Mapping Land Degradation, Sustainable Land Management Tools and Capacity Building for GIZ Prosoil

Final report for ISRIC contribution to the WOCAT project "Knowledge Management and Decision Support in Soil Protection and Rehabilitation Initiatives"

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March 2024

Citation:
Zhanguo Bai, Ingrid Teich, Maria Gonzalez Ruiperez, Francis Silatsa Tedou, Andre Kooiman. Mapping Land Degradation, Sustainable Land Management Tools and Capacity Building for GIZ ProSoil. Final report for ISRIC contribution to the WOCAT project “Knowledge Management and Decision Support in Soil Protection and Rehabilitation Initiatives”. ISRIC Report 2024, ISRIC-World Soil Information, Wageningen, the Netherlands.

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Document details

Project	WOCAT project: 'Knowledge Management and Decision Support in Soil Protection and Rehabilitation Initiatives' for GIZ 'Soil Protection and Rehabilitation for Food Security' project (ProSoil).
Version	1.1
Filename	ProSoil Completion Report 2024 ISRIC 20240408
Report contact-points	Andre Kooiman (ISRIC): andre.kooiman@isric.org Zhanguo Bai (ISRIC): zhanguo.bai@isric.org
Submission date	8 April 2024

Project details

This report is an output of the project 'Knowledge Management and Decision Support in Soil Protection and Rehabilitation Initiatives', implemented by World Overview of Conservation Approaches and Technologies (WOCAT), with partners International Center for Tropical Agriculture (CIAT) and ISRIC World Soil Information. The project aims to support GIZ's 'Soil Protection and Rehabilitation for Food Security (ProSoil)' project and its partner countries in documentation of sustainable land management (SLM) practices as well as mapping land degradation (LD) and SLM using different tools and methods. Prosoil is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the Kreditanstalt für Wiederaufbau (KFW) and relevant ministries and non-governmental organizations (NGOs) in Benin, Burkina Faso, Ethiopia, Kenya, Madagascar, Tunisia, and India. It is part of the ONEWORLD – No Hunger Initiative of the Bundesministerium für wirtschaftliche Zusammenarbeit (BMZ).

Project partners are:

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ACRONYMS

Al	Aluminum
B	Boron
BMZ	Germany's Federal Ministry for Economic Cooperation and Development
Ca	Calcium
CaCO3	Calcium Carbonate
CDE	Centre for Development and Environment
CEC	Cation Exchange Capacity
CIAT	International Center for Tropical Agriculture
Cu	Copper
DSM	Digital Soil Mapping
DSS	Decision Support System
FAO	Food and Agriculture Organization of the United Nations
Fe	Iron
GEE	Google Earth Engine
GEOLDN	The GEO Land Degradation Neutrality Flagship (GEO-LDN)
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
ISRIC	International Soil Reference and Information Centre
IUSS	International Union of Soil Sciences
K	Potassium
KFW	The Kreditanstalt für Wiederaufbau, GmbH
LandPKS	Land Potential Knowledge System
LD	Land Degradation
LDN	Land Degradation Neutrality
LUS	Land Use System
Mg	Magnesium
Mn	Manganese
Na	Sodium
NGO	Non-governmental Organization
NPP	Net Primary Production
P	Phosphorus
PRAIS	Performance Review and Assessment of Implementation System
QA	WOCAT Questionnaire Approaches
QM	WOCAT Questionnaire Mapping
QT	WOCAT Questionnaire Technologies
RZ-PAWHC	Root Zone Plant-available Water Holding Capacity
SDG	Sustainable Development Goal
SLM	Sustainable Land Management
SOM	Soil Organic Matter
SOC	Soil Organic Carbon
SWC	Soil and Water Conservation
UNCCD	United Nations Convention to Combat Desertification
WOCAT	World Overview of Conservation Approaches and Technologies
WRB	World Reference Base for Soil Resources
Zn	Zinc

1. INTRODUCTION

Soil degradation is a global issue. Soil protection and rehabilitation of degraded areas safeguard the natural resource of agricultural production which secures income, food supplies and reduces poverty and hunger in rural areas. Germany's Federal Ministry for Economic Cooperation and Development (BMZ) has made substantial investments in soil protection and rehabilitation to enhance food security (ProSoil) as well as adaptation to climate change and explore co-benefits with carbon sequestration. The ProSoil project is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the Kreditanstalt für Wiederaufbau (KFW) and relevant ministries and non-governmental organizations (NGOs) in Benin, Burkina Faso, Ethiopia, Kenya, Madagascar, Tunisia, and India and as part of BMZ's ONEWORLD – No Hunger Initiative.

The World Overview of Conservation Approaches and Technologies (WOCAT) consortium implemented the 'Knowledge Management and Decision Support in Soil Protection and Rehabilitation Initiatives' project with the aim to support ProSoil partner countries in documentation of sustainable land management (SLM) practices as well as mapping land degradation (LD) and SLM using different tools and methods. The project includes two components:

Component 1: Standardized reporting and sharing of good SLM practices
Output 1.1: SLM good practices in countries of the "ONEWORLD- No Hunger" Initiative are documented and shared in a standardized format.

Output 1.2: National SLM compilations are produced and presented in view of mainstreaming and scaling out at national or sub-national levels.

Component 2: Mapping, digital solutions and platforms
Output 2.1: Countries trained in LD/SLM mapping tools and LDN mapping implemented

This report presents the activities, results and lessons learned of ISRIC contribution to the above components. It was prepared for Center for Development and Environment (CDE) of the University Bern, as coordinator of WOCAT, and focuses on the ISRIC contributions to the two above components of the 'Knowledge Management and Decision Support in Soil Protection and Rehabilitation Initiatives' project.

2. ACTIVITIES

Component 1: Standardized reporting and sharing of good SLM practices
ISRIC supported: Output 1.2: National SLM compilations are produced and presented in view of mainstreaming and scaling out at national or sub-national levels, by implementing activity 1.2.a: 'Produce national compilations of good practices (based on the entries in the Global WOCAT SLM Database) which included national soil maps showing the linkage between soils and SLM Technologies'. Soil maps were produced by ISRIC in collaboration with national partners, making use of existing national and global data sets and were integrated in the good practices compilations.

Component 2: Mapping, digital solutions and platforms,
ISRIC supported output 2.1: Countries trained in LD/SLM mapping tools and LDN mapping implemented. ISRIC carried out:

2.1.a. Implemented a 2-day online webinar:
for partners we presented existing and innovative mapping tools to assess land degradation and support evidence-based planning of SLM interventions in the context of SDG 2, 13 and 15, as well as related SDGs and with focus on LDN (SDG target 15.3). The webinar was also carried out in French with by a French-speaking expert.

2.1.b. Developed concrete roadmaps for Benin, India and India:
for the application of mapping tools, including capacity building needs on specific tools, identification of participating experts and institutions, timeline of activities, responsibilities). The roadmap includes a) a screening of what is already existing in terms of LD/SLM spatial data (existing data layers and national maps) and b) identification of past and current activities by national actors in LD/SLM mapping in the context of LDN.

2.1.c. Implemented the roadmaps in Benin, India and Kenya:
with the three countries, instructing mapping land degradation and SLM and developing LD/SLM maps relevant to LDN.

3. RESULTS

3.1 Standardized reporting and sharing of good SLM practices

3.1.1 Soil Maps for ProSoil partner countries

Activity 2.1.a developed a series maps of soil types and soil properties for each of the project countries Benin, Burkina Faso, Ethiopia, India, Kenya, Madagascar and Tunisia, using ISRIC's global product SoilGrids Version 2 (Poggio et al., 2020), African SoilGrids nutrients (Hengl et al, 2017) and SoilGrids GYGA (Leenaars et al., 2015; 2018). These soil maps include soil type, soil pH, soil texture (sand, clay, silt) content, coarse fragments, bulk density, CEC, $CaCO_3$, SOC content, soil organic density, SOC stock, total Nitrogen, extractable Al, extractable B, extractable Ca, extractable Cu, extractable Fe, extractable K, extractable Mg, extractable Mn, extractable Na, extractable P, extractable Zn, total P, root zone plant-available water holding capacity (RZ-PAWHC) and rootable depth. The soil types were predicted based on IUSS-FAO WRB at spatial resolution of 250 meters; the soil property maps (pH, texture, coarse fragment, SOC) are mapped at 250 meter resolution for depth of 0-30cm that are aggregated by soil depths of 0-5 cm, 5-15cm, 15-30 cm. Soil nutrients, water holding capacity and rootable depth are mapped at spatial resolution of 250 meters for depth of 0-30cm.

A table that summarizes the soil maps, units, spatial resolution, data layer name, format and sources, report and all actual soil maps have been uploaded on the GIZ MS Teams channel 'WOCAT - ProSoil Cooperation with guests/Benin and other countries' and can be accessed here: Link. As illustration, for each country the respective soil type maps are presented below:

Benin

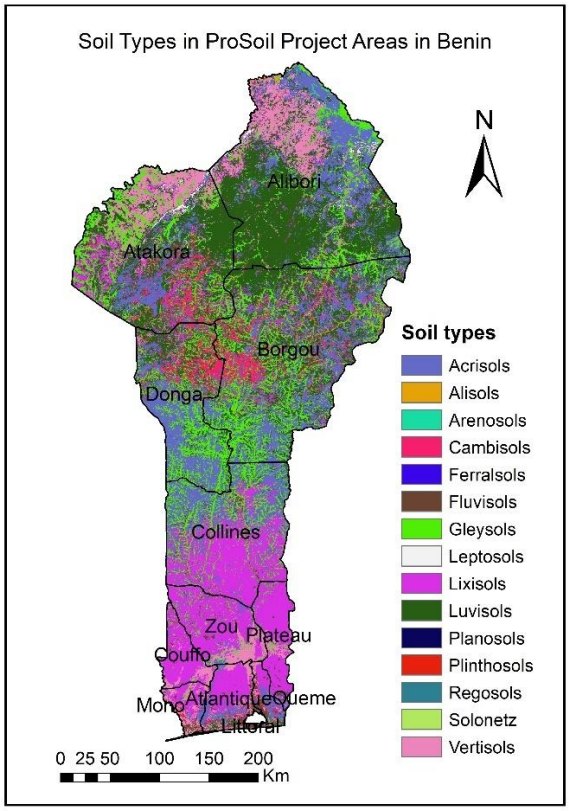


Figure 1: Soil types of the ProSoil project areas in Benin

Burkina Faso

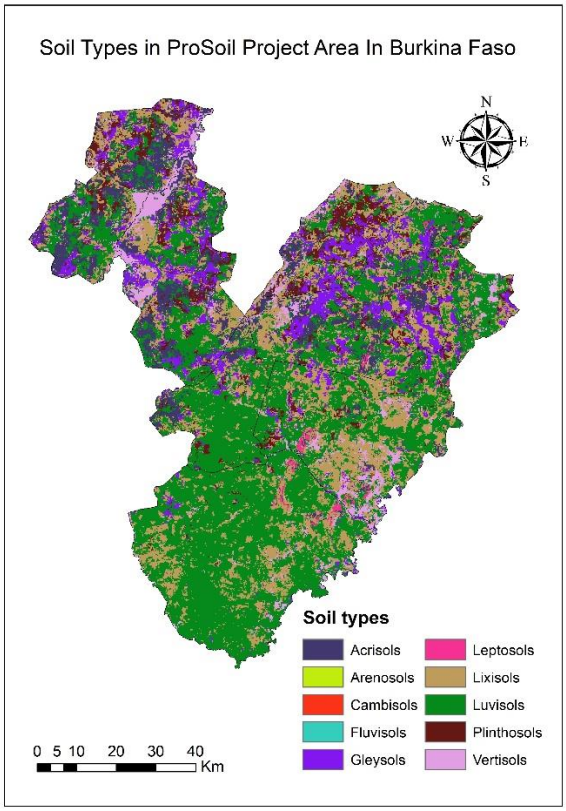


Figure 2: Soil types of the ProSoil project areas in Burkina Faso

Ethiopia

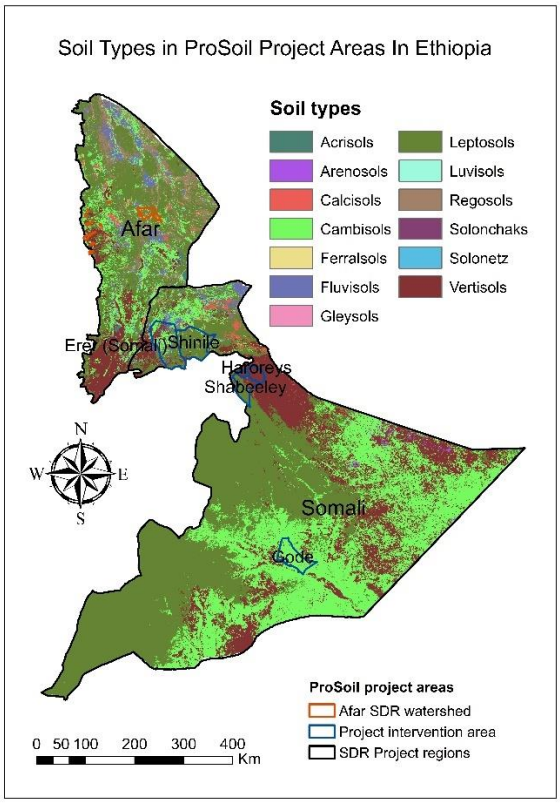


Figure 3: Soil types of the ProSoil project areas in Ethiopia

Kenya

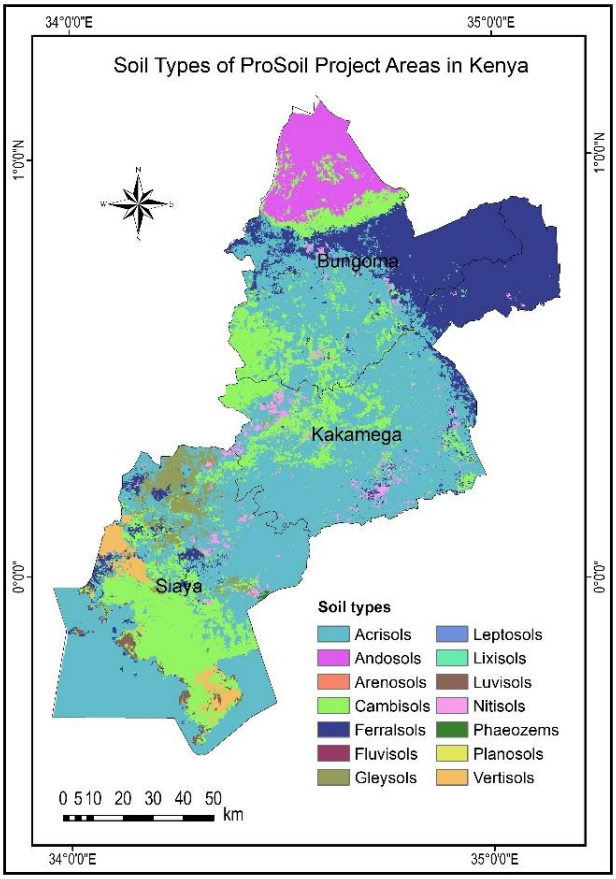


Figure 4: Soil types of the ProSoil project areas in Kenya

Madagascar

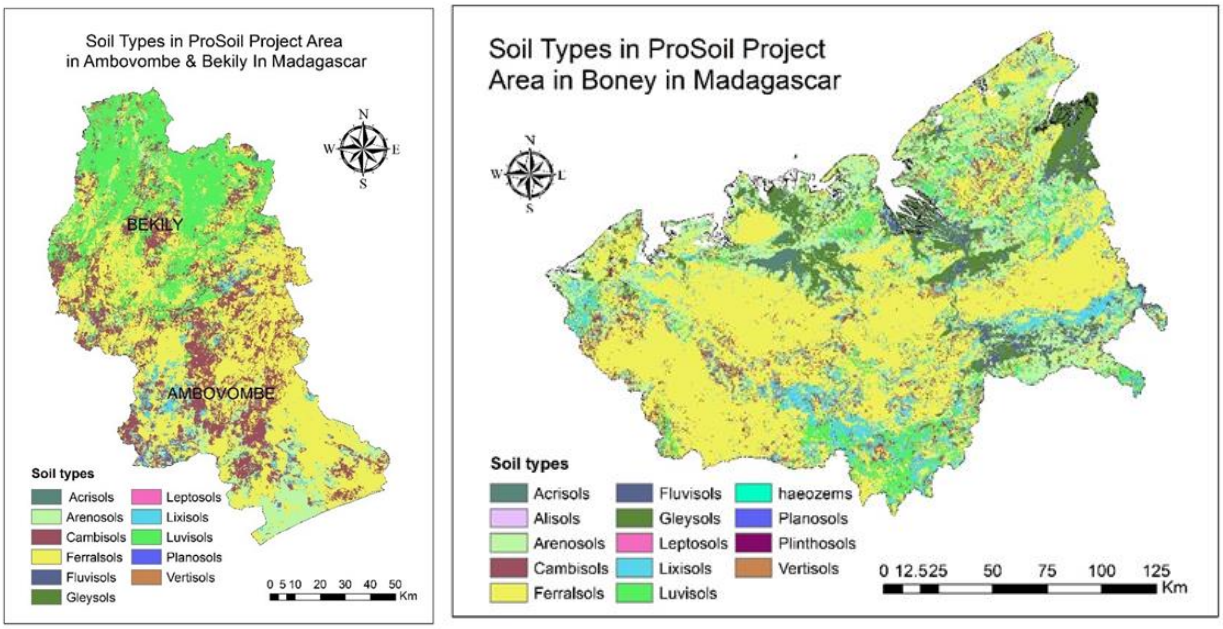


Figure 5: Soil types of the ProSoil project areas in Madagascar

Tunisia

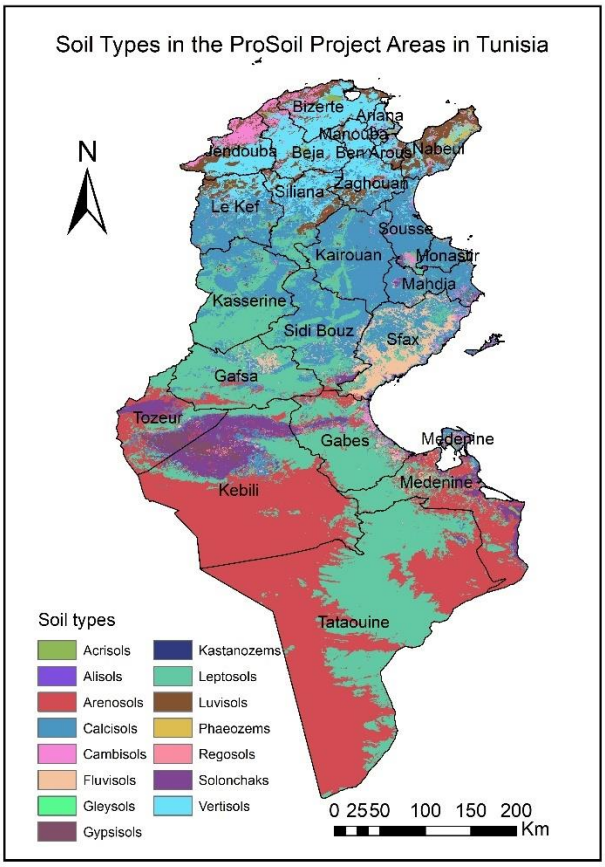
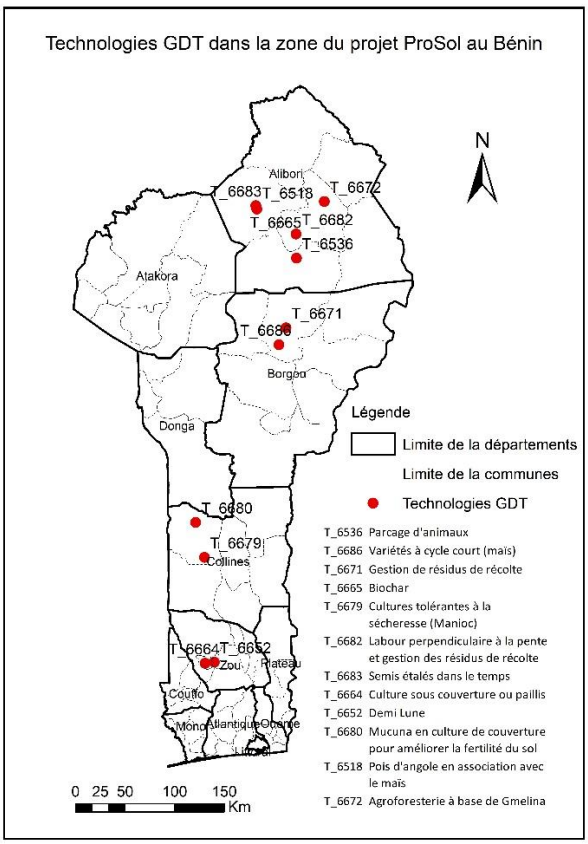
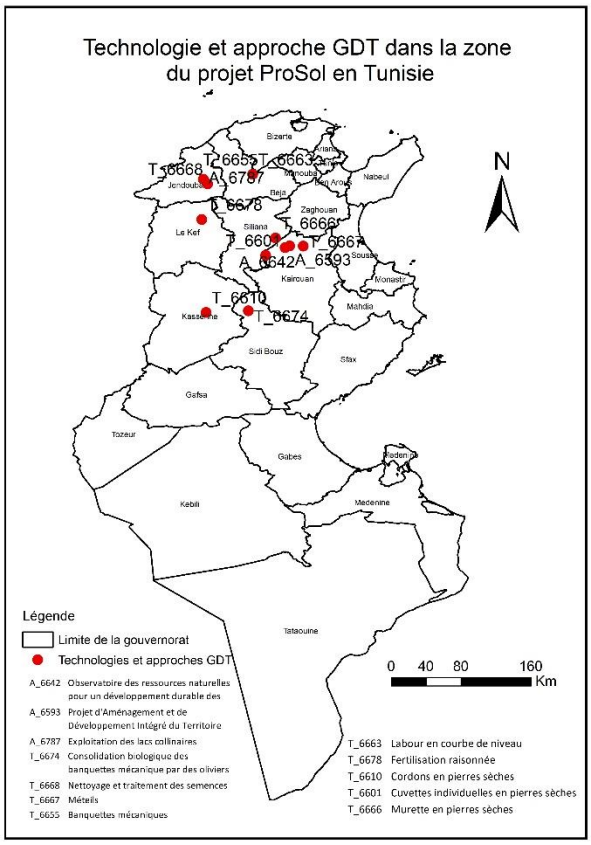


Figure 6: Soil types of the ProSoil project areas in Tunisia

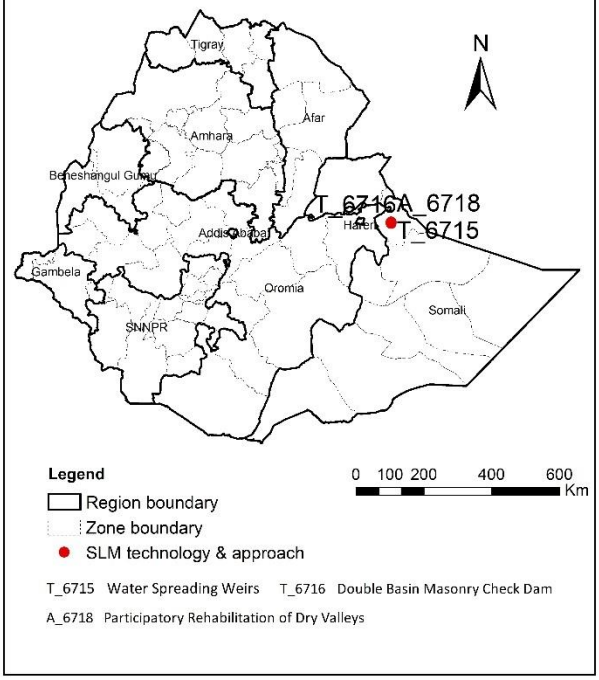
3.1.2 Spatial distribution of documented WOCAT QTs and QAs

The partner countries were trained by Alliance-CIAT on documentation of SLM practices and approaches through WOCAT's standardized Questionnaires on SLM Technologies (QT) and Approaches (QA). Some 70 Technologies and 17 Approaches were documented using WOCAT standard templates. In communication with CIAT, ISRIC as its 2nd part of activity 1.2.a prepared maps that visualize the location of the SLM technologies and approaches for the partner countries. The maps are presented in Figure 7. The corresponding GIS files were shared with CIAT. The corresponding high resolution files that can be included in the country reports can be found here: Link.


Technologies GDT dans la zone du projet ProSol au Bénin
N
Alibori
Atakora
Borgou
Donga
Collines
Couffo
Zou
Plateau
Mono
Atlantique
Ouémé
T_6683
T_6518
T_6672
T_6665
T_6682
T_6536
T_6671
T_6686
T_6680
T_6679
T_6664
T_6652
0 25 50 100 150
Km
Légende
Limite de la départements
Limite de la communes
Technologies GDT
T_6536 Parcage d'animaux
T_6686 Variétés à cycle court (maïs)
T_6671 Gestion de résidus de récolte
T_6665 Biochar
T_6679 Cultures tolérantes à la sécheresse (Manioc)
T_6682 Labour perpendiculaire à la pente et gestion des résidus de récolte
T_6683 Semis étalés dans le temps
T_6664 Culture sous couverture ou paillis
T_6652 Demi Lune
T_6680 Mucuna en culture de couverture pour améliorer la fertilité du sol
T_6518 Pois d'angole en association avec le maïs
T_6672 Agroforesterie à base de Gmelina


Technologie et approche GDT dans la zone du projet ProSol en Tunisie
N
Bizerte
Nabeul
Jendouba
Beja
Le Kef
Siliana
Zaghouan
Kairouan
Sousse
Monastir
Mahdia
Kasserine
Sidi Bouz
Sfax
Gafsa
Tozeur
Gabes
Medenine
Kebili
Tataouine
T_6668
T_6655
T_6663
A_6787
T_6678
T_6666
T_6667
A_6642
A_6593
T_6610
T_6674
0 40 80 160
Km
Légende
Limite de la gouvernorat
Technologies et approches GDT
A_6642 Observatoire des ressources naturelles pour un développement durable des
A_6593 Projet d'Aménagement et de Développement Intégré du Territoire
A_6787 Exploitation des lacs collinaires
T_6674 Consolidation biologique des banquettes mécanique par des oliviers
T_6668 Nettoyage et traitement des semences
T_6667 Méteils
T_6655 Banquettes mécaniques
T_6663 Labour en courbe de niveau
T_6678 Fertilisation raisonnée
T_6610 Cordons en pierres sèches
T_6601 Cuvettes individuelles en pierres sèches
T_6666 Murette en pierres sèches

SLM technology and approach in the ProSoil project LSRP area in Ethiopia



Legend

Region boundary

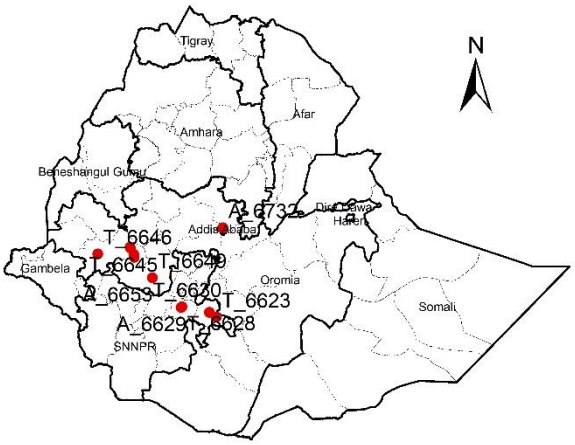
Zone boundary

SLM technology & approach

T_6715 Water Spreading Weirs T_6716 Double Basin Masonry Check Dam

A_6718 Participatory Rehabilitation of Dry Valleys

SLM technology and approach in the ProSoil ISFM area in Ethiopia



Legend

Region boundary

Zone boundary

SLM technology & approach

A_6732 Integrated Soil Fertility Management

A_6629 Farmers Research and Extension Group

A_6622 Integrated Agroforestry System

A_6653 Soil Fertility Improvement Cluster

T_6641 Treating acid soils with lime

T_6643 Vermicomposting

T_6644 Crop Residue Management

T_6645 Green Manures

T_6646 Bioslurry

T_6649 Improved Compost

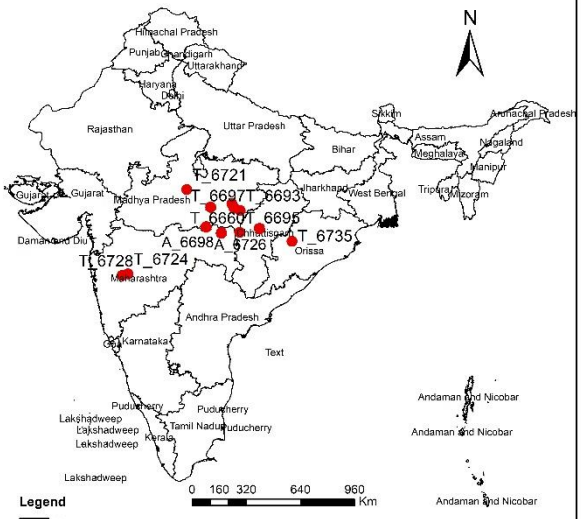
T_6621 Multistorey agroforestry

T_6628 Cover crops

T_6630 Relay Intercropping

T_6623 Livestock Urine Collection and Use

SLM technology and approch in the ProSoil project area in India



Legend

State boundary

SLM technology & approach

A_6726 E-Prakriti - An Approach Towards GIS Based Planning For Natural Farming

A_6698 Dissemination of Soil Test Results to Farmers through a Participatory Approach

T_6728 City Compost: A Solution For Waste Management And Soil Health Improvement

T_6735 Sustainable Biochar Production Through Agroforestry Systems And Its Application

T_6724 Multilayer Farming Systems For Ensuring Food Diversity And Increasing Resilience

T_6689 Community Based Soil Rehabilitation for Grassland on Common Lands After Eradication of the Invasive

T_6690 Biochar Production from the Invasive Species Lantana Camara

T_6660 Eradication of Lantana Camara (invasive species) for Soil Rehabilitation on Private Land

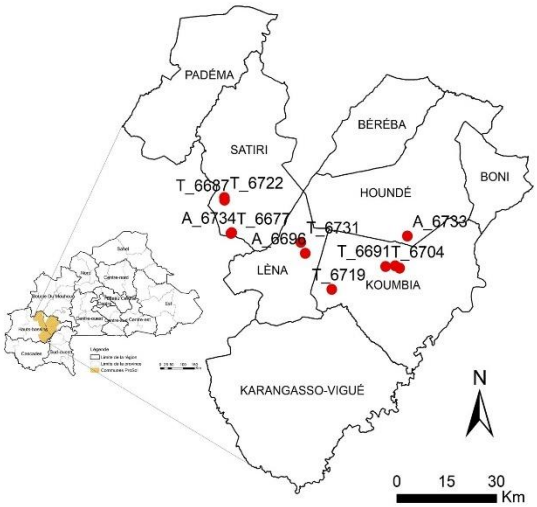
T_6695 Preparation of Bio-Inputs such as Vermicompost, Biofertilizers and Biopesticides

T_6721 Improved Cattle Shed Flooring for Conservation of Cow Dung and Urine for Biofertilizer Production at

T_6697 Pre-Monsoon Dry Sowing (PMDS)

T_6693 Biochar Application on Homestead Land

Technologie et approche GDT dans la zone du projet ProSol au Burkina Faso



Légende

Communes ProSol

Technologie et approche GDT

A_6696 Charte foncière locale relative à la gestion des berges de la rivière le « Son » de la Commune de Léna

A_6733 Expérience de la mise œuvre de la GDT avec l'approche foncier par les CVD

A_6734 Recherche-action sur les conflits liés au droit de propriété dans le village de Sala

T_6719 Production de plants d'essence forestière et leurs utilisations

T_6708 Réalisation de bandes enherbées

T_6691 Diguette filtrante

T_6731 Travail minimum du sol

T_6687 Diguette de Tiarako

T_6677 Compostage en fosse

T_6722 Traitement de ravines

T_6704 Fertilisation par la fumure organique

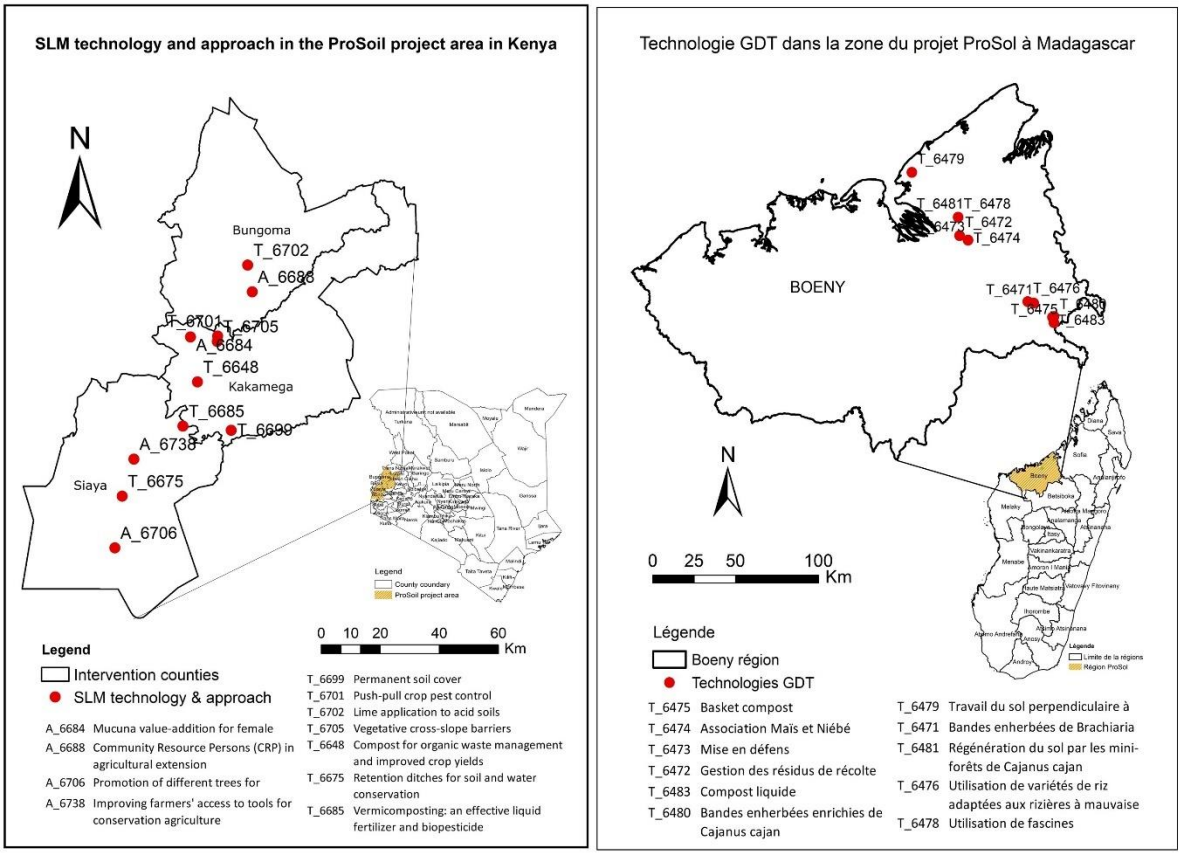


Figure 7: Spatial distribution of documented WOCAT QTs and QAs in the ProSoil partner countries

3.2 Mapping, Digital Solutions and Platforms

3.2.1 Preparations and training development

Under 2.1.a, to align other WOCAT training efforts with those that were being developed in this project, a training on using the GEE platform was given to ISRIC staff on 25th – 27th of April 2023 by expert Cesar Garcia. The training focused on use of GEE platform to estimate SDG 15.3.1 sub indicators and reporting to UNCCD in PRAIS4, incorporating QM results in GEE Apps and LDN monitoring as well as obtaining different maps (aridity index, NPP, precipitation trends, fire Index etc).

3.2.2 Development of a Roadmap for Benin, India and Kenya

Under 2.1.b we developed draft concrete roadmaps for the application of land degradation and sustainable land management mapping tools for Benin, India and Kenya. We included capacity building on specific tools, identification of participating experts and institutions, timeline of activities, responsibilities with three countries for application of tools on mapping and monitoring LD and SLM to achieve LDN.

The roadmaps included a screening of what is already existing in terms of LD and SLM spatial data (existing data layers and national maps) and an identification of past and current activities by national actors in LD/SLM mapping in the context of LDN.

The draft roadmaps were shared with the GIZ staff in Benin, India and Kenya and comments were requested. The documents are appended in Annex I.

3.2.3 Implementation of Road Map Activities

Some of the activities in the roadmaps were implemented. These activities focused on capacity building and dialogues with key actors to better understand the needs. For that reason, a short survey was sent to earmarked participants to gather information on previous experiences and interests on mapping Land Degradation and Sustainable Land Management (SLM) to better tailor WOCAT's capacity building activities on Mapping.

1. **Webinar: Mapping Land Degradation and Sustainable Land Management**

   The webinar was organized into two parts and agendas of the webinar Part I and part II are appended in Annex II.

   Part I – Tools for Mapping and Monitoring LD, SLM and LDN

   The webinar Part I was organized by WOCAT secretariat with GIZ on February 28th, 2023. The objectives of the webinar were:

   Familiarize participants with the QM and GEE apps for LD/SLM/LDN decision-making.

   Participants learn how the tools have been utilized and results have supported LD/SLM/LDN decision-making in different countries.

   Participants discuss their interest and feasibility of application of the tools in their specific project context.

   The webinar introduced the participants from all seven ProSoil partner countries to the WOCAT-FAO Mapping Questionnaire (QM), showed them examples of the application of the QM around the globe and participants discussed its utilization in the ProSoil project landscapes. Furthermore, the concept of convergence of evidence was presented, participants familiarized with the use of

Google Earth Engine (GEE) in the context of land degradation, SLM and LDN, and the GEE decision support apps for LDN showcased. There was interest in GEE from India and Ethiopia teams during and after the workshop and therefore a GEE App in Ethiopia was prepared for the second workshop and a training was organised by WOCAT.

Part II – Hands-on mapping of LD and SLM using GEE platform, DSM and LandPKS

The webinar part II was organised by ISRIC on April 5th, 2023. The objectives of the webinar Part II were to do hands-on mapping of land degradation and SLM using the GEE platform, present methods for mapping soil organic carbon (SOC) as well as mobile phone technologies for sustainable land. The participants 1) practiced hands-on mapping of land degradation and SLM using Google Earth Engine platform; 2) got to know digital soil carbon mapping using machine-learning; 3) familiarized with Land Potential Knowledge System (LandPKS) mobile technology/app for sustainable land management. The exercises were done through GEE App for Ethiopia (earthengine.app) in this workshop (Figure 1). During the workshop India partners expressed great interests in digital soil mapping technologies and requested for an in-depth review of the SOC monitoring tool with the intention to receive constructive advice on areas of potential enhancement for the GIZ I4Ag project. The review and advice were given by ISRIC experts Gerard Heuvelink and Niels Batjes.

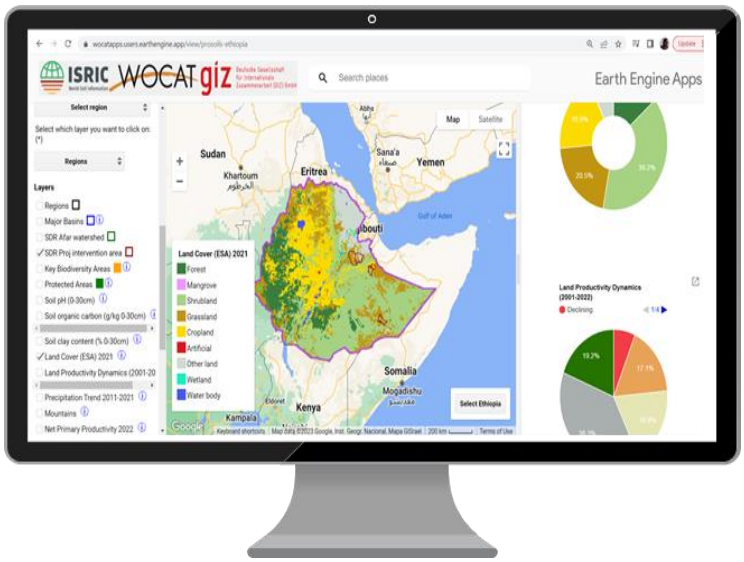


Figure 8: GEE App developed for ProSoil Webinar and Ethiopia (Teich et al., 2023)

2. Hands-on Training and Capacity Building for Country's Specific Needs

Besides the introduction and training via the webinar (Parts I and II, see Section 2), the hands-on training on application of LD and SLM mapping tools and methods were organised for the country partners. These trainings were on demand, meaning that they were only organized if the country's contact points had confirmed interest and a specific need.

3. Training on LDN Mapping & Monitoring in Kenya

On 9-13 October 2023, Dr Ingrid Teich gave a training on land degradation neutrality indicators mapping and monitoring in Kenya which was organized by WOCAT and GIZ. The training aimed to

co-develop tools, knowledge products and strengthen capacities to enhance national processes to UNCCD and LDN, such as reporting and LDN target setting, as well as to support evidence-based processes such as land use planning and monitoring. Agenda and list of the participants are appended in Annexed III.

Achieved outcomes of the training: Participants were familiar with the methodology to map Land degradation and estimate SDG indicator 15.3.1 (proportion of land degraded) proposed by UNCCD;
Participants knew how to use Kenya LDN Decision Support System to produce baseline assessments, identify priority areas, and support participatory planning processes;
Participants learnt use of Google Earth Engine and its Code Editor (Java Script) to access geospatial datasets and shared data by other users and platforms.
Jointly identified the most appropriate legend, data source and transition matrix to map degradation due to cover changes in Kenya;
Identified the most representative map of land productivity dynamics for Kenya based on the analysis of hotspots and bright spots.

4. **Training on WOCAT QM for Benin (in French)**

A hands-on training in French on WOCAT Questionnaire Mapping Tool for ProSoil Benin partners was organised on March 27, 2024. The participants learnt how to 1) create a georeferenced basic map of WOCAT QM mapping unit through land use map and administrative map; 2) filled in the basic map units attribute/Questionnaire Table based on the WOCAT standardized land degradation type, extent, degree, rate, cause, impact and land conservation technology name, category, purpose, extent (applied areas), effectiveness trend, impact on the ecosystems and 3) join the attribute table (Excel table) in the basic map and visualize the layers in QGIS.

5. **Decision Support Systems – Apps**

Benin faces challenges to access geospatial data and use geospatial data to measure progress towards LDN; also, they have no digital platform for monitoring progress or changes, a dynamic platform to reach LDN targets and goals. Therefore, a WOCAT-GEE App was developed for Benin by Ingrid Teich to support decision making through a multiple criteria analysis and convergence of evidence.

The App was presented during GEOLDN Global Dialogue Forum to the Benin UNCCD Focal Points in 2023 and some experts from the country were trained. The institutions involved were the Ministry of Environment with UNCCF NFP, Ministry of Agriculture with Head of the Geographic Information System, Cadaster and Remote Sensing Division. The link to the DSS or App is here: https://wocatapps.users.earthengine.app/view/dss-benin.

Also in Kenya, under the project "Soil protection and rehabilitation for food security", an app for decision system support (DSS) was co-developed to support knowledge management and informed decision making for soil protection and rehabilitation initiatives. The tool can facilitate easy access, use and mainstreaming of land management knowledge to contribute to wide scaling out of good sustainable land management. The link to the App for Kenya can be found here: https://wocatapps.users.earthengine.app/view/dss-kenya

Further capacity building and training could be provided at request.

4. LESSONS LEARNT AND RECOMMENDATIONS

Mapping land degradation and sustainable land management are crucial to decision making on soil protection and rehabilitation WHAT, WHERE and HOW. The ProSoil project partners got familiar with the knowledge management and mapping tools and methods using WOCAT standard templates and GEE platform and hands-on exercises on mapping tools and methods were only held for Kenya partially for Benin. The in-depth training on the WOCAT QM mapping tool and GEE LDN indicators mapping could be provided at request by other ProSoil project partners. Although we developed a roadmap on application of LD, SLM and LDN mapping tools and methods, UNCCD National FP in India were not contacted due possibly to the fact that the ProSoil project would be small activities compared with the FP's mega mandates in India. The ProSoil partners in India expressed great interests in digital soil mapping and ISRIC could offer an in-depth training at request.

The co-developed roadmaps remain preliminary, and they would need to be updated to the date if necessary; although the existing data and tools for mapping LD, SLM and LDN were identified in the roadmaps, implementation of the activities in the preliminary roadmaps depends on capabilities of organizations, targets and scales. First steps could be focused on identifying key stakeholders and contact persons in the country and setting up more and necessary training and capacity building.

Rather than following a top-down approach in which scientific and other authorities determine what is going to be done about a certain soil threat at a site, let all the relevant stakeholders make decisions in a participatory way. They are expected to engage in a dialogue by sharing their knowledge and experience in regard to the soil threats, contributing to a joint reflection, decision-making and evaluation process in regard to suitable mitigation and remediation practices. International efforts such as the EU FP7 project DESIRE have developed methodologies for participatory SLM appraisal and selection, successfully demonstrating that more sustainable solutions can be developed by integrating scientific and local knowledge.

Synergy with other on-going activities and projects related with LD, LDN and SLM is essential. Joining networks like WOCAT will link with other institutions and case studies that can help in the process.

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ANNEXES

Annex I: Roadmaps for Application of LD and SLM Mapping Tools

- Benin - Roadmap for Application of Land Degradation and Sustainable Land Management Mapping Tools and Implementation: Link.
- India - Roadmap for Application of Land Degradation and Sustainable Land Management Mapping Tools and Implementation: Link.
- Kenya – Roadmap for Application of Land Degradation and Sustainable Land Management Mapping Tools and Implementation: Link.

Annex II: Agendas for Webinar on Mapping Land Degradation and Sustainable Land Management

Agenda: Webinar Part 1 (February 28th , 2023)

11:00 – 11:10	Welcome	Marie-Christine Lemire (GIZ) and Nicole Harari (CDE/WOCAT)
11:10 – 11.20	Introduction round	All participants
11:20 – 11:25	Overview of the workshop Part 1 and Part 2	Nicole Harari (CDE/WOCAT)
11:25 – 12:00	Mapping LD and SLM with the QM Introduction to QM and Q&A	TBD
12:00 – 12.15	Insights from QM application from different countries	Ingrid Teich (CDE/WOCAT)
12:15 – 12.30	Discussion round	All participants
12:30-12:45	*Virtual Break*	
12:45 – 13:25	Mapping LD using Google Earth Engine and the principle of convergence of evidence Introduction to the tools and Q&A	Ingrid Teich (CDE/WOCAT)
13:25 – 13:40	Insights on use of GEE apps to support decision-making in different countries	Ingrid Teich (CDE/WOCAT)
13:40 – 13:55	Discussion round	All participants
13.55 – 14.00	Next steps and closure	Nicole Harari (CDE/WOCAT)

Agenda: Webinar Part 2 Agenda (April 5th , 2023)

11:00 – 11:05	Welcome	Andre Kooiman (ISRIC) Zhanguo Bai (ISRIC)
11:05 – 11:20	Introduction Round	All participants
11:20 – 11:30	Recap Workshop Part 1 and Program for Part 2	Zhanguo Bai (ISRIC)
11:30 – 13:00	Hands-on Mapping Land Degradation & SLM with GEE Platform (Continued with Part 1)	Ingrid Teich (CDE/WOCAT)
13:00-13:15	*Virtual Break*	

13:15 – 14:00	Machine Learning in Space and Time for Global Modelling of Soil Organic Carbon Change and Q & A	Gerard Heuvelink (ISRIC)
14:00 – 14:55	Land Potential Knowledge System (Land PKS): Mobile Phone Technology for Sustainable Land Management and Q & A	Zhanguo Bai (ISRIC) Maria Ruiperez Gonzalez (ISRIC)
14:55 – 15:00	Closure	Zhanguo Bai (ISRIC)

Annex III: Program and List of Participants on LDN Indicators Mapping and Monitoring in Kenya

Program of training on LDN indicators mapping and monitoring

9-13th October 2023 **Location: Jumuia hotel-Kisumu, Kenya**		
Time	**Task/Activity**	**Responsible**
Training: Day 1 (9 October 2023)		
09:00-10:30AM	**LDN Mapping and Monitoring**	
	Opening Program	
	Welcome and Introduction	GIZ Kenya
	Introduction of Participants	In Plenary
	Overview of LDN and SLM in Kenya	
	Group Photo Session	
10:30-01:00PM	• Objectives, Agenda, and materials of the workshop • Mapping LD, SLM and SDG 15.3.1 • Use of Cloud computing and Google Earth Engine for mapping LD • Introduction to Kenya LDN DSS	Ingrid Teich, WOCAT
01:00 – 02:00PM	**Lunch Break**	
02:00 – 05:30PM	*Degradation due to Land Cover Transitions. Part I* • GPG Methodology & Kenya default estimations • Group work: • Main LD processes due to LCC • Best LC data available • Minimum legend to monitor LD due to LCC • Defining a transition matrix	Ingrid Teich, WOCAT
Training: Day 2 (10 October 2023		
9:00 – 1PM	*Degradation due to Land Cover Transitions. Part II* • Use of Land cover transitions tool in the LDN DSS • Use of Drawing Tool in DSS • **DSS Exercise 1: LC Transitions** • Next steps: New LC maps (discussion)	Ms. Ingrid Teich, WOCAT
01:00 – 02:00PM	**Lunch Break**	
02:00 – 05:00PM	*Degradation due to Trends in Land Productivity* • GPG Methodology Group work: Defining the most appropriate LPD map for Kenya	Ingrid Teich, WOCAT
05:00 – 05:30PM	*Development of a validation strategy of LPD map*	Group Discussion

Training: Day 3 (11 October 2023)		
09:00 – 01:00PM	• Use of Multicriteria tool in the LDN DSS • **DSS Exercise 2: Multicriteria analysis** • Participatory Mapping of hotspots in DSS • Uploading a shapefile in GEE and visualizing it in the DSS • **DSS Exercise 3: Priority areas**	Ms. Ingrid Teich, WOCAT
01:00 – 02:00PM	**Lunch Break**	
02:00 – 05:00PM	*Degradation due to Trends in Carbon Stocks* • GPG Methodology • **DSS Exercise 4: SOIL PROPERTIES** *Final SDG 15.3.1 Maps* -1OAO Methodology and Final Results **DSS Exercise 5: SDG 15.3.1**	
05:00 – 05:30PM	Wrap up	
Training: Day 4 (12 October 2023)		
Time	**LDN Mapping and Monitoring**	
09:00 – 01.00PM	*Field Trip* Validation of maps Using the DSS in the field Mapping SLM • **DSS Exercise 6: FIELD VALIDATION**	Ms. Ingrid Teich, WOCAT
01.00-02.00 PM	**Lunch Break**	
02.00-05.30 PM	*Producing reports with the DSS* Organizing the information from the field Producing maps and assessments • **DSS Exercise 7: PROCESSING FIELD DATA**	Ms. Ingrid Teich, WOCAT
Training: Day 5 (13 October 2023)		
Time (GMT +6)	**LDN Mapping and Monitoring**	
09:00 – 01:00PM	• **DSS Exercise 8: LD ASSESSMENT ACROSS SPATIAL SCALES** (120 min) • **Presentation of results**	Ms. Ingrid Teich, WOCAT
01:00 – 02:00PM	**Lunch Break**	
02:00 – 04:00PM	*Future use of LDN DSS for informed planning and decision making* • Roadmap • Identification of potential uses of DSS	Dennis
04:00 – 05:30PM	**Evaluation and closure of the training**	

List of the participants on training on LDN indicators mapping and monitoring

No.	Salutation	Name	Surname	Institution	Position
1	Ms.	Ingrid	Teich	University of Bern, CDE/ WOCAT	Senior Research Scientist
2	Ms.	Maureen	Elegwa	GFA_ProSoil	County Project Coordinator_Bungoma
3	Ms.	Phinnaline	Onyango	Welthungerhilfe	MEAL Officer
4	Ms.	Vallary	Onyando	University of Nairobi	Geospatial Engineer
5	Mr.	Samson Geoffrey	Okoth	CESPAD	GIS Analyst
6	Ms.	Melvin	Achieng	Welthungerhilfe	MEAL Officer
7	Ms	Leah	Munala	GFA_ProSoil	County Project Coordinator_Kakamega
8	Ms.	Sylviah	Mungei	bukura agricultural college	Information communication technology officer
9	Ms.	Joyce	Atieno	Bukura Agricultural College	Student
10	Mr.	Soita	Wotia Bramwel	Welthungerhilfe	Head of Project (Technical Advisor)
11	Mr.	David	Olale	county government of siaya	Agricultural Officer
12	Ms.	Joy Julian	Aluoch	JKUAT	Biostatician
13	Mr.	Eliud Walimbwa	Wepukhulu	Kakamega County	County Enviroment and Land development Officer
14	Mr.	Lameck	Okeyo	County Government of SIaya	County Environment Officer
15	Ms	Faith	Innocent	GIZ	Technical Monitoring and Evaluation Expert
16	Mr.	Jones	Mutebi	Women in Water & Natural Resource Conservation	Corporate Communications officer
17	Mr	Bramuel Maniafu	Mukhwana	Tourism Climate Change	Tourism officer
18	Mr.	Benson Wanjala	Masinde	County Government of Bungoma	County Monitoring and Evaluation Officer
19	Mr.	Herbert	Muliro	County government of Bungoma	County Irrigation Engineer
20	Ms	Caroline	Majuma	County government of Siaya	Agriculturral extension officer
21	Mr.	Emmanuel	Kipchumba	Bukura Agricultural College	Instructor
22	Mr.	Jonathan Mulei	Makau	Kakamega County	County Horticultural Crops Development Officer
23	Ms	Scolastica	Matete	County Government of Kakamega	Environment Officer
24	Mr.	Maurice	Okeno	County Government of Siaya	Sub-county Agricultural Officer
25	Mr.	James Mwangi	Munene	County government of Bungoma	Sub County Water Officer - Mt. Elgon
26	Mr.	Dennis	Ncurai	GIZ	Agricultural Advisor

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