Back to Office Mission Report: Multi-Stakeholder Inception Workshop

18th July to 22nd July, 2022, Khartoum, Sudan

SOIL EROSION VALUATION USING ADVANCED LABORATORY MEASUREMENT METHODS TO SUPPORT CLIMATE-RESILIENT AGRICULTURE AND FOOD SECURITY

18th July to 22nd July, 2022,

Khartoum, Sudan

OFFICERS

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BACKGROUND

The Sudanese Natural Resources General Directorate of Ministry of Agriculture and Natural Resources (NRGD) with the support from Climate Technology Centre and Network (CTCN) seeks to evaluate soil erosion using advanced atomic absorption spectroscopy to support climate-resilient agriculture and food security in Sudan. This method is expected to provide a basis over which new or different methods of development of soil- and climate-based systems can be compared and objectively evaluated. Earth Observation-based monitoring systems complement the qualitative and quantitative analysis of micro-nutrients in the soil, enhancing the overall understanding of erosion. EO-based monitoring systems could play a significant role in improving soil information system and crop production assessments by validating soil analysis assessments identified through field soil surveys within a targeted area. The technical assistance shall contribute to enhance technological capacities by filling information gaps, providing physical and human capacities and demonstration of application Earth Observation technologies. Besides, this technical assistance will support technology transfer mechanism in using atomic absorption spectroscopy and Earth Observation tools, including the use of UAVs in monitoring the climate change variables on soil and their impacts on agricultural productivity, thereby strengthening soil monitoring systems and raising the resilience of the agricultural sector.

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Figure 1: Participants Group Photo

SUMMARY OF EVENTS

Day 1 & 2

The workshop was formerly opened by Undersecretary Ministry of Agriculture and Forests – Dr. Abubaker Omen Elbushra who underpinned the essence of this project in helping the Sudanese government through the relevant ministries and government departments in achieving food security. He also emphasized the importance of improving and increasing the agricultural productivity through precision agriculture by applying current innovations, including but not limited to UAV's.

FORMATION OF A TECHNICAL WORKING GROUP (TWG)

Establishment of the TWG was finalized by official letters from the Undersecretary of Ministry of Agriculture and Forestry, Sudan. The TWG will be chaired by the Director General of Natural Resources, comprising 11 experts. Representatives of stakeholder institutions will be as follows:

#	Name of the Organization	# Representatives
1.	Ministry of Agriculture and Forests (MoAF)	3
2.	Higher Council for Environment and Natural Resources (HCENR)	2
3.	River Nile state (sub-national) (farmer rep., agriculture research station, land use department and Rahjhi private soil laboratory)	3
4.	Dry land centre of Agriculture Research Cooperation	1
5.	Remote Sensing & Seismology Authority (RSSA) National Centre for Research	1
6.	Institute for Desertification Studies University of Khartoum (U of K)	1

ROLES OF THE TECHNICAL WORKING GROUP

- Oversee and supervise the implementation of the Technical Assistance (CTCN-TA).
- Provide a technical overview and a high-level guidance at every stage of implementation.
- Access existing maps, surveys and technical analysis that could have been done.
- Discuss possible sites in which the CTCN-TA could be implemented.
- Validate baseline data and approve Field data collection protocol.
- Revise final versions of the products, policy briefs and guidelines.

IMPLEMENTATION PLAN

NRGD held consultative meetings with the representatives and experts from the relevant institutions and determined responsibilities. Further to this, RCMRD and the TWG discussed and agreed on the proposed sites for the field survey, the field plan, sampling design, sample size and soil analysis methodology/ protocol.

PROPOSED PROJECT SITE: *Al Damar in the River Nile State*

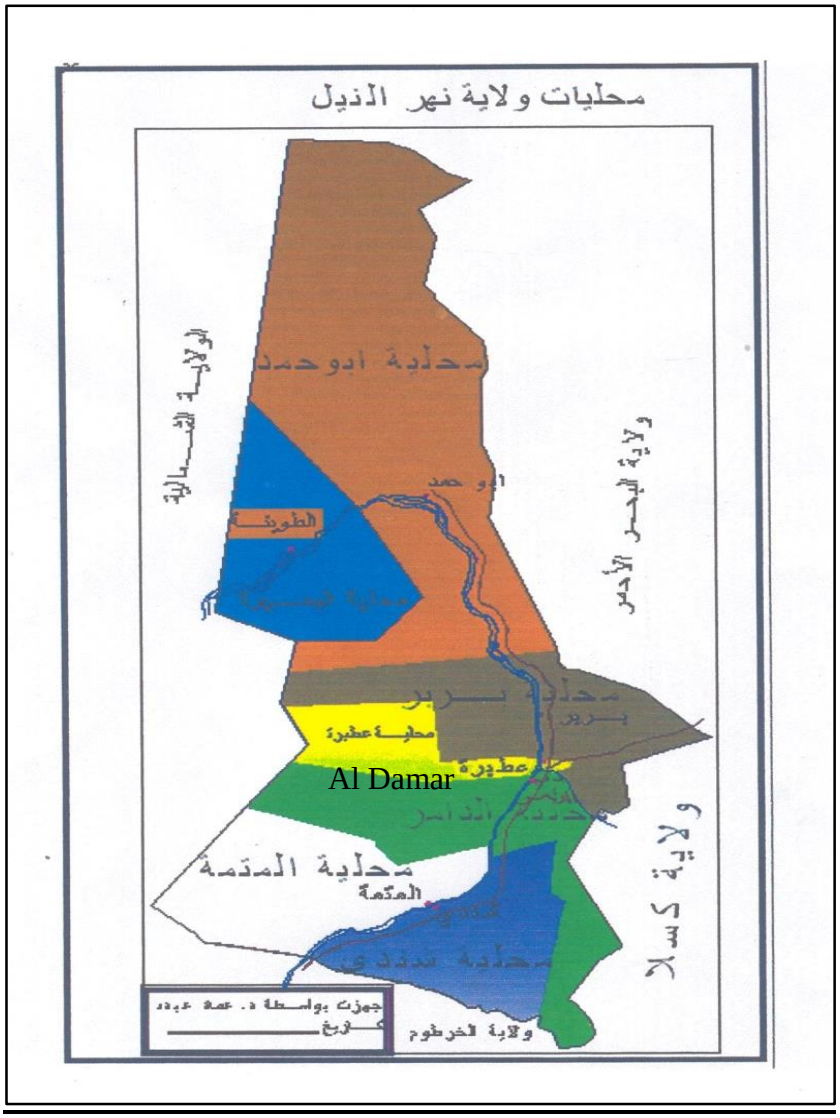

Figure 2: Study Area (Source: NRDG)

The River Nile state is located about 400 km north of Khartoum state between latitudes 16º and 22º N, longitudes 32º and 35º E. The total area is approximately 124,000 km² (12 million ha), which represents 7% of the total land area in Sudan (RN Performance report 2017). in terms of physiography, the landscape is generally flat, rising 100 to 600 feet above sea level, with mountains appearing in some parts and wadies, sand dunes and small hills in other parts. The population is about 1,097,356 according to the 2016 population census.

The River Nile state is prone to land degradation especially soil erosion by water and wind (ACSAD 2019). Five out of the seven districts were previously selected for the implementation of this TA; specifically, the areas where the Sudanese government is implementing food security projects. The districts include Barbar, Atbara, El Matama, Shandi and Al Damar. Following the discussion with TWG and RCMRD, it was agreed that due to the vastness of the districts and the associated budgetary implications constraints, only one district (i.e., Al Damar) will selected to act as a pilot site. This area also hosts a government-funded food security project site and hence its relevance to this TA, as the data collected during soil surveys and UAV's operation will also be used to develop crop suitability maps for informing the government where to grow specific types of crops within the pilot food security zone.

Figure 3: Consultation with the Technical Working Group (TWG)

JUSTIFICATION OF SITE SELECTION BY THE TWG

The site:

- Has been affected by climate change and desertification processes mainly soil erosion by wind and water, which is in line with the objectives of this TA of using RS, GIS and Drone technology to evaluate erosion.

- Hosts one of the four government-funded food security projects in the River Nile state.
- Has baseline data that was collected by the ACSAD project in 2019.
- Has high spatial variability of soils.
- Has many beneficiaries, and being the capital of River Nile State, support from the state government is guaranteed.

FIELD PLAN

Activity	Methodology	Responsible (Organization /Person)	Outputs/ outcomes	Indicator	Timeline
Soil survey (Soil morphology)	FAO Guidelines for soil description	Field survey team	Soil morphology description forms	Total covered Area per ha	17 days
Soil sampling	The food security project site within Al Damar will be surveyed at semi-detailed level (Random cross - Grid 500m), meaning more auger points (~ 100 points) and profile pits (~ 40 pits) will be dug at the site, and the remaining points will be evenly distributed across Al Damar taking into account the physiographic variability. DEM and satellite images will be used to delineate the physiographic units to be used for sampling.	Field survey team	Soil samples represented study area	Numbers of Soil samples/ ha	
Land degradation assessment	LDSF 2013	Field survey team	Land degradation form	Type and quantities of land degradation	
Soil analysis	USDA	Central laboratory NRGD	Laboratory soil analysis results	% soil elements	21 days
Soil classification	US classification system 2014	Technical group	Soil map	Soil classes	30 days

Source: (NRDG, 2022)

SOIL LABORATORY TESTING AND ANALYSIS

Soil analysis will be conducted at the NRGD laboratory using Atomic Absorption Spectrophotometer (AAS). The soil profile analysis will include: Physical properties (e.g., Saturation percent and Soil Texture) and Chemical properties (e.g., soil pH., Soil EC, $CaCO_3$, Soluble cations and anions, SAR, Exchangeable cations, ESP, CEC, OC, total nitrogen, available P, micronutrients for surface layers, such as Fe, Zn and Mn). The Auger soil sample analysis will include: Saturation percent, soil pH, Soil ECe, soil texture, $CaCO_3$, Soluble cations (Ca, Mg and Na) and SAR.

Deliverable	Responsible institutions/Person	Timelines
Field survey manual	NRDG/ HCENR	August, 2022
Soil sample preparation and analysis protocol	NRDG/ HCENR	August, 2022
Soil degradation assessment guideline/ surveillance frame work	NRDG/ HCENR	August, 2022
Soil survey, sampling & UAV field operation	NRDG/ HCENR	Oct/ Nov, 2023
Soil testing and analysis	NRDG/ HCENR	January, 2023
Capacity development	RCMRD	March/ Feb, 2023
Soil erosion modelling & Digital soil mapping	RCMRD	April/ May, 2023
Validation & Dissemination	RCMRD	July, 2023

ACTIVITIES SCHEDULE, ROLES AND TIMELINES

DAY 3: COURTESY CALL TO THE MINISTRY OF AGRICULTURE AND FORESTRY (NRDG) AND HIGHER COUNCIL FOR ENVIRONMENT AND NATURAL RESOURCES (HCENR)

Figure 4: Consultation with the Director General NRDG

The team paid a courtesy call to the office of the Director General (NRDG) and the Higher Council for Environment and Natural Resources (HCENR) - the Technical arm of the Ministry of Environment and Physical Development. The aim of the visit was to get familiarised with the directorates' mandates within the country and their contributions to the success of this project. We visited the soil testing laboratories for first-hand interactions with the equipment proposed for soil testing and analysis; especially the atomic absorption spectrophotometer (AAS), which will be instrumental in the analysis of collected soil samples for nutrients. The team was satisfied with the expertise and equipment at the Ministry of Agriculture. However, the AAS was brand new and had not been installed. If it is not installed on time, it might delay the analysis of the soils, unless if the laboratory resorts to using alternative equipment or collaborate with the other partnering institutions like the Dry land Centre of Agriculture Research Cooperation or the University of Khartoum. Nonetheless, the TA shall leverage on such resources during soil surveying and laboratory testing period. It was affirmed NRDG will lead the soil surveying and testing of samples collected in within the pilot areas; as outlined in the response plan. Further to this, at the Higher Council for Environment and Natural Resources, the team was shown the newly acquired UAV's which would assist in the acquiring drone images over the pilot area.

Figure 5: The Atomic Absorption Spectrophotometer

Figure 6: The Parrot Disco 4G Drone Owned by the Ministry of Agriculture and Forestry River Nile. State

GENDER ANALYSIS AND GENDER ACTION PLAN

The 3-day consultative workshop was concluded with a session on gender analysis and gender action plan. TWG was introduced to gender concepts and terminologies such as gender, sex, gender norms, gender relations, gender roles (Productive, reproductive, gender discrimination, gender socialization, social inclusion, intersectionality, gender equality and gender equitable which are the critical in understanding and conducting the gender analysis.

The TWG had a brain storming session on the status of gender equality in Sudan based on the available literature. Sudan is among the most vulnerable countries in the world to climate variability and change. Sudan is exposed to heat stress, floods and storms and climate change is not gender neutral. The gender specialist informed the meeting that climate vulnerability cannot be effectively addressed without understanding the effects of climate stressors on women, girls, men and boys, as well as how intersecting identities, geographies, and social positions contribute to those vulnerabilities. It was emphasized that Men and women use natural resources differently and as a result they are affected differently by changes to these resources.

The TWG were taken through the process of conducting a gender analysis which was followed by gender action plan for the project.

Key issues highlighted by the TWG on Gender

- There was general concern over the generalization of Sudan gender equality status in some publications. It was proposed that primary data is collected to capture the actual realities on ground because the status of women had changed
- It was also proposed that religion is very critical in Sudan and any gender responsive strategy should take into consideration religion and the different cultures
- There are new policies and revised laws on gender mainstreaming
- The TWG appreciated the training and requested for gender awareness training for relevant stakeholders on the project

- The group requested for capacity building of their gender officers on conducting a gender analysis

Figure 7: The Gender and Environment Expert taking TWG through gender sensitization.

DAY 4: FIELD RECONNAISSANCE TO AL DAMAR GOVERNMENT FOOD SECURITY PROJECT ZONE

RCMRD in collaboration with technical working group under facilitation of the NRDG visited various Sudanese food security projects located within the River Nile state specifically in Al damar. This was an opportunity for the team to familiarise with proposed TA project site; the human activities, the soil types and level of degradation by both wind and water. The gender expert was also able to put a human face to the genders issues and effects of climate to the environment.

Figure 8: A Soil Scientist from the Dryland Centre of Agriculture Research Cooperation - explaining effects of Wind and Water Erosion to the Soil.

Figure 9: Main Irrigation Channel for Food Security Project at Al Damar

Figure 10: RCMRD team, some members of TWG at one of the irrigation channels.

Figure 10: Palm dates Planted under Irrigation & its Fruits

The Planned Activities

The field soil survey and drone image acquisition is scheduled for October after the onset of short rains; this is meant to help capture variations in vegetation characteristics. RCMRD will transfer the funds allocated for soil survey, testing and analysis to NRDG in good-time in preparation of the field-work. This will be effected through an official request by DG - NRDG to DG - RCMRD.

Challenges and Way Forward

The technical working group through the Ministry of Agriculture stated that the process of importing drone/ UAV's into Sudan is quite long and might delay and affect the TA delivery. The ministry owns drones, but with limited skills of operation, installation, and derived data processing. RCMRD will explore ways to avoid project delay by acquiring drones from the ministry (NRDG) at agreed cost of hire and operation; based on the budget and the response plan requirements.

APPENDIX

#	Name	Name of the Organization	Position	Specialization	E-mail	Mobile	Gender
1.	Dr.Sawsan Khair Elsied Abdel Rahim Mustafa	NRGD /Ministry of Agriculture and Forests (MoAF)	DG NRGD, GGW focal point	NR & Environmentali	sawsanatkh@yahoo.com	+249 912559438 +2499116438063	F
2.	Dr. Mohammed Abdallah Alsheikh	Institute for Desertification and Desert Cultivation Studies University of Khartoum (U of K)	Director	Soil Scientist	mohmedelsheikh@gmail.com	+249123845688	M
3.	Dr.Adil Mahgoub Farah	Dryland centre of Agriculture research Cooperation (ARC)	Researcher	Soil Scientist	adil.m.farah@arc.gov.sd	+249918301143	M
4.	Hatim Elobied	Remote Sensing & Seismology Authority(RSSA) National Centre for Research	Researcher	RS& GIS specialist	Hatimoo22@yahoo.com	+249904366220	M
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14	Amna Jubara Ali	NRDG_MOF	Director Dersertification			+09122549	F
15	Shaza Elbaloula	NRDGM	Gis Special list	GIS	Rozlinda@re	+0920296675	F

KEY GENDER RELATED OBSERVATIONS - Personal Observation by the Gender & Environment Expert

Arabic is the national language used in communication both spoken and written including meetings. Preferably a trainer of trainers (ToT) on gender analysis should be organized by the Gender and Environment specialist for Sudan gender officers to empower them to collect primary data and analysis. In relation to women's empowerment the NRGD has a considerably good number of women at senior management level who are able to influence decision making which was evidenced in their participation during the meeting. In addition to this, the TWG has 2 PHD holders Dr. Swasan Khair and Dr. Reem Ahmed. The technical working group was well balanced with 8 women and 7 men. Meetings were highly participatory by both men and women.

As ones move away from the urban setting in Khartoum to rural setting in River Nile state the gender roles and norms are different. Women from the River Nile state are less visible within the public space during day time because of social norms and climate change. The women during day time are more confined to their homes doing the unpaid care work and are seen late in the evening when it is cooler going out to fetch firewood and water. The men and young boys are more visible and involved in transport and other commercial activities. Women also expected to be indoors by 5pm while men freely go about their roles and responsibilities outside the home. The reason given was that it was unsafe for women to be outside their homes. An exception has been made for women who have migrated from elsewhere to conduct business in River Nile State. At the time of our visit, we were informed that school going children are on holiday and the education system has been impacted by climate change. From August to September children cannot go to school because of the anticipated floods. However, during the holidays, the boys work with their fathers in the productive activities such as businesses.