Training of stakeholders and dissemination of information about the results of the Technical Assistant

Capacity Development in RUSLE (Revised Universal Soil Loss Equation),

Digital Soil Mapping and UAV data Management

VENUE: RCMRD

DURATION: 3RD TO 9TH JUNE 2024

Figure 1: Group photo

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 has contributed to enhanced technological capacities by filling information gaps, providing physical and human capacities and demonstration of application Earth Observation technologies. Besides, this technical assistance has supported 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.

Figure 2: Opening Session

Scope

The training was expected to demonstrate some of the ways in which:

- The RUSLE modelling approach can be used to determine the spatial extent of soil erosion risk, quantify the annual soil loss rates, and delineate the priority areas for climate-smart and sustainable soil management.
- Demonstrate how digital soil mapping techniques can be applied to create spatially explicit digital maps of soil functional properties, such as NPK, SOC and pH to assess the impact of soil erosion and develop soil erosion mapping framework.
- Apply and manage the UAV data on mapping erosion/agriculture.
- Validate and Disseminate the products of soil vulnerability maps, digital soil maps and UAV products.

The general goal of the six-day workshop is:

- To share knowledge in GIS techniques and data utilized for Soil erosion mapping for the Sudan.
- To bring together Soil Scientists, GIS practitioners and Data managers in the Sudan to share experiences and tools for Soil mapping work.

- To discuss and suggest practical approaches to Identify adaptation measures to address soil degradation and development of strategic action plan.

Training methodology

The training was conducted both in class room setting (formal training with testing/certification), group discussion and field work setting. The trainees were introduced to soil erosion mapping concepts where they learnt how to carryout soil data capture, and formula implementation in ArcGIS software. They further learnt how to derive the formulas for RUSSLE model and use raster calculator to produce surface variables of the targeted area. Further the attendees were taken through a machine learning module implemented in R used to produce digital soil maps.

Figure 3: Participants following the class sessions

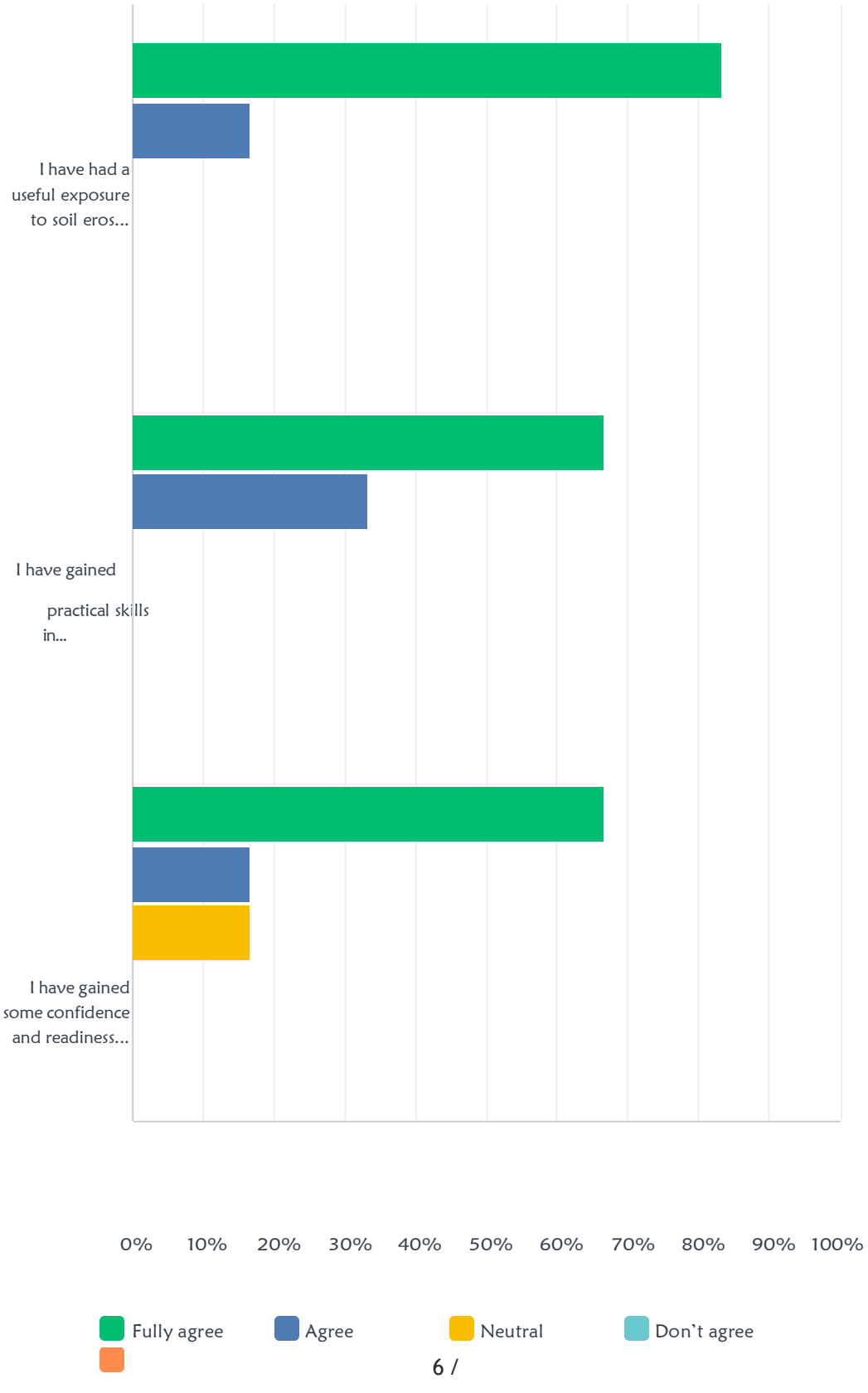
On processing UAV data; an open source Pix4D software was used to process drone images for a pilot area in Kenya; this was meant to give the participants a sneak preview of how drone images can be applied as proxy variables in generating erosion and digital soil maps. The last day the participants were taken through the use of drones in the field - including parts of the drones, pre-flight requirements, how to operate drone and each participant flying the drones as a trial.

Figure 4: A Participant operating drone

POST Training Evaluations

Q1 Objectives of the GIS course

Answered: 6 Skipped: 0

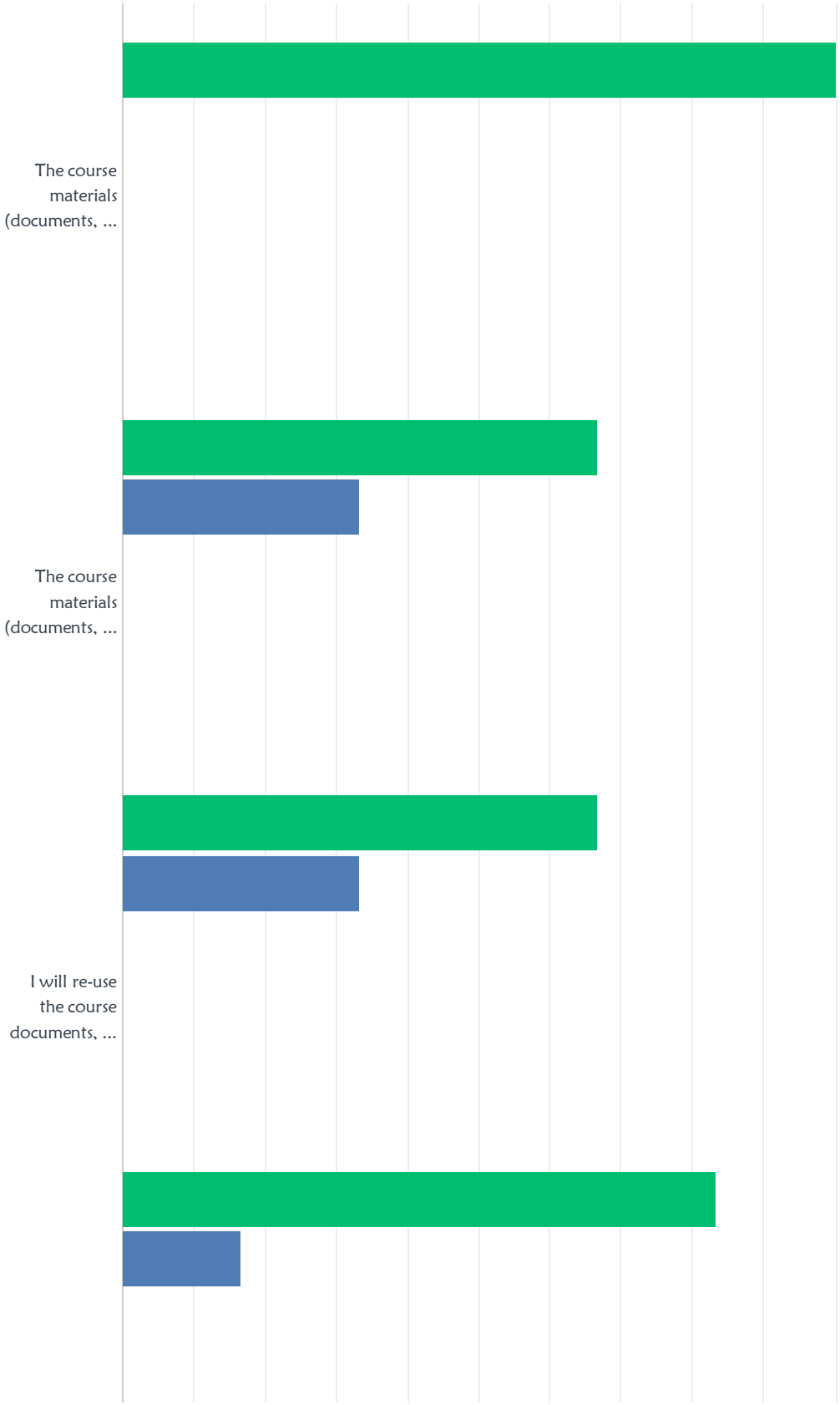


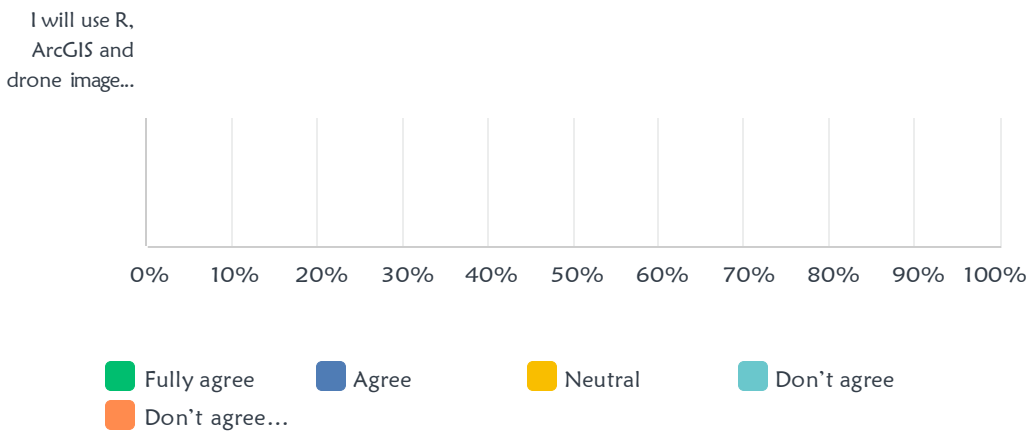
Don't agree...

	FULLY AGREE	AGREE	NEUTRAL	DON'T AGREE	DON'T AGREE AT ALL	TOTAL	WEIGHTED AVERAGE
I have had a useful exposure to soil erosion risk mapping, digital soil mapping and drone image processing: theory and practice	83.33% 5	16.67% 1	0.00% 0	0.00% 0	0.00% 0	6	4.83
I have gained practical skills in working with drone, R and ArcGIS	66.67% 4	33.33% 2	0.00% 0	0.00% 0	0.00% 0	6	4.67
I have gained some confidence and readiness to teach and train other people on soil erosion risk mapping, drone image processing and digital soil mapping	66.67% 4	16.67% 1	16.67% 1	0.00% 0	0.00% 0	6	4.50

Q2 Materials of the GIS course

Answered: 6 Skipped: 0

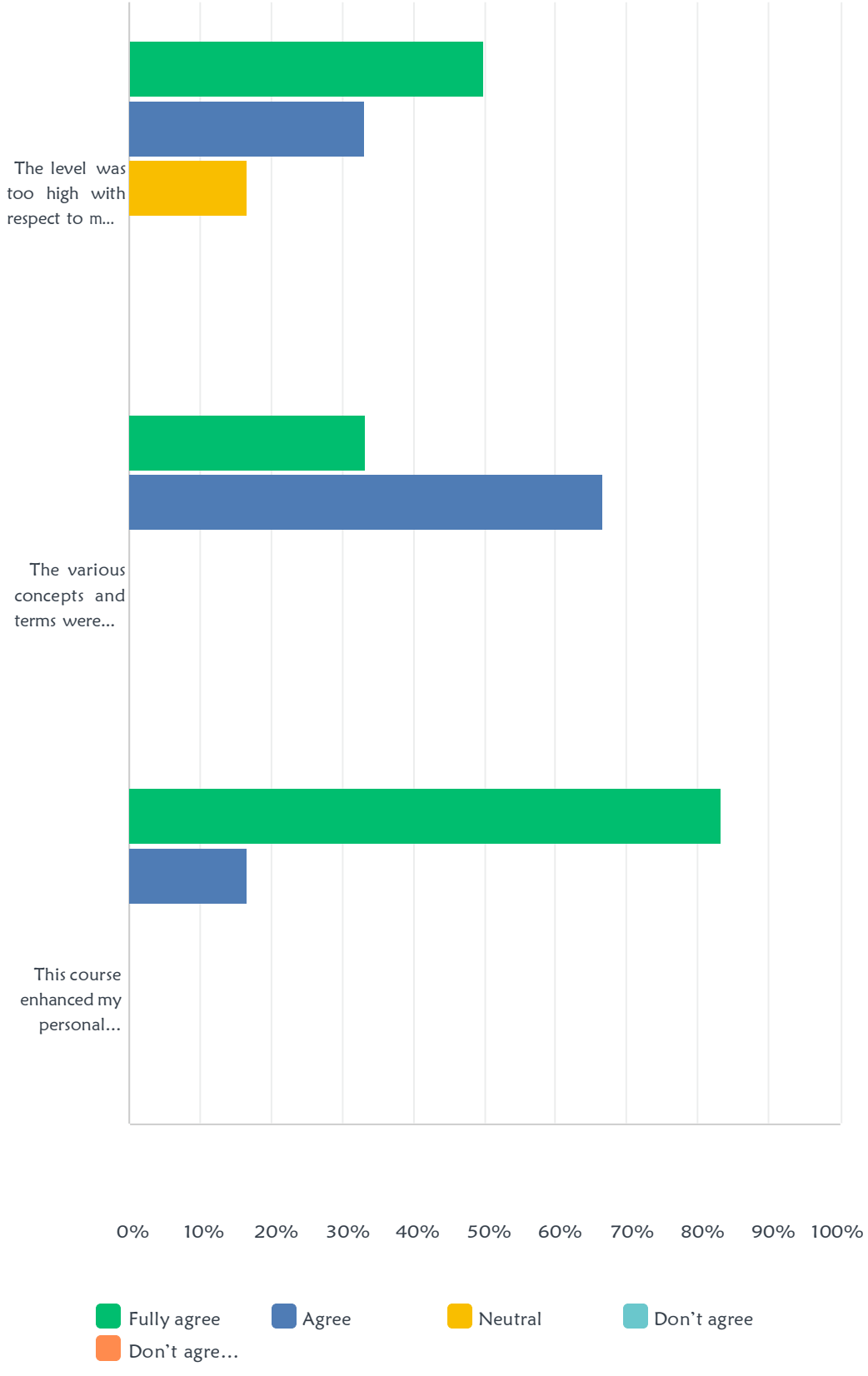




	FULLY AGREE	AGREE	NEUTRAL	DON'T AGREE	DON'T AGREE AT ALL	TOTAL	WEIGHTED AVERAGE
The course materials (documents, presentations, and data) are useful	100.00% 6	0.00% 0	0.00% 0	0.00% 0	0.00% 0	6	5.00
The course materials (documents, presentations, and data) are sufficiently complete	66.67% 4	33.33% 2	0.00% 0	0.00% 0	0.00% 0	6	4.67
I will re-use the course documents, presentations, and data in my own practice (teaching, research, other professional use)	66.67% 4	33.33% 2	0.00% 0	0.00% 0	0.00% 0	6	4.67
I will use R, ArcGIS and drone image processing skills (or QGIS) in my own practice (teaching, research, other professional use)	83.33% 5	16.67% 1	0.00% 0	0.00% 0	0.00% 0	6	4.83

Q3 Level of the RUSLE, DSM & Drone image processing courses

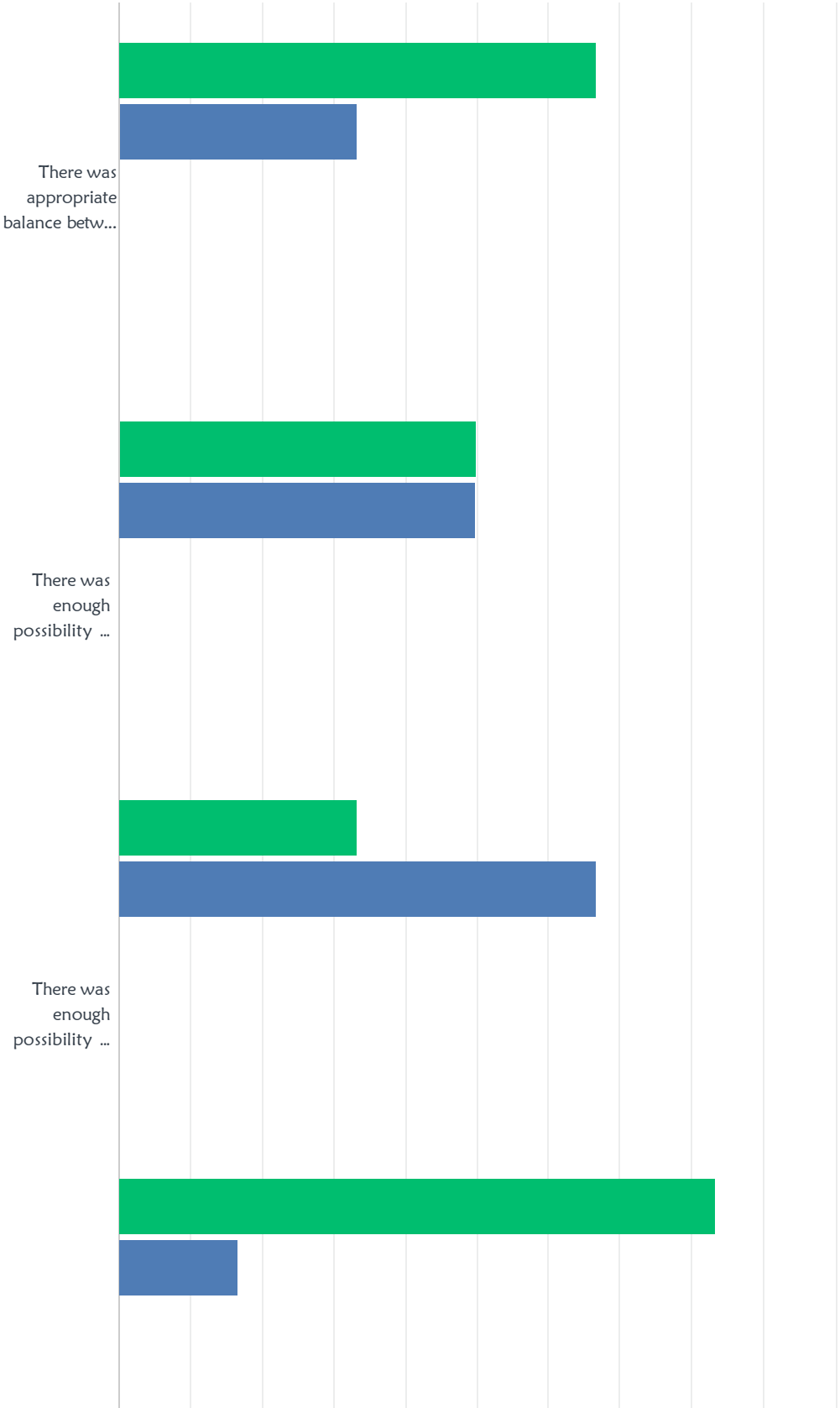
Answered: 6 Skipped: 0

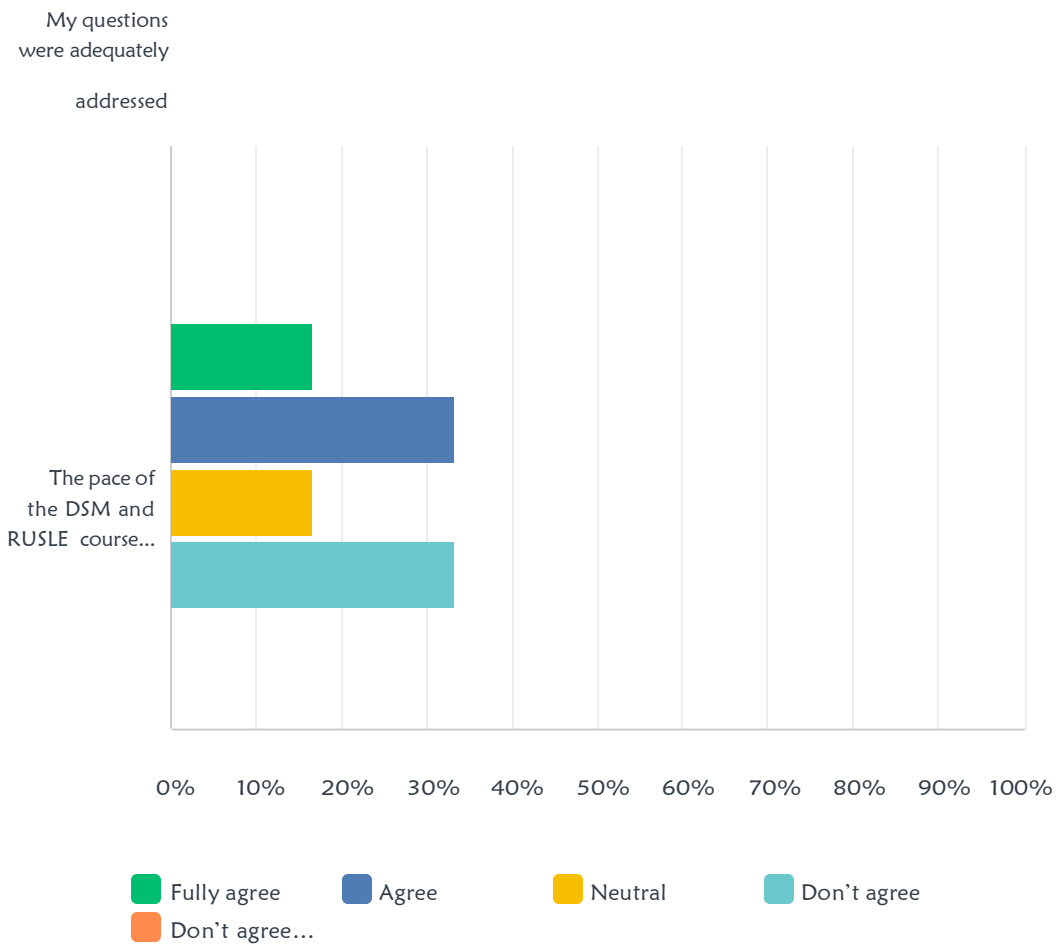


	FULLY AGREE	AGREE	NEUTRAL	DON'T AGREE	DON'T AGREE AT ALL	TOTAL	WEIGHTED AVERAGE
The level was too high with respect to my prior knowledge	50.00% 3	33.33% 2	16.67% 1	0.00% 0	0.00% 0	6	4.33
The various concepts and terms were addressed with sufficient conceptual and technical detail	33.33% 2	66.67% 4	0.00% 0	0.00% 0	0.00% 0	6	4.33
This course enhanced my personal knowledge and technical skills	83.33% 5	16.67% 1	0.00% 0	0.00% 0	0.00% 0	6	4.83

Q4 Teaching practice

Answered: 6 Skipped: 0





	FULLY AGREE	AGREE	NEUTRAL	DON'T AGREE	DON'T AGREE AT ALL	TOTAL	WEIGHTED AVERAGE
There was appropriate balance between hands-on exercises and other forms of learning (e.g., presentations)	66.67% 4	33.33% 2	0.00% 0	0.00% 0	0.00% 0	6	4.67
There was enough possibility for personal contribution	50.00% 3	50.00% 3	0.00% 0	0.00% 0	0.00% 0	6	4.50
There was enough possibility for interaction with the other participants	33.33% 2	66.67% 4	0.00% 0	0.00% 0	0.00% 0	6	4.33
My questions were adequately addressed	83.33% 5	16.67% 1	0.00% 0	0.00% 0	0.00% 0	6	4.83
The pace of the DSM and RUSLE courses was appropriate (not too fast)	16.67% 1	33.33% 2	16.67% 1	33.33% 2	0.00% 0	6	3.33

Q5 If you have other specific comments, you can write them here.

Answered: 4 Skipped: 2

#	RESPONSES	DATE
1	The training and information and the teachers was very good but the period is too short	6/28/2024 11:22 PM
2	No	6/28/2024 10:45 AM
3	We hoped that the duration of the training course would last for up to three months, so that the information would be more firmly established in our knowledge.	6/27/2024 11:08 PM
4	The course was very nice and interesting, my comment regards to the course duration it was not quite enough to go throw the data processing (data preparation)	6/27/2024 8:45 PM

Training schedule

Day	Main Topic	Session	Sub Topic
Day 1	RUSLE (Revised Universal Soil Loss Equation	Session 1	Introduction to RUSLE Software installation (QGIS/ ArcGIS)
		Session 2	Spatial data acquisition Preparation of RUSLE factor Maps - R, K & LS
Day 2	RUSLE (Revised Universal Soil Loss Equation	Session 1	Preparation of RUSLE factor maps - C & P
		Session 2	Calculation of soil erosion loss using RUSLE factors Creation of the final soil erosion map
Day 3	Digital Soil Mapping	Session 1	Introduction to Digital Soil Mapping Software installation (R/ QGIS/ ArcGIS)
		Session 2	Data acquisition Data preparation
Day 4	Digital Soil Mapping	Session 1	Model development (Multiple linear regression/ Random forest)

		Session 2	Model evaluation Model application (Spatial mapping)
Day 5	Introduction to Drone Technology and Image Acquisition	Session 1	- Welcome and Course Overview - Introduction to Drone Technology - Basics of Aerial Photogrammetry
		Session 2	- Types of Sensors Used in Image Capture - Flight planning - Demo (Drone Deploy)
	Image Processing Techniques	Session 3	- Image Formats and Metadata, EXIF - Pix4d settings
		Session 4	- Ortho- rectification (Practicals) - Image Mosaicking - Image Processing with GCPs
Day 6	Image Processing Techniques	Session 1	- 3D Modeling (Textured Model) and Point Clouds - Digital Terrain Models (DTMs) and Digital Surface Models (DSMs)
	Applications and Practical Implementations	Session 2	- Applications in Agriculture, Environmental Monitoring, and Urban Planning - Q&A and Review of Key Concepts
	Recap	Session 3	- Tips for Further Learning and Resources - Course Recap and Closing Remarks

Network of Partners

- Institute of desertification and desert cultivation studies
- MOAF-NRGD
- ARC -Shandi Research Station
- University of Khartoum
- Jomo Kenyatta University of Technology

Climate change platforms in which the Technical Assistance has been disseminated.

https://rcmrd.org/en/revolutionizing-soil-erosion-assessment-for-climate-resilient-agriculture-and-food-security

https://www.ctc-n.org/news/sudan-juggling-priorities-during-difficult-time

RCMRD

Issue No. 1

NAME OF WORKSHOP/TRAINING: Training & validation Worshop, Soil Erosion Modelling – Sudan Project

DATE 3–9 June 2024 LOCATION RCMR Complex – Computer lab B7

NO.	NAME (CAPITAL LETTERS)	GENDER	ORGANIZATION	POSITION	EMAIL ADDRESS	MOBILE NO.	SIGNATURE						Flash Drive
							Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	
1	Dr. MOHAMMED ABDALLA ELSHEIKH ELHASSAN ABDALLA	M	U o K-Institute of Desertification and Desert Cultivation Studies	Director	mohmedelsheikh @gmail.com	+249 12 384 5688	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]	[signature] 12863
2	MOHAMED SULIMAN MOHAMED AHMED	M	MOAF-NRGD	Soil specialist-RS /GIS	mohaalkhwaja@gmail.com	+249 91 132 2240	[signature]	[signature]	[signature]	Hospital (Sick)	[signature]	[signature]	[signature]
3	EMAN ABDELGADER MOHAMMEDTOM ABODRAA	F	MOAF-NRGD	Soil specialist	emomohd53@gmail.com	+249 91 701 3103	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
4	HOZIFA ABDALLAH ELMAKY MOHAMMEDAHMED	M	MOAF- RN	Soil specialist-RS /GIS	hozifa.almaky@yahoo.com	+249 12 284 5825	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
5	ALI ALKHAZIN ALI YOUSIF	M	ARC -Shandi Research Station	Soil specialist-RS /GIS	alialkhazin@yahoo.com	+249922968605	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
6	AWATIF MUZAMEL ELSHEEKH ELBASHEIR	F	University of Africa	NR Researcher	awatifmuzamil2@gmail.com	+249 92 087 7906	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
7	MOHAMED ADAM SULIMAN ISHAG	M	UNIVERSITY OF KORDOFAN	Lecturer	mohamedas96068@gmail.com	+254740543743	—	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
8	MOHAMED ALI MOHAMMED RIHAN	M	University of Kordofan	Lecturer	moharihan20@gmail.com	+254725391881	—	MRL	MRL	MRL	[signature]	[signature]	M.Rih
9	HEBA AMIN MUSA MOHAMED	F	Ministry of Irrigation and Water Resources-Hydrological Research Center	Researcher	hiba.ameen@yahoo.com	+254705130034	—	[signature]	[signature]	[signature]	[signature]	[signature]	heba Amin Resived 12863 Thanks

Page 1 of 2

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NO.	NAME (CAPITAL LETTERS)	GENDER	ORGANIZATION	POSITION	EMAIL ADDRESS	MOBILE NO.	SIGNATURE					
							Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
10	Remmy Kesis	M	RCMRD	GIS	rkesis@rcmrd.org	0727905633	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
11	Fredrick Onyango	M	TUK	Trainer	f.arthur.onyango@gmail.com	0727480534	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
12	MOLLY SHARONE	F	UN-CTCN	Participant	sharone.molly@un.org	0758196711	—	[signature]	—	—	–	–
13	Edward Ouko	M	—	Trainer	[illegible]	[illegible]	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
15	Saleh Abukashawa	M	RCMRD	Consultant	sabukashawa@rcmrd.org	728544750	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
16	Kennedy Were	M	–	Trainer	Kenwere@yahoo.com	0717429539	[signature]	[signature]	[signature]	[signature]	[signature]	[signature]
17												
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