAO procedures for the evaluation of initiatives funded by voluntary contributions, the project will undertake:

224. *An independent Mid-Term Evaluation (MTE),* at mid-point of scheduled project duration, to review efficiency and effectiveness of implementation in terms of achieving project objective, outcomes and delivering outputs. The MTE will be instrumental for contributing through operational and strategic recommendations to improve implementation for the remaining period of the project’s life. FAO Office of Evaluation, in consultation with project stakeholders, will be responsible for organizing and backstopping the Mid-Term Evaluation, including: finalizing the ToR, selecting and backstopping the team and Quality Assurance of the final report.

225. *An independent Final Evaluation,* within six months prior to the completion date (NTE date) of the project. It will aim at identifying project outcomes, their sustainability and actual or potential impacts. It will also have the purpose of indicating future actions needed to assure continuity of the process developed through the project. FAO Office of Evaluation, in consultation with project stakeholders, will be responsible for organizing and backstopping the Final Evaluation, including: finalizing the ToR, selecting and backstopping the team and Quality Assurance of the final report.

226. The M&E and reporting process (table below) will also form the foundation of the project’s communication and knowledge sharing strategy. Thanks to data collected and analyzed during the whole project, stakeholders and general public will be constantly exposed to best practices and lessons learned so to capitalize on project’s experience and to magnify impacts in target areas as well as in others not directly involved in the project. Thanks to a pressing communication activity and key formal events at Start-up, Mid Term and Completion the project will ensure a constant flow of knowledge that will as well increase ownership of stakeholders and enhance its capacity to support an effective and efficient change into the policy making environment.

**Table 7: Project Reporting Framework**

Report type	Prepared by	Approved by:	Proposed timeframe:	Diffusion
Technical report	Service providers/partners/LT	PMU/M&E	Monthly	Internal
Quarterly report	PMU/M&E	PMU	3 reports per year	Internal
Supervision report	FAO	FAO	2 reports per year	Public

Audit report	External independent auditor	FAO	On an annual basis	Internal
Annual report/AWPB	PMU/M&E	SC/FAO	On an annual basis	Public
Mid-term review	External independent auditor	FAO	Third year	Public
Completion report	PMU/M&E	SC/FAO	Fifth year	Public
Terminal evaluation	External independent auditor	FAO	Fifth year	Public
Impact evaluation	GCF	GCF	To be determined	Public

227. FAO will support the SC and the PMU in reviewing and analyzing progress reports and assessing performances against baseline and targets. In addition to the support provided from FAO-Soudan, FAO-HQ will organize two supervision missions per year.

### M&E Outputs and budget

228. Results of the process will be available to stakeholders and partners in both project reports and Google Earth Pro Files. In order to execute evidence and result based management approach, the project will ensure the establishment of a dedicated M&E team that will work under the direct supervision of the Project Coordinator.

229. The PMU must ensure that M&E activities are appropriately budgeted in each AWPB. Budget should include the cost of human resources, equipment as well as the cost of data collection and processing. Additionally, it should contain adequate resources to ensure activities with communities as well as with administrations and stakeholders. The cost per year of the process is detailed in the project budget and will include all costs related to Planning, Learning and Knowledge Management.

## LEARNING AND KNOWLEDGE MANAGEMENT

230. Learning and knowledge management represents a paramount element of the project. As became apparent during project preparation, there is a dearth of geo-referenced, verified information on the merits of different methods of land restoration and reforestation, making it hard for decision makers to propose robust climate change adaptation policies and investments for the land use sector. The project will aim at transferring not only information and knowledge generated during activities implementation but also tools and skills that will support stakeholders in factoring in climate change into the decision-making process (institutions and private sector) and into livelihood strategies (communities). In order to achieve this, and to inform upscaling of the GAMS concept under GCF-UNCCD GGW Umbrella Programme, the project will produce a good practice guide covering the following key topics: (i) smallholder NTFP producer capacity building to meet international quality standards (as GAMS will do for gum Arabic production by the GAPAs, according to AIPG standard); (ii) facilitation of equitable contract farming arrangements between smallholder NTFP producers and private sector buyers; (iii) development with microfinance institutions of financial services modules that are more suited and accessible to smallholder producers (e.g. using private NTFP purchase contracts in lieu of traditional guarantees); (iv) capacity building of local farming and pastoralists communities to co-manage livestock corridors in collaboration with local authorities; and (v) identification of innovative revenue generating and sharing mechanisms to ensure the sustainability of climate change adaptation investments.

231. The project will ensure transfer of knowledge to stakeholders via capacity building activities and knowledge sharing events well identified on a yearly basis in the AWPBs and described in each of the project components. To this end, stakeholders' involvement in planning and monitoring will be among the main objectives of the project. Each project component will support the Learning and Knowledge Management process with specific trainings targeting both communities and institutions. Key objective of the learning and knowledge management process is to mainstream relevant policy frameworks and climate change related information to all the stakeholders involved in project's activities

as well as to the public.

## APPENDIX A. Monitoring and Evaluation (M&E) plan with responsible party and time frame

Milestone/ Type of M&E activity	Responsible party(ies)	Time frame
Project Inception Workshop	Project Management Unit (PMU) in consultation with the FAO Lead Technical Officer (LTO) representing FAO AE, and FAO Budget Holder (BH) representing FAO EE and Project Steering Committee (PSC)	Within one month after the <b>Funded Activity Agreement (FAA) effective date</b> , which marks the start of project implementation
Results-based Annual Work Plan and Budget (AWP/B)	PMU in consultation with the FAO project team	Six (6) weeks following the FAA effective date, and yearly on 15 December thereafter
Inception Report	PMU in consultation with the LTO and BH; report to be cleared by FAO EE and FAO AE in their respective capacities	Within six (6) months after the FAA effective date
Recruitment of Project M&E expert	FAO will hire full-time M&E officer to be integrated in PMU	One month following project start-up
Finalisation of baseline information (disaggregated by gender) and reassessment at mid-term and project closure	Impact evaluation consultants	During project year's 1, 2/3 and 5
Supervision visits	FAO Project Task Force (PTF)	Annual
Annual Progress Reports (APRs)	PMU with inputs from SCUs, CTA and implementing partners	No later than sixty days after each annual reporting period (ending 31 December)
Leveraged financing Reports	PMU with inputs from SCUs, CTA and implementing partners	Annually in July (after the end of the gum arabic collection season)
Technical Reports	Project staff and consultants; peer-reviewed by LTO/CTA	As appropriate
Mid-term lessons learned workshop (including discussion of first draft good practice guide)	Project staff, short-term consultants and FAO PTF	Project mid-term

Milestone/ Type of M&E activity	Responsible party(ies)	Time frame
Independent Interim Evaluation Report	Independent consultant to be hired and supervised by FAO Evaluation Office; assistance to be provided by PMU and FAO EE	Within six (6) months after year 2 from FAA effective date
Lessons learned workshop	PMU, SCUs, short-term consultants and FAO	Project end
Project Completion Report (Final APR)	PMU with the assistance of impact evaluation consultants recruited by the project, under supervision of the LTO and cleared by FAO EE and FAO AE	Within three (3) months from the <b>Completion Date</b> , the latter being five (5) years after the FAA effective date
Independent Final Evaluation Report	Independent consultant to be hired and supervised by FAO Evaluation Office; assistance to be provided by BH, PMU, LTO and implementing partners	Within six (6) months from the Completion Date



## CHAPTER 8 - CARBON IMPACT ESTIMATES

### CARBON IMPACT SUMMARY

232. Sudan is highly vulnerable to climate change and climate variability, predominantly a result of climatic and non-climatic factors. Land use, land-use change and forestry (LULUCF) account for a large proportion of Sudan's greenhouse gas (GHG) emissions. The total GHG emissions of the three sectors that are covered by Sudan's 2015 INDC (based on 2000 data) are estimated at 19,946 Gg CO<sub>2</sub>e, 47% of which (9,392 Gg) are from LULUCF, making it the largest single GHG emissions sector. The mitigation investments proposed in Sudan's INDC, submitted in October 2015, foresee spending of US\$3.2 billion in the forestry sector (including land-use change), conditional on climate finance becoming available given the country's LDC status.

233. The project aims to improve resilience of rural livelihoods and ecosystem services to climate change. It will do this by addressing institutional, policy, regulatory, fiscal and financial services access barriers to improved land use and by improving the management of 276,000 ha of land. Apart from its adaptation impacts, the project will also generate significant climate change mitigation benefits. Within the national engagement process led by the Forest National Corporation (FNC) – under the guidance of the Nationally Designated Authority (NDA) for the GCF and with assistance from the Rangeland Management Department) – and supported by FAO, stakeholders identified 11 Localities<sup>65</sup> in North, West and South Kordofan States, located in the semi-arid belt of Sudan, as the target area, with 371,528 direct and 1,210,000 indirect beneficiaries.

234. The project components are the following:

- Component 1: Restoration of smallholder gum agroforestry systems and improvement of gum value chain improved
- Component 2: Climate change adaptation at landscape level through establishment of livestock routes, restoration of rangelands and enhancement of policy/institutional environment in the three Kordofan States.

235. This document provides an ex-ante estimate of the carbon impact of project interventions with a direct carbon sequestration potential, i.e. the land use management and restoration activities included under Components 1 and 2. The other project activities, however, relating to improving the enabling environment for scaling up project methods and results and mainstreaming best practices in the land use sector's policy and legal frameworks are also essential for ensuring longer-term sustainability of the Sustainable Land Management practices introduced by the project, and their related carbon impacts.

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<sup>65</sup> The 11 project Localities are enumerated in Table 8 below.

Table 8: GAMS Project carbon impacts - With Project/Without Project- all GHG are expressed in tCO<sub>2</sub>e. Positive sign means source while negative sign means sink.

PROJECT STRUCTURE		Activity	With Project Scenario	BAU Scenario <sup>66</sup>
Component 1: Smallholder gum agroforestry systems restored and gum value chain improved	Outcome 1: M9.0 Improved management of land or forest areas contributing to emissions reductions	Reforestation	50,000 ha of abandoned agricultural land converted into forest land would <u>sequester -52,530 tCO2e per year.</u>  -1,050,592 tCO2e sequestered for the entire duration of the investment (20 years). <sup>67</sup>	50,000 hectares of abandoned agricultural land would remain degraded.
		Agroforestry	75,000 ha of existing cropland systems will be converted to agroforestry capturing <u>-329,538 tCO2-eq per year.</u>  -6,590,752 tCO2e sequestered for the entire duration of the investment.	No improvement on 75,000 hectares of cropland system.
Component Climate2: change adaptation at landscape level including rangeland restoration		Grassland management and degradation	151,000 ha of degraded grasslands will be improved through the demarcation of livestock corridors and restoration of associated rangelands, <u>which would sequester -79,376 tCO2e per year.</u>  -1,587,514 tCO2e sequestered for the entire duration of the investment.	151,000 hectares of degraded grassland will remain at the same level of degradation.
Overall carbon balance		Gums for Adaptation and Mitigation in Sudan (GAMS) activities will improve management on <u>276,000 hectares of degraded land with a potential sequestration of -461,441 tonnes of CO2e per year.</u>  For the entire duration of the investment <u>-9,228,818 tonnes of CO2e are sequestered over 20 years.</u>		

<sup>66</sup> The “without project” scenario, or baseline/ business-as-usual scenario, corresponds to a description of expected conditions in the project area in the absence of project activities.

<sup>67</sup> The 20 year period (accounting duration) is in line with the idea that even after the point at which a new equilibrium in land use practices is reached at the end of the implementation phase, further changes may occur as the result of the preceding interventions. For instance, for the soil C estimates, the default values are based on default references for soil organic C (SOC) stocks for mineral soils to a depth of 30 cm (Table 2.3 of IPCC 2006). When SOC changes over time (land use change or management change), the default time period for transition towards a new equilibrium is assumed to be 20 years. These values are used either in IPCC 1996 or 2006 Guidelines and are gathered from a large compilation of observations and long-term monitoring.

## Methodology: FAO EX-ACT tool

236. EX-ACT was developed using the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (IPCC, 2006) and augmented with the wetlands supplement (IPCC-WS, 2014). These equip EX-ACT with recognized default values for emission factors and carbon values – the so-called Tier 1 level of precision.

237. EX-ACT is also based on Chapter 8 of the Fourth Assessment Report from Working Group III of the IPCC (Smith et al., 2007) to account for more specific mitigation options not covered in IPCC 2006. Other required coefficients are taken from published reviews or international databases. For instance, GHG emission values for farm operations, transportation of inputs, and irrigation systems implementation are derived from Lal (2004). Electricity emission factors are based on data from the International Energy Agency (2013). In the fishery sector, fuel use intensity (FUI) data from the capture phase of target species at sea are taken from Parker & Tyedmers (2014).

238. Each tier of analysis represents a level of methodological complexity that is used to estimate GHG emissions, according to the definitions in IPCC 2006. Tier 1 methods rely on default values and entail less complexity. Tier 2 methods require region-specific carbon stock values and emission coefficients, demanding higher data requirements but offering higher precision. Whilst users may use the Tier 1 default values provided, EX-ACT encourages users to substitute these values for more location-specific Tier 2 data to improve the accuracy of the analysis.

239. Typically, GHG emissions are reported in units of carbon dioxide equivalent (CO<sub>2</sub>e). Gases are converted to CO<sub>2</sub>e by multiplying by their Global Warming Potential (GWP)<sup>68</sup>. The emission factors listed in this document have been converted to CO<sub>2</sub>e automatically by EX-ACT using the GWP listed in the table below.

<i>Gas</i>	<i>100-year GWP</i>
CO <sub>2</sub>	1
CH <sub>4</sub>	21
N <sub>2</sub> O	310

*Source: Intergovernmental Panel on Climate Change (IPCC), second Assessment Report (AR2), 1996. See the footnote for further explanation.*

### Afforestation reforestation module

240. Material used to develop this analysis can be found in Volume 4 (AFOLU) of the NGGI-IPCC2006, in Chapter 4 entitled “Forest Land”, and particularly in Chapter 2 “Generic Methodology Applicable to Multiple Land-Use Categories.

241. The first part is dedicated to the description of the vegetation used in the afforestation or reforestation (regeneration or plantation of native species, or plantation of exotic species). According to the climatic information provided in the Description Module, different kinds of most common vegetation types in the corresponding ecological zone are provided with their main characteristics. Up to eight different vegetation are divided into two main groups: natural vegetation and plantations.

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<sup>68</sup> The older IPCC second assessment report has been chosen to align with the existing official communications of the Government of Sudan to the UNFCCC, which also use this source. Global Warming Potentials: The Global Warming Potentials (GWP) used for presentation of CH<sub>4</sub> and N<sub>2</sub>O in terms of CO<sub>2</sub> equivalent are 21 and 310, respectively. For HFCs, PFCs, and SF<sub>6</sub> the GWP values for a 100 year time horizon have been used. (Source of GWP: Climate Change 1995: The Science of Climate Change, table 4, p. 22, Intergovernmental Panel on Climate Change, 1996).

242. The distinction in “Native” and “Plantation” is justified by the fact that main characteristics (e.g. the growth rate of trees) strongly depend on management regime, therefore a distinction should be made between intensively (e.g., plantation forestry) and extensively (naturally re-growing stands with reduced or minimum human intervention) managed forests.

243. For each of the default vegetation proposed, information is quantified for the five pools according to the generic methodologies outlined above, but with specific characteristics for forest vegetation. Values of annual growth rates are given for the above-ground and belowground biomass. But as IPCC 2006 highlighted, it is important, in deriving estimates of biomass accumulation rates, to recognize that biomass growth rates will occur primarily during the first 20 years following changes in management, after which time the rates will tend towards a new steady-state level with little or no change unless further changes in management conditions occur.

244. Above-ground biomass growth rate: These values derived from table 4.9 of IPCC 2006 (pages 4.57-4.58) for natural forest, EX-ACT retains either the value proposed or the central value when only a range is proposed. The values are given according to the continent and the ecological zone (Table A/R-1). When no specific numbers were available, the default value for a determined continent is proposed, this value corresponds to the default used for a full tier 1 approach Table 4.12 (page 4.63 of IPCC 2006). Table A/R-1 reported default values for a system being more or less than 20 years.

#### Perennial module

245. Material used to develop this module can be found in Chapter 8 “Agriculture” of volume “Mitigation” of the fourth Assessment Report of the IPCC (Smith et al., 2007), and in Chapter 2 of IPCC 2006 “Generic Methodology Applicable to Multiple Land-Use Categories”. The perennial systems, e.g. agroforestry, distinguishes between two components: (1) perennial systems from other land use or converted to other land use, and (2) perennial systems remaining perennial systems.

#### Grassland management

246. Material used to develop this module can be found in Chapter 6 “Grassland” of the Volume 4 (AFOLU) of the IPCC 2006, and in Chapter 2 of IPCC 2006 “Generic Methodology Applicable to Multiple Land-Use Categories”. The Grassland Module distinguishes two components: (1) the grassland systems from other LU or converted to other LU, thus built on information filled up in the Land Use Changes Module, and (2) grasslands systems remaining grasslands systems.

247. For each of the vegetation proposed, information regarding the state of the grassland and the initial and the final state (without project and with project) if there is a change of management. Available options are: Non-degraded - Severely Degraded, - Moderately Degraded, - Improved without inputs management - Improved with inputs improvement.

248. The estimation method is based on changes in SOC stocks over a finite period following changes in management that impact on SOC, and periodic burning of the grasslands. The soil C estimates are based on default references for SOC stocks for mineral soils to a depth of 30 cm as previously described in generic methodologies above, see table 1. According to information provided, EX-ACT calculates a coefficient  $\Delta C$  soil used to estimate the C stocks variation according to the change in the grassland management. The coefficients  $\Delta C$  soil are based on the relative factors  $k$  soil given by IPCC 2006 for Grassland (see Table 6.2 page 6.16 of IPCC 2006). Note that these factors in the case of the four reserved grassland systems are in addition to nominal values used for grassland in the deforestation, afforestation/reforestation and other land use changes modules.

## Detailed project analysis per activity (agroforestry restoration, reforestation, rangeland restoration) for Carbon Sequestration

### Project description in EX-ACT

249. The impacts from project implementation on GHG emissions and carbon sequestration can be viewed at from different angles and using a diverse set of metrics. The key GHG impacts will in the following be presented using three kind of entry points: (i) the total net GHG impacts from project implementation will be presented as they occur over time in the entire project implementation area and considering the larger set of diverse GHG emission and sequestration sources as outlined in the project description above, (II) the share per GHG emissions of the balance, and (iii) the project contribution to the increase/decrease of GHG emissions in time.

250. The project carbon balance provided below was analyzed with EX-ACT tool to provide a detailed GHG results distribution between all activities affected by the project. It provides results both for the whole 20 years duration of a usual project GHG appraisal, the share per GHG of the balance (highlighted in red figure 1), and per year. Baseline EX-ACT Assumptions. The EX-ACT analysis takes into account specific environmental features (soil and climate types) of each case study. Soil and climate information are needed to determine the coefficients used in the analysis. Average climates considered in the analysis are **Tropical**, the moisture regime was classified as **Dry**, and the dominant soil type was classified as **sandy soils**. The implementation phase of the project was specified as **5 years** followed by an estimated **capitalization phase<sup>69</sup> of 15 years**.

Emissions baseline is set at zero to be conservative, though in reality there is likely to be a positive emissions baseline because of ongoing degradation in the without project scenario (meaning that effective project emissions reductions are likely to be higher).

251. The aforementioned set of information was determined as the minimum information required by EX-ACT. Some calculation will only need the first piece of information, or also the moisture regime, whereas other calculations may particularly require the MAT, e.g. the CH<sub>4</sub> emissions from manure management. In order to reduce the risk of overestimating emissions reductions generated by the project, the emissions baseline has been set at zero, though in reality there is likely to be a positive emissions baseline because of ongoing degradation in the without project scenario (meaning that effective project emissions reductions are likely to be higher). Other assumptions introduced to arrive at conservative mitigation outcomes are discussed under the individual project activities (reforestation, improvement of agroforestry systems, rangeland management) below.

### Key project Activities acting on GHG

252. The project targets reforestation, agroforestry development, and grassland management on a total area of 276,000 ha via tailored investments at the smallholder producer groups' level to increase the resilience of ecosystem services provided by agroforestry systems and rangelands improvements, as follows:

#### **Reforestation/Forest enrichment (50,000 ha)**

253. The project aims at reversing the gum area decline by collaborative and more effective reforestation on degraded lands by planting *Acacia senegal*. With the project implementation, the reforestation/restoration activities would take place on at least 50,000 ha of direct reforestation activities (table 2). Under the baseline scenario, no reforestation activities would take place.

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<sup>69</sup> The capitalization phase is defined in EX-ACT as the period where project benefits are still occurring as a consequence of the activities performed during the implementation phase.

254. The reforestation activities are summarized in the below tables.

**Table 9: type of planted vegetation and corresponding surface areas**

No	Total target		Area (ha)	Previous land use	Species
	Forest resources: Afforestation/Reforestation/Enrichment				
1	North Kordofan	Shikan		Abandoned Land	Acacia senegal
		Om Rwaba			
		Al Rahad			
Total (ha)			5,000		
2	West Kordofan	Al Nuhod		Abandoned Land	Acacia senegal
		Gibeish			
		Wad Banda			
		Abo Zabad			
Total (ha)			5,000		
2	South Kordofan	Al Guz		Abandoned Land	Acacia Senegal (and Acacia seyal)
		Gibeish			
		Wad Banda			
		Abo Zabad			
Total (ha)			40,000		
	Total			50,000 ha	

255. Based on FAO's Global Ecological Zones (FAO, 2011), experts' consultation and relevant publications<sup>70</sup>, the forest in the area of influence and depending on the density of plantation have the following characteristics:

**Table 10: Biomass carbon sequestration for *Acacia senegal***

Species	mean annual increment (tC/ha/yr)	R=ABG/BGB <sup>71</sup>	Growt h rates ABG	Averag e ABG	Growt h rates BGB	Averag e BGB	Growt h rates BGB	Averag e BGB	Growt h rates BGB	Averag e Growth BGB
			Up to 20 years (t CO <sub>2</sub> /ha/year)				After to 20 years (t CO <sub>2</sub> /ha/year)			
<i>Acacia senegal</i>	0.64	0.27	0.14	0.08	0.04	0.02	1.63	0.98	0.44	0.26

ABG: above ground biomass. BGB: below ground biomass.

256. No fire will be used for the conversion. Thus, the replantation of gum trees, which concerns **50,000 hectares** of degraded land is expected to sequester -52,530 tCO<sub>2</sub>e per year or -1,050,592 tCO<sub>2</sub>e for the entire duration of the project.

<sup>70</sup> Wafa E. Abaker, Frank Berninger, Gustavo Saiz, Victor Braojos, Mike Starr, Contribution of *Acacia senegal* to biomass and soil carbon in plantations of varying age in Sudan, Forest Ecology and Management, Volume 368, 2016, Pages 71-80, ISSN 0378-1127, <https://doi.org/10.1016/j.foreco.2016.03.003>.

<sup>71</sup> Ratio of roots to the stem: Below-ground biomass to above-ground biomass ratios (R) is taken from 2006 IPCC Guideline [Gen-1, Volume 4, Chapter 4, Table 4.4] which is chosen according to climatic zones – moderate, and ecological zone – moderate zone for mountain systems given that above-ground biomass in forests of varies in the range of 75-150 tons per 1 hectare.

## Improvement of agroforestry systems <sup>72</sup> systems)

257. **75,000 hectares** of existing cropland systems will be subject to conversion to agroforestry with planted trees dispersed throughout annual crops areas. This is expected to sequester carbon at an annual rate of -329,538 tCO<sub>2</sub>-eq or -6,590,752 tCO<sub>2</sub>e sequestered for the entire duration of the project.

Baseline scenario: No improvement on **75,000 hectares** of cropland system.

258. The improvement of the agroforestry system in the project region will lead to an increase in the carbon stored within the biomass. Average annual increments for agroforestry in the project area are 2.01 cubic meters of above ground biomass per ha (m<sup>3</sup>/ha) and 0.69 tC/ha, for above-ground biomass.<sup>73</sup>

## Rangeland management

259. The project will promote better grassland management practices on **151,000 ha**, through the demarcation of 400 km of stock routes to improve livestock mobility (key for enhancing resilience of pastoralists' livelihoods to climate change) and the restoration of associated rangelands by agro-pastoralist and transhumant pastoralist communities supported by the project. These activities will sequester carbon at a rate of -79,376 tonnes of CO<sub>2</sub>e per year or -1,587,514 tCO<sub>2</sub>e over 20 years.

260. A conservative baseline of severely degraded grassland is used to avoid overestimating carbon impact, with an average soil carbon stock of 21.7 tC/ha . This will be gradually rehabilitated to non degraded pasture at 31.0 tC/ha. No fire will be used to manage the grassland systems.

261. Baseline scenario: The level of degradation of the grasslands will remain the same and no improved management practices will be developed.

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<sup>72</sup> Multi-storey combinations of annual crops and trees.

<sup>73</sup> Cardinael et al. 2018. Revisiting IPCC Tier 1 coefficients for soil organic and biomass carbon storage in agroforestry systems. Environmental Research Letters, 13 (12) 124020, 20 p.  
<https://doi.org/10.1088/1748-9326/aaeb5f>

## Carbon monitoring system based on EX-ACT for GAMS project

262. Table 12 describes the carbon balance of each of the three major project activities that have climate mitigation impacts: reforestation, better grassland management and agroforestry improvement.

**Table 11: Carbon balance and Emission Factor from Carbon Sequestration**

EX-ACT Module	Activities	Area (ha)	C balance (tCO <sub>2</sub> -eq)	C Balance tCO <sub>2</sub> -eq.year-1	Emission Factor (tCO <sub>2</sub> -eq.year-1.ha)
Reforestation (under LUC)	Reforestation	50,000	-1,050,592	-52,530	-1.05
Grassland degradation and management	Improved management of degraded rangelands	151,000	-6,590,752	-329,538	-1.06
Crop production	Agroforestry improvement	75,000	-1,587,514	-79,376	-4.39
Net Carbon Balance 276,000 ha			-9,228,818	-461,441	-1.67

### Results provided by EX-ACT

263. All calculations done in the EX-ACT tool are reported in the results module. After a short reminder of the description module (name of the appraised project, its duration, the continent, the dominant climate, and the soil chosen by the user) including the total area of the project, the following table (see figure 1) summarizes the GHGs sequestration and the share of the balance per GHG from the adopted scenario. The balance is the difference of GHG gross fluxes between the “with project” situation and the “without project” situation. Results are given in tonnes of CO<sub>2</sub> equivalent (tCO<sub>2</sub>e). Positive numbers represent sources of CO<sub>2</sub>e emissions while negative numbers represent sinks. The left table section summarizes estimated gross fluxes and CO<sub>2</sub>e emissions and sinks from the scenario without-project (left column), from the scenario with-project (middle column) and the total balance (right column). The middle table details the Carbon Balance under project implementation, showing the GHG fluxes from the different modules. The right table details annual CO<sub>2</sub>-e fluxes for the different activities without and with-project implementation, and for the carbon balance.

264. The carbon balance (C Balance) of the project, which consists of the difference of tCO<sub>2</sub>e emitted or sequestered between a scenario with project and a scenario business-as-usual (BAU or baseline scenario), demonstrates the benefits of implementing the project and its different components in terms of mitigation potential. For this project which covers 20 years in EX-ACT (five years of implementation and 15 years of capitalization), the net carbon balance is **-9,228,818 tonnes** of CO<sub>2</sub>-eq, which means a mitigation potential of -1.67 tonnes of CO<sub>2</sub>e per hectare and per year compared to a scenario “without project” (Business-as-usual, BAU scenario).

265. The highest carbon sinks will result from the agroforestry improvement (-6,590,712 tCO<sub>2</sub>e) followed by rangeland management (-1,587,514 tCO<sub>2</sub>e), and the afforestation activities (-1,050,592 tCO<sub>2</sub>e). To note, the GAMS project carries a strong additionality rationale with regard to its mitigation achievements: (1.) In its National Determined Contributions, the Sudan outlines the importance of i.a. CC resilient afforestation and restoration. However, being classified as Least Developed Country, the



Sudan has made the achievements of mitigation targets conditional; i.e. dependent on external funding. Therefore, the GCF funded activity, in combination with the leveraged private sector funding, enables Sudan to achieve additional tangible mitigation action, which would not be possible in the absence of this project; (2.) without the project, gum farmers and mobile pastoralists would not have a financial incentive to continuously support CC resilient land restoration and subsequent management, which is key for the long-term carbon sequestration potential within this sub-sector in the Sudan.

EX-ANTE CARBON-BALANCE TOOL - EX-ACT										
Food and Agriculture Organization of the United Nations										
Start	Description	Land Use Change	Crop production	Grassland Livestock	Management Degradation	Coastal Wetlands	Inputs Investments	Fisheries Aquaculture		
	Deforestation	0	0	0	0	0	0	0	0	0
	Afforestation	0	-1,050,592	-1,050,592	-702,488	-348,104	0	0	-52,530	-52,530
	Other LUC	0	-1,233,162	-1,233,162	1,059,850	-2,293,012	0	0	-61,658	-61,658
Agriculture										
	Annual	0	0	0	0	0	0	0	0	0
	Perennial	0	-5,357,550	-5,357,550	-5,357,550	0	0	0	-267,878	-267,878
	Rice	0	0	0	0	0	0	0	0	0
Grassland & Livestocks										
	Grassland	0	-1,587,514	-1,587,514	0	-1,587,514	0	0	-79,376	-79,376
	Livestocks	0	0	0	0	0	0	0	0	0
Degradation & Management										
	Forest degradation	0	0	0	0	0	0	0	0	0
	Peat extraction	0	0	0	0	0	0	0	0	0
	Drainage organic soil	0	0	0	0	0	0	0	0	0
	Rewetting organic soil	0	0	0	0	0	0	0	0	0
	Fire organic soil	0	0	0	0	0	0	0	0	0
Coastal wetlands										
	Inputs & Investments	0	0	0	0	0	0	0	0	0
Fishery & Aquaculture										
		0	0	0	0	0	0	0	0	0
Total		0	-9,228,818	-9,228,818	-5,000,188	-4,228,630	0	0	0	-461,441
Per hectare		0.0	-33.4	-33.4	-18.1	-15.3	0.0	0.0	0.0	-1.7
Per hectare per year		0.0	-1.7	-1.7	-0.9	-0.8	0.0	0.0	0.0	-1.7

Figure 16: EX-ACT results. All GHG are expressed in tCO<sub>2</sub>e. Positive result means source while negative result means sink.

## CHAPTER 9 PROJECT COST AND FINANCING

### INTRODUCTION

266. This section describes the Project's estimated costs and financing. The Project costs are based on September 2018. Some of the key parameters are presented below:

- Project duration: The proposed project duration is five years (from 2021-2025).
- Exchange rate: The Base Exchange rate used for the project cost calculations was 47.6 Sudanese Pound (SDG) per 1 United States Dollar (USD), corresponding to the average exchange rate prevailing during the design period. (September 2018). The project account maintains funds in USD to shield funds from any foreign currency losses, acting as a contingency for changes in local pricing.

### PROJECT COSTS

267. The total investment and recurrent Project costs, including contingencies are estimated at USD 9,975,000. Most of the expenditure is for professional services, 57.4 percent, formed of either public or private sector service providers. Stakeholder capacity building and support services for workshops, training and consultancies form 30.0 percent of expenditures. Collectively, they are 87.4 percent of the total project budget.

Table 12: Expenditure Category (USD)

Expenditure Category	Total (USD)	% of total
Consultant - Individual	1,831,400	18.4%
Equipment	270,500	2.7%
Others	147,500	1.5%
Professional Services – Companies/firms	5,722,000	57.4%
Staff	849,600	8.5%
Workshop/Training/Meeting	1,154,000	11.6%
<b>Total</b>	<b>9,975,000</b>	<b>100%</b>

268. The budget is well distributed over the five years of the project, with between 17 to 23 percent of the total budget allocated in any one year. A cost breakdown by outcome and by year is provided in the below table.

Table 13: Project Budget by Outcome and by Year

	Budget by Year					
	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Total
<b>Component 1</b>						
Outcome 1	752,690	933,760	1,071,900	1,240,450	1,260,450	5,259,250
Outcome 2	596,400	662,700	625,950	719,200	347,350	2,951,600
Outcome 3	506,400	631,350	87,500	36,800	27,100	1,289,150
PMC	116,600	87,100	87,100	87,100	97,100	475,000
<b>TOTAL</b>	<b>1,972,090</b>	<b>2,314,910</b>	<b>1,872,450</b>	<b>2,083,550</b>	<b>1,732,000</b>	<b>9,975,000</b>

### PROJECT FINANCING

269. The main financier of the Project is the Green Climate Fund, with USD 9,975,000 of funding. The Government contribution is in-kind in the form of office space. The Forest National Corporation of the Sudan also allocates significant staff resources to the project, however these are not counted in the

budget as they are not considered to be new and additional resources. FAO, as the Accredited Entity, will cover baseline studies, financial and technical supervision, mid-term review (MTR) and final evaluation to ensure the management of the project responds to GCF standards. In addition, the Project anticipates significant additional parallel funding from the private sector and has received written letters confirming financial support by a Microfinance Institution (EBDA'A Bank, USD 1.2 million) and a gum buyer (ELEMATS, USD 13.5 million) in support of GAPA producer groups (see Full Proposal document Annexes 5a and 5b). The Project anticipates other MFIs and gum buyers to follow suit. However, since these private sector funds will not flow through FAO or the project account, they are not included in the project budget.

270. **Components one**, Restoration of smallholder gum agroforestry and improvement of the gum value chain, **and two**, Climate change adaptation at landscape level through establishment of livestock routes, restoration of rangelands and improvement of policy/institutional enabling environment represent **56.1 percent and 39.1 percent of the total costs, respectively**. The below table sets out the budget by output, under each of the components. Due to the crosscutting nature of the Project, activities and outputs of **each component contribute to both adaptation and mitigation outcomes**.

Table 14: Expenditure Breakdown by Component, Output and Financier (USD)

Project Costs by Year						
	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Total
<b>Component 1</b>						
Output 1.1.	265,300	283,600	348,600	508,600	518,600	1,924,700
Output 1.2.	238,940	306,760	312,200	383,600	383,600	1,625,100
Output 1.3.	424,500	402,500	382,000	352,000	180,400	1,741,400
Output 1.4.	34,700	44,300	33,800	28,800	28,800	170,400
Output 1.5.	23,500	38,500	2,500	9,250	3,000	76,750
Output 1.6.	19,000	13,000	13,250	14,750	750	60,750
<i>Sub-total C1</i>	<i>1,005,940</i>	<i>1,088,660</i>	<i>1,092,350</i>	<i>1,297,000</i>	<i>1,115,150</i>	<i>5,599,100</i>
<b>Component 2</b>						
Output 2.1.	94,700	164,400	194,400	314,400	134,400	902,300
Output 2.2.	462,700	566,150	55,900	23,700	14,000	1,122,450
Output 2.3.	248,450	343,400	411,100	348,250	358,250	1,709,450
Output 2.4.	43,700	65,200	31,600	13,100	13,100	166,700
<i>Sub-total C2</i>	<i>849,550</i>	<i>1,139,150</i>	<i>693,000</i>	<i>699,450</i>	<i>519,750</i>	<i>3,900,900</i>
PMC	116,600	87,100	87,100	87,100	97,100	475,000
<b>TOTAL</b>	<b>1,972,090</b>	<b>2,314,910</b>	<b>1,872,450</b>	<b>2,083,550</b>	<b>1,732,000</b>	<b>9,975,000</b>

Table 15: Cost Breakdown by Outcome, USD

Outcome	Total (USD)	% of total
Outcome 1: M9	5,259,250	55.4%
Outcome 2: A7	2,951,600	31.1%
Outcome 3: A5	1,289,150	13.6%
<b>Total Outcome</b>	<b>9,500,000</b>	<b>100%</b>
PMC	475,000	
<b>Total</b>	<b>9,975,000</b>	

## MAIN CONCLUSIONS OF ECONOMIC AND FINANCIAL ANALYSIS

271. The economic and financial analysis (EFA) uses cost-benefit analysis to assess GAMS project performance ex ante, focusing on financial, economic and environmental co-benefits generated from investments in agroforestry systems, reforestation and rangeland restoration in 11 Localities across three states of Sudan – North, South and West Kordofan.

272. The primary project beneficiaries are smallholder farmers engaged in mixed agroforestry farming systems and transhumant pastoralists engaged in livestock rearing. The project will invest in improved management of resources and conflict avoidance through both climate change adaptation and mitigation activities. Farmers benefit from improved prices for gum and from enhancing their land management practices (agroforestry and reforestation), while pastoralists benefit from improved fodder and increased access to water under conflict free livestock mobility. Gum farmers face an expected reduction in gum yields of 25-30% (comparing favorably to cereal yield reductions of 50-60%) over the coming decades but by doubling the gum producer price, they would still come out ahead and make their livelihoods more resilient to climate change. In addition to improving the resilience of their livelihoods against climate change, the above-mentioned activities will sequester significant amounts of carbon dioxide.

273. Ecosystem services generated by project investments include climate change adaptation benefits such as reduced wind speed, increased shading, improved water infiltration, reduced surface run-off, and subsequently reduced evapotranspiration. Additional benefits include increased biomass, increased soil nutrient retention and higher crop and gum yields. Additional off-site benefits, such as reduced damage to infrastructure from flooding due to improved water infiltration and reduced surface run-off, are not quantified under the analysis.

274. The economic analysis uses a 10 percent discount rate to reflect the opportunity cost of capital. The economic analysis uses shadow pricing by converting financial prices using a conversion factor in conjunction with a discount rate (SDR) used by GCF for comparable projects. Overall, economic and financial indicators generated by the EFA are modest, with an Economic Internal Rate of Return of 21 percent, a Net Present Value of USD 12.7 million, and a Benefit-Cost Ratio of 2.67. While these values are quite marginal, once greenhouse gas emission reductions (ER) are included in the analysis at the social price of carbon of USD 8/Mt CO<sub>2</sub>e established by the World Bank, the project is much more viable, both economically and financially speaking.

275. Switching values suggest that benefits would have to decrease by -63 percent and costs increase by 167 percent before returning zero for the project investments, which is acceptable. The break-even point for the agroforestry investment is in the 45-50 percent range of adoption rates, well below the 90-95% adoption rates achieved by the AFD-funded pilot project that GAMS will scale up. However, given the low levels of investment in gum Arabic over the past few years and the strong emphasis of the recently adopted national gum arabic strategy on stepping up industrial gum processing in Sudan, returns may well turn out to be higher than anticipated in our models.

276. While the Economic Rate of Return to the project activities may seem high once ER benefits are included, from the beneficiary standpoint, the GCF grant funding is essential. Commercial financial institutions would not be willing to provide smallholder gum producer groups with the initial funds necessary to build their technical and organizational capacity and reposition them in the gum value chain. In addition, gum farmers would be unable to get the ER they generate through their agroforestry activities to market, in part because of the high transaction cost of verifying ER in dispersed, small landholdings. The global social benefit from the 9.2 million tCO<sub>2</sub>e of emissions reductions generated by GCF's USD 9.975 million grant, however, is considerable and the grant is highly efficient – the Forest Carbon Partnership Facility, which uses a USD 5/tCO<sub>2</sub>e standard purchase price, would have paid USD

46.1 million for the ER generated.

277. Once smallholder groups will have “graduated” from the project, they will be able to continue to leverage the purchase guarantees provided by the participating gum exporters to obtain formal financial services from microfinance institutions. They will also be able to invest in their own storage facilities, allowing them to sell some of the gum later in the season, when the prices are higher, through the newly established higher grade and standard for quality gum at the public auction. These economic benefits provide a strong incentive, inducing beneficiaries to continue to invest in and maintain the restored landscapes producing these benefits, thereby establishing a reinforcing and virtuous cycle of climate change adaptation and carbon sequestration through poverty reduction. All made possible by investments along the length of the gum Arabic value-chains.

278. This scaled up model of the AFD project is highly replicable across the nine other gum-producing States in Sudan and in various countries along the Sahel gum belt. The fact the model can survive beyond the end of the project after a three-year intervention without relying on government funding is truly transformational and a rarity among donor funded projects.

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