Sustainable Grazing Management

to support EMGs

OASIS Training-of-Trainers Online-Course,
5th Sept 2024, Stephen M. Mureithi

BRiCS Building Resilient Communities in Somalia

BOKU UNIVERSITY

CIFOR

World Agroforestry

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Module 1 Learning Objectives

Overall Objective:

To provide an overview of Sustainable grazing management strategies, including techniques to prevent overgrazing, how to establish grazing enclosures/exclosures, and determine optimal grazing levels to protect and restore ecosystems;

Specific objectives:

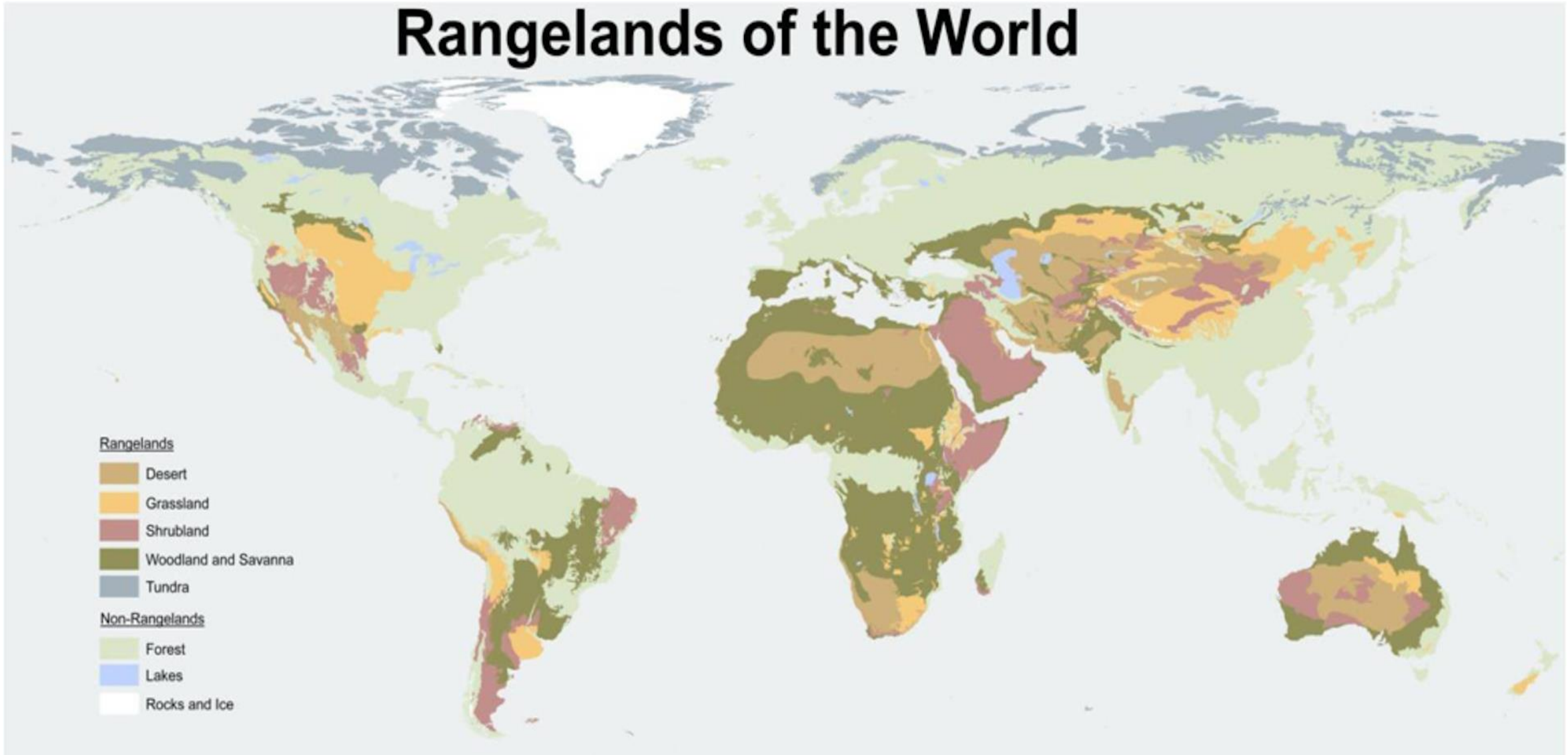
1. To scan the global environment in context of holistic/Sustainable development and management of Rangelands,
2. To sensitize participants on the approaches for Sustainable Grazing Management
3. To provide an overview of the Kenyan Rangeland development and management institutional and policy environment.

Global Extent of Rangeland Ecosystems

What are Rangelands and the coverage?

- Rangelands are places of important biodiversity and ecosystem services.
- Occupy up to half of all land and up to **three quarters (75%) of the world's drylands**
- Provide benefits to local communities, to economies and to global society
- Extent of Rangelands in **Kenya** (ASALs) – **80%**
- Extent of Rangelands in **IGAD Subregion - 60 to 70%**
- Typical rangeland ecosystems - grasslands, shrublands, woodlands, wetlands, and deserts that are grazed by domestic livestock or wild animals;

Rangelands of the World



Whys do we need to Sustainably manage the Rangelands

The ASAL's of Kenya & Potential

Kenya ASAL's

Livestock Wealth

- 14 target ASAL pastoral counties have;
- 9.140 M cattle= 52.3%
- 13.462M sheep= 78.6%
- 21.024M goats= 75.8%
- 2.962M camels= 99.7%
- This is a huge livestock wealth

Rangeland Management Defined

Range management defined:

- "manipulation of rangeland components to obtain optimum combination of goods and services for society on a sustained basis

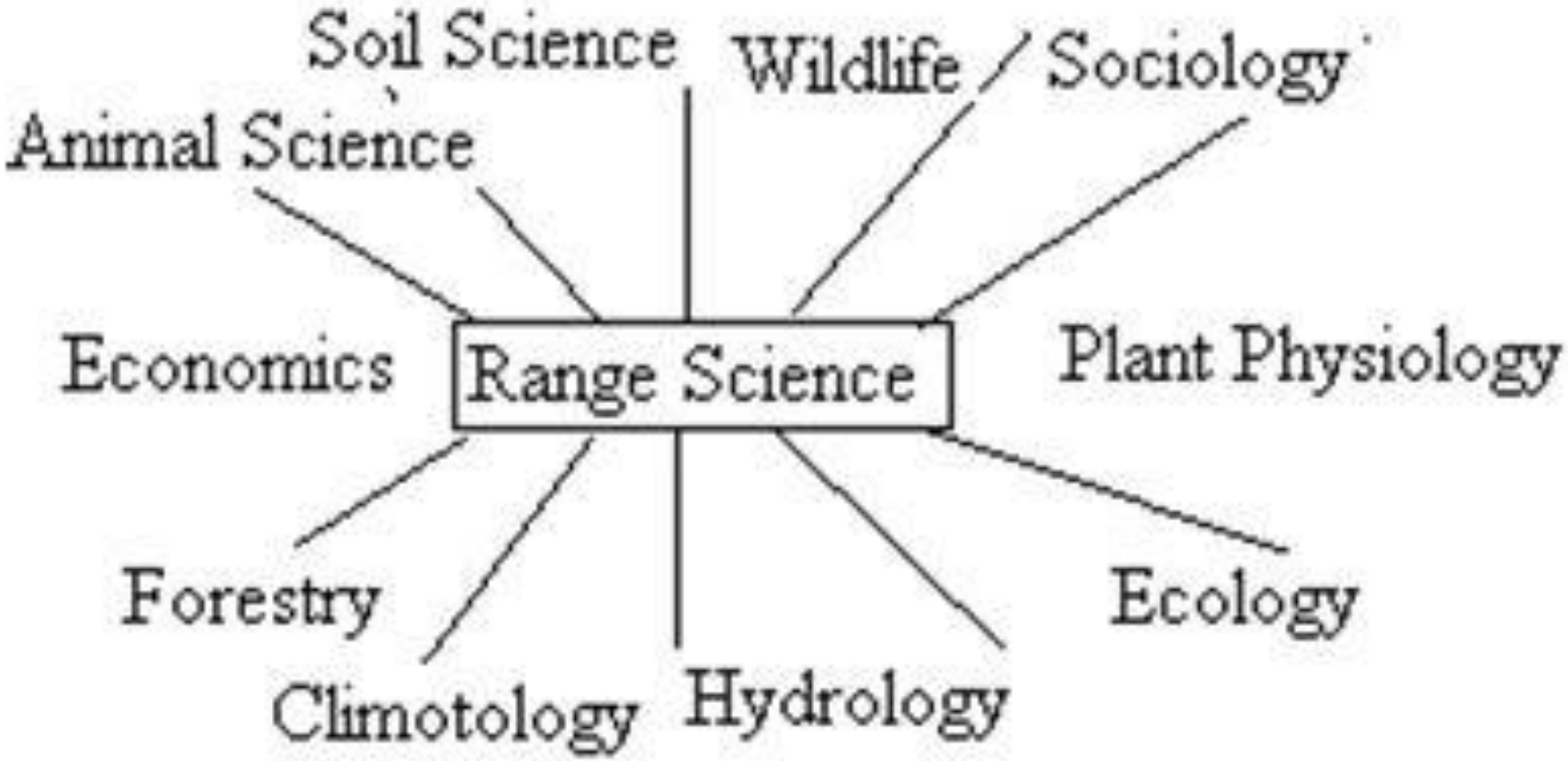
A profession in natural science

- Conservation and sustainable management [of Arid-Lands] for the benefit of current societies and future generations.”

A distinct discipline founded on ecological principles and dealing with the use of rangelands and range resources for a variety of purposes.

- Watersheds, wildlife habitat, grazing by livestock, recreation, and aesthetics, as well as other associated uses.

Multidisciplinary Approach in Range Management



Diversity of Rangeland Ecosystems

Rangeland Management in Laikipia

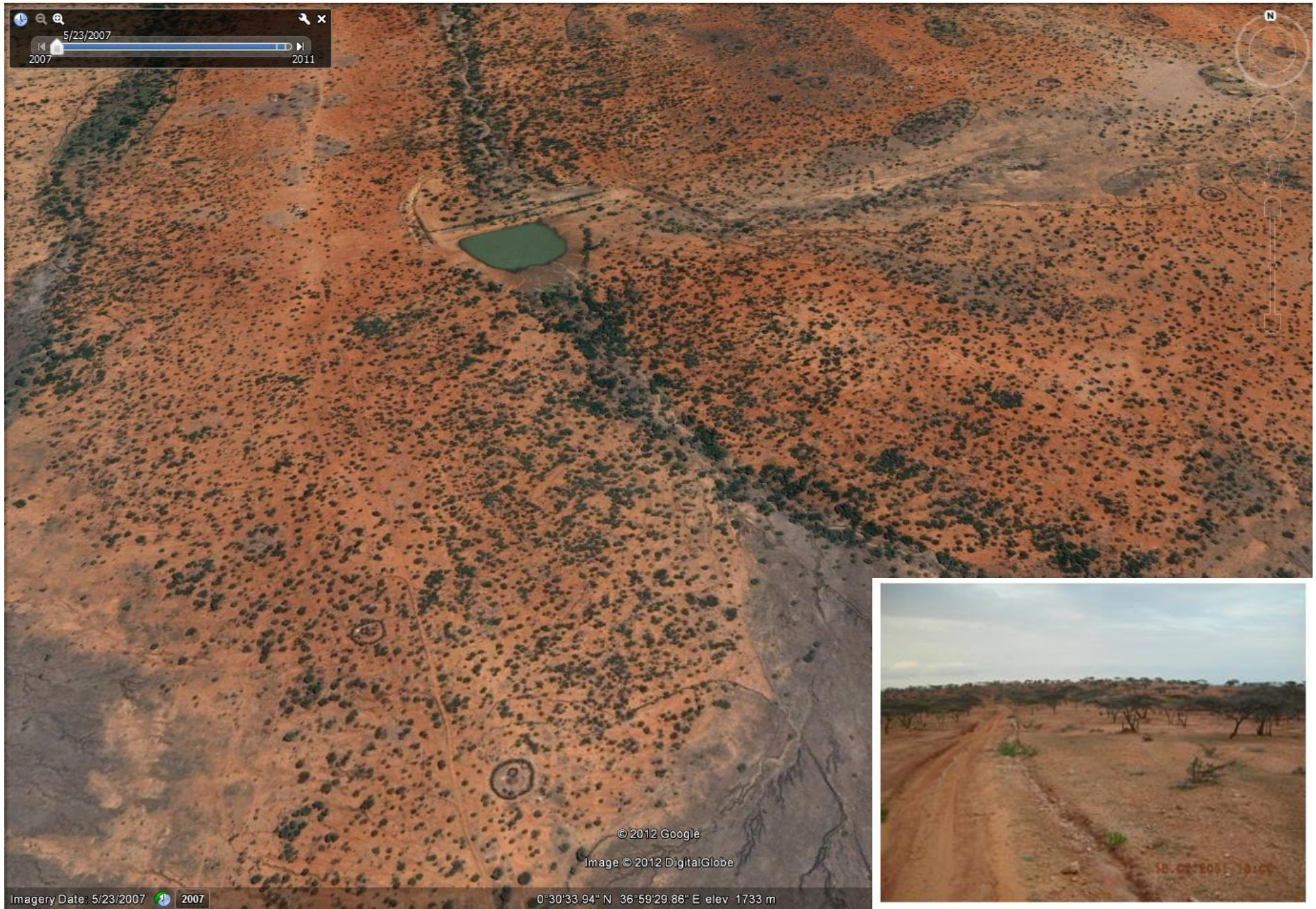
Land degradation in communal rangelands

Mount Kulal Areas, Marsabit

Rangeland in poor condition

Northern Rangelands – Turkana, Kenya

Where did all the grass go?



Rangelands also support wildlife

Maasai Mara Conservancy at Eagle View, Kenya by *Peter Proskosch*

Maasai cattle herding , Maasai Mara, Kenya, *Peter Prokosch*

Sudan goats, camels and camp, Wolfganga Bayer

A livestock watering point in Somalia, Wolfgang Bayer

Effects of livestock grazing:

Proper grazing management ensures;

- Animals have sufficient forage to remain healthy.
- Grazing does not permanently damage soil and vegetation

Repeated grazing by animals;

- Weakens forage plants, allowing less palatable species (Increasers) to replace them.
- Exposes rangelands to wind erosion due to absence of vegetation, leading to dust and poor quality air.
- Exacerbates water erosion, thus increased sediment load in watersheds and subsequent decrease in water quality.

Carrying capacity and stocking rate

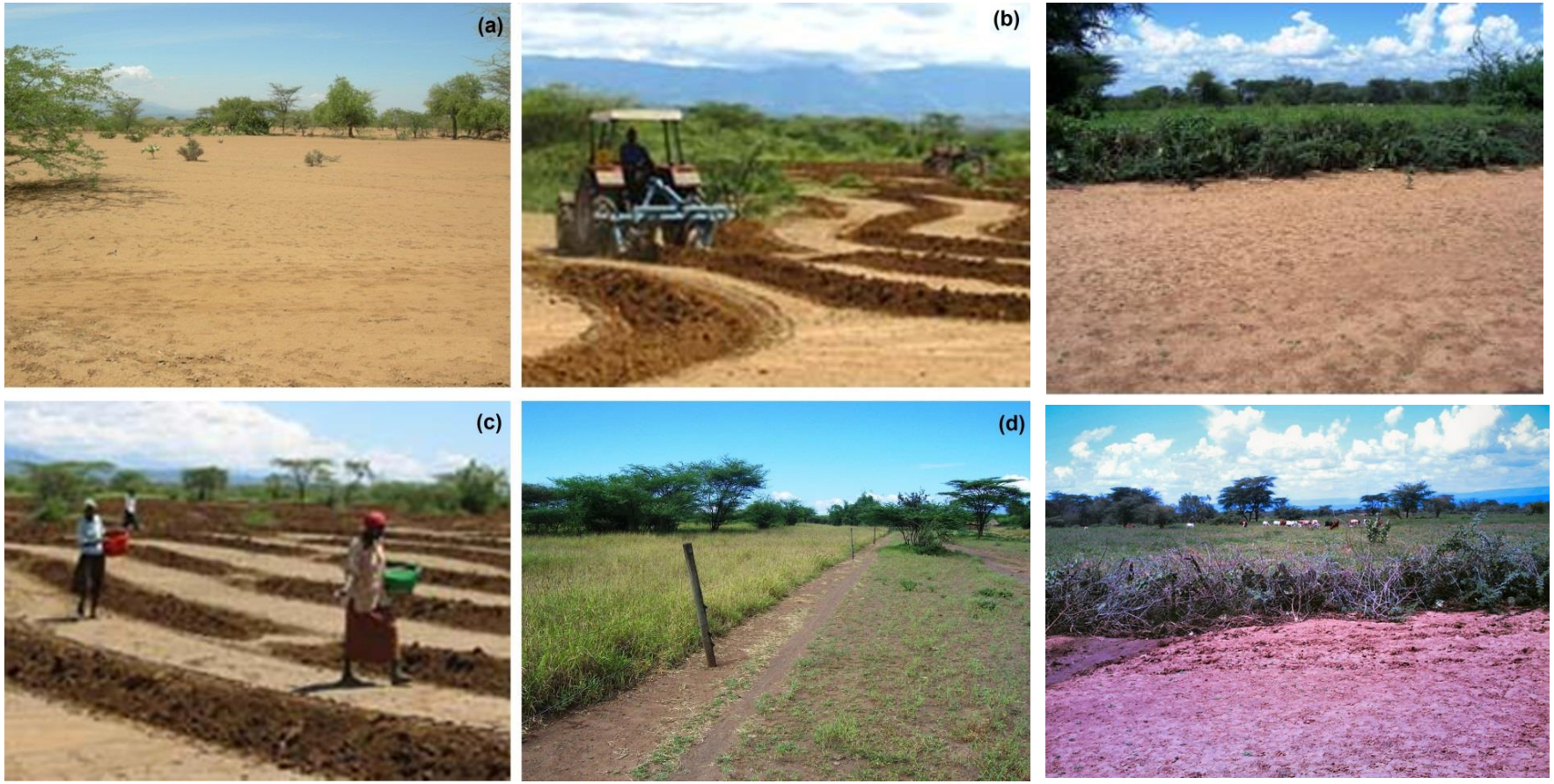
- **Carrying capacity** is the maximum stocking rate possible without inducing damage to vegetation or related resources the maximum sustainable stocking rate which maintains soil and vegetation integrity.
- **Stocking rate** is the number of animals on a given area at one point.
- Carrying capacity and stocking rate (expressed in AUMs) both refer to the tenure of the animals allowed to graze in a pasture and the amount of forage that we expect these animals to harvest.
- Stocking rate does not reflect the effects of the grazing on the vegetation and soil resources.

Approaches for Sustainable Grazing Management

1. Rangeland closure – Communal or private enclosures
2. Participatory Rangeland Planning (PRM)

Rangeland closure approach

Enclosures - areas closed off from grazing to allow revegetation



Communal enclosure

Private enclosure

Combating land degradation a priority in Lake Baringo basin

3 aims of rangeland rehabilitation:

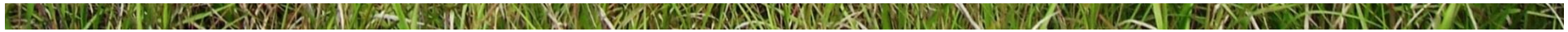
- provide pasture for livestock (agro-pastoral communities);

- alleviate poverty and improve livelihoods

- production of fuelwood and construction wood

- save Lake Baringo (Depth reduced from 8.6m in 1975 to 2.15m in 2001).

Study Objectives:



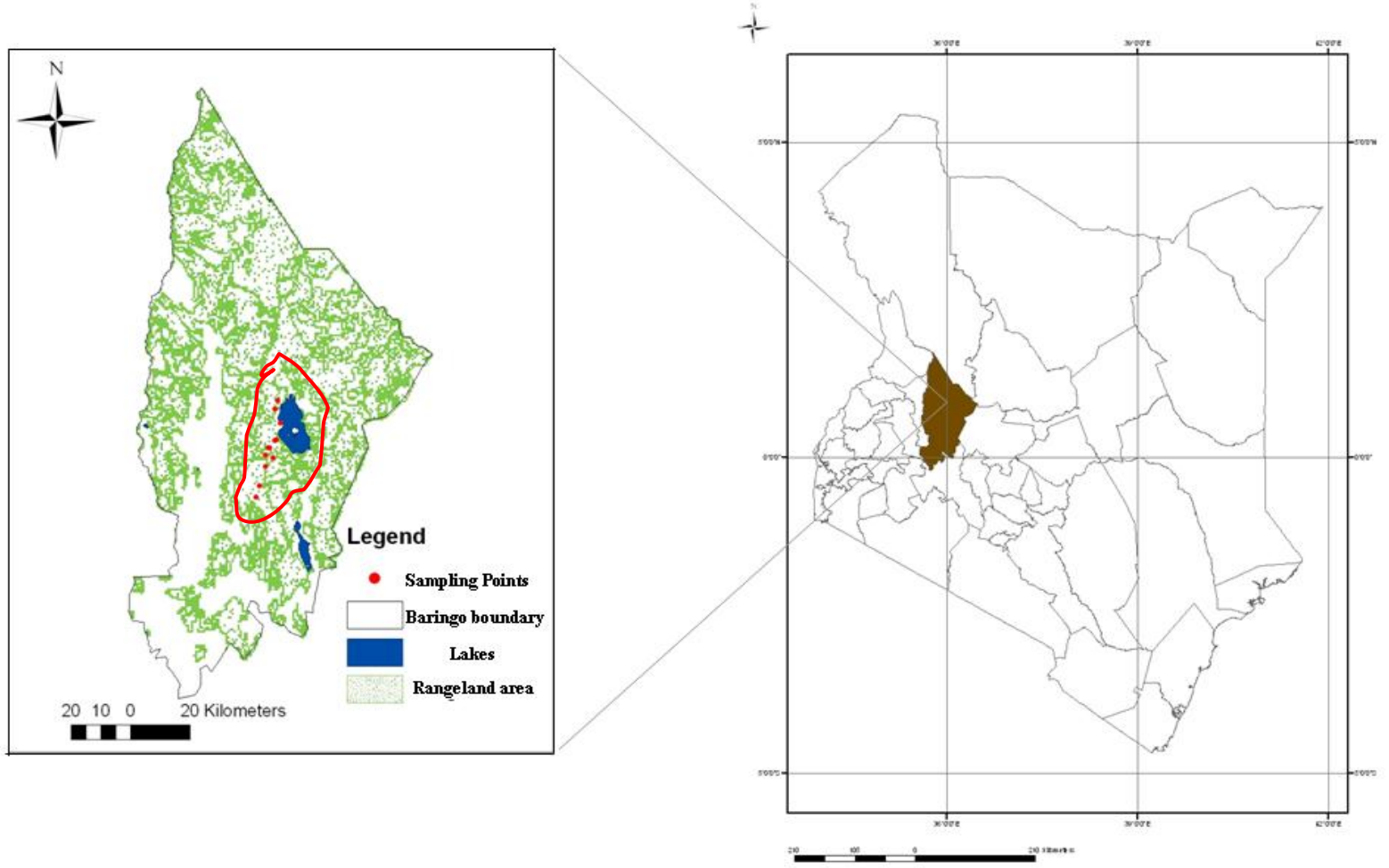
Need to **evaluate the effects of enclosures** in a severely degraded semi-arid communal rangeland

i. assess and compare **range condition and trend**: using key **biotic** (herbaceous vegetation) and **abiotic** (soil) **indicators** of ecosystem health;

ii. evaluate and compare level of land quality within and outside the enclosures

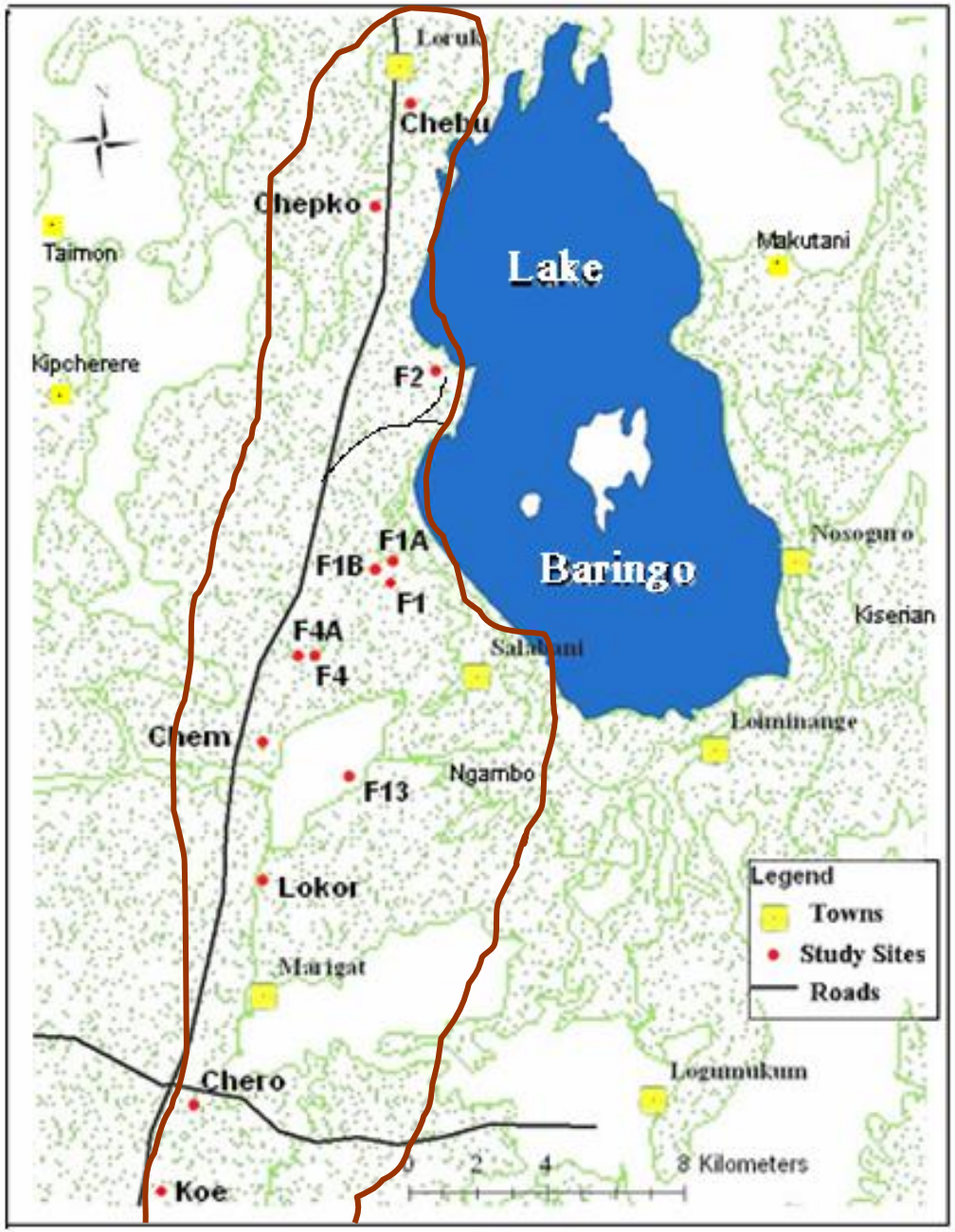
2. Study area

- Njemps Flats, Lake Baringo Basin, Baringo County, Kenya



Njemps Flats

- West of Lake Baringo
- Rainfall 300-700 mm
- Acacia grassland
- Fluvisols (Soil Map of the World, 1974)
- Pastoralism, overgrazed
- Severe risk of irreversible degradation
- Siltation off-site damage to Lake Baringo



Njemps Flats

Unpalatable forbs dominate

After the rains, annuals germinate very fast

and then disappear leaving the soil bare and prone to erosion

Analytical procedures

Plant samples	▪ **Botanical identification;** ▪ **Biomass samples dried to constant weight**

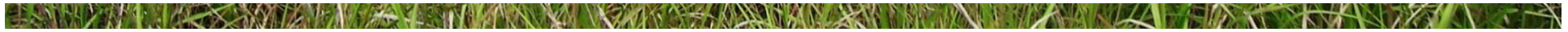
General characterisation of the selected enclosures

ID[a]	Local ID	Management	Area (ha)	Age (yr)	Utilization[b]	Communal Vs. Private enclosures
Co13	F13	Communal	140.0	13	G – GC – BK	-Solar-power electric -Shared rights/ access -RAE back-stopping -Utilised only occasionally
Co16	F4A	Communal	102.3	16	G – GC	
Co18	F1B	Communal	16.7	18	G – GC – BK – GS - WC	
Co20	F4	Communal	22.4	20	G – GC	
Co22	F1A	Communal	6.6	22	G – GC – BK – GS - WC	
Co23	F1	Communal	9.3	23	G – GC – BK – GS - WC	
Pr3	LOKOR	Private	13	3	G	-Cut-thorn bush/ Opuntia fences -Private rights/ access -Intensely utilised
Pr6	CHEM	Private	2	6	G – GC	
Pr8	CHEROP	Private	0.7	8	G – GC – GS	
Pr11	CHEPKO	Private	1.0	11	G – GC – BK	
Pr15	KOE	Private	2.5	15	G – GC – BK	
Pr17	CHEBU	Private	1.6	17	G – GC	

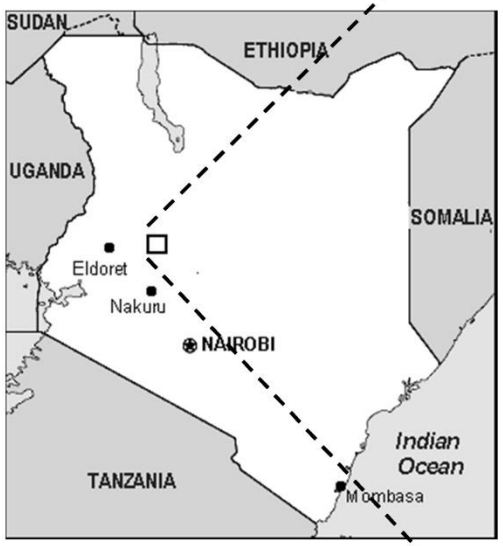
[a] In the ID, "Co" refers to communal enclosures, "Pr" indicates private enclosures and the number represents the enclosure age

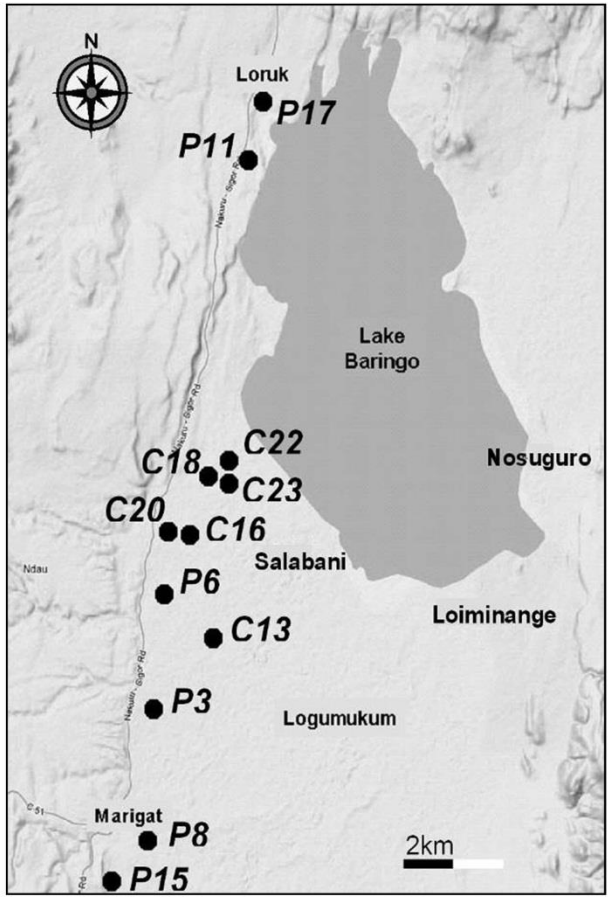
[b] G (Grazing), GC (Grass Cutting), GS (Harvesting Grass Seed), BK (Bee Keeping), and WC (Wood Cutting)

Sampling strategy

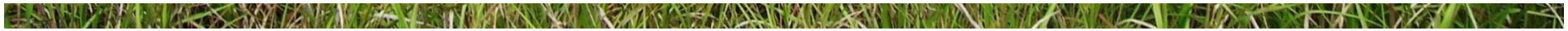


- Twelve (6 communal and 6 private) enclosures selected
- Line transect method for herbaceous parameters
- 3 transects inside enclosure, 1 outside
- Five 0.5 m^2 quadrats along each transect for biomass;
- Soil sampling
- Visual observation for indicators of range condition





3a. Results: Biotic component



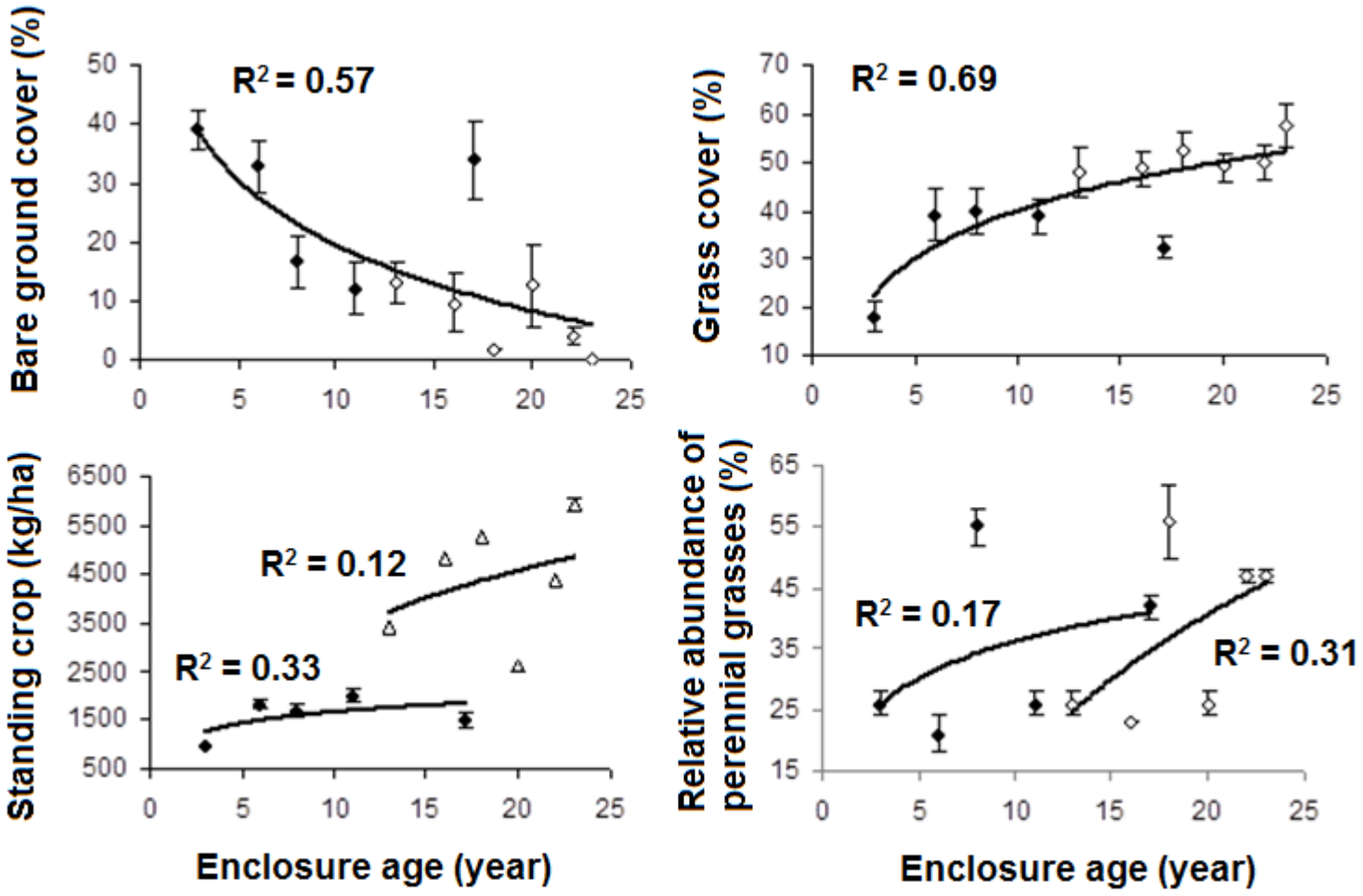
- Introduction
- Rangeland enclosure
  - **- Impact on vegetation (biotic component)**
  - - Impact on soil (abiotic component)
- General conclusions

Herbaceous parameters of the private and communal enclosures

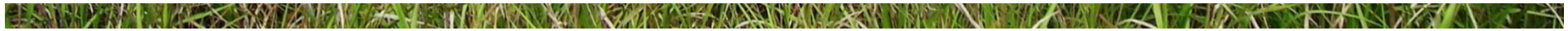
Herbaceous vegetation	Private management (n = 5)		Communal management (n = 6)	
	Open range	Enclosure	Open range	Enclosure
Cover (%)				
Bare ground	63(11)	25(11)*	67(9)	7(6)*
Grass	9(9)	34(9)*	0(0)	51(4)*
Relative abundance (%)				
Perennial grasses	0(0)	34(14)*	0(0)	38(14)*
Annual grasses	9(9)	22(10)^{ns}	0(0)	19(11)*
Standing crop (kg DM ha^{-1})	562(213)	1602(383)*	428(231)	4405(1217)*

* = significant ($P < 0.05$); mean ± SD in parentheses

Rangeland condition attributes (mean ± SD) logarithmic trends with enclosure age



Carrying capacity of enclosures



Higher biomass production = higher grazing capacity = less hectarage required for 1 TLU in the enclosures

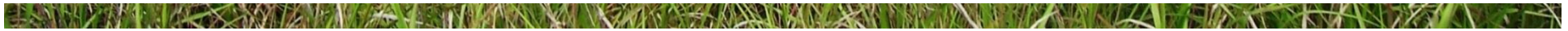
Type of livestock	Live weight (kg)	Number of stock equivalent based on 250 kg lwt[a]	Unenclosed rangeland open communal grazing (ha TLU^{-1})	Enclosed rangeland	
				Private[b] enclosure (ha TLU^{-1})	Communal[c] enclosure (ha TLU^{-1})
Cattle	250	1.0	4.0	1.3	0.6
Sheep	25	10.0	5.4	3.4	0.7
Goats	22	11.0	2.5	1.8	0.7
Camels	360	0.7	2.7	2.7	2.7

[a]Calculations based on Herlocker *et al.,* 1994a, b.

[b]Chepko (Pr11) private enclosure standing biomass production 2500 kg ha^{-1}

[c]F1B (Co18) communal enclosure standing biomass production 5250 kg ha^{-1}

3. Results: Abiotic component



- Introduction
- **Rangeland enclosure**
  - Impact on vegetation (biotic component)
  - **Impact on soil (abiotic component)**
- General conclusions

Soil physical properties of the private, communal enclosures and open rangelands

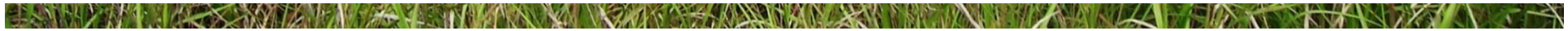
Land use		Private		Communal	
		open	Enclosed	Open	Enclosed
Bulk density	(g cm^{-3})	1.57(0.10)a	1.31(0.07)b	1.48(0.08)a	1.19(0.06)c**
Soil moisture	(w %)	16(2)a	21(2)b	16(2)a	22(2)b**

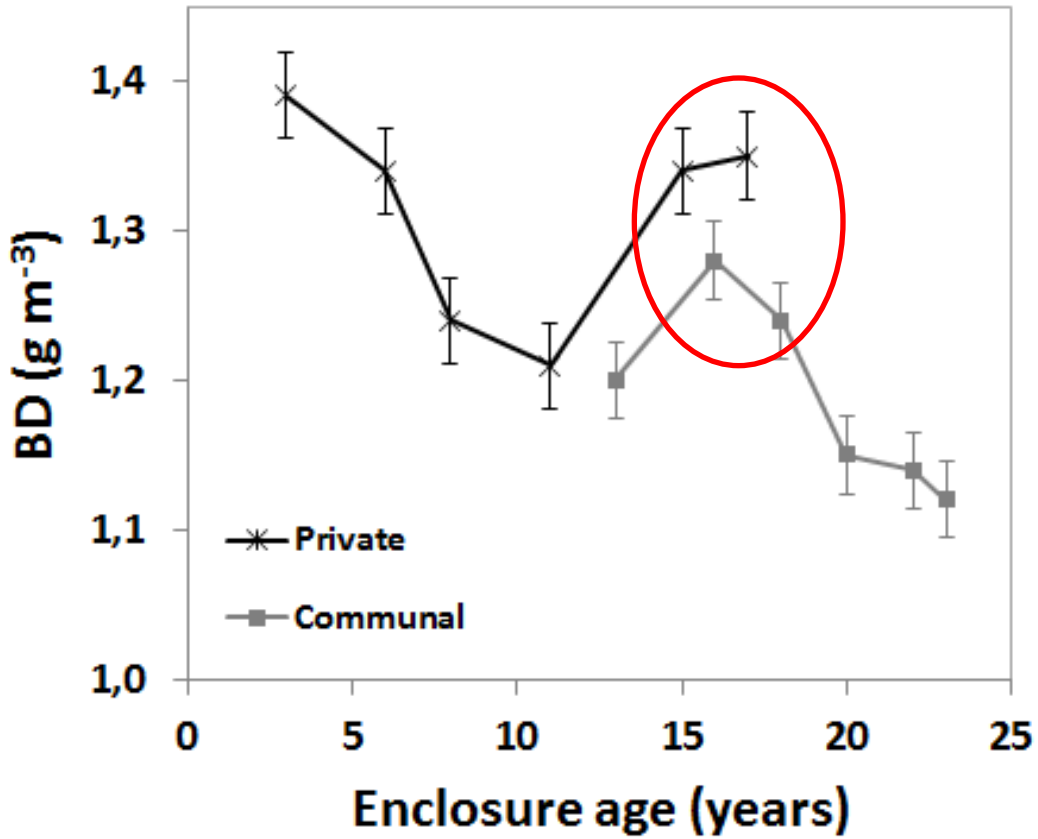
(n=18; mean ± SD in parentheses)

Slightly impeding

Optimal BD

Evolution of topsoil bulk density with enclosure age



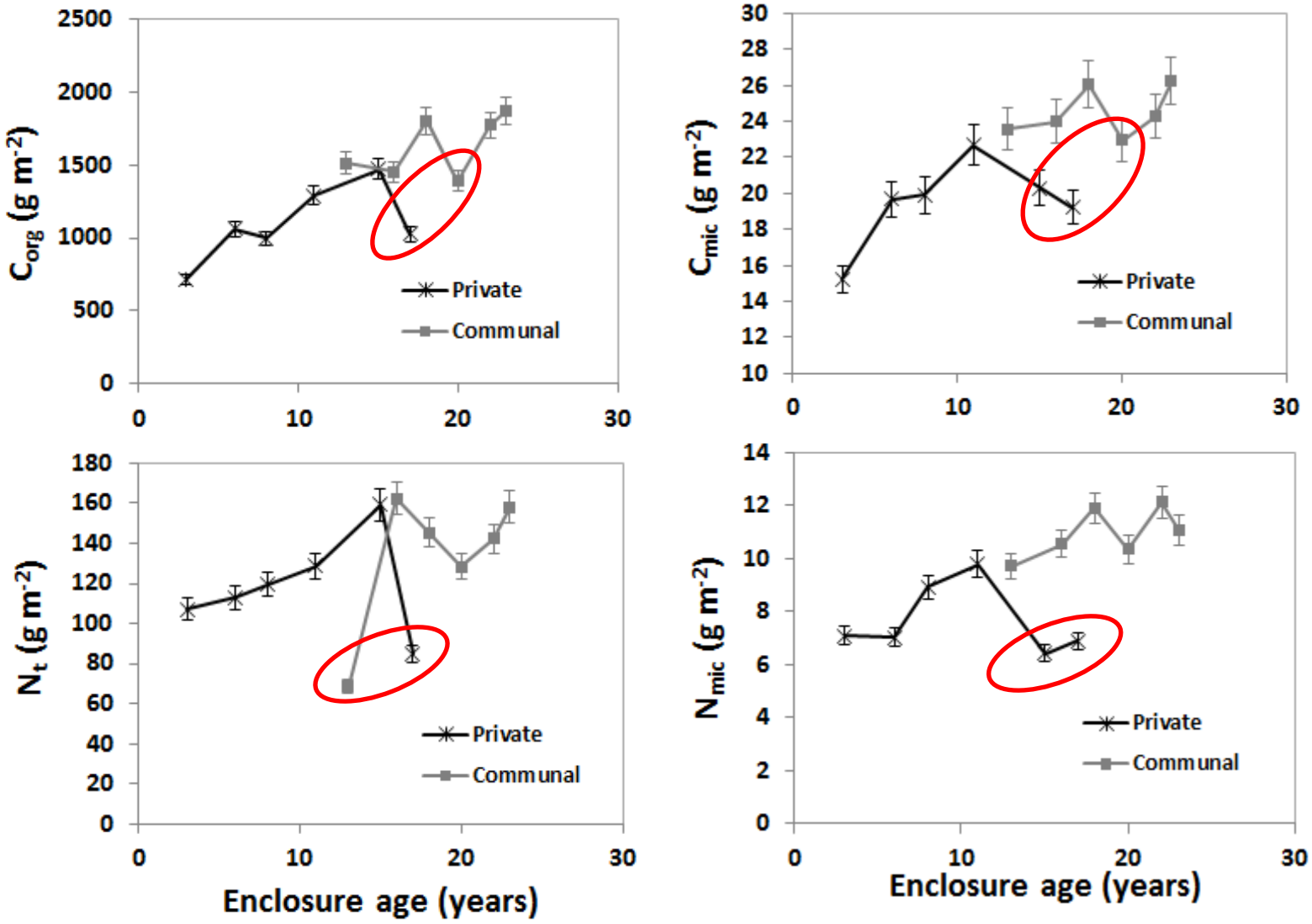


Soil chemical properties and microbial biomass in enclosures, and in open rangelands

Land use		Private		Communal	
		Open	Enclosed	Open	Enclosed
pH	(-)	8.2(0.9)a	8.4(0.3)a	8.4(0.4)a	8.3(0.2)a
CEC	($cmol_{(+)}$ kg^{-1})	34.3(4.2)a	40.8(3.7)b	39.8(3.4)a	46.3(3.4)b*
C_{org}	(g m^{-2})	925(325)a	1095(260)a	812(238)a	1633(207)b**
N_t	(g m^{-2})	96(31)a	119(25)ab	89(28)a	134(34)b*
C_{mic}	(g m^{-2})	13.7(1.1)a	19.5(2.4)b	12.7(0.6)a	24.5(1.3)c**
N_{mic}	(g m^{-2})	6.8(0.8)a	7.7(1.3)a	6.7(0.5)a	11.0(0.9)b**

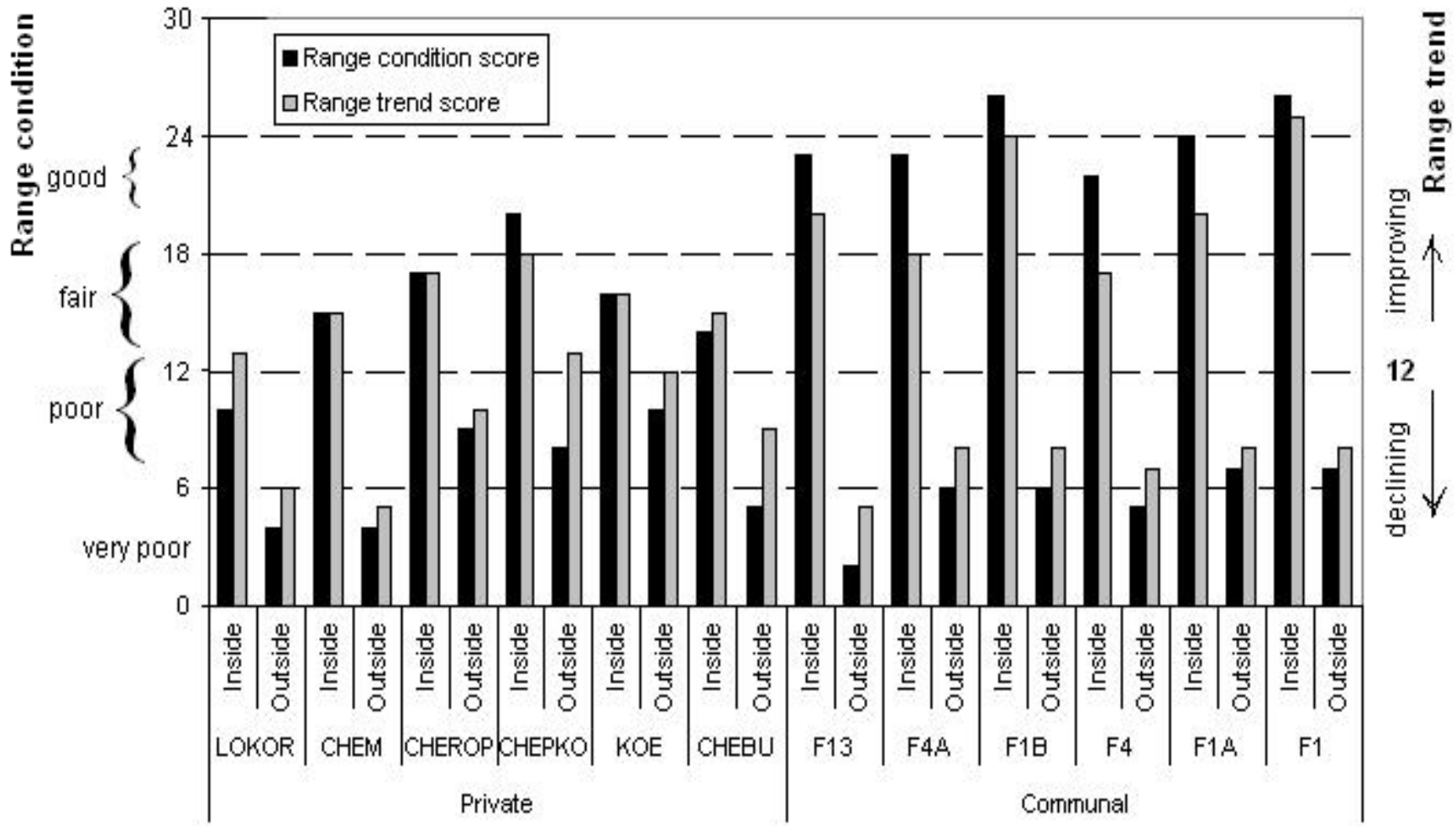
(n = 18; mean ± SD in parentheses)

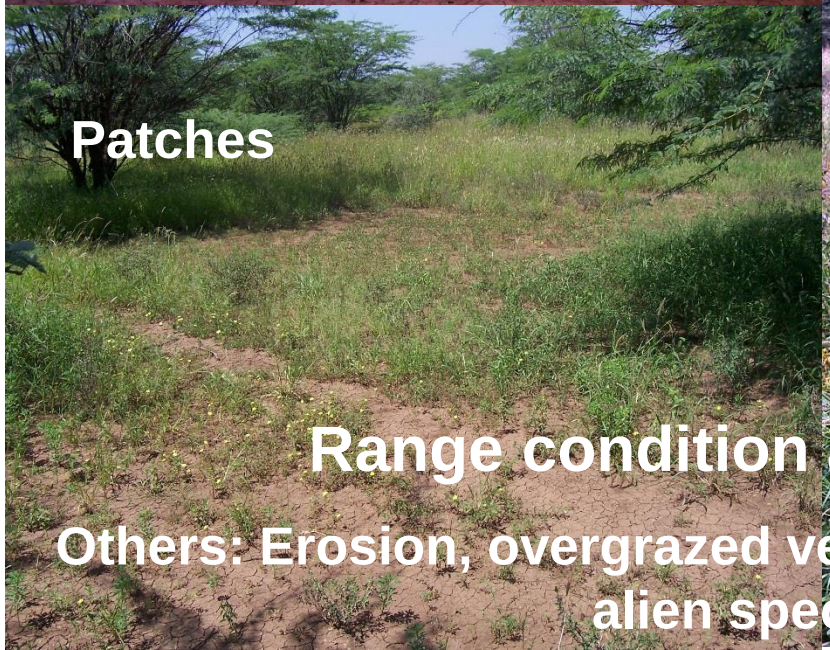
Topsoil OC and total N stocks, and microbial C and N stocks in private and communal enclosures



3. Results

a. Range condition and trend

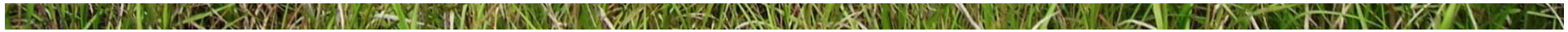




Range condition and trend indicators

Others: Erosion, overgrazed vegetation, hard-setting, unpalatable alien species, key species

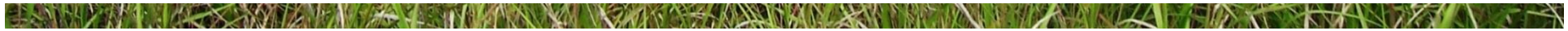
Rangeland health index



Based on key rangeland quality indicators [range condition, vegetal cover (biomass pdn), site and soil protection and soil properties]

Enclosure	Range condition	Range condition score	Range health index
Open grazing areas in Njemps Flats	Very poor (severely degraded)	**0 - 6**	**1**
Lokor (p), few open grazing areas	Poor	**7 - 13**	**2**
Cherop (p), Koe (p), Chem (p), Chebu (p)	Fair (intermediate)	**14 - 19**	**3**
F1A (c), F4A (c), F13 (c), F4 (c), Cherop (p)	Good	**20 - 24**	**4 - 4.5**
F1 (c), F1B (c)	Very good	**25 - 28**	**5 - 5.5**
-	Excellent	**28**	**> 5.5**

5. Conclusions



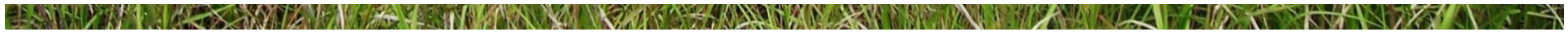
Range rehabilitation through enclosures and reseeding significantly:

- **Improved range condition**: grasses cover; relative abundance of perennial grasses; standing crop and litter

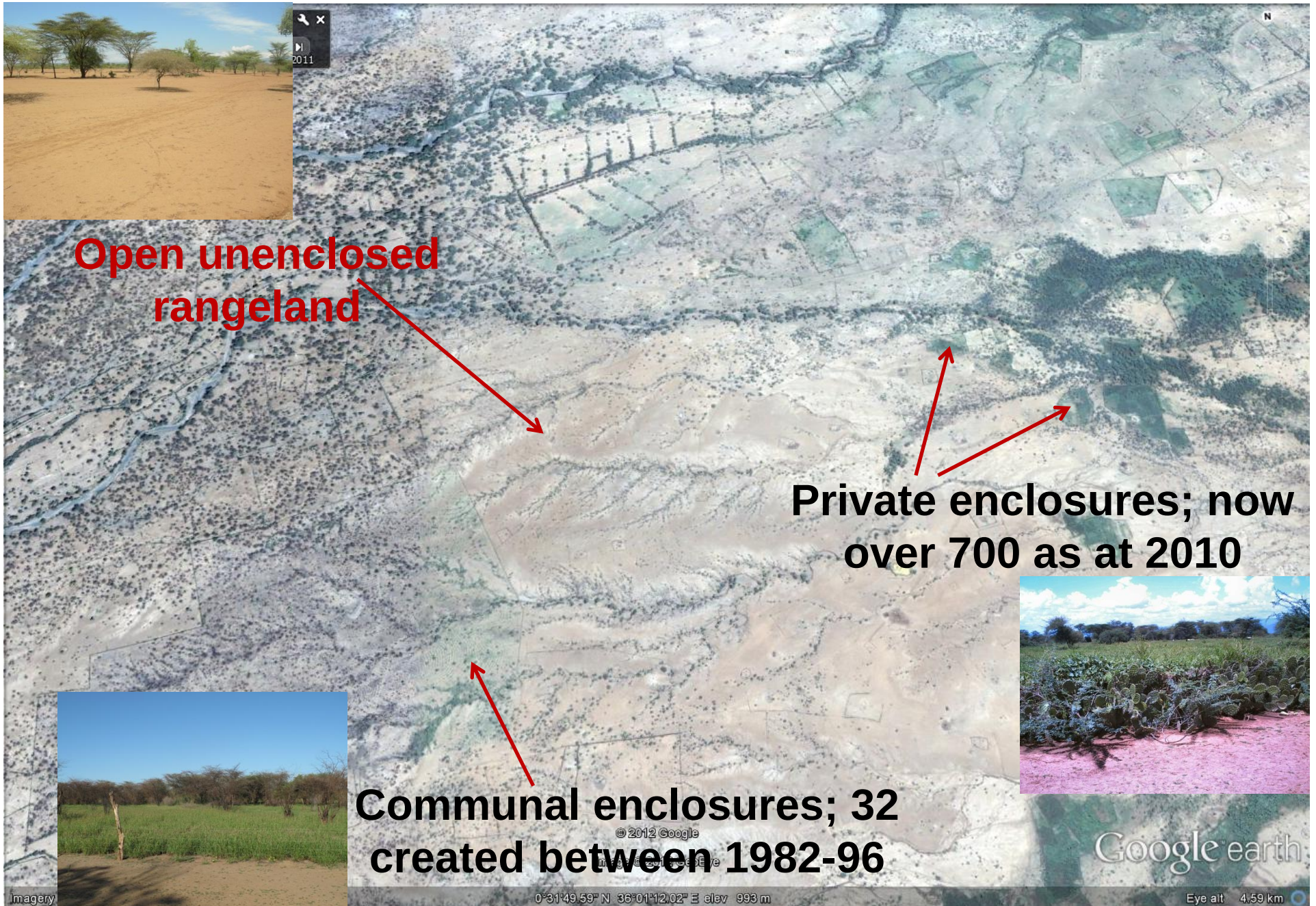
- **Reduced bare ground cover**, protecting the soil against erosion

- Improved the **carrying capacity** and **economic productivity** of the rangeland

Conclusions



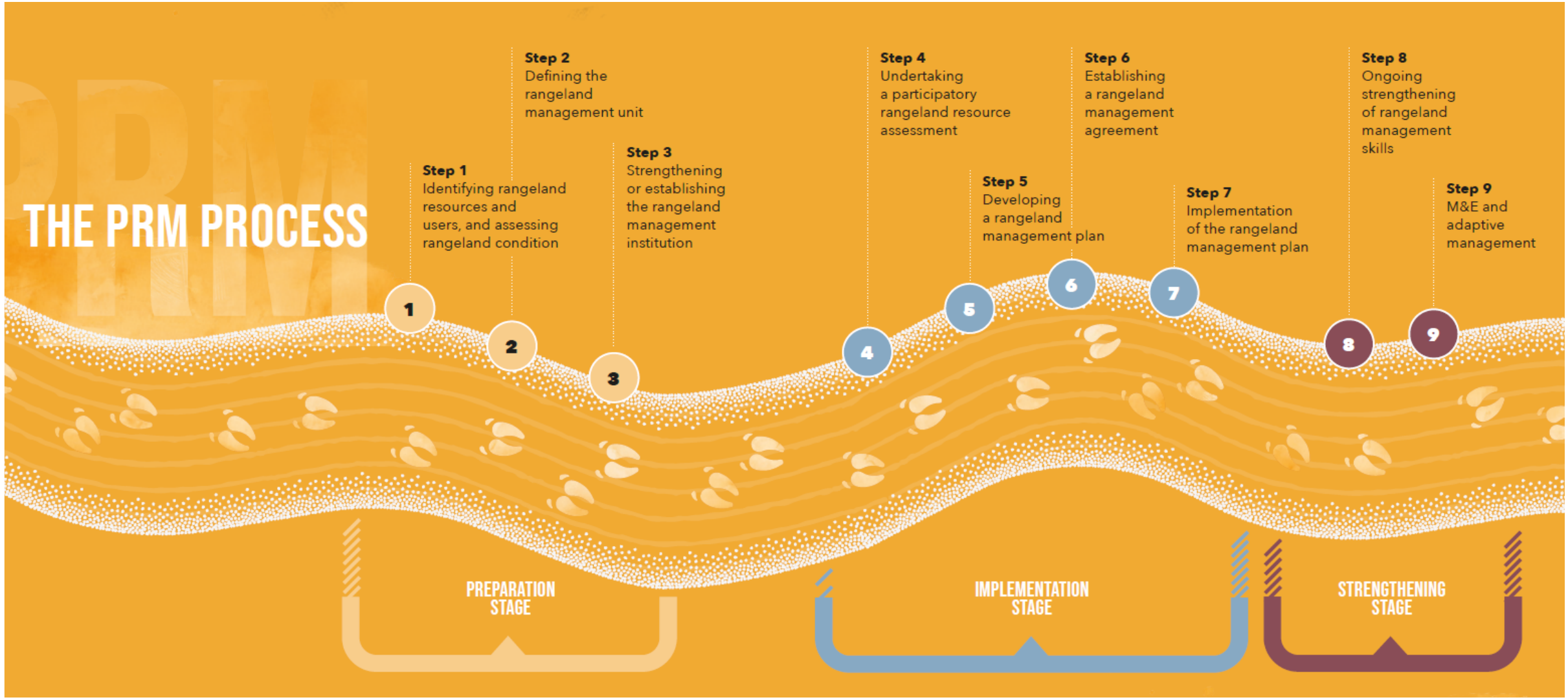
- Rangeland enclosure is effective in **restoring** degraded rangeland **soil quality** (physico-chemical and biological fertility)
- **Enclosure management** (establishment, maintenance and utilisation) plays a key role in rangeland recovery
- The impact of **enclosure time** on the recovery of soil quality is **variable** due to the influence of management and local site factors
- Overall, rangeland enclosure enhances long-term ecosystem functioning and resilience and Provision of ecosystem good and services (benefits)


Open unenclosed rangeland
Private enclosures; now over 700 as at 2010
Communal enclosures; 32 created between 1982-96
© 2012 Google
Google earth
imagery
0°31'49.59" N 36°01'12.02" E elev 993 m
Eye alt 4.59 km

Approaches for Sustainable Grazing Management

1. Rangeland closure – Communal or private enclosures
2. Participatory Rangeland Planning (PRM)

The PRM Process



Case Example: Kutima Ranch Management Plan

Grazing Resources Management Plan for Kutima Ranch

- *Plan Purpose*

"To sustainably manage the grazing rangeland for the benefit of environment sustainability"

- Kutima ranch plans to sustainably manage its natural resources sustainably. To attain this, the ranch seeks to have programmes that contribute to the management of natural resources, including wildlife resources and its habitats.

Guiding Principles of the plan

- Maintaining rangeland ecological integrity through protection of wildlife biodiversity and their habitats within Kutima Ranch

- Protect and maintain wildlife corridor for connectivity within Tsavo National Park and Kutima Ranch ecosystem and the surrounding areas.

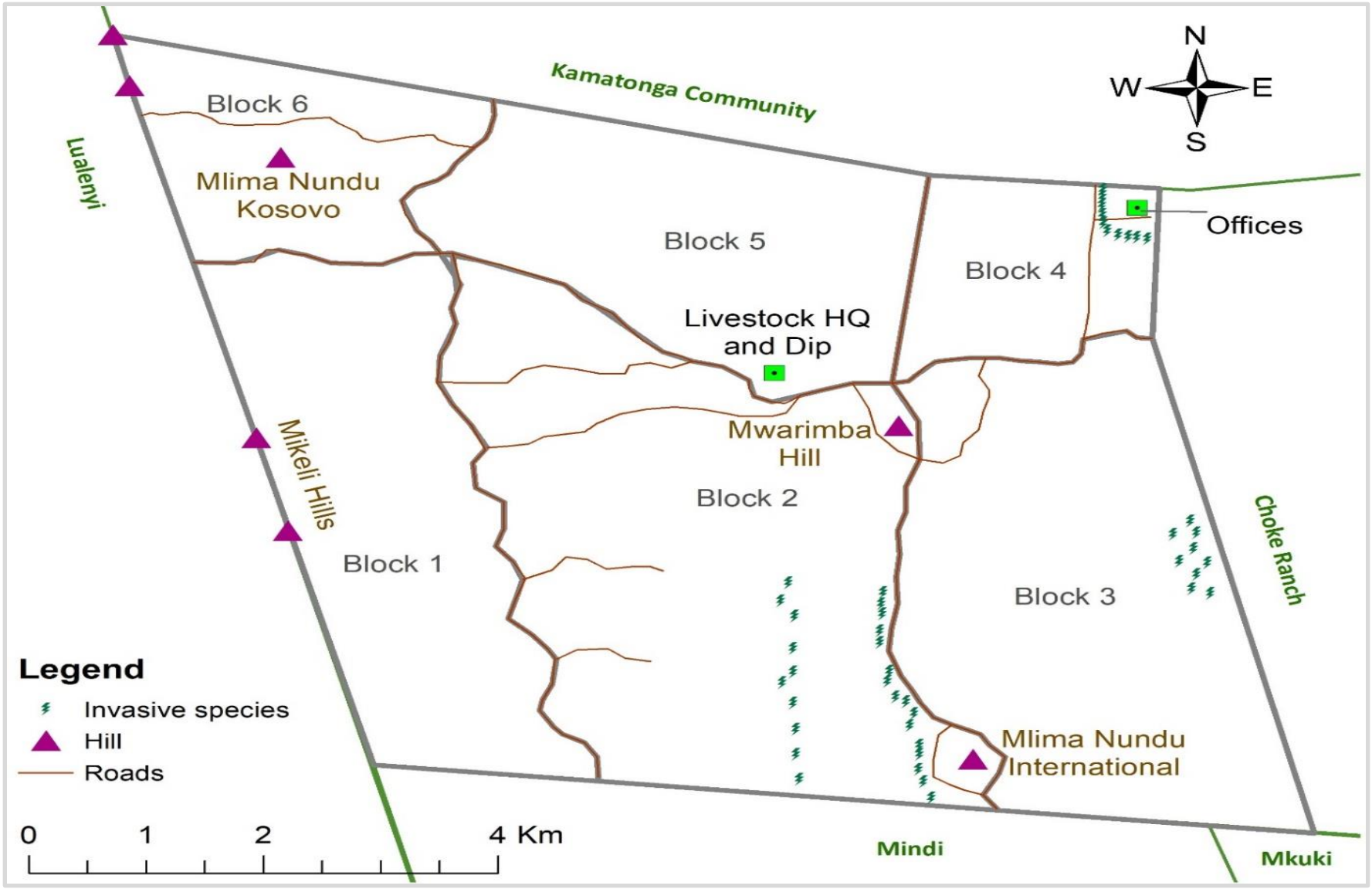
- Biodiversity conservation within the Tsavo ecosystem and Kutima Ranch ecosystem

- Support to the monitoring of ecological trends and threats for informed decision-making

Proposed plans/Activities

- Support game rangers for wildlife and grazing resources security in the ranch
- Sensitise the community on biodiversity conservation and its importance
- Promote protection of wildlife habitats from destruction e.g. charcoal burning, tree cutting, wildfires
- Seek support to remove persons who have encroached the wildlife corridor
- Sensitize landowners within the wildlife corridors on the importance of maintaining and protection of the corridor
- Sensitise the community and the neighbours on the need to avail and protect wildlife corridor as identified within the ranch
- Protection of all wildlife biodiversity from poaching
- Protection of land from degradation and loss of soil gene bank
- Support rehabilitation of degraded lands through reseeding and enhanced natural regeneration through Farmer managed natural regeneration practices (FMNR), Natural Holistic grazing regeneration in all the six grazing blocks.
- The ranch also notes invasive species threats and will put in place control strategies, like use of herders to control the invasive, mainly targeting affected grazing Blocks 1, 2 and 3 with Ipomea, Cissus and Xanthium species identified
- Establish an ecological monitoring and documentation unit/office within the ranch offices
- Create a partnership for monitoring of the ecological parameters within the Ranch

Map showing the invasive species distribution within Kutima ranch



Kutima Livestock Grazing Management Plan

- ***Program Purpose***

“To enhance livestock productivity through planned grazing for increased performance for better and improved livelihoods”

- The ranch seeks to support livestock development and management plan to improve livestock productivity and hence returns to the ranch and community.

- The livestock production is reported to have faced many challenges in the ranch, chiefly being feed seasonality, with frequent droughts leading to losses and migration that increase conflicts with other communities.

Strategic objectives to Livestock grazing and Management plan

- Support the development of livestock infrastructure and Husbandry practices
- Enhance grazing management within the ranch
- Promote strategic fodder production and conservation
- Establish and manage dry season strategic grazing blocks within the ranch
- Support livestock breed improvement
- Support livestock trade and marketing within Kutima ranch livestock unit

Planned Activities/Interventions

- Develop animal production support infrastructure;
  - ✓ Renovation of water pans in Blocks 1, 2, and 4
  - ✓ Rehabilitation of broken dipping race and provision of electric fence for protection from periodic destruction by elephants
  - ✓ Animal vaccination race is needed to reduce time and stress by animal health worker

- Establish grazing blocks within the ranch with six blocks identified (Figure 4)

- Manage the animal carrying capacity for every grazing block following Holistic grazing practices

- Control of overgrazing through timely movement and rest period for regeneration.

- Build pasture store as strategic feed storage unit for excessive biomass harvest from termites' risk blocks during good seasons: Block 4.

- Develop pasture value addition within the pasture production unit and processing into hay/feed blocks/pellets.

- The ranch to consider mini feed processing unit equipment like pelletiser Acquire feed pelletizer for feed processing during favourable conditions.

- The ranch should plan to have strategic feed plants/trees like moringa to support value addition and feed processing

- Establish a dry season grazing area for the ranch.

- Ranch Identifies Block 5 as strategic grazing area near the office block

- Block 2 is reserved as core conservation area and will act as critical period use for community livestock

- Develop strategic water resources within the grazing block areas.

- The ranch has the following water points within the grazing blocks, as also shown in water resource Figure 3;

  - Block 1: The block has Toli and Ziwa la Vumbi water pans that last for a month when in use. It is recommended that water pans should be expanded.

  - Block 2: It has a functional Bakuli water pan but the water pan needs to be expanded.

  - Block 3: It is a mining point. It has two boreholes and the management has proposed to build one more borehole in the area.

  - Block 4: It is served by a functional pua la mdomo water pan that last for between 4–5 months when full. However, the water pan needs silt traps to prevent siltation.

  - Block 5: The block has Dam ya Mbuzi water pan and serves as a strategic grazing reserve for the ranch.

  - Block 6: The block is served by both dam ya mbuzi and pua la mdomo water pans which are functional. Pua la mdomo water pan need silt traps.

- Establish breeding programmes at the ranch for both small stock (Sheep and Goat) and cattle.

- The ranch has already started a breed improvement plan, with breeding Steers from KALRO Buchuma for Boran breed and Boer Goats from South Africa in place to support the initiatives. Establish high quality community support breeding herds to support community herds during offtake for breed improvement.

- Develop animal finishing unit/herd within strategic grazing blocks within the Ranch to support offtake.

- Establish partnership and linkages with terminal livestock markets e.g. KMC

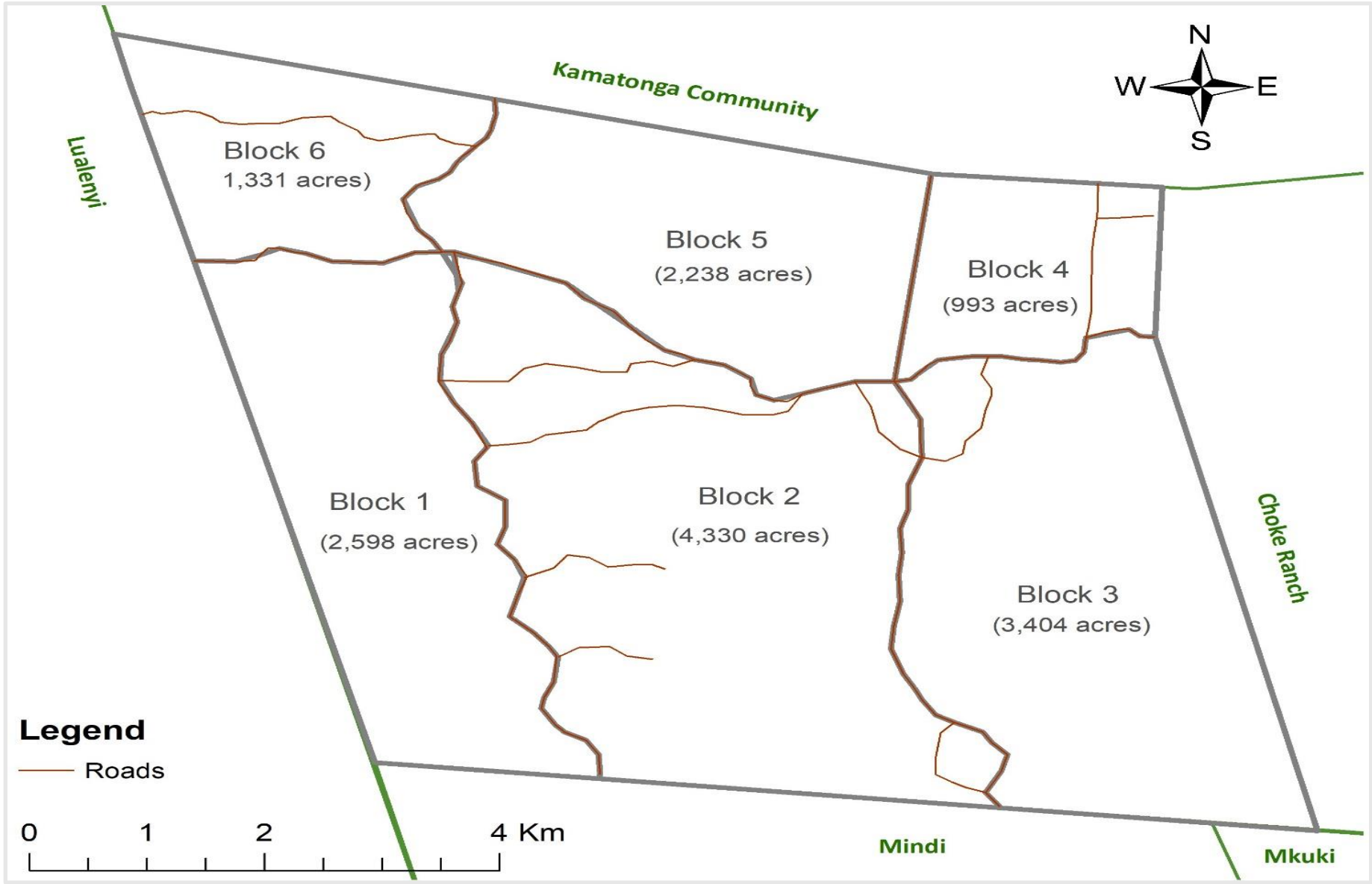
- Establish an active livestock marketing unit within the ranch management to create linkages and market access

- Develop a marketing system for the ranch livestock

- Digital/online platform for wide market reach

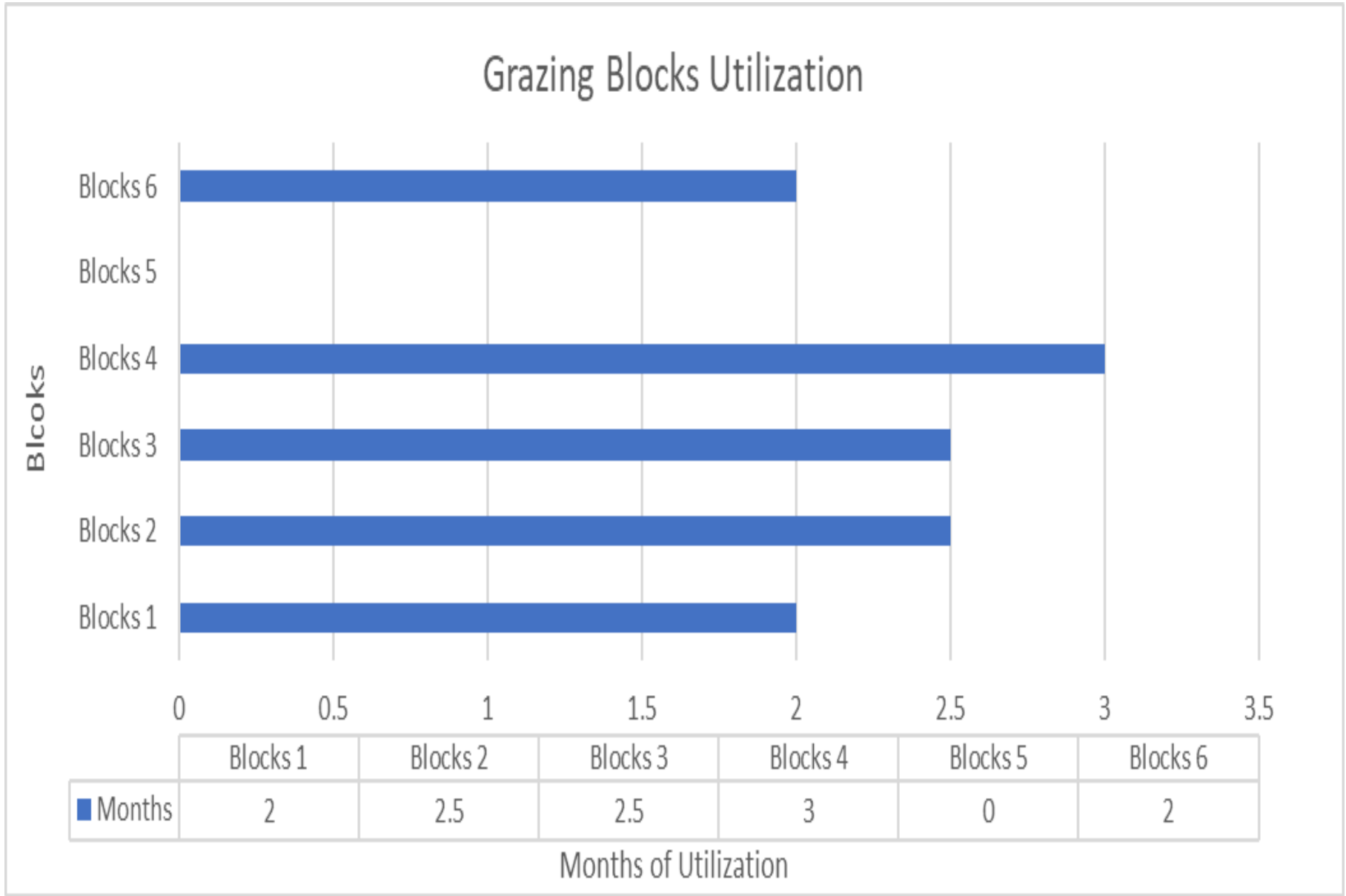
- Ranch livestock beef/meat outlet to target clients

The planned grazing Blocks for Kutima ranch

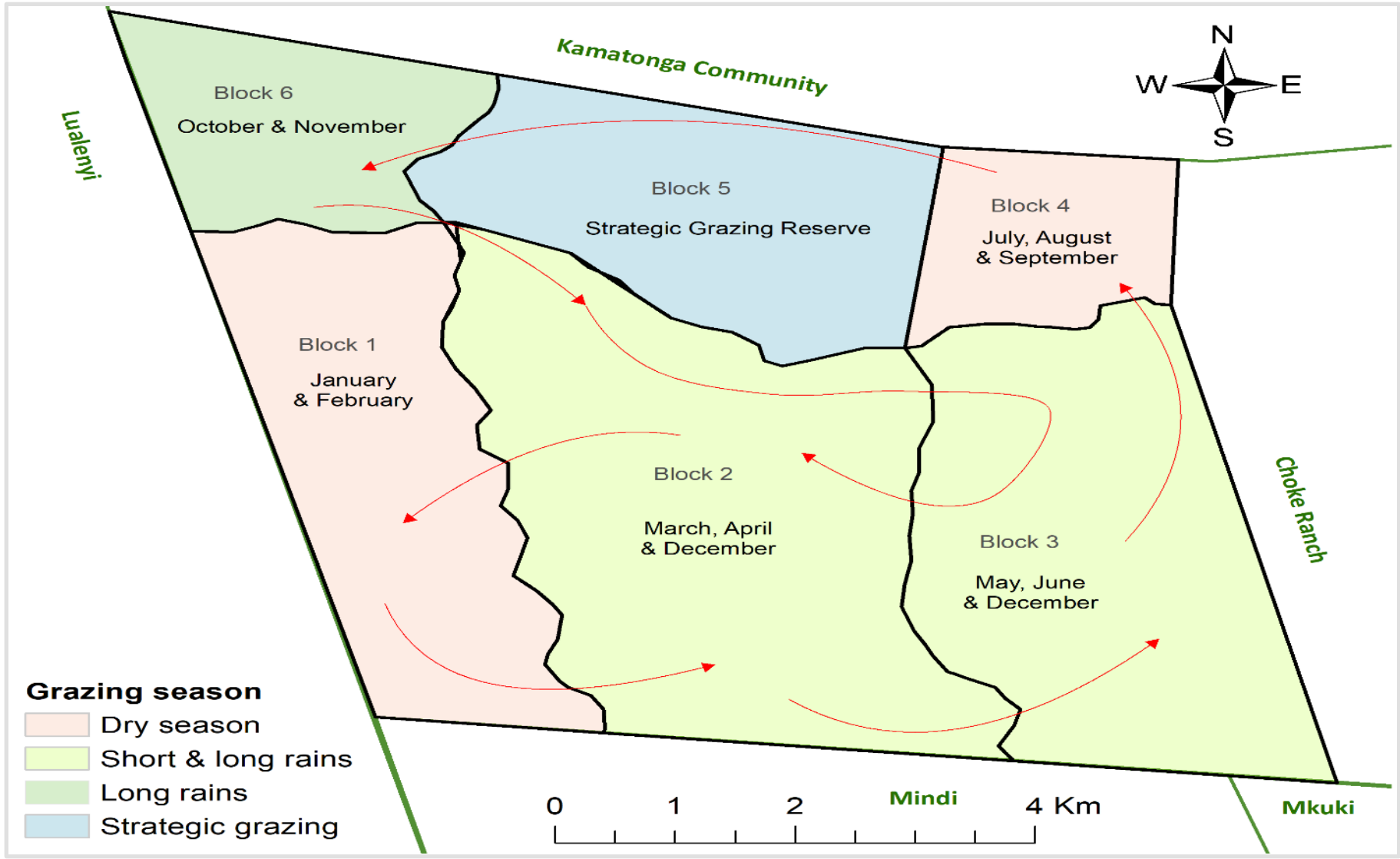


Kutima Ranch Seasonal Grazing schedule/plan

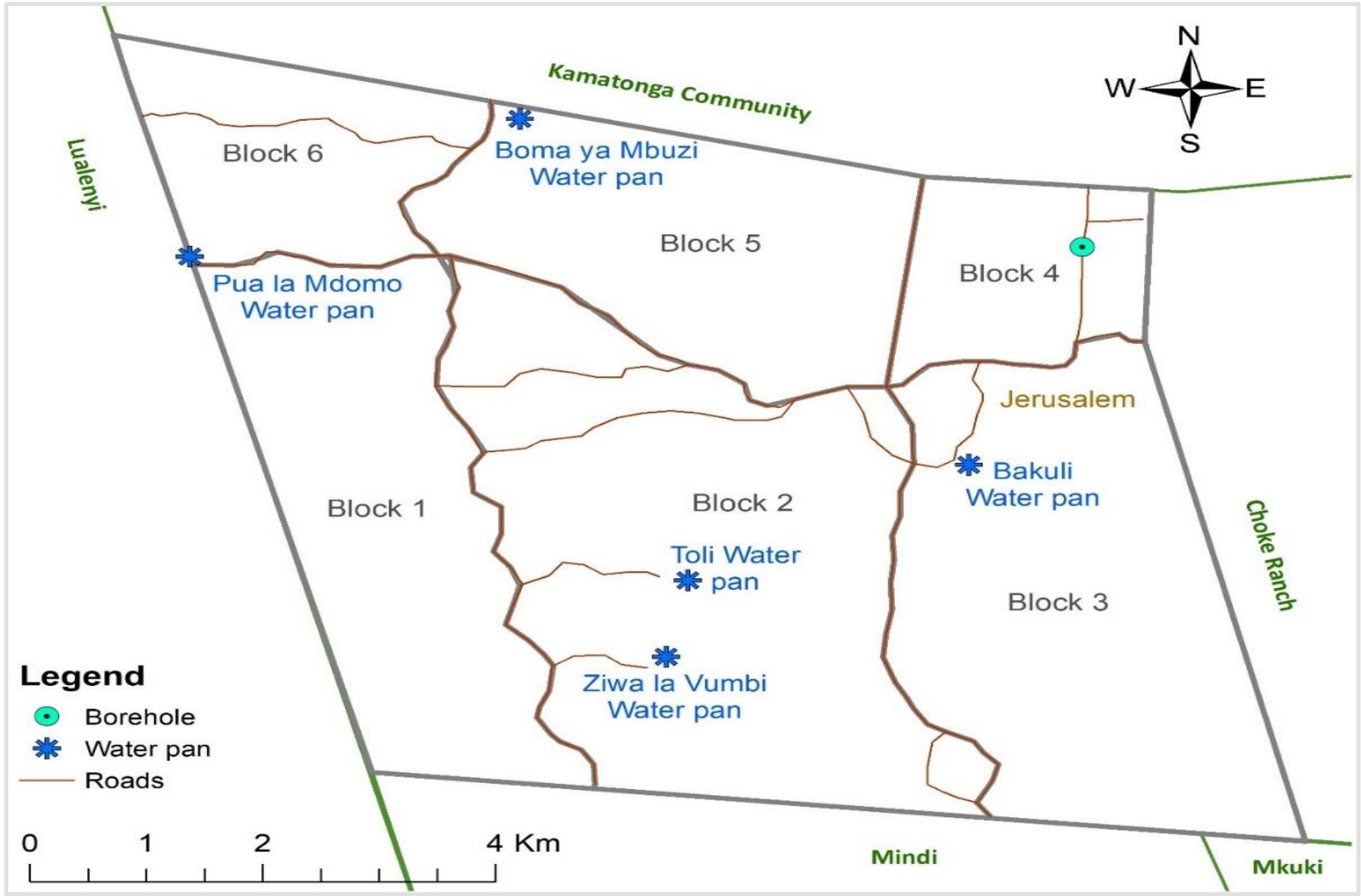
Months	Season	Block1	Block 2	Block 3	Block 4	Block 5	Block 6
Jan	Dry season	X				Strategic G. Reserve	
Feb	Dry season	X				Strategic G. Reserve	
Mar	Short Rains		X			Strategic G. Reserve	
Apr	Short Rains		X/2			Strategic G. Reserve	
May	Short Rains			X/2		Strategic G. Reserve	
Jun	Dry Season			X		Strategic G. Reserve	
Jul	Dry Season				X	Strategic G. Reserve	
Aug	Dry Season				X	Strategic G. Reserve X	
Sep	Dry Season				X	Strategic G. Reserve X	
Oct	Long Rains					Strategic G. Reserve	X
Nov	Long Rains					Strategic G. Reserve	X
Dec	Long Rains		X	X		Strategic G. Reserve	


Grazing Blocks Utilization
Blocks 6
Blocks 5
Blocks 4
Blocks 3
Blocks 2
Blocks 1
Blcoks
0
0.5
1
1.5
2
2.5
3
3.5
Blocks 1
Blocks 2
Blocks 3
Blocks 4
Blocks 5
Blocks 6
Months
2
2.5
2.5
3
0
2
Months of Utilization

Map of planned rotation grazing within the grazing blocks for Kutima Ranch



Map of identified water points for Kutima Ranch



Discussion Prompt

Which grazing management approach is suitable for the location/region where you are working?

Thank you all