



RESEARCH
PROGRAM ON
Water, Land and
Ecosystems



Summary of stakeholder and cross sectoral engagement process

with Makueni County Government and partners to co-design interaction with socio-ecological evidence for targeting land restoration investments

Mieke Bourne, Tor Vagen, Leigh Winowiecki, Faith Musili, Jane Mumina, Christine Magaju and Sabrina Chesterman

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Background

Land restoration and avoiding further degradation are key pathways to achieving food security and exiting poverty for some of the most vulnerable people living in Africa's drylands. Achieving the UN's SDGs requires that successful restoration efforts reach larger numbers of farmers and hectares over the coming decade.

Under **WLE's Flagship on Restoring Degraded Landscapes (RDL)**, this work introduces a novel framework for targeting and monitoring land restoration through the use of evidence- and human-centred design. In partnership with Makueni County Government, the work builds off their leadership in effective development and desire to ensure evidence-based decision-making. In their Vision 2025, the county views environment, natural resources and climate change as underpinning the social, economic and political dimensions.

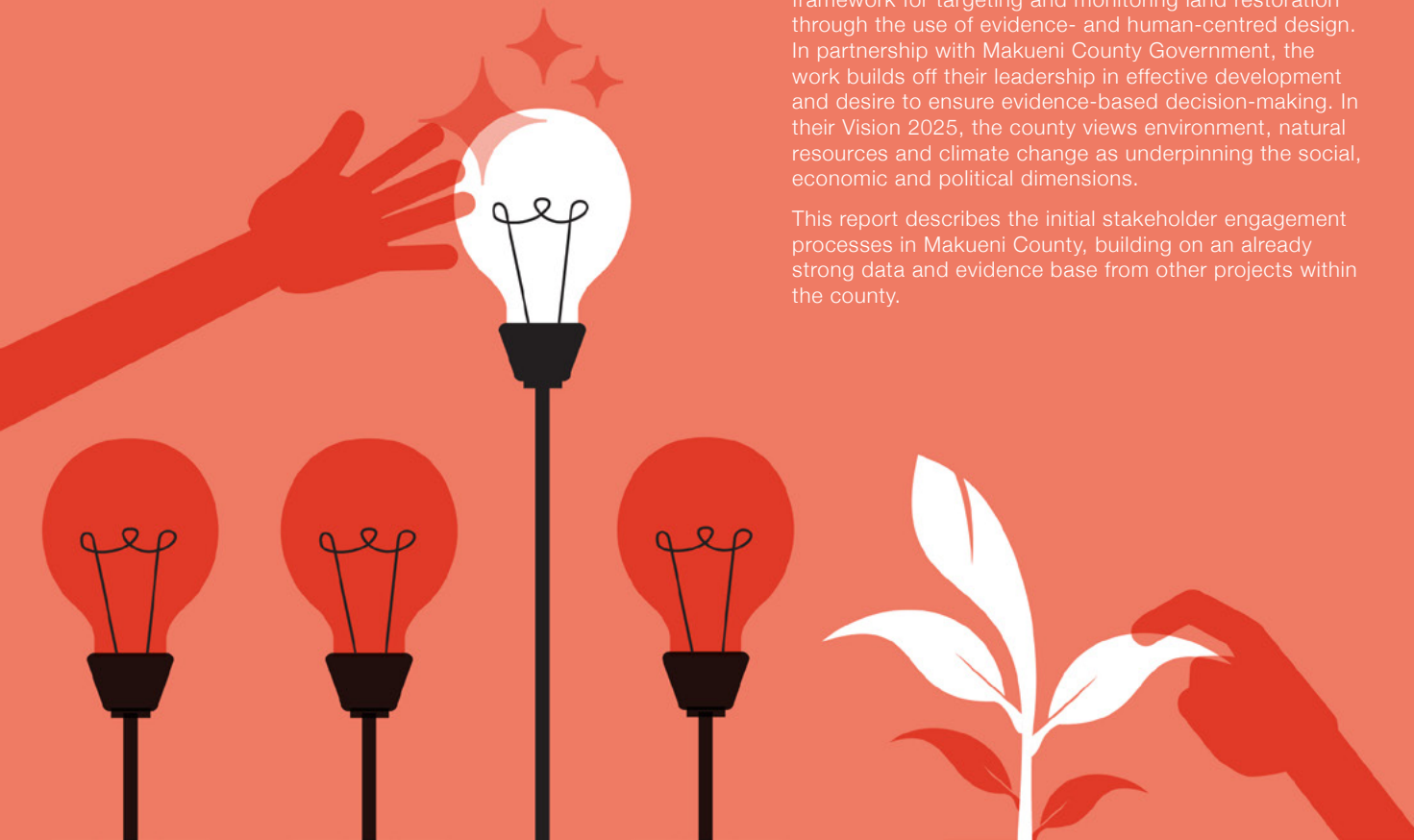
This report describes the initial stakeholder engagement processes in Makueni County, building on an already strong data and evidence base from other projects within the county.

Stakeholder engagement methodology

In order to strengthen approaches to the monitoring and evaluation of land restoration and the assessment of land degradation risks, stakeholder engagement is required, to facilitate a detailed understanding of user needs, decision processes and context. The project uses ICRAF's specialised stakeholder engagement unit, The SHARED Decision Hub, and its methodology for evidence-based decision-making engagement, with the aim of detailed sub-national engagement with key stakeholders in Kenya to assess land degradation risk, soil health, land management and socio-economic dimensions of gender analysis. The intended impacts of this detailed human-centred design are to enhance understanding and practical implementation of gender-responsive land management policies and decisions.

The SHARED (Stakeholder Approach to Risk Informed and Evidence-based Decision-making) methodology provides a comprehensive framework, tailored to specific decision contexts, to bring together processes, evidence, and tools, and shift the decision paradigm towards more inclusive, inter-sectoral and inter-institutional integration to tackle complex decisions and to achieve desired outcomes.

The report will summarize the key stakeholder engagement findings based on the SHARED methodological framework.



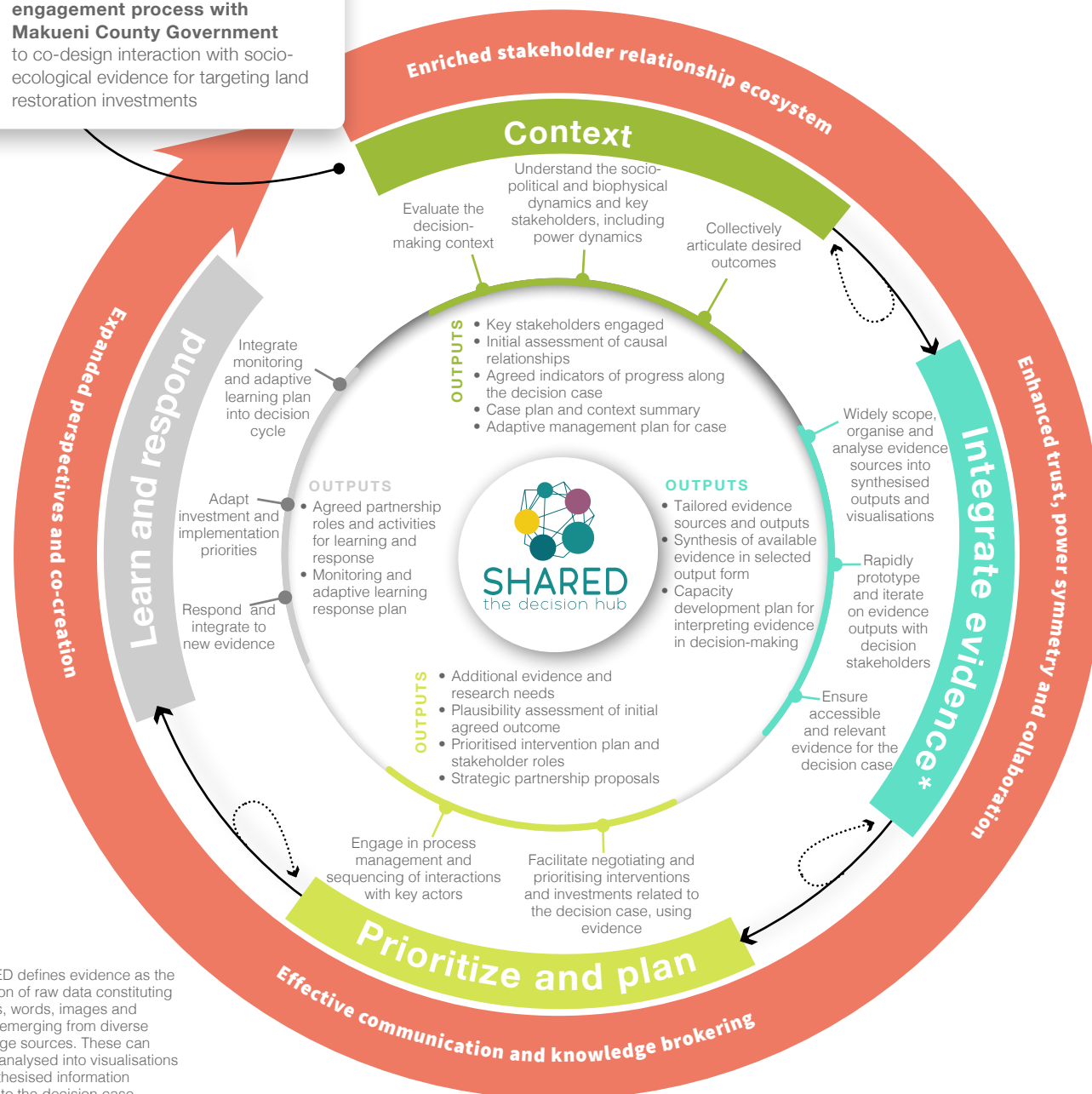
The **SHARED** approach includes **four inter-related phases** using comprehensive facilitation to support interaction with evidence, enhance co-learning, building long-term relationships and ensure that evidence can be critically interpreted, queried, and evaluated. This approach ensures cohesive communication across multiple institutions, political levels and knowledge systems to build capacity and the evidence base as a continuously linked process, within the same development outcome pathway.

Key factors, steps and principles in the SHARED framework include:

- i. advancing a **holistic or systems view** to raise awareness on the integrated and interdependent nature of the environmental, social, cultural and economic dimensions and causal relationships;
- ii. establishing a **clear understanding of the influencing factors** of human and group decision-making;
- iii. **facilitating discourse and learning** among different government sectors and multi-stakeholder platforms;
- iv. **collectively articulating** mutually agreed, desired sustainable development outcomes and indicators building upon fundamental ecosystem services and nested within national and global goals;
- v. **generating evidence and experience** and tailoring tools in a readily consumable way for problem solving and options identification;
- vi. **reviewing options** based on collectively defined criteria, including risks and potential synergies; and
- vii. **designing option implementation** with monitoring and evaluation and co-learning feedback into the process.








Decision case: Cross sectoral engagement process with Makueni County Government
to co-design interaction with socio-ecological evidence for targeting land restoration investments




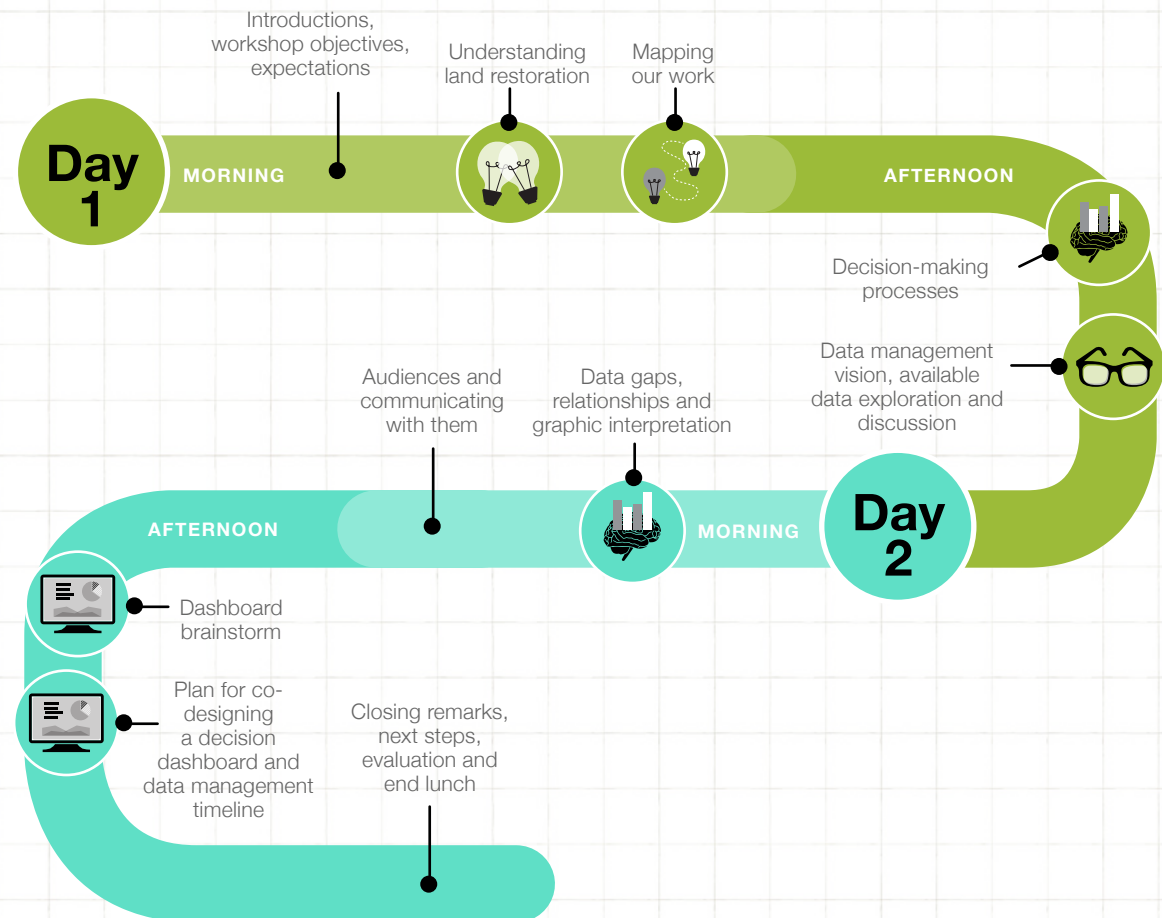
Stakeholder engagement workshop

The County Government of Makueni and World Agroforestry (ICRAF) held a two day stakeholder engagement workshop held between 8th - 9th August 2019, in Makueni County. The workshop brought together County Government departments and key partners to achieve the following key outcomes:

-  **Developed a shared understanding of land restoration work** in the county, the partners and sectors involved.
-  **Mapped decision processes for land restoration** and related work in the county, involving planning, monitoring, reporting and decision making.
-  **Identified the data and information** that is collected and held by various departments and partners in the county and evaluated the quality and accessibility of this data and any information or knowledge gaps.
-  **Developed a vision for data management**, access and use related to land restoration.
-  **Agreed on a road map to co-design a decision dashboard for the county**, including related capacity building opportunities and facilitation events to support interpretation and application.

This report provides a synthesis of these key outcomes, using the relevant SHARED methodological approach to highlight the key stakeholder engagement methods employed, summarise engagement, feedback and outcomes.

 Where you see this icon, it describes an application of SHARED activities within the Makueni County decision case.



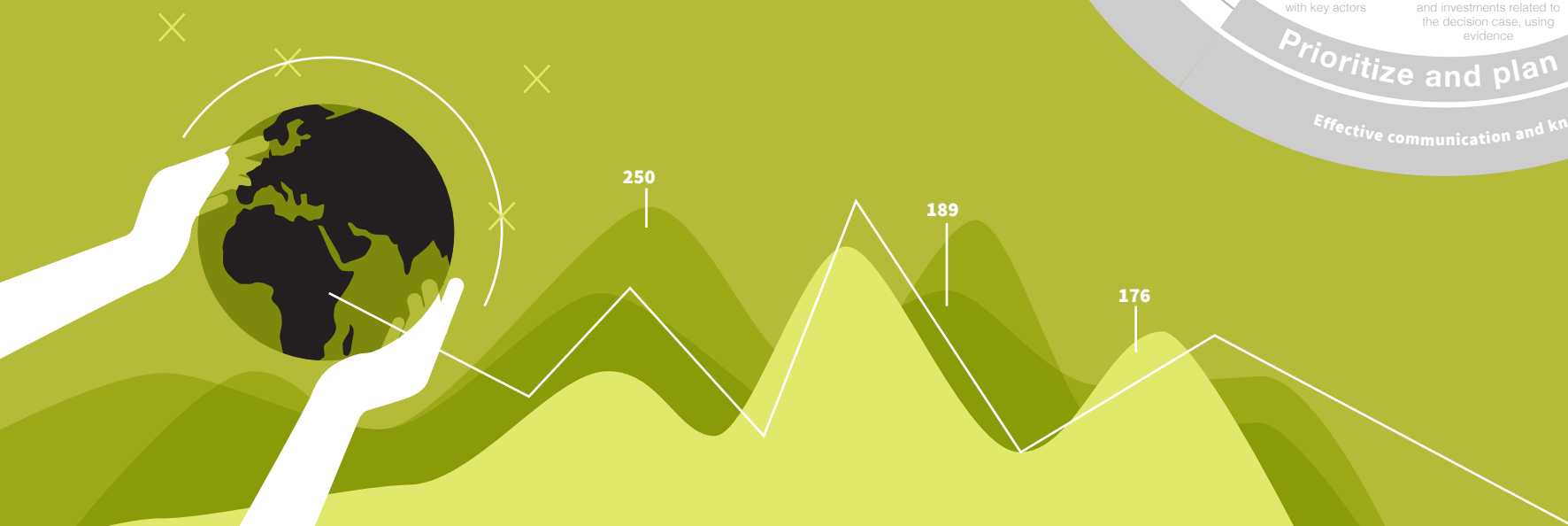
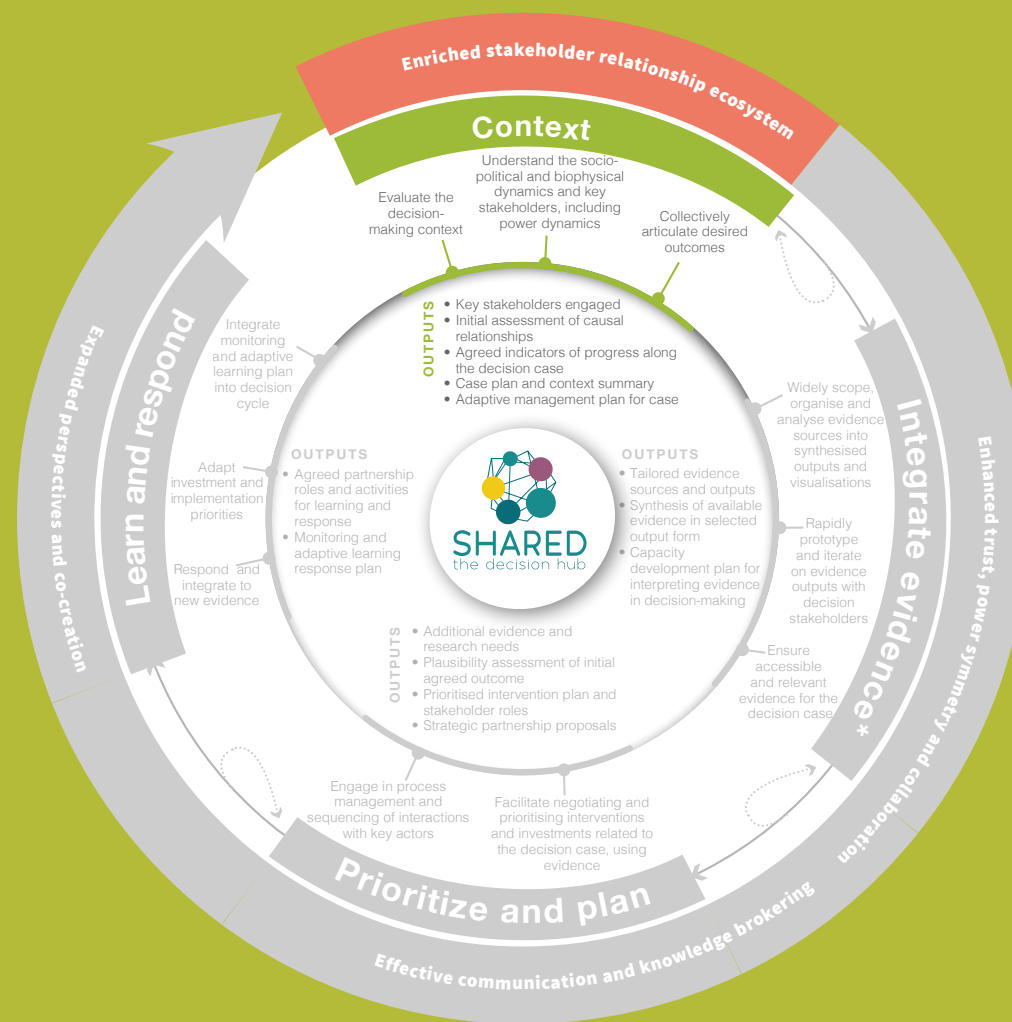
Context

In this stage, we:

- Evaluate land degradation in Makueni County, the decision-making context
- Understand the socio-political and biophysical dynamics and key stakeholders, including power dynamics
- Collectively articulate desired outcomes

Outputs of this stage include:

- Engage key stakeholders
- Assess causal relationships
- Create a case plan and context summary
- Create an adaptive management plan for Makueni County





Open perspectives



Open perspectives



Using open space allows for neutral and individual responses to a set of proposed statements or questions, whereby stakeholders respond by moving to a marked station representing their view of proposed options or a scale of agreement.

There is the necessary commitment and investment for restoring degraded land in Makueni County

Most of the participants either strongly or somewhat agreed with the statement, with some participants moving to neutral or somewhat disagree.



"The rivers have dried up and there is a lot of soil erosion hence there is need for more investment in the area"

"The County has set aside funds for natural resource management and are bringing partners together to discuss and act on land degradation collectively"



Participants are not sure of the level of degradation in the County, some efforts have been made by the county government to ensure degraded land is restored by allocating funds, formulating initiatives to restore the water catchments, creation of awareness and sensitisation on land restoration activities. There is room for more efforts to be made.

We have enough information to prioritise, plan, implement and monitor restoration work

With this statement, more participants moved to neutral or somewhat disagree.



"The minimal data available is not conclusive."

"The available resources are limited for analysis, sharing and use of data."



"Available data is non-conclusive, minimal, non-reliable and of poor quality hence can't be utilized."



"Data is still being gathered therefore not conclusive for planning and monitoring."

"Information on the targeted interventions is not enough and cannot be relied upon."

"The information or data is not centralized nor disseminated and there are limited funds to spread out the information to a wide group."

KEY:



Strongly agree



Somewhat agree



Neutral



Somewhat disagree



Strongly disagree



Visual cues

Leigh Winowiecki, soil scientist from ICRAF, led the group through the exercise, focusing on land degradation in Makueni County.

Is it easy to identify degraded land?

"It's not easy to identify because land degradation involves multiple drivers and aspects that cannot be recognised without proper understanding."

"Drivers of degradation need to be systematically assessed in order to address root causes."



Poor management practices can also lead to land degradation

Are these landscapes degraded?



"The landscape is degraded because soil erosion is visible and minimal trees are present."

"No expected yields as per the current status of the maize stalk."



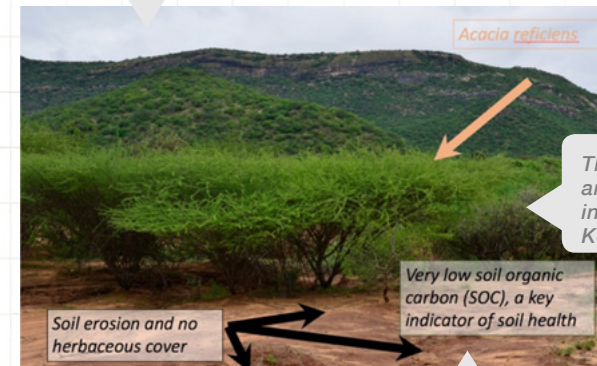
"It is not easy to tell whether the soil is degraded because it is on agricultural land."

"The condition of the maize stalk seems to be growing in a low soil organic carbon land."

Visual imagery, usually photographs or short video excerpts, are used to 'test' a group of participants on their views and knowledge on a subject.



Some invasive species can establish without ground cover, leading to erosion



This is a semi-arid rangeland in northern Kenya.

A detailed explanation was given of the different states of erosion and how erosion changes soil characteristics (pH, organic carbon, etc.). Insights were provided into how degraded landscapes can have trees.

Invasive species can impact the land negatively, leading to increased soil erosion and low plant diversity.



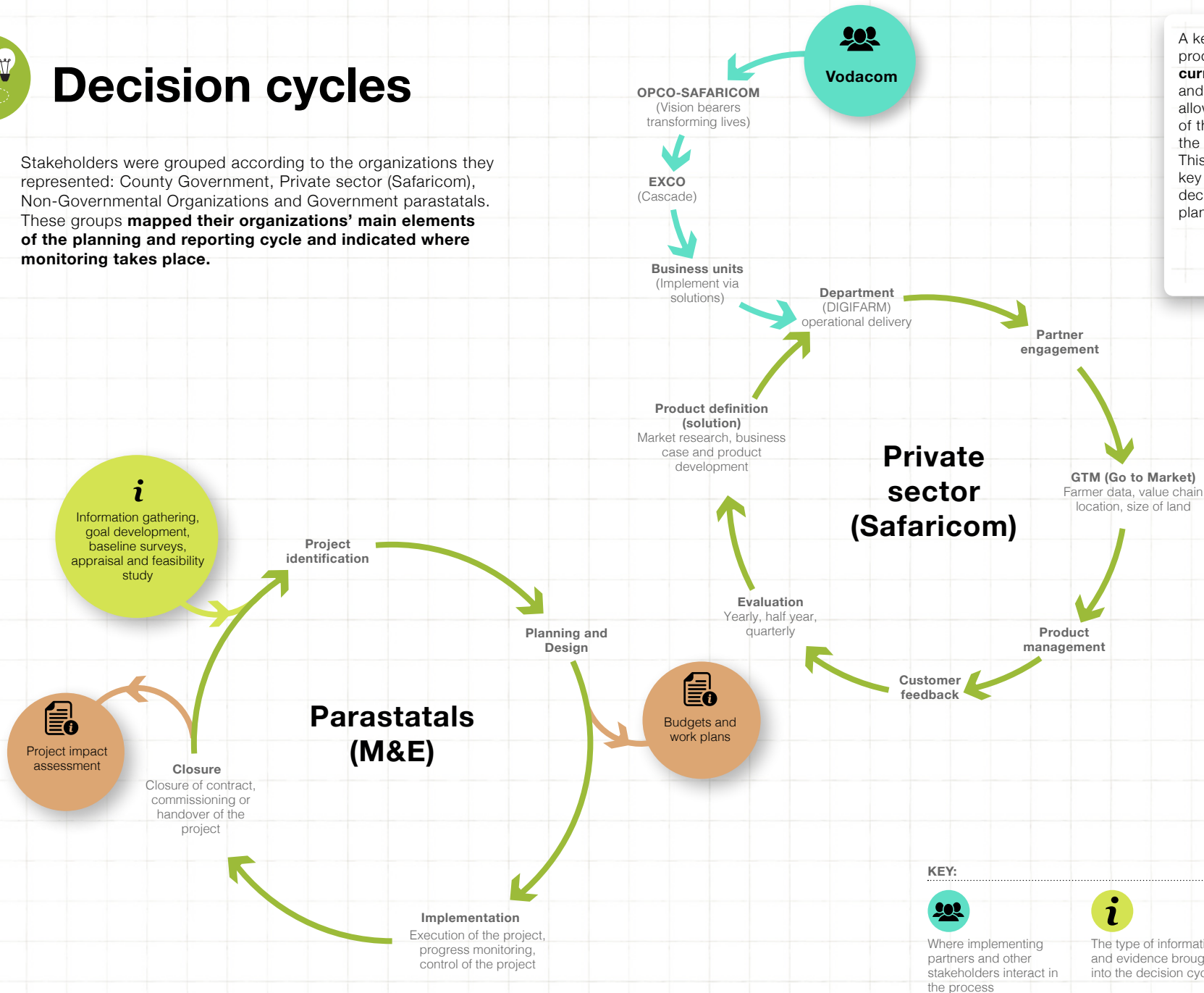
"This farmer is trying to combat land degradation and improve agricultural productivity by using planting basins and leaving mulch on the soil surface."

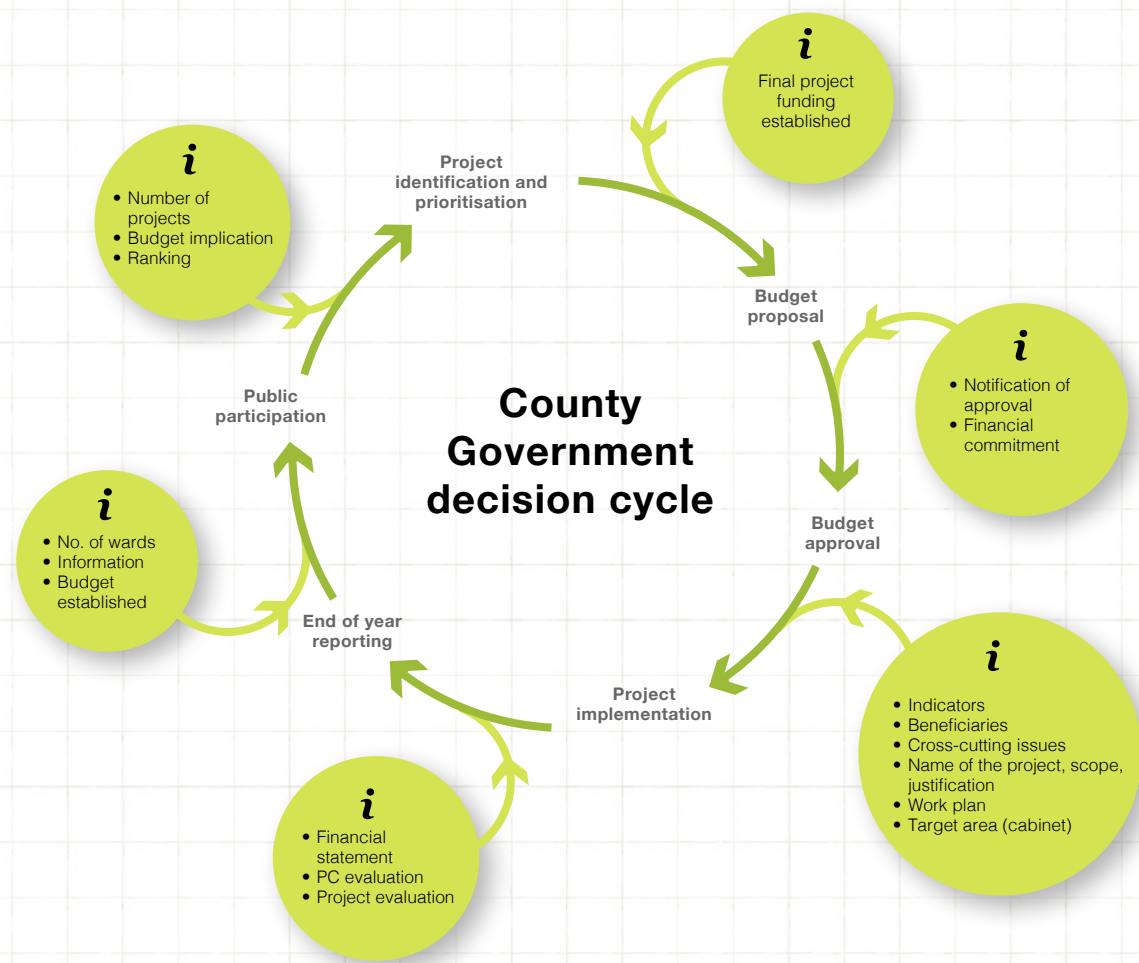


Decision cycles

Stakeholders were grouped according to the organizations they represented: County Government, Private sector (Safaricom), Non-Governmental Organizations and Government parastatals. These groups **mapped their organizations' main elements of the planning and reporting cycle and indicated where monitoring takes place.**

A key first stage in any co-design process includes **understanding the current context for decision-making** and defining the information needs. This allows for a user defined understanding of the context (empathy) and outlining the key entry points for the entry (define). This tailored SHARED exercise has three key steps to outline reporting cycles, decision making and the role of data in planning, implementation and monitoring.





KEY:



Where implementing partners and other stakeholders interact in the process



The type of information and evidence brought into the decision cycle



The type of broad information shared and reported



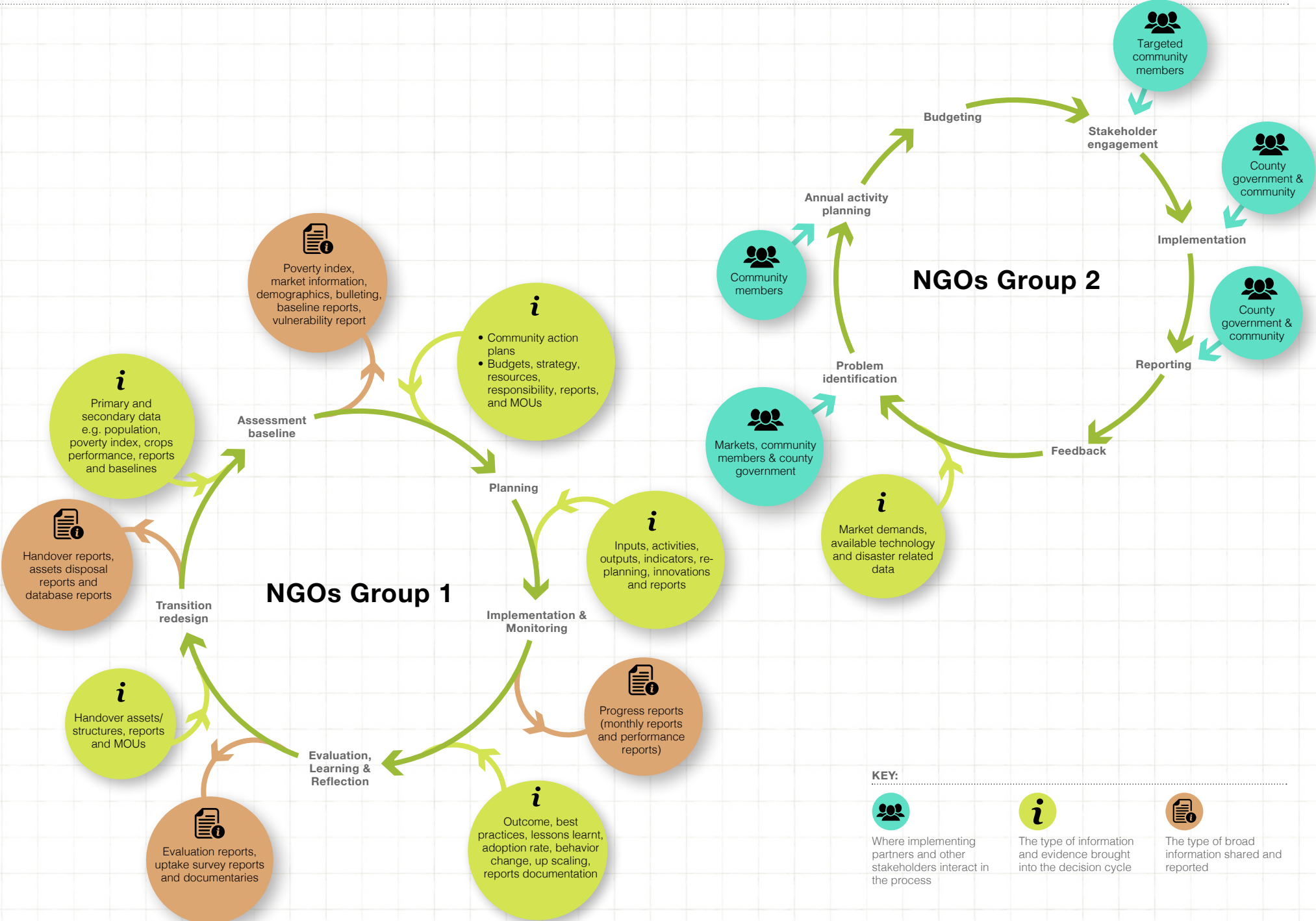
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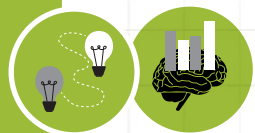
Data is key for a farmer, especially knowing the market and areas where you can break even to avoid labour wastage and investments. The lands and agriculture ministries play a key role in attaining this (data) especially for proper planning. Currently both ministries are working on a County Spatial Plan and have tabled it to the cabinet for approval.

The County plan will act as an important framework for efficient, productive and sustainable use of land as advocated for in the Constitution and national land policy.

The CEC also emphasized the importance of sharing data with other counties including data on the types of soils, to advise on what to grow in a particular area and the available markets. ”

- Hon Julius Kaloi, CEC Department of Lands, Mining, Physical Planning and Urban Development





Baseline inventory

Stakeholders mapped the partners, projects and technologies that already exist in relation to land degradation and restoration efforts in Makueni County. With this information, stakeholders also created a project database for the County.

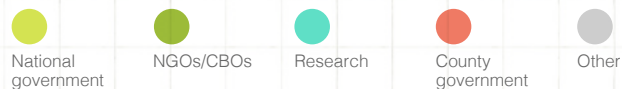


Baseline inventory

This SHARED process ensures stakeholders can identify what already exists in the context of the decision case, such as projects, tools and data. This enables any suggested interventions to address development gaps and needs.



KEY OF LAND RESTORATION PROJECTS:





Key	Organization	Project	Scope	Start Year	End Year	Technologies	Interventions	Data collected	Community engagement approach	Contact name
1	World Agroforestry (ICRAF)	Land restoration	Mbooni sub-county		2019	Tree planting and management; Zai pits	By context approach	Seasonal data collection on Zai pits and trees performance	Farmers practice their normal ways to compare with scientific treatments to ensure they come out with concrete decisions from results realized in per roll outs	Sylvester Muendo; Mercy Muema
2	The International Center for Tropical Agriculture (CIAT)	Land restoration	Kilome Sub-county	2018		Soil Conservation	Data Collection	Rural-urban Migration	Focus Group Discussion; Key informant Interviews	Ravic Nijbroek
3	World Vision Kenya	3a. Water sanitation and hygiene	Mbooni sub-county; Kibwezi East sub-county	2017	2020	Automated aquatabs for water; Drilling boreholes, Equipping and distribution; Community lead total sanitation	Community (men, women, youth, children) water distribution; Children hand washing in schools	Quarterly	Training; Reflections	Jackson Muraguri
		3b. Community engagement and Sponsorship	Mbooni sub-county; Kibwezi East sub-county	2010	2026	Child protection; Spiritual nature for children	Children school fees and uniform provision; Households - promote universal health coverage with county and National health Insurance Fund (NHIF)	Quarterly	Training; Sensitization; Children camps; Crusades	Jackson Muraguri
		3c. Livelihood and resilience	Mbooni sub-county; Kibwezi East sub-county	2017	2020	Farm ponds, zai pits, Nursery establishment (FMNR); Savings for transformation; improved breed; local value chain development	Improve livelihoods and resilience to community and youth empowerment; skill development (women, men, youth); transformation by tree planting	Quarterly data collection	Farmers extensions; Field day; Training; Community barazas; Reflections	
4	KCEP-CRAL	Kenya cereal enhancement project	Mbooni, Kibwezi East, Kibwezi West, Kilome, Makueni sub-counties			Soil fertility management; Soil water management using zai pits and tied Ridges; Variety performance evaluation		Soil data; Seasonal data collection on crop performance	Technologies tested as requested by farmers	Fatuma Omari; Kalro Katuma

Key	Organization	Project	Scope	Start Year	End Year	Technologies	Interventions	Data collected	Community engagement approach	Contact name
5	Kenya Agricultural and Livestock Research Organization (KALRO)	5a. Land restoration (promotion of underutilized fruits)	Entire County			Varieties; Water management; Soil fertility; Utilization	Female and vulnerable groups targeted; schools targeted	Seasonal crop performance data	Participatory evaluation of technologies	
		5b. Improving food and nutrition security of vulnerable groups in semi-arid areas through amaranth production	Entire County			Amaranth varieties grown under different organic and inorganic fertility management; Utilization of grain amaranth	Female and vulnerable groups targeted	Crop performance; Number of beneficiaries	Community Based Organization's used for disseminating information to others	
		5c. Introduction and evaluation of green-gram varieties for ASAL Regions	Entire County			Breeding of green grams varieties tolerant to drought		Seasonal data on crop performance for selection of favorable varieties	Participatory selection	
6	Micro Enterprises Support Programmes Trust	Green growth and employment programme	Makueni sub-county	2016	2020	Water harvesting farm ponds and wells; Waste management biogas; Solar pumps; Eco jikos	Promotion of trade and investment; Promotion of sustainable use of natural resource and community resilience; value chain and green financing	Quarterly on production across selected value chains; Uptake on green technologies	Organized producer groups; financial intermediaries county government and development partners	Margaret Miano
7	Kenya Red Cross Society	Protracted Relief and Recovery Operations (PRRO)	Kibwezi East sub-county	2010	2018	Water harvesting technologies	Male and Female farmers (aged, youth, middle aged)	Monitoring and Evaluation	Farmer/Capacity building trainings; Focused group discussions; Farm visits	
8	CARITAS	DryDev	Kibwezi East sub-county	2014	2019	Rehabilitation of degraded lands through tree planting; Gabions; Terracing; FMNR		Uptake survey on adoption rate; Water recharge percentage	Farmer to farmer learning; Planned comparisons, Trainers of Trainees' (TOT) Model	Raphael Mwau
9	National Environment Management Authority (NEMA)	Land restoration	Entire County			Environment Impact Assessment (EIA)	Environment conservation and protection	Social-economic and environmental impact of project	Stakeholder participation; Decision making process; project ownership	Patricia Mumbi
10	Kibwezi Youth Group 1	a) Kamina nthina	Kibwezi East sub-county			Planting trees, seedlings and selling	Youth and women targeted	No records	Training	Kaloki Komu
		b) Conservation Agriculture	Kathozweni Area	2008		Minimum tillage to conservation of water and improve soil fertility	Working farmers, train and demo-farms; implement tools provided	Seasonal data on farm yields after adoption; Baseline data- 2004/2008/2013	Farmers based learning; Training TOT	
11	Kibwezi Youth Group 2	Umiisyo wa ndaunii	Kibwezi East sub-county	2017		Tree planting; Table branding; Goat rearing	Youth and women targeted	No data	Training on the technologies	Jackson Kiio

Key	Organization	Project	Scope	Start Year	End Year	Technologies	Interventions	Data collected	Community engagement approach	Contact name
12	Centre for Training and Integrated Research in ASAL Development (CETRAD)	Data management (knowledge management)	Makueni sub-county	2015		Portal data and visualization of data and information	Research and information dissemination	Hydrological data and weather data and publications	Resource persons who manage and collect data	
13	World Resource Institute	Nzaui landscape restoration	Makueni sub-county	2019	2025	Remote Sensing in Assessing Degradation	Community based forest management system	Remote sensing data; Social-economic data on household and income levels	Community engagement in tree planting; Eco-tourism route mapping; Investment action plan for natural landscape	Mary Mbenge
14	National Drought Management Authority (NDMA)	Climate proofed infrastructure	Mbooni sub-county	2018		Fish farming; Irrigation; pasture production and enhancement; Greenhouse drip	Women and youth targeted	Early warning information; Bi-annual food security assessment report	Running of model plots (community groups); Fingerling; Pooled account for the money collect; Sale of water at a subsidized rate	
15	Department of health services	Construction/upgrading and equipping health facilities	Entire County			Facility upgrade/construction and equipping; Human resource; health commodities and technologies	Maternal, newborn and child-health; drugs and equipment; screening for NCDs; campaigns (immunization)	Continuous data on mobility trends; other key health indicators	community dialog days; community open days; outreaches; medical camps; Barazas	Dr. Andrew Mulwa
16	GAFFSP	Small-scale Irrigation and Value Addition (SIVAP)	Mbooni sub-county; Kilome Sub-county; Kaiti sub-county; Kibwezi West sub-county	2016	2022	Micro irrigation; value addition (drip system, sprinkler)	Irrigation infrastructure developed and rehabilitated	Number of beneficiaries; Acreage to be put under irrigation	Identification of sites suitable for water harvesting structures; Identification of denuded sites for rehabilitation	
17	African Sand Dam Foundation	Water conservation	Entire County	2019	2020	Sand dam construction; school water tanks; Rock catchments	Work with self-help groups-expertise in sand dam construction; Pupil and students school water tanks	Quarterly monitoring of sand dams, school water tanks; Number of person trained; Number of water structures constructed	Capacity building for the self-help groups	Dorcus Wambua
18	Kibwezi Horticulture Youth Group	Land restoration	Kibwezi West sub-county	2015		Irrigation of ASAL and the best agronomic practices	Training youths and farmers on dry land development like irrigation using drips/farm pond construction	Annual data collection on number of youths trained; Crop productivity and performance	Assisting farmers in farm pond construction; Training farmers on agronomic practices; Advising farmers on the best crops based on agroecological zones	Mambo Nzali
19	Safaricom	DIGIFARM	Entire County			Precision agriculture	Access to financial services; Access to extension services; Access to Market	Location and size of land; value chain (milestone specific); Bio-data (name, phone number, age, gender)	Farmer barazas (meetings); Involvement of community members to run initiatives like registration of lead farmers	Melvin Mutai



Cross-sector linkages

Achieving the Sustainable Development Goals and their targets will depend on coherent planning, investments and implementation across thematic sectors (e.g. environment, health, agriculture, nutrition, and education) and stakeholders (e.g. public, private and market sectors).

SHARED approaches cross-sectoral work through linking practitioners and institutions across different sectors, disciplines and perspectives. Through structured facilitation processes the the cross-sectoral nature of targets is understood and how sectors could more effectively link workflow.



	 ECONOMIC	 SOCIETY	 ENVIRONMENT	 POLITICAL
				
	   	       	  	 
				
	<ul style="list-style-type: none"> • High standard of living, well being • Transformed economies, job creation • Modern agriculture, production • Financial and monetary institutions • World class infrastructure • Africa financing development 	<ul style="list-style-type: none"> • Healthy, well-nourished citizens • Educated citizens, Science, Technology, Innovation • Empowered youth and children • Full gender equality • Cultural renaissance 	<ul style="list-style-type: none"> • Blue/ocean economy • Environmentally sustainable climate resilience 	<ul style="list-style-type: none"> • United Africa • Democratic values, justice, rule of law • Capable institutions • Peace, Security, Stability preserved • Stable and Peaceful Africa • Partner in global affairs
				
	<p>Aims to achieve average economic growth of 10 % per annum and sustaining the same until 2030.</p> <ul style="list-style-type: none"> • Tourism • Oil and Other Minerals • Financial Services • Business Processing, ITES • Agriculture, Livestock and Fisheries • Trade • Financial Services • Infrastructure • Manufacturing 	<p>Engender just, cohesive and equitable social development in a clean and secure environment.</p> <ul style="list-style-type: none"> • Education and Training • Health • Population, Urbanization and Housing • Gender, Youth, and Vulnerable Groups • Sports, Culture and Arts 	<p>Environment, Water and Sanitation</p> <ul style="list-style-type: none"> • Environment, Water and Sanitation 	<p>Realize an issue-based, people-centred, result-oriented and accountable democratic system.</p> <ul style="list-style-type: none"> • Devolution • Governance and Rule of Law
				
				
				
Departments	<ul style="list-style-type: none"> • Department of Lands, Mining, Physical Planning and Urban Development • Department of Finance and Socio-economic Planning • Department of Trade, Industry, Marketing, Tourism and Cooperatives 	<ul style="list-style-type: none"> • Department of Education, Sports and ICT • Department of Agriculture, Irrigation, Livestock and Fisheries Development • Department of Health Services • Department of Roads, Transport, Energy and Public Works 	<ul style="list-style-type: none"> • Department of Water, Sanitation, Environment and Climate Change 	<ul style="list-style-type: none"> • Department of Gender, Children, Culture and Social Services
Makueni Vision Pillars	<p>Economic Affairs Pillar</p> <p>Goal: To improve household income</p>	<p>Social Amenities and Services Pillar</p> <p>Goal: A just, all-inclusive and cohesive society enjoying equitable social development in a clean and secure environment</p>	<p>Environment, Natural Resources & Climate Change</p> <p>(underpins the three pillars)</p>	<p>Political and Governance Pillar</p> <p>Goal: A people-centred and accountable Government</p>
Country Integrated Development Plan Aims	<ul style="list-style-type: none"> • Secure land tenure and urbanization 	<ul style="list-style-type: none"> • Increased agricultural productivity, value addition and commercialization • Enhanced quality health care for all 	<ul style="list-style-type: none"> • Increased availability and access to water 	<ul style="list-style-type: none"> • Youth, women and PWD economic empowerment

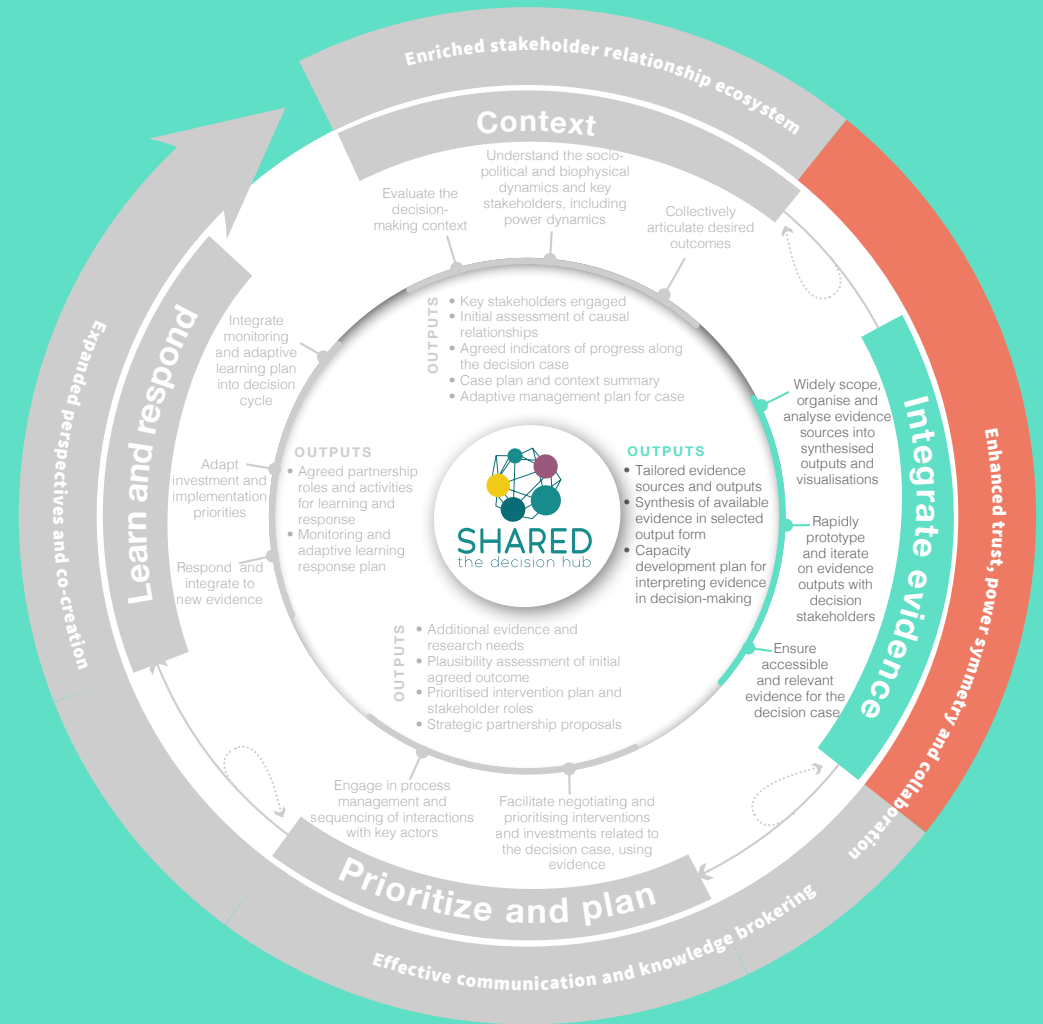
Integrate evidence

In this stage, we:

- Widely scope, organise and analyse evidence sources into synthesised outputs and visualisations
- Rapidly prototype and iterate on evidence outputs with decision stakeholders
- Ensure accessible and relevant evidence for the decision case

Outputs of this stage include:

- Tailored evidence sources and outputs
- Synthesis of available evidence in selected output form
- Capacity development plan for interpreting evidence in decision-making





Contextual knowledge and local evidence

Evidence can be defined as the integration of raw data constituting numbers, words, images and insights emerging from diverse knowledge sources. A key aspect of this exercise is to capture indigenous knowledge, local perspectives and appropriate language and definitions for a concept.



Stakeholder explanations and definitions of land restoration

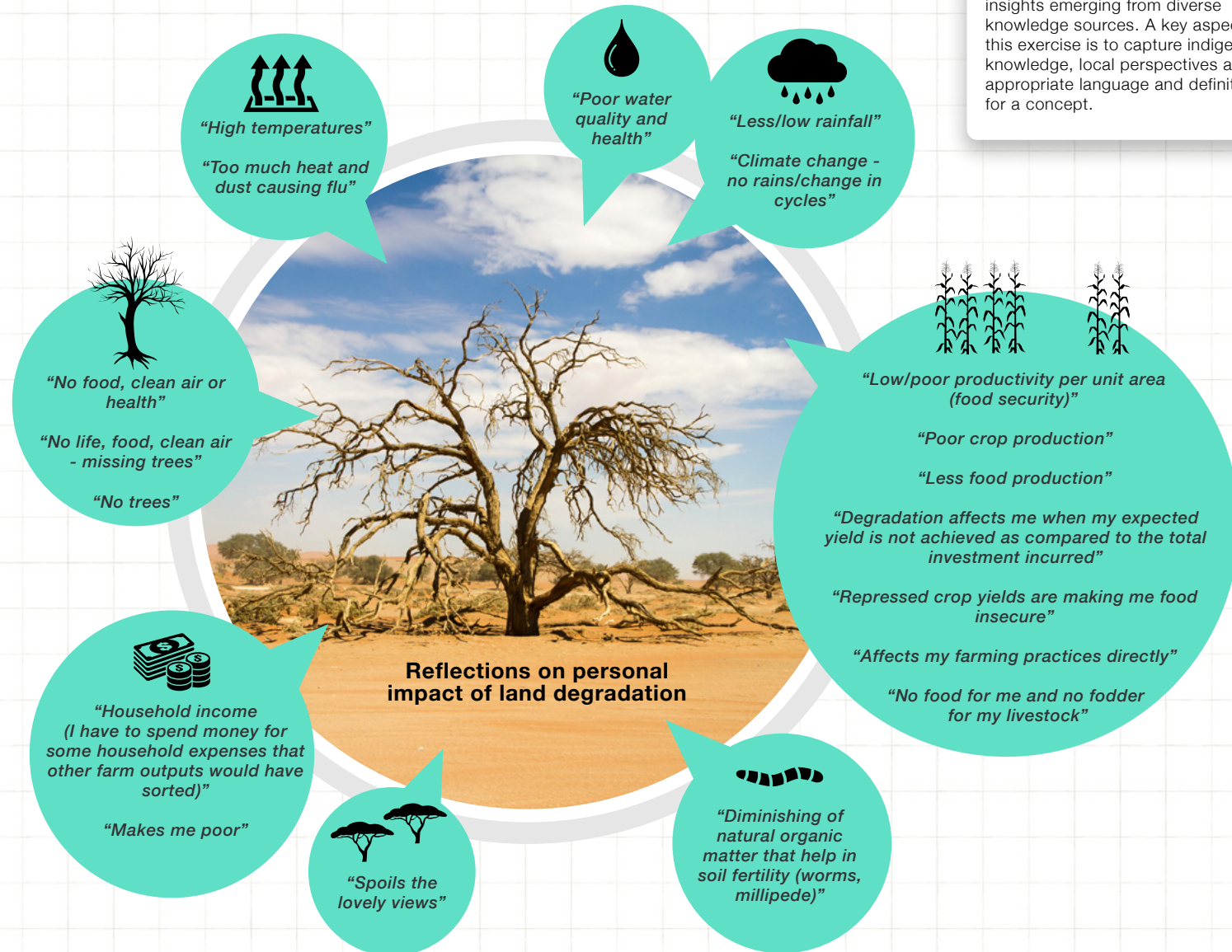
"Bringing land back into productive use (rehabilitation) that is land that is currently not into productive use."

"Taking land into its natural condition."

"Taking the initiative of putting into good use a previously unproductive piece of land."

"The process of making the land productive for agriculture, human use, forestry, pasture (animals), etc."

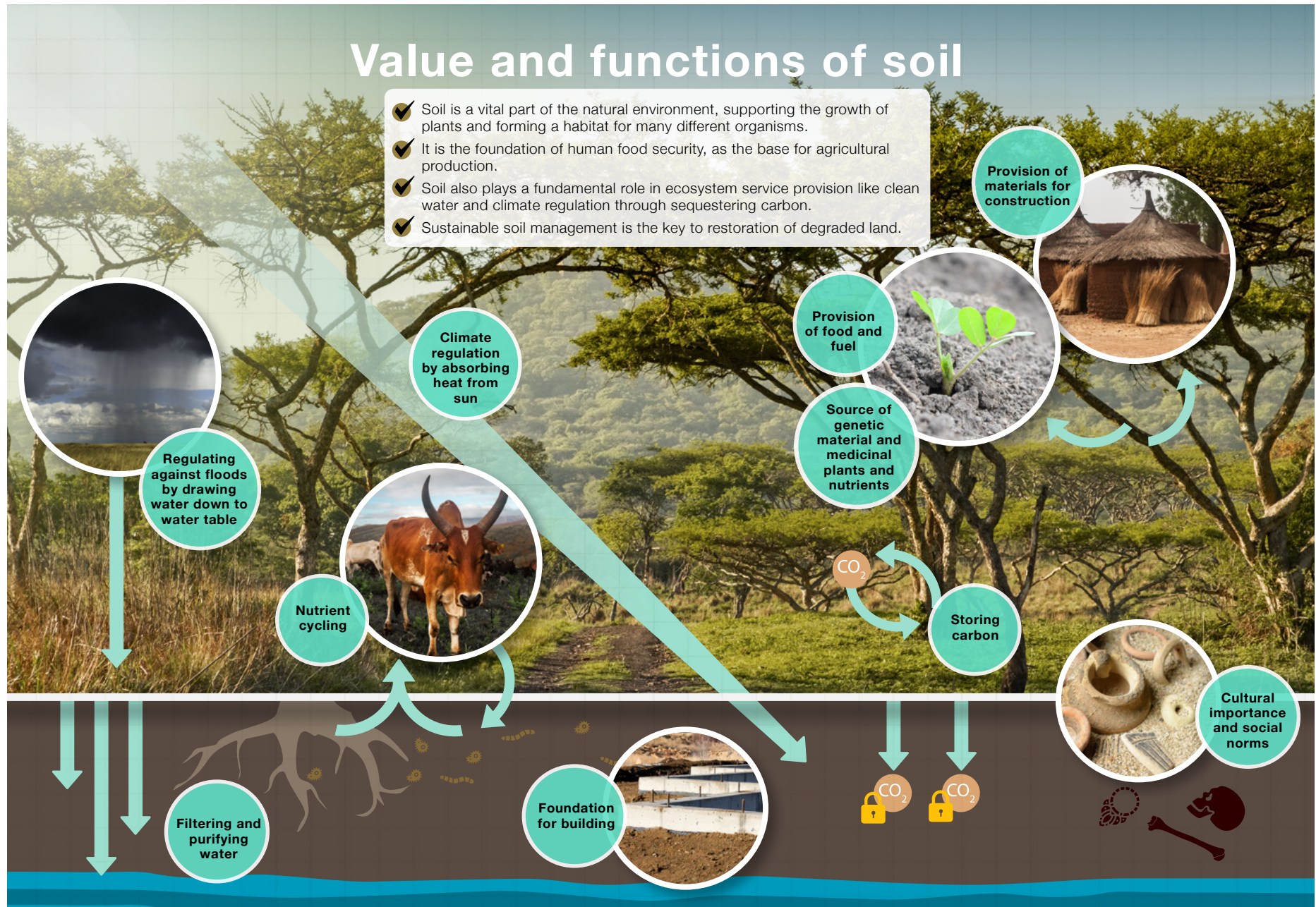
"Bringing degraded land back to perform its normal functions - making it healthy."





Accessing scientific evidence

Sequenced scientific information and research results are conveyed in user friendly and appropriate visual formats, to allow for easy interpretation and use of information by target users.



Land degradation



Healthy soil

- Contains **plant residue** that helps retain moisture and prevent erosion
- Contains **diversity of soil organisms**, including microorganisms, fungi and macroinvertebrates such as earthworms.
- Can **support** healthy rangelands, forests and productive agriculture
- Efficient **nutrient and water cycling**

Building rich, diverse and healthy soil ecosystems is a critical farming practice. Without it, soils become degraded and unproductive.



Unhealthy soil

- Bare soil without any residue or cover crops, that is **unprotected** from the elements and leads to water runoff
- **Unable** to sustain **productivity**
- **Compacted** and leading to further erosion
- **Low water holding capacity**
- **Low soil organic carbon**

Types of soil degradation



CHEMICAL

Includes soil acidification, sodification, or nutrient deficiencies



PHYSICAL

Includes soil erosion, soil compaction and water logging



BIOLOGICAL

Includes low diversity of soil microorganisms or macroinvertebrates

Causes of land degradation



Urban sprawl and commercial development



Quarrying of stone, sand, ore and minerals



Land clearance, such as clearcutting and deforestation



Bare soil exposed to wind and water erosion



Agricultural depletion of soil nutrients through poor farming practices



Spread of invasive species



Lack of soil and water conservation measures



Unsustainable agricultural practices



Overgrazing

Consequences of land degradation



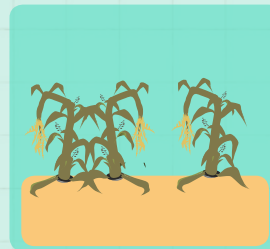
Water scarcity, food and nutrition insecurity



Unable to respond to a changing climate



Poverty, social insecurity, migration



Reduction of ecosystem services

Examples of land degradation



Biodiversity loss



Erosion



Encroachment of invasive and/or alien species



Low agricultural or rangeland productivity



Pollution



Salinisation and sodification



Compaction



Acidification



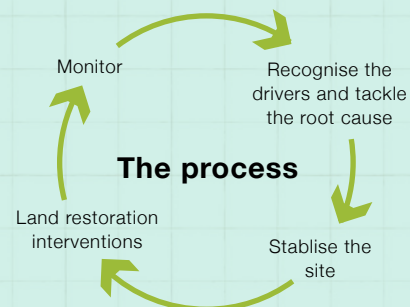
Loss of organic carbon

There are many pathways for restoring degraded land. What is urgently needed are locally relevant restoration options that will work for different people in different places.

Land restoration

Landscape restoration is a planned process that aims to regain the functioning of the landscape and soil and enhance human well-being. Land restoration and avoiding further degradation can be a key pathway to achieving food security and exiting poverty for some of the most vulnerable people living in drylands.

Achieving the UN's Sustainable Development Goals requires that successful restoration efforts reach larger numbers of farmers and hectares over the coming decade. Soil restoration can simultaneously increase food production, reduce greenhouse gas emissions by capturing carbon, and help communities adapt to climate change. Noting that SDG 15 (Life on Land) recognizes soil as the basis of food production on land, one participant said maintaining soil carbon is "an important strategy for a well-functioning soil ecosystem".



Sustainable soil management:

- ✓ Increase investment in sustainable soil management
- ✓ Establish soil information systems
- ✓ Analyse and assess soil condition
- ✓ Implement land use planning
- ✓ Restore/rehabilitate degraded soils
- ✓ Keep soil surface covered
- ✓ Use nutrients wisely
- ✓ Minimum tillage
- ✓ Crop rotation
- ✓ Appropriate waste disposal
- ✓ Waste water management
- ✓ Reduce erosion

Agroforestry: Establishing and managing trees on active agricultural land either through active planting or regeneration.

Crop selection: Selecting crops that don't leave the soil bare between harvesting periods. More effective crops to address soil erosion are perennial crops.

Crop rotation: Growing different types across and within seasons reduced risk from pests and diseases and improves soil structure and fertility - especially differentiating between deep and shallow rooted crops.

Zai Pits: The 2 feet by 2 feet square and 1 foot deep pits are often lined with mulch at the bottom and topsoil mixed with manure to conserve nutrients and reduce soil erosion. This is particularly effective in very dry areas.

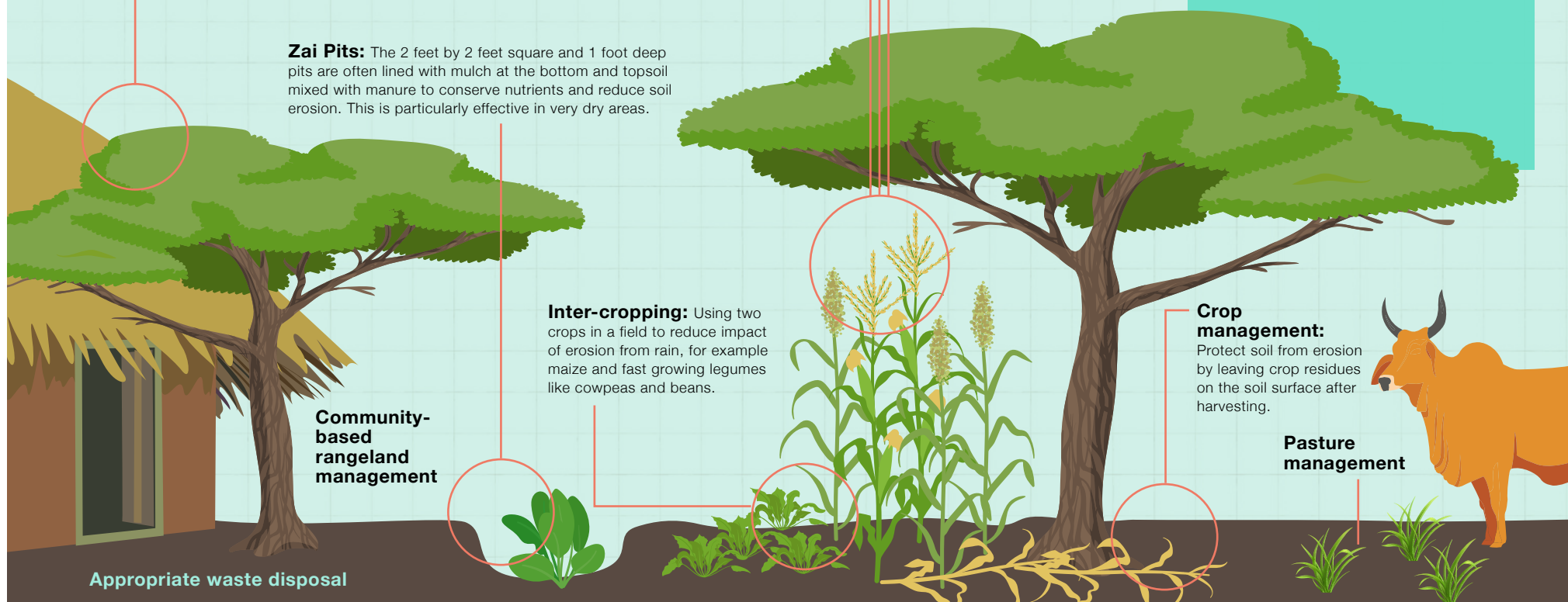
Inter-cropping: Using two crops in a field to reduce impact of erosion from rain, for example maize and fast growing legumes like cowpeas and beans.

Crop management: Protect soil from erosion by leaving crop residues on the soil surface after harvesting.

Pasture management

Community-based rangeland management

Appropriate waste disposal





Evidence walls

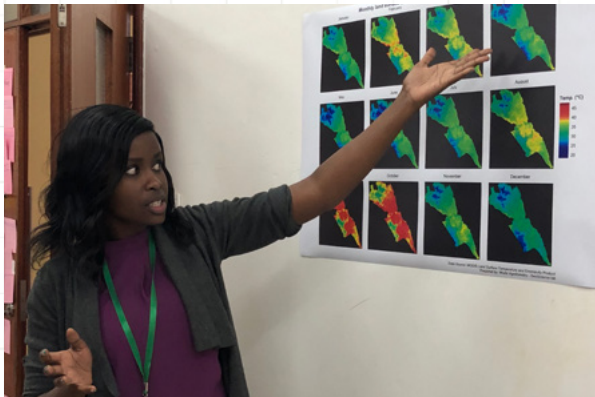
A range of current data and evidence on Makueni County was presented to allow for the interrogation of existing evidence.

Presenting visual evidence, for example graphs, maps, photographs in an organised and sequenced format on a wall with stakeholders standing allows for an interactive interrogation of information.

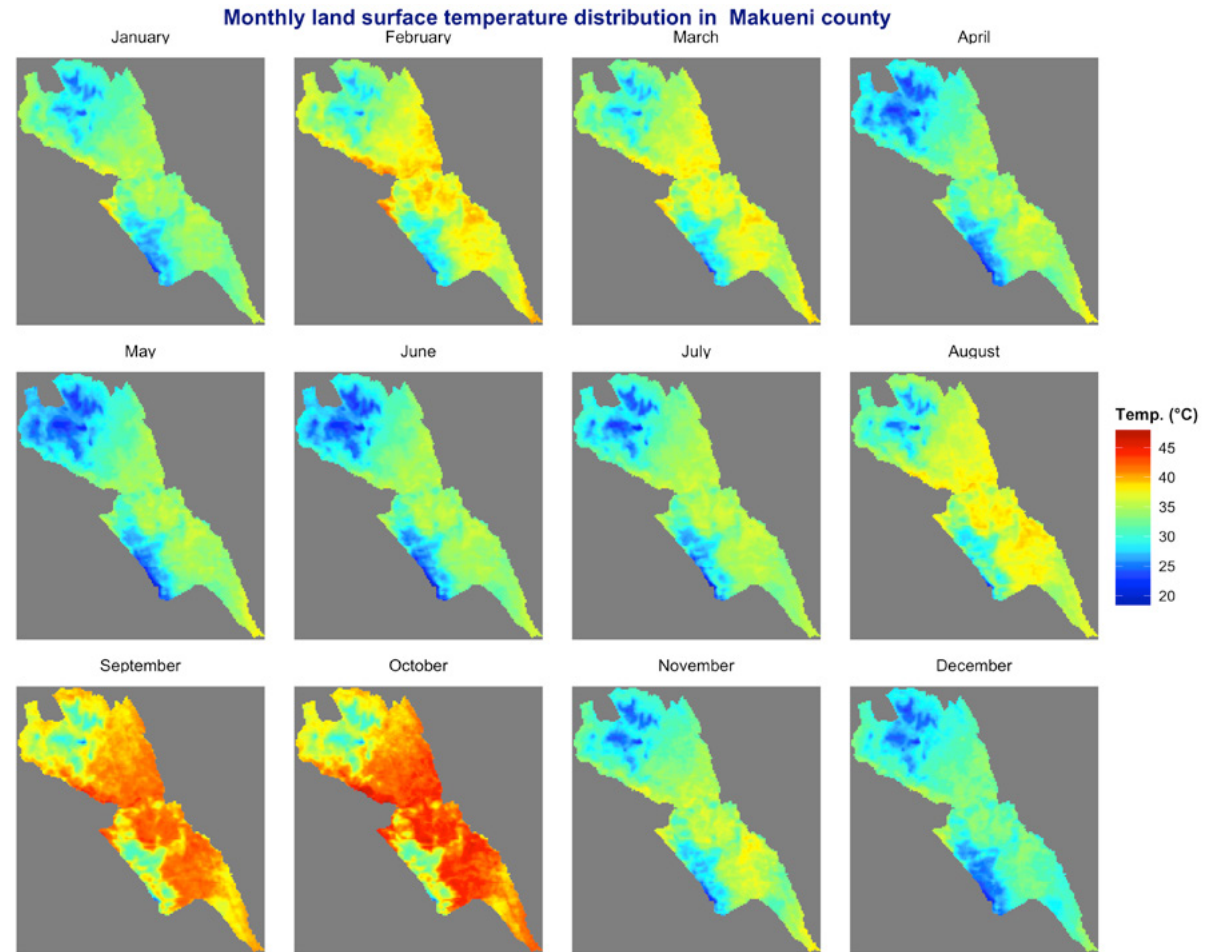


1 Land Surface Temperature Map

Presentations highlighted the hottest months (August, September and October) and the coldest (May and June) according to satellite imagery.

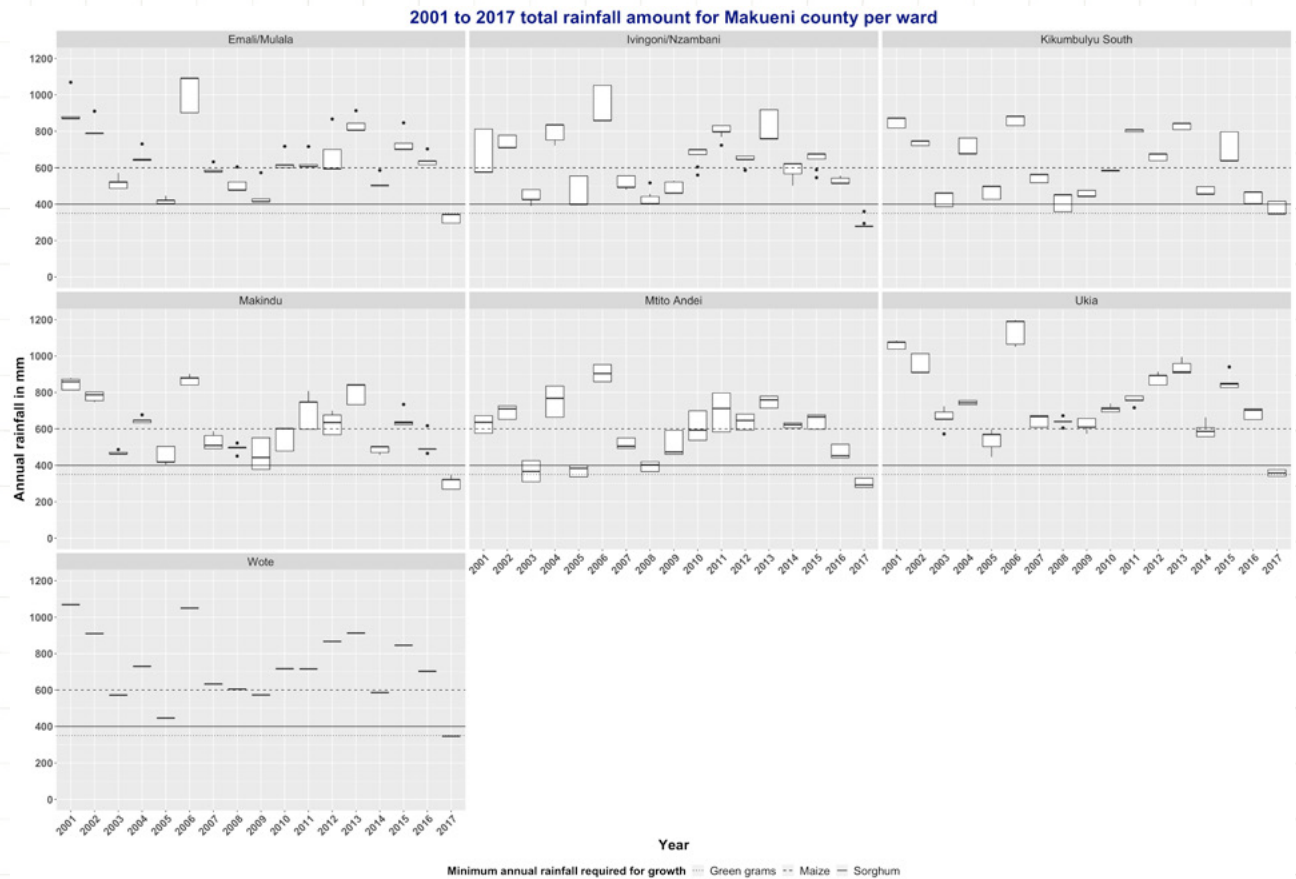
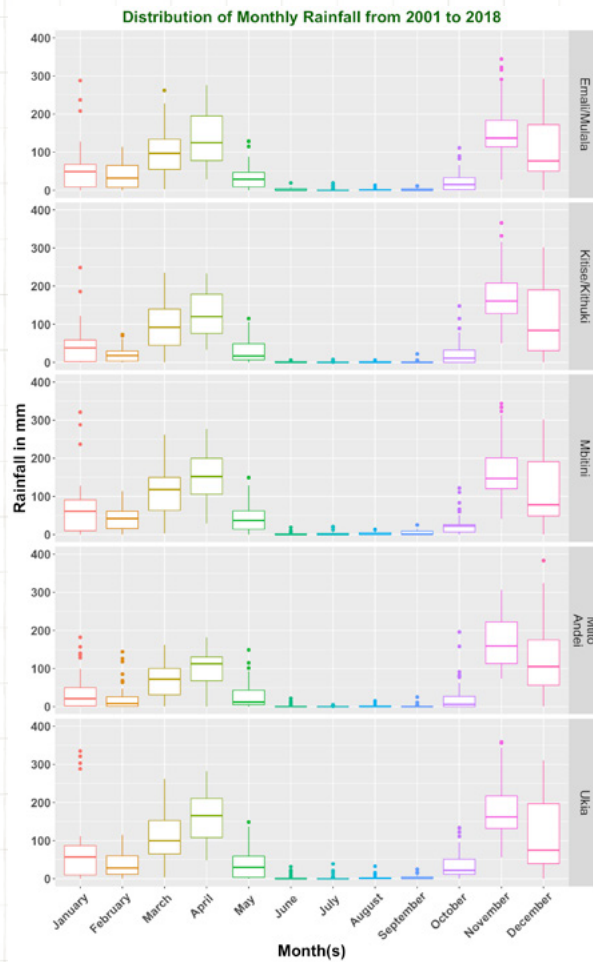


ABOVE. Faith Musili from the ICRAF Geoscience Lab explains the land surface temperature maps to participants



2 Annual rainfall amounts

Data from 2001 to 2017 for five wards (picked at random) were visualized using boxplots. Boxplots of the five wards were explained with the maximum monthly temperature required for maize, green grams and sorghum growth included.



3 Exploring gender related impacts from land degradation

Given their different roles, responsibilities, access to and control of resources, the costs and benefits of land restoration are likely to differ for men and women. Assessing the opportunities and risks that restoration presents for both men and women is thus key to the design of equitable and sustainable restoration initiatives. Yet many restoration projects fail to consider gender dimensions when designing their interventions.

With this evidence wall, Leigh Winowiecki, ICRAF soil scientist, presented initial findings from a gender assessment of land restoration practices conducted in Kalawa and Mtito Andei in Makueni County. Project data was analysed on the basis of gender to help understand gender roles and dynamics in land restoration.

Project background

The World Agroforestry-led project entitled 'Restoration of degraded land for food security and poverty reduction in East Africa and the Sahel: Taking successes in land restoration to scale', is an IFAD/EC funded initiative aimed at developing innovative ways to achieve the scaling of land restoration through embedding research in development. In Makueni County the project is working with over 600 farmers to implement on-farm comparisons of various land restoration options, including different tree planting practices and the use of planting basins. Almost 80% of project farmers in Makueni are women.

Shifting labour patterns

Planting basins may alter the traditional division of labour between men and women, with respect to land preparation. Monitoring the planting basins revealed a higher incidence of female-only labour for digging basins compared to normal planting practices, particularly in Mtito Andei (below left). This may be due to the higher incidence of male migration in Mtito Andei compared to Kalawa, meaning that men are less available to dig basins during the dry season.

Impacts on other activities

This potential shift in labour for land preparation presents both opportunities and risks for women. While basins increase the time taken to prep land and can limit the ability to carry out other tasks, such as collecting water, farmers reported weeding basins takes significantly less time than their normal planting practices – an activity carried out predominately by women. While 64% of women reported basins increased the time taken to prep land, 55% reported they had no effect or reduced the total time they spend farming (below right). Use of basins can also increase women's autonomy to carry out farming activities that previously required male assistance (e.g., ploughing).



FAR LEFT. Comparison of men and women's involvement in land preparation using basins and farmers' usual planting practices (e.g. ploughing).

LEFT. Comparison of the impact of basins on time taken to prepare land and the overall amount of time that men and women spend on the farm.

Land restoration amid male out-migration

Survey data on migration confirms Mtito Andei has a slightly higher percentage of households with short-term migrants compared to Kalawa (right). Most of these short-term migrants are men working in urban areas such as Nairobi and Mombasa, and often the household head. Only 10% of households in Kalawa reported not having enough labour while migrants are away, compared to 69% of household in Mtito. A similar pattern is seen for whether households with migrants have sufficient skills and knowledge to manage the farm. Since land restoration is often labour and knowledge intensive such trends may challenge restoration efforts in Mtito Andei.

Changes in decision-making

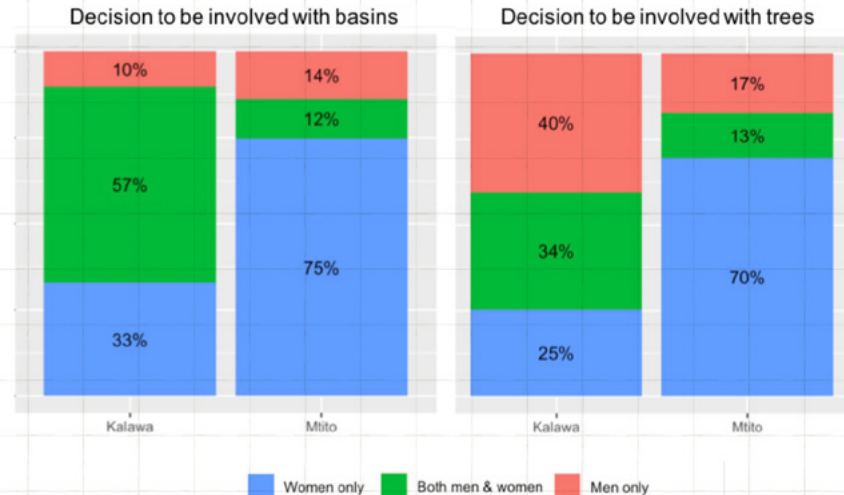
Decision-making dynamics are changing. In group discussions female farmers reported increased participation in decision-making compared to five years ago, due to increased awareness of gender equality and women's participation in agricultural projects. As reflected in Figure 4 and the higher rates of migration in Mtito, the short-term migration of men for work was also reported to have increased women's participation in farming decisions. We also see that decisions over planting trees are more male-dominated than for basins, especially in Kalawa. This may reflect gendered interests and roles, with women being responsible for food for household use (i.e. maize from basins), and men with income (i.e., sale of fruits from trees).



Key messages

- Variation of practice uptake and time taken to prepare land for women, men and both men and women
- Different yields harvested by the farmers at different times of the year in the project cycle. The data was visualized using ridge plots which not only show the peaks but also the distribution.
- The process of establishing the zai pits and the increase in yields experienced in Makueni County were explained.

Do any household members leave for some months of the year to earn cash? Does your household have enough labour to manage the farm while these members are away?



TOP. Comparison between project sites of the percentage of households with short-term migrants and, for those with migrants, whether their household has enough labour to manage the farm productively when these members are away.

ABOVE. Comparison of who was involved in the decision to take up the practice between tree planting and basins and by project site.

4 Tree survival data

There have been several challenges in tree planting in the eastern drylands of Kenya, specially characterized by low seedling survival. This is partly due to erratic rainfall, planting of ecologically-unsuitable tree species, poor quality seedlings, and poor tree seedling management practices. Tree (re) establishment in landscapes is a key approach to land restoration. However, low survival rates, especially of tree species highly valued by farmers, has remained a major bottleneck in the drylands. Understanding which trees farmers prefer, and what determines tree survival, as well as enhancing farmer knowledge of tree management is key to scaling up land restoration.

This evidence wall presented data on various tree species survival, showing an average 50% tree survival rate in Makueni County. Pawpaw exhibited a 100% survival rate and mango 60%, among others. Stakeholders responded to the data commenting that manure, rainfall and adaptation are needed for tree survival within a household.



Project background

To support farmer learning on tree seedling survival, 1600 farmers in Kitui, Machakos and Makueni counties in Kenya conducted on-farm planned comparisons to explore the performance of different planting and management practices on survival.

Planned comparisons are an innovative way of embedding research into development by reaching a large number of farmers and ensuring high participation as options are tested with farmers, in farmers' fields. Planned comparisons aim to answer key research questions around which options work where, for whom, and facilitate rapid learning by generating good data, assessing heterogeneity and taking innovations to scale. Options compared by farmers included tree species, hole size, manure application, mulch application and watering. The context compared included farm size, planting niche and soil health status.

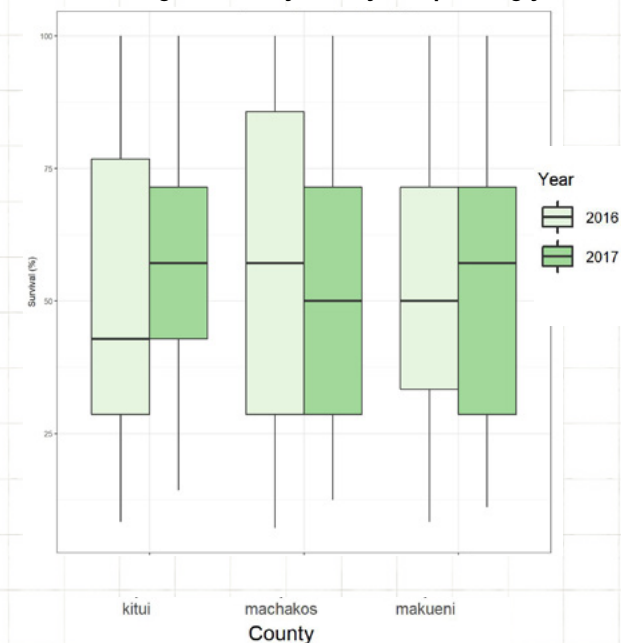
Implementing partners within the Drylands Development Programme distributed seedlings of 6 tree species in November 2016 (n=14,836) and 7 species in November 2017 (n=18,106). Farmers planted between 7 and 21 seedlings on their farm, testing various management options. Survival was monitored 6 months after planting using electronic data entry. Data was analysed using R statistical software and STATA.

Monitoring the performance of options was complemented by feedback from farmers through Community of Practice (CoP) workshops. The farmers' CoP is part of the nested CoPs on restoration of degraded lands that aim to foster relationships, develop learning situated in practice and share knowledge on how to restore degraded lands.

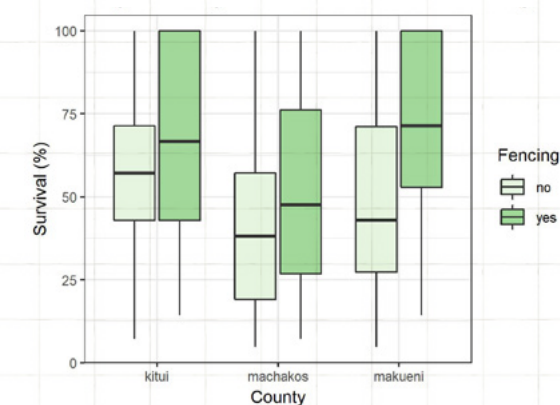
Results

Tree seedlings planted with manure had a higher survival compared to those planted without manure. However, differences were observed within species and across counties and planting years. Mulching resulted in increased seedling survival in Kitui and Makueni while in Machakos, there was no variation in the survival, with or without mulching.

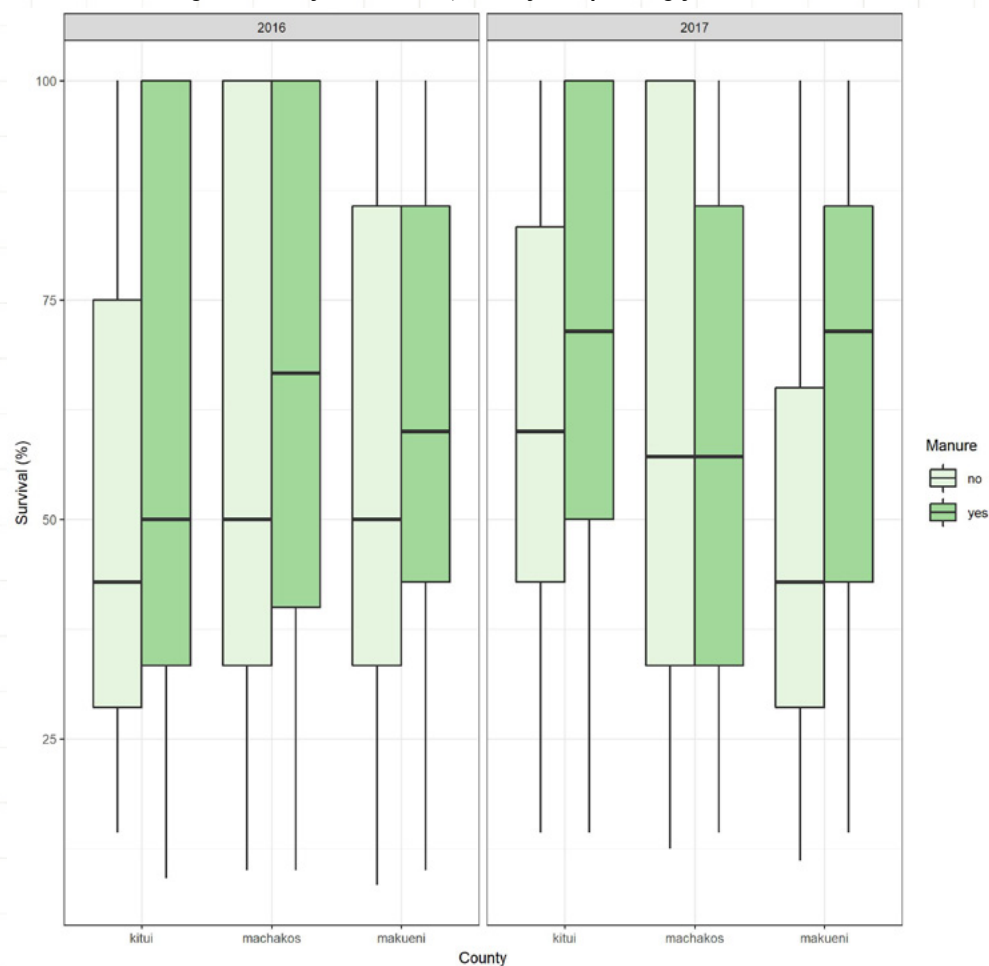
Tree seedling survival by county and planting year



Percentage seedling survival with and without fencing



Tree seedling survival by manure use, County and planting year



RIGHT. The boxplots show the variation in survival by species and county for seedlings planted in 2017. The black horizontal line is the median survival rate. The length of the green box illustrates the variation in survival rate for each species. For example, Mango had a median of 50% survival in Kitui County, ~27% survival in Machakos and >55% survival in Makueni. Moringa had a higher survival rate in Kitui (~65%) compared to Makueni (>38%).

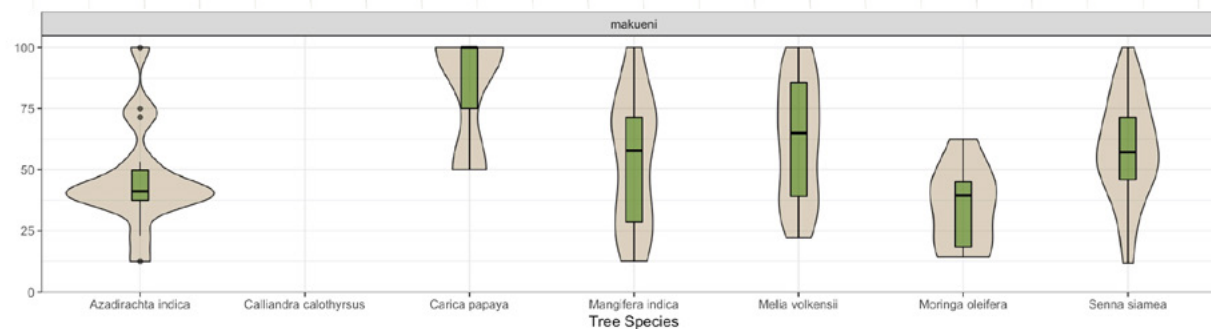


Survival was better for tree seedlings planted in 2017 compared to those planted in 2016 with variation across the counties (20% increase in Kitui, 4% in Makueni and 4% in Machakos). During CoP workshops, farmers explained that this was partly due to increased rainfall during the 2017 planting and improved farmer management of the seedlings due to practices learned during training workshops. Farmers also reported a change in perception on ownership of the tree seedlings.

Of the seven tree species, *Moringa oleifera* seedlings had the highest survival rate in Kitui while *Carica papaya* and *Senna siamea* had the highest survival rate in Machakos and Makueni, respectively.

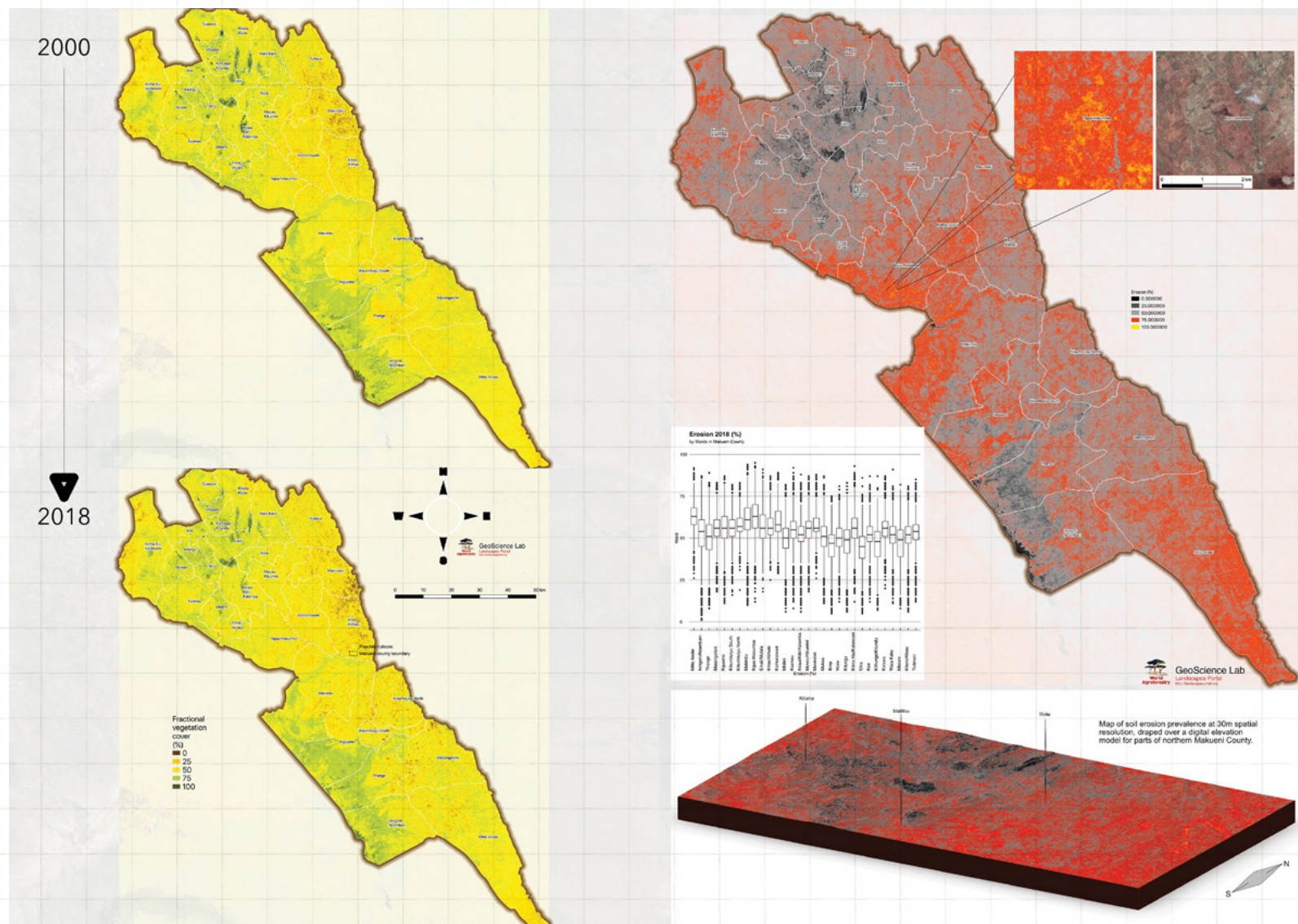
Lessons learned

Tree planting can have an important positive influence on environmental, social and economic realities of farmers. To scale up successful tree planting efforts, continued training on tree and nursery management for all stakeholders is necessary and beneficial. Moreover, planned comparisons have fostered farmer learning, resulting in farmers' willingness to innovate and experiment to identify options that work best for them. For example, farmers have been modifying the planting hole size from what was defined in the protocol, with varying results across species and counties.



5 Land health

Tor Vågen, a geoinformatics senior scientist and head of the Geoscience Lab at ICRAF explained the maps to County stakeholders. Maps of fractional vegetation cover were generated from Landsat 5, 7 and 8 satellite imagery and presented for the years 2000 and 2018, as shown on the right. Vegetation cover trends going back to 1990 were also shown as part of the workshop and used in the discussion of the changes that can be observed in these maps. Maps of land degradation and soil properties were produced and presented for 2018 at a spatial scale of 30m on the ground, based on a combination of Land Degradation Surveillance Framework (LDSF) field and laboratory data and Landsat 8 satellite imagery. These maps allow users to track changes over time and identify hotspot areas of degradation for prioritizing interventions. For example, areas around Nguu Masumba ward and Mito Andei ward had the highest erosion as per the 2018 map.



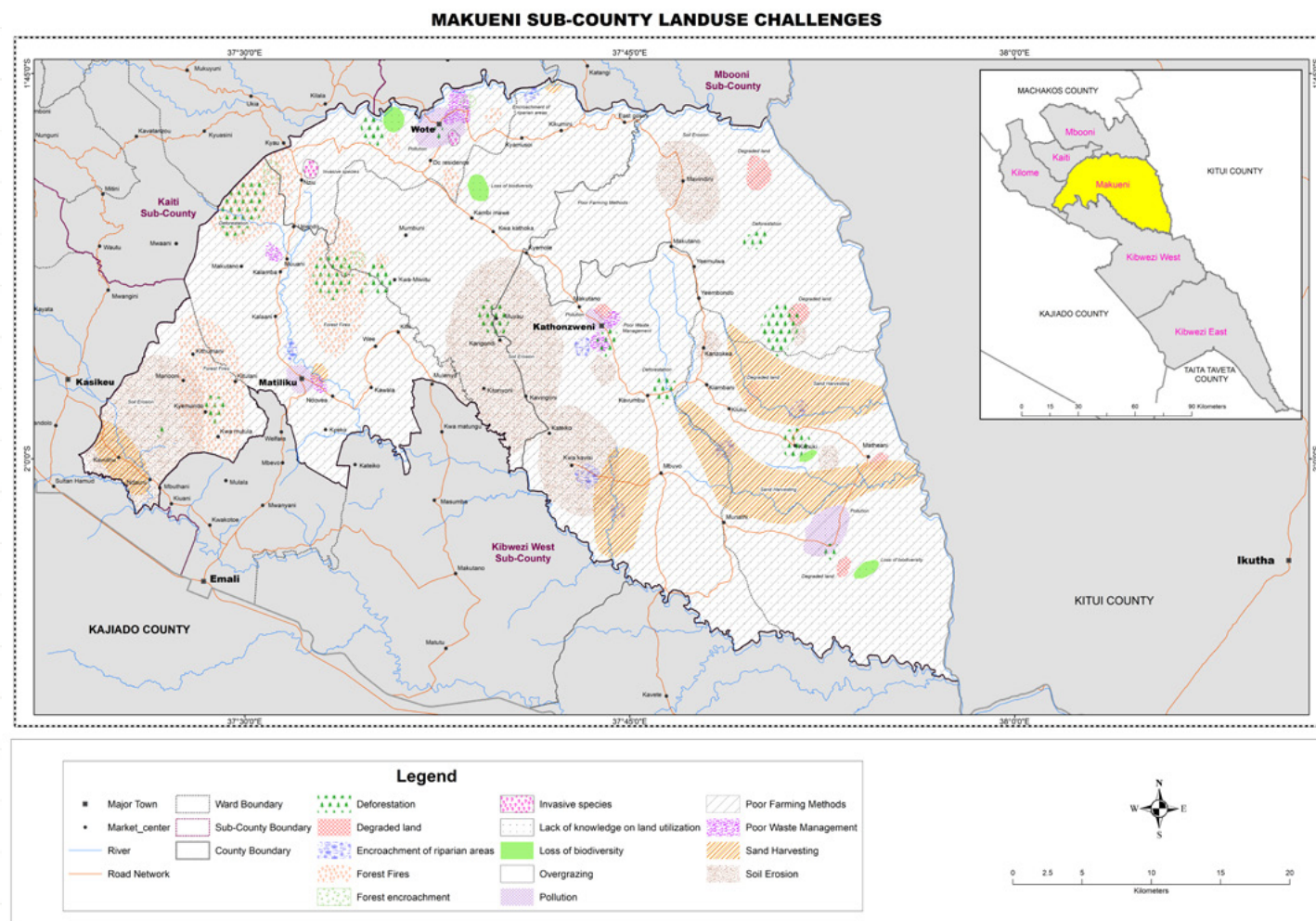


6 Land use

Benson Mutuku, principal GIS officer from Makueni County, explained the maps generated from a participatory sub-county land use challenges exercise. It involved the public drawing the challenges in their areas. The county government is currently in the process of comparing the maps with satellite modelled imagery for planning and way forward. The exercise was in collaboration with CIAT.

Key findings

According to the results, Nziu in Wote sub-county had the highest land degradation rate due to deforestation.





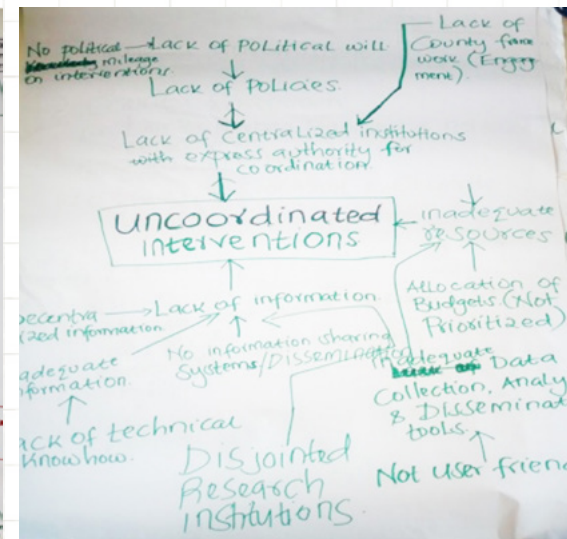
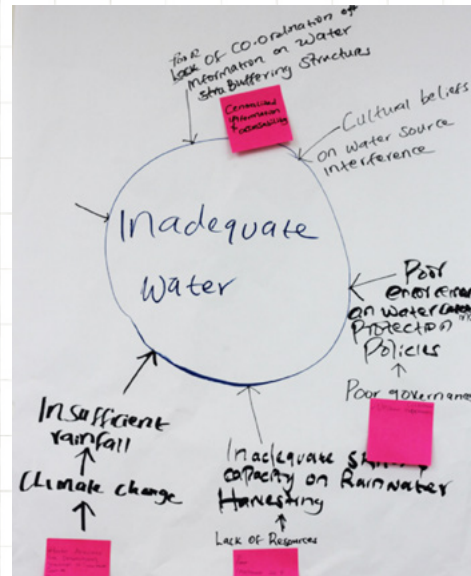
Root cause analysis

Groups completed root cause analyses choosing a key challenge that they felt was important. Once the causal maps were developed, groups identified the necessary stakeholders required to overcome the root causes, and reported on the risks associated with not addressing underlying causes. Root causes, stakeholders and discussion points from each group are outlined in the following pages.

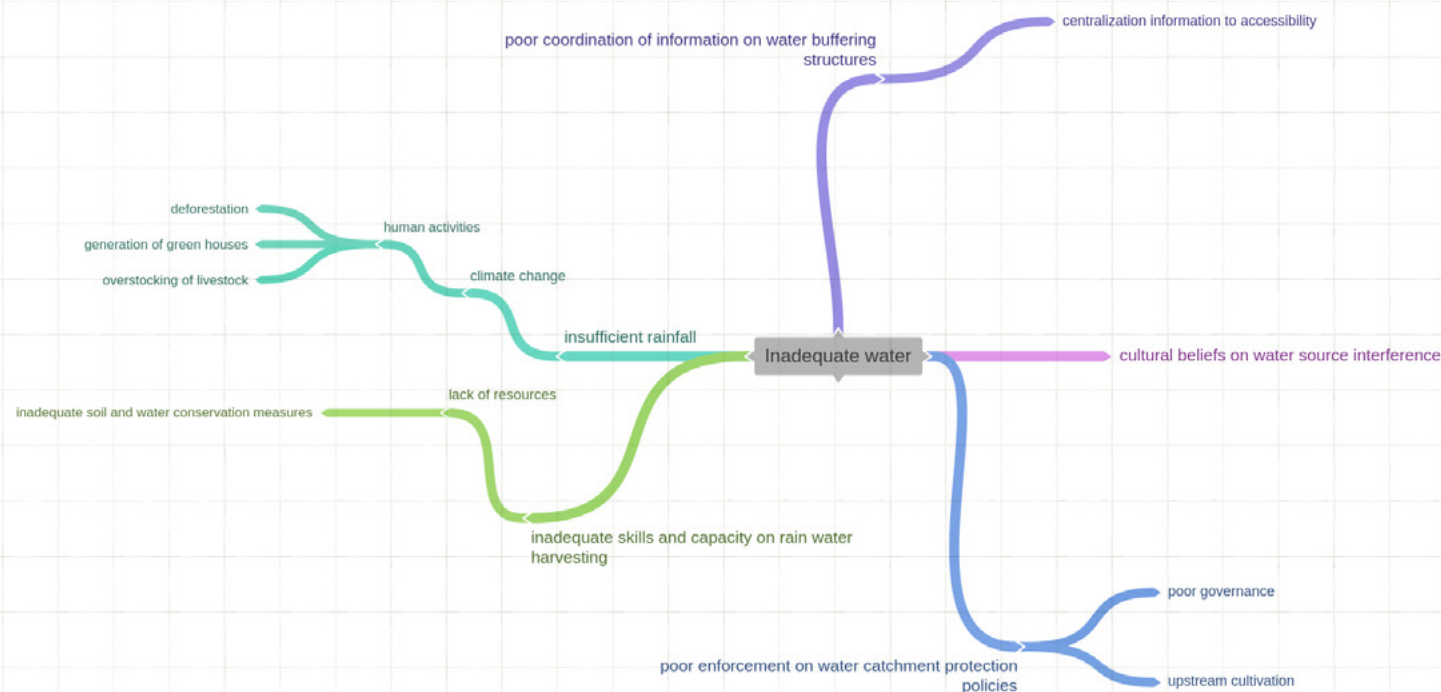
Identified challenges to restoring degraded land in Makueni County and their root causes

- Inadequate water
- Lack of sensitization and creating awareness and ownership
- Inadequate knowledge on how to restore land (technologies)
- Change of attitude (mind set) towards healthy land
- Information – not knowing areas which areas are degraded
- Inadequate resources
- Uncoordinated interventions
- Lack of government commitment to political will to restore land to its productive use – no enforcement of land use policy
- Climate change e.g. unpredictable rain patterns, temperature
- Clear and simple policies on land restoration
- Tenure system prohibitive - Land use policy – most of our land is privately owned
- Human activities

This method explores the root of a problem or issue, by using structured tools to dig and ask 'why' and issue is happening and understand this along socio-economic, cultural and behavioral, environmental and political dimensions.



Root cause analysis of inadequate water



Cultural beliefs that affect the prevention of conservation of the water catchments e.g. the elders believe that when water catchments are being conserved it's against the traditional beliefs because it disturbs their ancestors who have passed on, so they request them to offer a goat as a sacrifice to appease them before they can begin any activities to conserve the water catchments or they would be cursed.

Gender and youth considerations

Cultural beliefs that affect the prevention of conservation of the water catchments e.g. the elders believe that when water catchments are being conserved it's against the traditional beliefs because it disturbs their ancestors who have passed on, so they request them to offer a goat as a sacrifice to appease them before they can begin any activities to conserve the water catchments or they would be cursed.



They have partners with the information and data required but the challenge of coordinating the information flow.



If they continue investing without addressing the cultural beliefs then the issues of inadequate water will not be handled.

KEY:



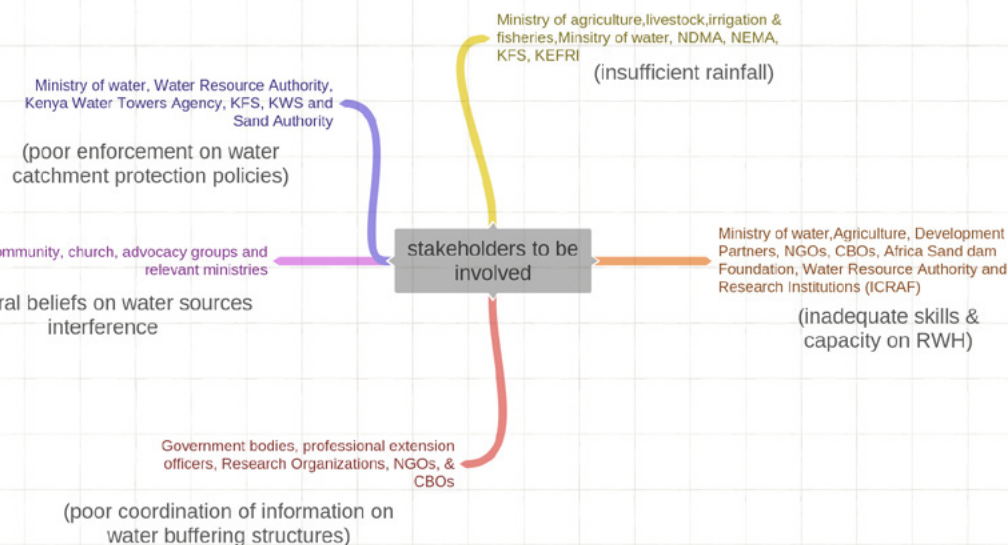
What came out that you hadn't thought of before? Was there an underlying cause that surprised you?



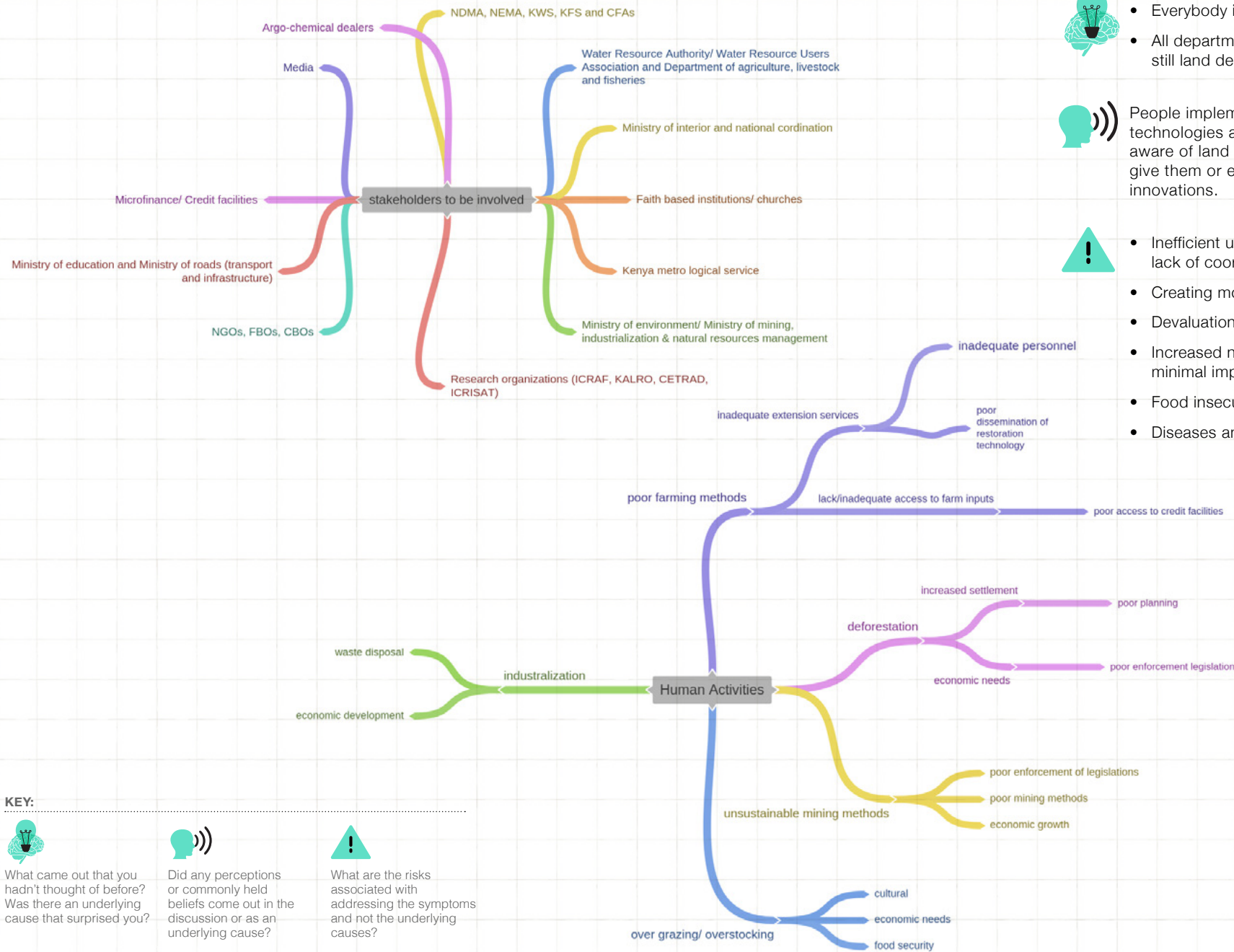
Did any perceptions or commonly held beliefs come out in the discussion or as an underlying cause?



What are the risks associated with addressing the symptoms and not the underlying causes?



Root cause analysis of human activities



- Everybody is involved
- All departments should be involved but still land degradation is occurring.



People implementing projects technologies assume that farmers are not aware of land degradation and tend to give them or encourage them to use their innovations.

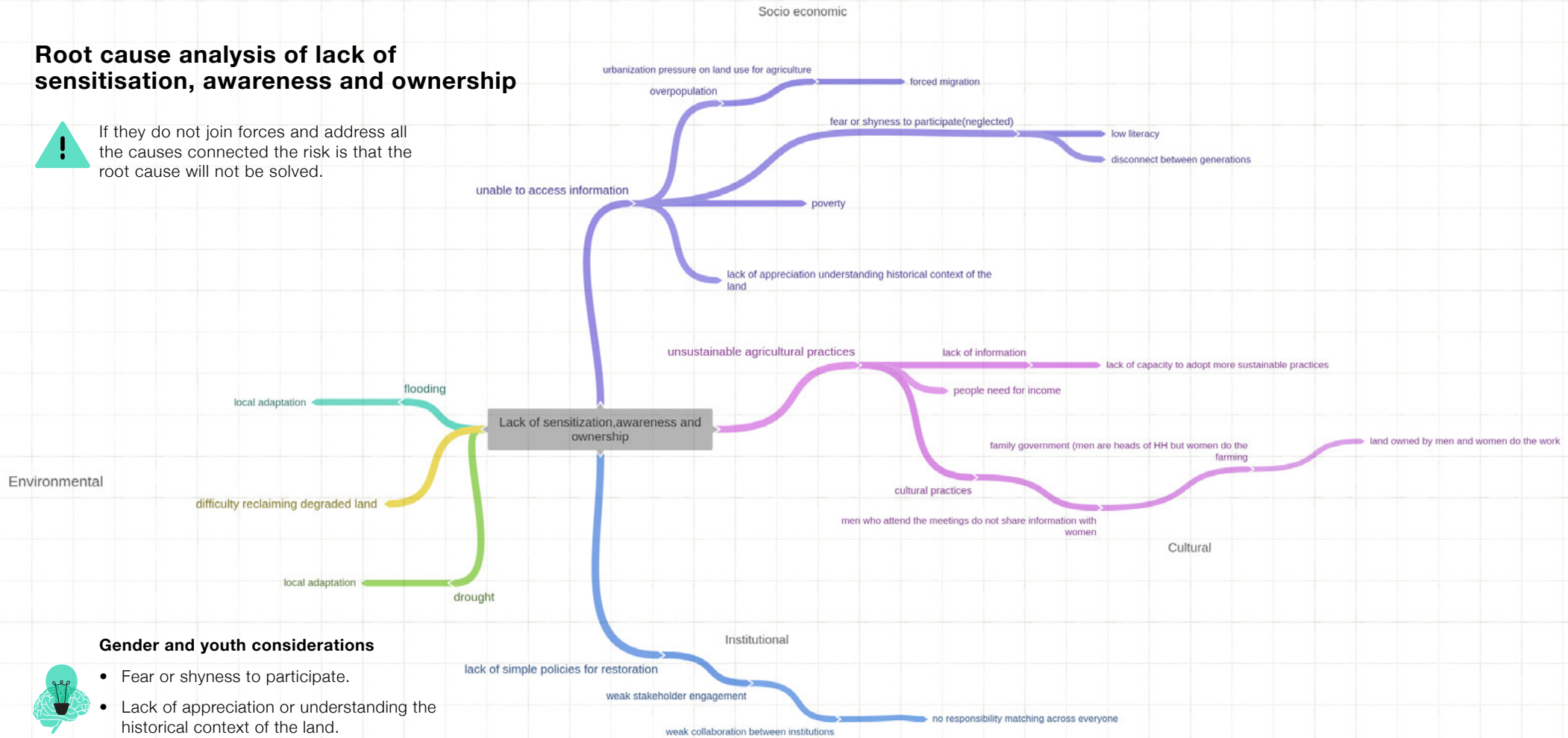


- Inefficient use of resources due to of lack of coordination
- Creating more confusion
- Devaluation of land
- Increased number of interventions but minimal impact
- Food insecurity
- Diseases and pest prevalence

Root cause analysis of lack of sensitisation, awareness and ownership



If they do not join forces and address all the causes connected the risk is that the root cause will not be solved.



Gender and youth considerations



- Fear or shyness to participate.
- Lack of appreciation or understanding the historical context of the land.
- Men who attend the meetings do not share the information with the women hence gender inequality.



- Gender and relationships, that is people empowered are not the ones who do the work.
- Gender and culture should be addressed to ensure the issue of land tenure, ownership and control of assets are addressed

KEY:



What came out that you hadn't thought of before? Was there an underlying cause that surprised you?

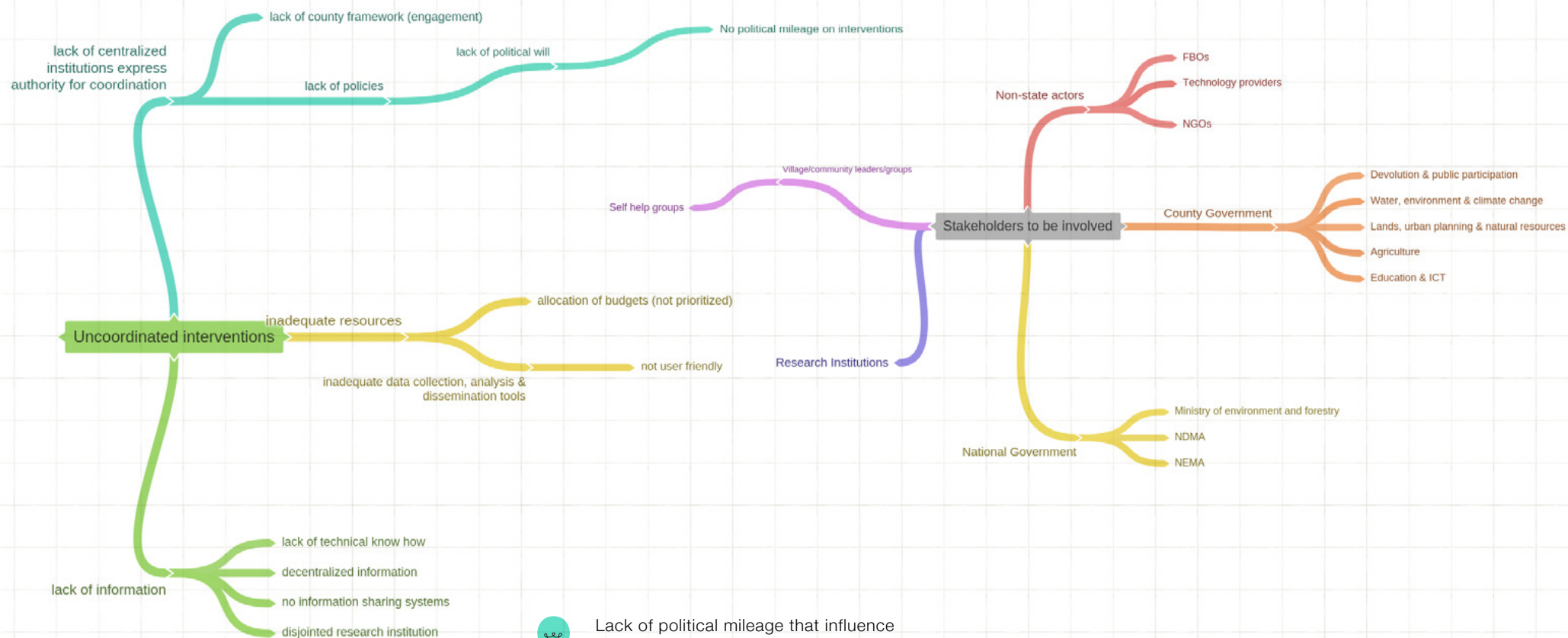


Did any perceptions or commonly held beliefs come out in the discussion or as an underlying cause?



What are the risks associated with addressing the symptoms and not the underlying causes?

Root cause analysis of uncoordinated interventions



Lack of political mileage that influence the kind of intervention because of lack of data evidence, test and analysis.



- Information is not centralized
- Avenues of prioritization
- Coordination platform of the stakeholders
- Frameworks within which the stakeholders can plug in

KEY:



What came out that you hadn't thought of before? Was there an underlying cause that surprised you?

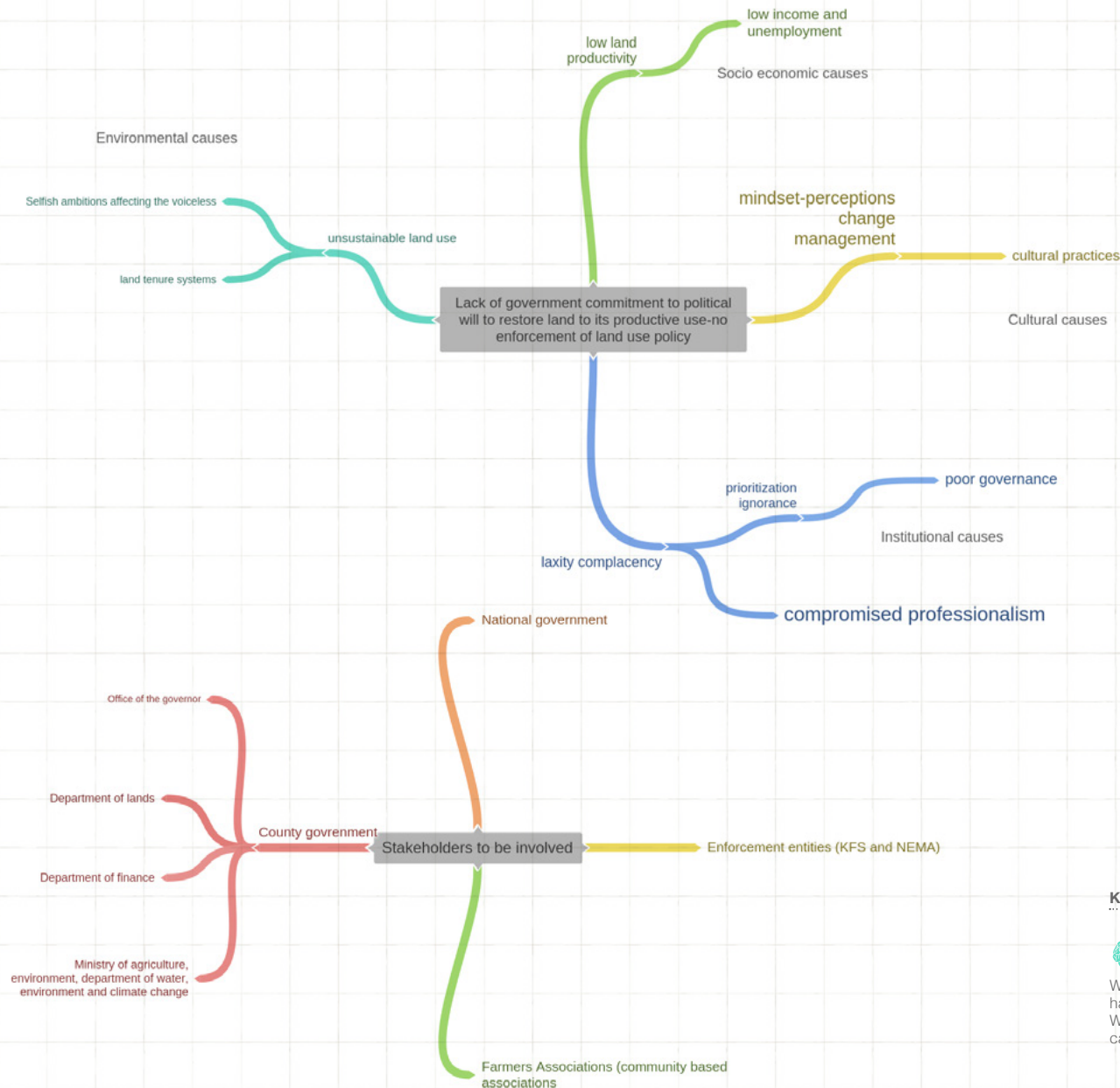


Did any perceptions or commonly held beliefs come out in the discussion or as an underlying cause?



What are the risks associated with addressing the symptoms and not the underlying causes?

Root cause analysis of lack of government commitment



- Compromised professionals, that is most of the key docket holders have no background or proper knowledge on issues to do with land restorations.
- Lack of proper need based assessment or baselines to address the key issues concerning land restoration.



Lack of continuity, for example in terms of policy and laws formulation or regulations that are shelved without ever being implemented because most of the responsible personnel are more interested in leaving a legacy.



Focus on the end results and not mitigating the key problems facing the community

KEY:



What came out that you hadn't thought of before? Was there an underlying cause that surprised you?



Did any perceptions or commonly held beliefs come out in the discussion or as an underlying cause?



What are the risks associated with addressing the symptoms and not the underlying causes?



Quality and availability of evidence

Reflecting on existing data (including the data wall, stakeholders identified where data was held, its quality and any gaps in terms of data. This was done based on key focal expertise including County Government stakeholders, NGOs and researchers.

Using stakeholder expertise in a specific area or context to identify, quantify and evaluate the existing evidence sources.



TABLE 2. Data available for Makueni County as identified by working groups

	Indicator	Data available, scale and frequency of collection	Quality of data	Contact Person
RESEARCH INSTITUTION	Cereals crops yields	Seasonal	HIGH	Grace
	Drought coping mechanism	Seasonal	MEDIUM	KALRO- Katumani
	Yields of drought tolerant crop/varieties (fertilizers use)	Seasonal	HIGH	KALRO- Katumani
	Number of farmers/groups growing indigenous fruit trees	Seasonal	HIGH	KALRO- Katumani
	Survival rates of fruit trees	Seasonal	MEDIUM	KALRO- Katumani
	Crop yields-Water harvesting technologies	Seasonal	HIGH	KALRO- Katumani
NGOs GROUP 1	Yield production in Zai pits (sampled farmers)	Different sizes of Zai pits, crop yield per Zai pits (biannual)	MEDIUM	ICRAF (Mercy Muendo)
	Water retention	Treatment	MEDIUM	
	Youth urban migration	Household survey Kaiti subcounty (Ilima ward)	HIGH	CIAT (Ravic)
	Degradation	Sites for restoration (once)	MEDIUM	WRI (Peter Ndunda)
	Tree survival	Species planted, survival rate, treatment mulching and manure (annual)	HIGH	ICRAF (Mercy Muendo)
	Household surveys (adaptation rates of technologies, farm sizes and farm practices)	Baseline-2013 and uptake surveys 2017	HIGH	ICRAF (Karl Hughes)
	Vulnerability drought assessment	Drought management 2018(Kibwezi East, Masongaleni Ward)	HIGH	Tom Nguli
	Early warning Information	Monthly	HIGH	NDMA (CDC)
	Food security	Bi-annual (long rains & short rains)	HIGH	NDMA (CDC)

	Indicator	Data available, scale and frequency of collection	Quality of data	Contact Person
NGOs GROUP 2	Household surveys	Water sources (annually)	HIGH	Dorcas (ASDF)
	Access to portable water	Twice in a year	HIGH	World Vision
	Number of boreholes drilled	Quarterly and annually	HIGH	World Vision
	Number of villages certified	Annually	HIGH	World Vision
	Number of farmers trained on smart agriculture	Quarterly and annually	HIGH	World Vision
	Number of farmers practicing smart farming	Quarterly and annually	HIGH	World Vision
	Access to food (HH)	Annually	HIGH	World Vision
	Agricultural yields and income	Targeted groups (quarterly production)	MEDIUM	MESPT (Margaret) & Kibwezi Horticulture youth group (Mambo Nzali)
	Agricultural yields (green technology uptake)	Targeted beneficiaries, volume & income (quarterly)	MEDIUM	Red Cross (Musango)
	Health (access to medical care)	General population (monthly)	MEDIUM	Bretta
	Finance (access to credit facilities)	Targeted beneficiaries (Number of farmers accessing agricultural loans)	MEDIUM	KCB (Tetheka), Juhudi Kilimo, UTS, Yehu, Equity Bank and Digifarm
COUNTY GOVERNMENT OF MAKUENI	Education Primary schools, secondary schools and TVETs	Location, number of enrollment, number of teachers, performance, number of schools	LOW MEDIUM	County officers
	Health Health facilities UHC enrollment Disease prevalence	Location, number of health facilities, reports on diseases enrollment, patient-doctor information	HIGH	County officers
	Environment/Water Boreholes Rivers Sanddams Protected areas Forests Water-piping projects	Location, number, types, names, information on beneficiaries, volume, budget, length of pipeline, water points, time of project commencement	MEDIUM	County officers
	Agriculture Livestock Mango value chain Green grams Honey development	Amount of produce, value chain actors details, productivity, margin, market access, information on types of irrigation	HIGH	County officers
	Health	Monthly (DHIS)	HIGH	CHRIO-0721469269

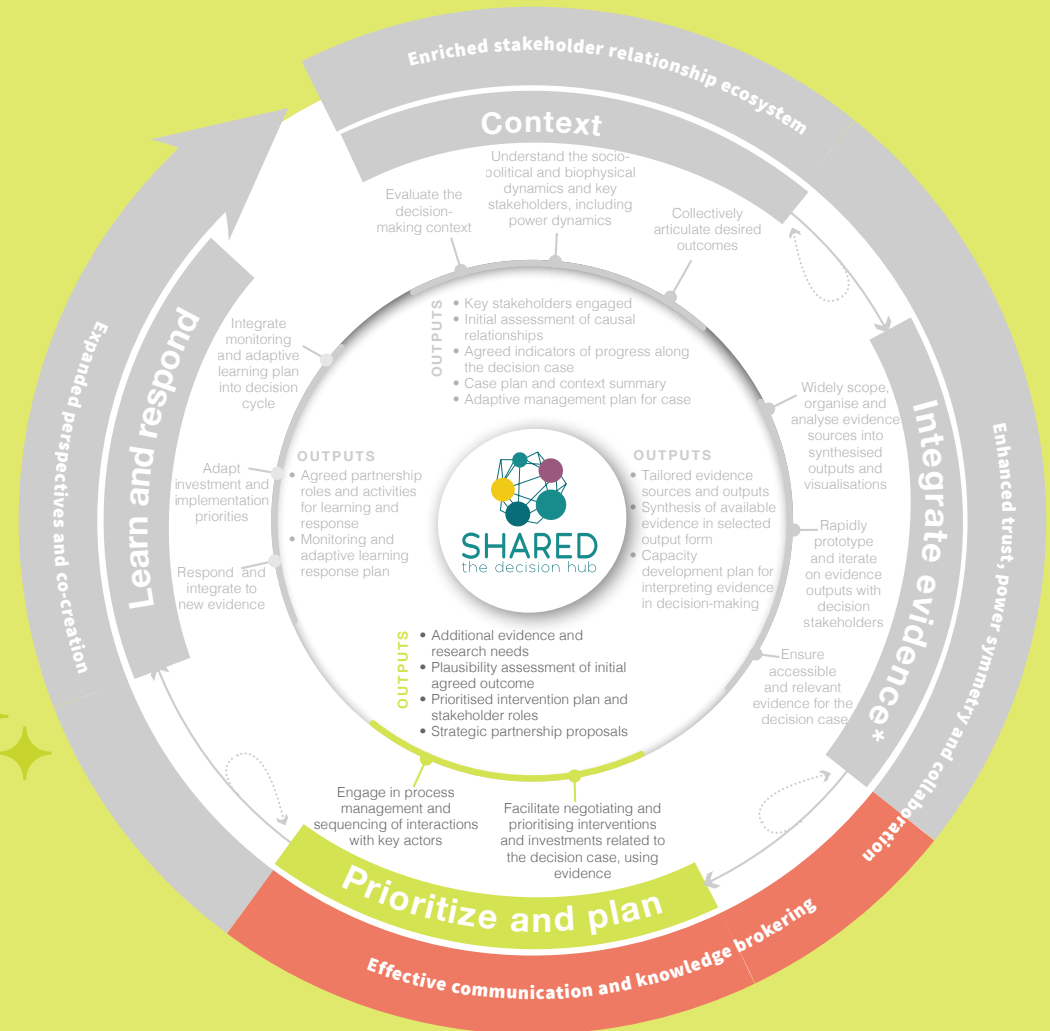
Prioritise and plan

In this stage, we:

- Engage in process management and sequencing of interactions with key actors
- Facilitate negotiating and prioritising interventions and investments related to the decision case, using evidence

Outputs of this stage include:

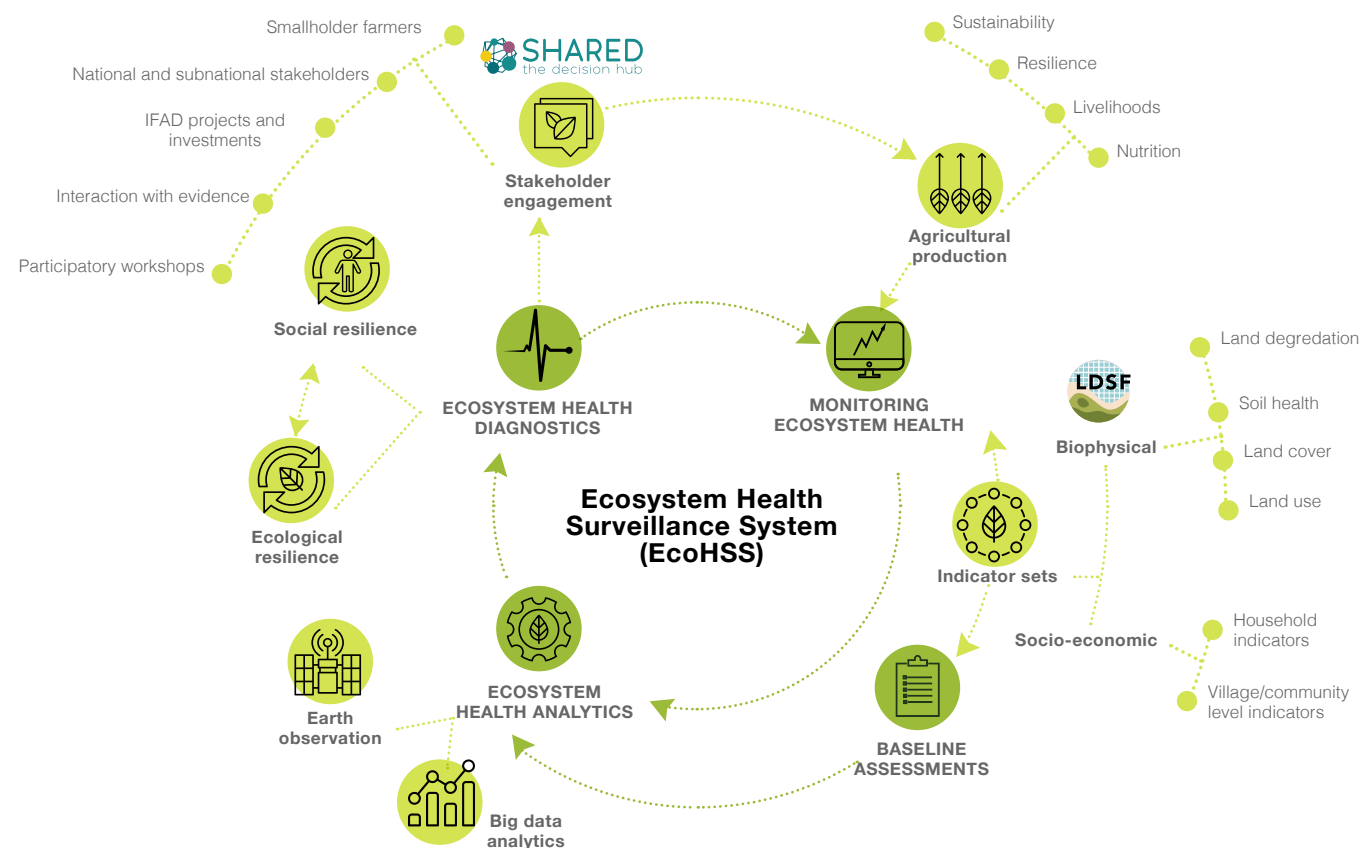
- Additional evidence and research needs
- Plausibility assessment of initial agreed outcome
- Prioritised intervention plan and stakeholder roles
- Strategic partnership proposals



Engaging with evidence on land degradation, soil health and land restoration

A key objective of the activities underway by ICRAF in partnership with Makueni County Government will be to implement a comprehensive socio-ecological assessment of land degradation status and restoration options, based on the Ecosystem Health Surveillance System (EcoHSS) framework.

The Ecosystem Health Surveillance System (EcoHSS) combines systematic indicator framework, data analytics and diagnostics at multiple scales to understand land health status, trends and drivers. This in turn allows for interventions to be designed that are both contextually and spatially explicit.



ICRAF approach – systematic assessments of land and soil health for evidence-based decision making on restoration and land management options

Earth observation has greatly evolved with increased platforms and diversified sensors for systematic assessment and mapping of land health characteristics. ICRAF senior scientists have developed and applied The **Land Degradation Surveillance Framework (LDSF)** over the past 15 years to systematically collect land health data using a robust indicator framework and consistent sampling and currently has over 250 sites globally.

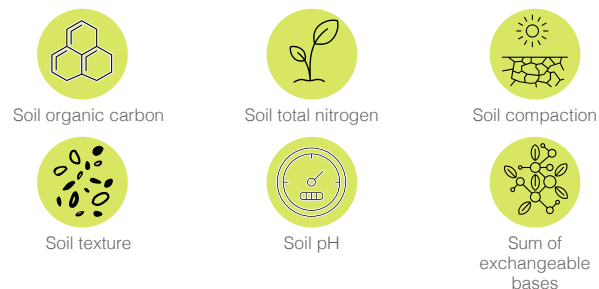
The LDSF is designed to provide **a biophysical baseline at landscape level and a monitoring and evaluation framework** for assessing processes of land degradation and the effectiveness of rehabilitation measures (recovery) over time.

Measuring land health

The LDSF forms a comprehensive method for field-based assessment of land and soil health. Land health generally refers to the degree to which the integrity of the soil, vegetation, water and air, as well as ecological processes, are balanced and sustained.

The LDSF provides a field protocol for measuring indicators of the “health” of an ecosystem including **vegetation cover, structure and floristic composition, historic land use, land degradation, soil characteristics, including soil organic carbon stocks for assessing climate change mitigation potential, and infiltration capacity**, as well as providing a monitoring framework to detect changes over time.

Indicators of soil health using the LDSF include:

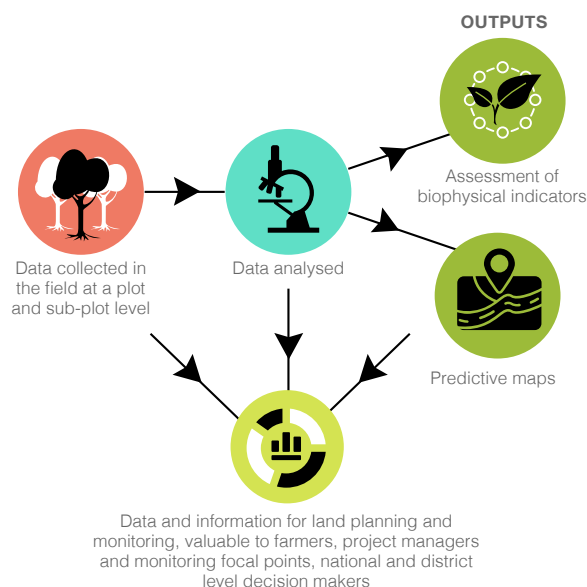


Qualities of robust indicators for assessment and monitoring of land degradation include:

- ✓ Science-based
- ✓ Readily measurable (quantifiable)
- ✓ Based on field assessment across multiple scales (plot, field, landscape, region)
- ✓ Rapid
- ✓ Representative of the complex processes of land degradation

Data collection and analysis

The process involves field data collection, soil analysis, data analytics and diagnostics and, finally, the LDSF data is used to validate models and for the generation of accurate maps.



Value of the LDSF

- Understand variability of biophysical indicators, and establish a baseline
- Monitor soil organic carbon for climate change mitigation
- Produce high quality maps of soil and land health indicators at scales relevant for stakeholders
- Target land management interventions in landscapes and monitor and assess their impacts
- Assess land management practices
- Prioritize interventions
- Enable inputs into bio-economic trade-off analysis
- Inform investments
- Improve crop/rangeland/climate models
- Provide evidence to decision and policy makers
- Communicate with local district officers and farmers

Helpful links

- ICRAF Online Data Portal <http://landscapeportal.org/>
- LDSF Field Guide <http://landscapeportal.org/blog/2015/03/25/the-land-degradation-surveillance-framework-ldsf/>

Field collection of data

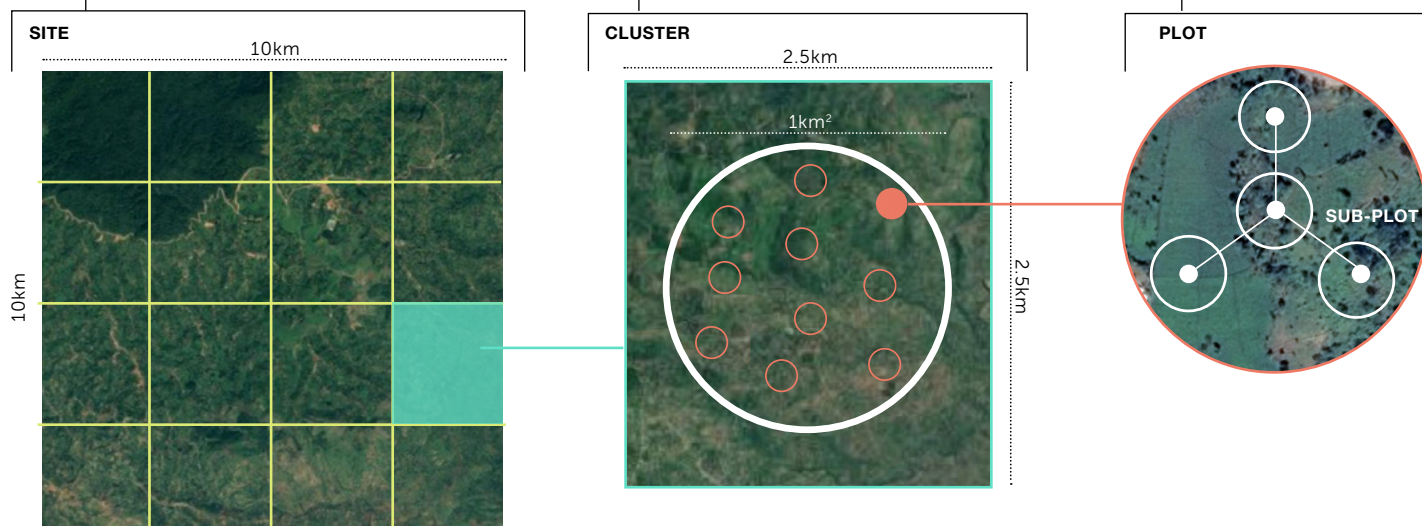
Assessing land health in landscapes using multiple indicators at the same time (e.g. land use, land cover, soil properties, soil erosion, etc) requires multiple perspectives to understand how these indicators vary at different spatial scales. Data is therefore collected from four nested spatial scales: sites, clusters, plots and sub-plots, as illustrated below.







Sites [100km²] are selected at random across a region or watershed, or they may represent areas of planned activities (interventions) or special interest. Each site is divided into 16 tiles of 2.5km x 2.5km each.

Within each tile, random centroid locations are generated for clusters. **Clusters [1km²]** are made up of 10 plots [1000m² or 0.1ha].




Each plot consists of four **sub-plots [100m² or 0.01ha]**.



At plot level, basic site characteristics are described and recorded:

-  Slope, landform, presence/absence of soil and water conservation structures
-  Land use
-  Rangeland health (applied where needed)
-  Topographic position

At sub-plot level, the following are recorded:

-  Vegetation measurements (woody cover rating; tree and shrub density and diversity)
-  Visible erosion recorded and classified
-  Top and subsoil samples are collected from each sub-plot then composited at the plot level for each depth.



Makueni County Decision Dashboard



The incorporation of the rich, interdisciplinary information from the EcoHSS into decision dashboards facilitates the engagement of decision makers to interact with and interrogate data and evidence and ultimately establishes an evidence-based decision-making modality. By conducting a deeper data analysis across biophysical and socio-economic gradients in Makueni, this allows for the integration of the analysis and findings into key county decision-making processes and annual planning and budgeting to enhance restoration outcomes in the county.

Components of a decision dashboard

A decision dashboard is an online, open access platform that enables easy access and interaction with diverse and visualized information.

Dashboards typically have a **dynamic interface**, where information is not static like a report, but is instead **regularly updated** and can be viewed interactively and in 'real-time'. A dashboard can be built to automatically update and visualize data and information, saving time and allowing for effective presentation of data.

A decision dashboard is designed **based on user needs**, such as key themes, departments, or outcomes of a project. It can also be designed to **incorporate different levels of data for different users** – for example, a simple overview for policy makers and more detailed information for technical or specialist staff. In this way, **users are able to 'filter' and 'select' data**, using functions such as drop down menus to display specific information (e.g. gender or livelihood type) or live maps to select specific locations.

Decision dashboards link to a wider approach by an institution or government towards **data management and evidence use** in decision-making and planning.

Benefits for Makueni County

By applying a user-centered co-design approach to the development of an online open access dashboard, these up to date and accurate spatial assessments will be embedded into a co-designed and tailored Makueni County dashboard.

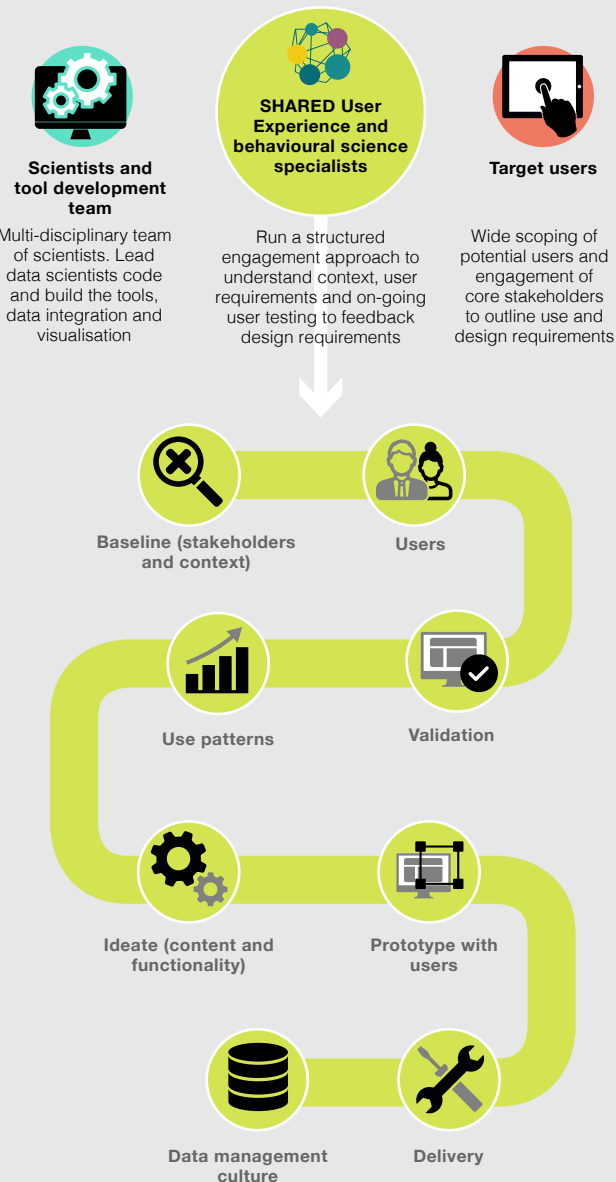
This will allow for enhanced engagement by county government, and will allow stakeholders to assess soil health, land degradation and target areas for restoration activities (investment), and track progress over time. The following report section will describe activities to date in Makueni County using the ICRAF dashboard co-design framework to expand on activities and stakeholder feedback.

The co-design process - putting users at the centre of the design process

The decision dashboards are co-designed with users from the onset, ensuring that users of the dashboards are at the center of the design and implementation process from the conceptual stage. This involves seeking to understand what questions decision makers are trying to answer and where data or information is needed, and then how we can collect, organise and visualise data to answer some of these questions. By having capacity development embedded from the outset, co-design includes data quality appraisal, scoping of data, and prioritising data specifically for the planning and decision-making process. Co-design allows for ownership from target decision makers of the dashboard and for functionality and visual aspects to be tailored to the audience.

The decision dashboard will support the Makueni County Government's efforts to bring together the diverse partners and data sources related to land restoration to enhance coordination, planning, communication and decision-making.

ICRAF approach to building decision support dashboards





Baseline (stakeholders and context)

- Wide scoping of different stakeholders engaged in the topical area the decision dashboard is targeting
- Context understanding on data use
- Existing sources and data access methods
- Definitions of key concepts

Other online platforms and dashboards available to Makueni County

DIGIFARM

Digifarm (digital farming) was created by Safaricom when they realized that many of their customers farm and send money for this, such as to buy agrovet supplies. The first step in the application is registration: the farmer registers him/herself by clicking (* 28#). Next, the farmer registers where the farm is located, or searches by ward. The size of the land has to be less than 6 hectares, as Digifarm targets smallholder farms. Lastly, the farmer indicates the value chains s/he is growing.

Digifarm has three key offerings for the farmers, extent information to the farmers through shamba shape up, they upload the farmers based on the value chain, but they are not limited to that. Digifarm also extends credit facilities to farmers (first loan is based on how the farmers interact with M-shwari, Fuliza and Mpesa). Other focus areas are access to market for the farmers in Makueni County, improving the livelihoods, improving the yields. There are currently 1.2 million farmers on Digifarm in the country.



Steve Karanja from Safaricom explaining how the platform works



LEFT. James Wanjau explaining how some of the CETRAD platforms work. ABOVE. Landing page of the Atlas.

CETRAD's platforms

The Kenya Socio-Economic Atlas is a platform developed by CETRAD in collaboration with Kenya Bureau of statistics (KNBS). The platform visualizes data collected in the 2009 Kenya Population and Housing Census and aims to enable policymakers at all levels and development experts to use the combination of geographic and socio-economic data available to understand dynamics affecting Kenya. The platform is interactive and available to everyone via

<https://www.kenya-atlas.org/>

Other platforms showcased were:

- Social Hydrological Information Platform(Ship) https://www.cetrad.org/index.php?option=com_content&view=article&id=162:social-hydrological-information-platform-ship&catid=1:latest-news&Itemid=50
- <http://www.cetrad.ews/>



Users

- Clear target audience for the dashboards
- Long-term dashboard host, e.g. a ministry or private sector

Validation

- Required level and desire for data management
- Validate demand for decision support with stakeholders
- Define aspirations for using a dashboard and data
- Outline the benefits, core intended behaviour change and how intended changes will be tracked
- Opportunities to use a decision support tool

	Target Audience	Interest	Data to be shared and how to visualize it
MAKUENI COUNTY GOVERNMENT	Investors	Market gaps; project identification	Urban land use plan, county investment plans, market populations, infrastructure, network, maps, graphs, charts, websites, reports.
	County government leadership	Decision making; budgetary allocations for projects, monitoring and evaluation.	Administration units, project budget, beneficiaries, M&E, visualized in decision support systems.
	Project partners, donors	Details of project; impacts of project to beneficiaries, environment.	Reports, success stories, details, in photos, impact analysis
	CBOS (farmer groups)	Market information, climate smart agriculture, environmental protection.	Trade analysis, trend analysis, success stories, visualized in flow charts, graphs and maps.
NGOs GROUP 1	Financial Institutions	Resources required for the interventions	Number of farmers engaged in farming activities (disaggregated in male, female and youth)
	Technology service providers	To balance resources allocation (budgeting)	Approaches used to identify the farmers
	Donors	Access impact on interventions	Volume produced across different agricultural regions and incomes
	Development agencies	Training progress on intervention	Number of technologies adopted
	County and national government	Develop demand driven products	Types of technologies used
	Farmers	Look for vulnerable areas which require aid	
	Research institutions		
RESEARCH INSTITUTION	Research personnel/ institutions	Evidence and statistics (number of people	Charts/Tables
	County	Vulnerable groups/ Marginalized wards	Maps/Charts
	National government	Population	Reports
	NGOs	Vulnerable groups/Marginalized wards	Reports
	Private sector	Statistics on number of farmers	Reports, Charts, pictures
NGOs GROUP 2	Farmers	Yields-improved	Photos, images, videos and reports.
		access to market	Reports and graphs.
	Women	Yield and nutrition value, utilization, access to food	Videos, (case studies and success stories), photos.
	Investors	investment opportunities, profit.	Graphs, reports and box plots
	National and county government	Planning, coordination, and M&E	Boxplots, photos and reports
	Researchers	Interventions, gaps and results	Boxplots, photos and reports

TABLE 3. Target audiences, their interests and types of information shared and preferred visualization



Use patterns

- Decision cycle and process and where data/evidence is useful
- Capacity to interpret data and information
- Quality and accessibility of data
- Define how information is currently used and viability of technology application



Vision for data management and use in Makueni County

Alex Nthiwa, Chief Officer, Department of Lands, Mining, Physical planning and Urban development in Makueni County updated on the status and plans for county data management.

- **A GIS lab** is already in place in the county and has been helping other departments collect, manage and archive geospatial data.
- The unit successfully designed the **county ten-year GIS-based spatial plan** to be tabled in the county assembly for approval.
- **County and administrative boundaries have been mapped** and prepared land use plans for planning and monitoring purposes.
- Legal frameworks for counties provide the impetus for developing spatial planning and Makueni as a county has aimed to **embed GIS in the day-to-day activities and planning**. The county is focused in incorporating GIS in all departments data collection and hopes to create a geo-enabled M&E system



Some innovative ways of sharing data discussed were:

- Data collection apps e.g. Kobo collect
- Forum theatres
- Exchange visits
- Community review meetings
- Focused group discussions
- Mobile cinemas
- Field days
- Field demonstrations
- Community of practice
- Public participation use of CAP reports
- Videos and pictures (farmers are shown videos demonstrating success stories on farming technologies.
- Mothers are shown videos demonstrating benefits of breastfeeding and other feeding options.
- Data comparisons among the stakeholders
- Use of GIS mapping tools to demonstrate and locate interventions



Ideate (content and functionality)

- Key focus for the dashboard
- Functionality requirements
- Theme and module structure
- Landing page
- Access credentials
- Priority data
- Data visualization



Many tools exist, and they come together to support the County, the importance of bringing data together to inform planning and decision making of the county and for the decision support tool that was being developed, while the capacity for data was there, the required data was not all available.

- CEC Agriculture Hon. Lawrence Nzungu

Data visualisation and interpretation

A key feature and novelty of the dashboards is the ability for customisable visualisations of the data. Participants were taken through a learning exercise on data visualisation and interpreting evidence.

Tor Vågen presented to stakeholders an overview on data visualisation and how misleading baselines while visualizing data can lead to wrong interpretation of the data or trends and may result in incorrect implementation of interventions. Different visualization graphs show diverse quantity of data and a deep understanding of the data should first be sought. For example, a boxplot shows a wider range of data than a bar plot or line graph. The visualization used should depend on the data available and the message to be communicated.

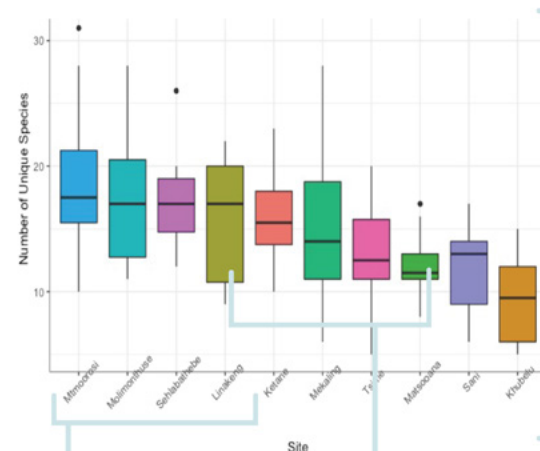
Data is key in decision making and is complex in nature and only the right user-friendly visualization can give it a concrete meaning. Data quantity should not be confused with quality.

- Need to combine direct visual evidence with scale and context
- Box plots to explore the data (dots to show outliers and variations)
- Bar chart and the variation - how do we make the data representative

Through the co-design process, interpretation capacity will be a strong capacity development focus.

Interpreting box plots

Box plots visualise data in such a way that it allows us to understand distributional characteristics. The example below shows the number of unique species across the 10 LDSF sites in Lesotho.



Understanding a box plot:

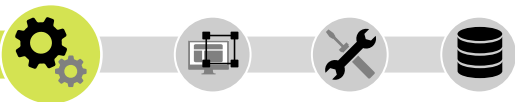
- **OUTLIER** More than 3/2 times of upper quartile
- **MAXIMUM** Greatest value, excluding outliers
- **UPPER QUARTILE** 25% of data greater than this value
- **MEDIAN** 50% of data greater than this value; middle of dataset
- **LOWER QUARTILE** 25% of data less than this value
- **MINIMUM** Least value, excluding outliers
- **OUTLIER** Less than 3/2 times of lower quartile

Same median, different distribution. For these four sites, the medians (which generally will be close to the average) are all at the same level. However the box plots show very different distributions of species.

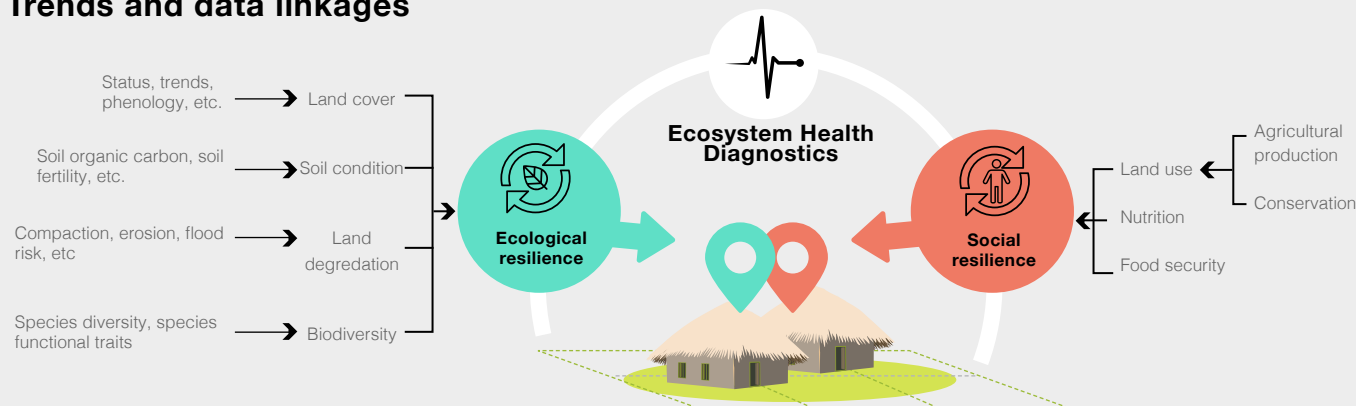
The box plot for the Linakeng site is comparatively tall. This suggests there is a higher diversity of unique species.

The box plot for the Matsieng site is comparatively short. This shows a lower diversity of data, and therefore a lower number of unique species.

The 4 sections of the box plot are uneven in size. This shows that some clusters in the site showed low species diversity and in other clusters there was a more variable number of species. The long upper whisker in the example means that species diversity is varied in the most species quartile group, and very similar for the least lowest quartile group.



Trends and data linkages



Building capacity with stakeholders, looking at trends - where both socio-economic and biophysical indicators and issues overlap. Building this kind of capacity within the decision dashboard design allows unpacking of root causes, linked issues and targeting integrated solutions.



Functionality criteria

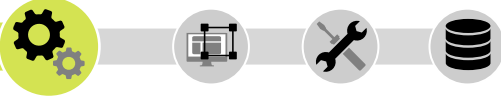
- ✓ User friendly and different for each person based on their expertise
- ✓ Have a split-aggregate for technical experts and for laymen
- ✓ Show achievements to the donor
- ✓ Project mapping to know what is happening in different localities
- ✓ Sources of funding and which organizations are funded
- ✓ It should have a feedback tool
- ✓ Resources and printing option
- ✓ Tracker to see how many people are accessing it and using it
- ✓ Export function for the outputs e.g. reports
- ✓ Data integrity/who manipulates what and to what extent
- ✓ Meta data
- ✓ Innovations (tech advancement)
- ✓ Spatial data at different levels e.g. villages, district, wards subcounty and county
- ✓ Stakeholder identified priority information gaps to focus data collection/research

Key focus areas



Address information gaps

- ! Lack of technological advancement
- ! Institution integration
- ! Dissemination of data/information
- ! Incompleteness of data
- ! Data quality
- ! Resources
- ! Duplication
- ! Availability of sampled data and not the whole population
- ! Project level data



Makueni Decision Dashboard Co-design team

The County Government of Makueni and World Agroforestry are currently inviting key stakeholders to be engaged into the co-design team for developing the decision dashboard. This co-design team will be responsible for supporting data collation efforts, provide input into the utility and design of the dashboard and support the ICRAF team in raising awareness on how to use the decision dashboard.

Draft roles for a dashboard co-design core team were shared and the facilitator asked for suggestions from the participants in terms of team membership and process, as outlined below:

- The **County Government** should lead the process and decide on which key departments should be involved. There was a suggestion that people with disabilities are included and their needs catered for.
- **Financial institutions** to be included, that is Kenya Commercial Bank since they have a coordinator working with the County.
- **Non-Governmental Organizations** representation such as World Vision, Caritas and Red Cross.

- **National Government;** National Environment Management Authority (NEMA), National Drought Management Authority (NDMA), Greening Kenya Trust, and Kenya National Bureau of Statistics (KNBS).
- **Research institutions and universities;** Kenya Forestry Research Institute (KEFRI) and Kenya Agricultural and Livestock Research Organization (KALRO).
- **Community Based Organizations.**



“Congratulations to the team for the inputs and time invested to make the co-designing of the decision dashboard a success for the benefit of all people of Makueni County. If one gets the data wrong then the decision made based on the said data will not stand the test of time. Dashboards help us to see what has been happening, show trends, are driven by credible data, support prioritization and help in making the right and sustainable decision.”

- Hon. Philip Wambua Ndambuki, CEC for Gender, Children, Culture and Social Services



Steps still to be implemented in the dashboard co-design process for Makueni County



Prototype with users

- Focal teams are facilitated through testing of the functionality
- Rapid iterations on design and functionality
- Documenting and setting up a system for regular feedback on use and functionality
- Adaptive integration of capacity development on interpretation and use



Delivery

- Engage wider network of users and stakeholders
- Drafting annual budget plan for maintenance, updating and core data analyst team
- Training needs for interpreting data and information
- Plan for institutional arrangements for hosting



Data management culture

- Embedding dashboard into decision processes through facilitated events
- Host institution and sustainable funding source for dashboard maintenance
- Establishment of a local user community that assesses metrics and data - scoping new datasets, conducting quality control, on-going data curation



Annex

Stakeholder workshop participants

Mary Mbenge	County Government of Makueni	David Okoto	ICRAF
Benson Mutuku	County Government of Makueni	Jane Mumina	ICRAF
Hon. Lawrence N. Nzunga	County Government of Makueni	Fiath Musili	ICRAF
Mary Muteti	County Government of Makueni	Joyce Kasyoki	ICRAF
Dr. Martin M. Mboloi	County Government of Makueni	Sylvester Muendo	ICRAF
Josesph Ngila Munyao	County Government of Makueni	Mercy Muema	ICRAF
Augustine Kitheka	County Government of Makueni	Dorcas Wambua	Africa Sand Dam Foundation
Cecilia Mutua	County Government of Makueni	Fred Wakaba	NDMA
Hon. Julius Kaloi	County Government of Makueni	Vincent Mutinda	KCEP-CRAL
Alex Ntiwa	County Government of Makueni	Patricia M. Wambua	NEMA
Mambo Nzali	Kibwezi Hortipreneurs Youth Group	Bright Mbithi	County Government of Makueni
Kaloki Komu	Kibwezi Youth Group	Mutheu Muthiani	County Government of Makueni
Jackson Muthama	Kibwezi Youth Group	Ruth Kaloki	County Government of Makueni
JackSson Muraguri	World Vision	Festus Kyaka	KCEP-CRAL
Raphael Mwau	Caritas	Mieke Bourne	ICRAF
Joy Nzomo	Red Cross	Christine Magaju	ICRAF
Japheth Munyao	Red Cross	Steve Karanja	Safaricom
Margaret Miano	MESPT	Melvin Mutai	Safaricom
John Mutua	CIAT	Gilbert Wachira	Safaricom
Emeritu Njiru	KALRO	Einstein Mulli	County Government of Makueni
James Wanjau	CETRAD	Gapuzwa Kanzere	County Government of Makueni
Tor-Gunnar Vagen	ICRAF	Hon. Philip Wambus Ndambuki	County Government of Makueni
Leigh Winowiecki	ICRAF		



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For more information, contact Mieke Bourne (m.bourne@cgiar.org) or
Dr Tor Vagen (t.vagen@cgiar.org)