

Kuku Group Ranch, Kajiado County

GRAZING MANAGEMENT PLANS

for Itilal, Oltiasika & Kuku pilot zones



Using the holistic planned grazing approach

Compiled: June 2015

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EXECUTIVE SUMMARY: “CHANGING TIMES NEED A CHANGE IN FOCUS”

The Maasai community that is living in Kuku Group Ranch is traditionally pastoral and as a consequence the use and management of pasture has been historically regulated using the rich traditional knowledge and elaborate political structures.

However, the community has seen a steady erosion of regulation and management over the past few decades, accompanied by a steady decline in land health and productivity: according to this initiative’s biological monitoring, some 45% of Kuku GR is now bare land; whilst the quality of the remaining vegetation has declined through arrival (‘invasion’) of ‘less useful’ grass, shrubs and trees.

MWCT (Maasai Wilderness Conservation Trust), together with the community, seeks to facilitate conservation and enhancement of the rich livestock economy and culture, which also supports rich wildlife populations. MWCT engaged Natural Capital East Africa (NCEA) as specialists in rangeland regeneration and management, to begin the process of transforming degradation into wealth regeneration, utilizing a modest budget.

The engagement is split into two parts: Year 1 (Preparation) and Year 2 (Implementation). Year 1 was then split into (a) Mobilisation for support of the approach (b) Grazing Planning. This document reports on Year 1 Part B: Grazing Planning, in advance of implementation anticipated to begin July 1 2015 (start of the long dry season). Year 1 Part A: Mobilisation has been reported on in previous documents.

Sections 1 and 2 give some relevant background that overlaps with previous reports, whilst the remaining sections present the concrete grazing management strategies and plans for each of the three pilot zones, as preparation of implementation.

Overall, they reflect and embed the overriding reality of modern times in the world’s open rangelands: grass needs to be valued, and users need to take responsibility for it, otherwise the richness of life supported by rangelands is not going to survive.

PART 1: RELEVANT BACKGROUND FOR THINKING ABOUT & ADDRESSING THE GRAZING ISSUE

- The modern context of land use on Kuku Group Ranch
- Specific changes in Rangeland Health
- Overview of Holistic Planned Grazing (HPG) as a solution
- Practical aspects required for success going forward

The modern context of land use in Kuku Group Ranch

Livestock Production: Traditionally, Kajiado district's major economic activity is semi-nomadic pastoralism. Over 75% of the population derives its livelihood from livestock production which account for about 60% of the total labour force. The lifestyle of the majority of the population depends on livestock and livestock products for subsistence. Three livestock production systems are identified, namely: the group ranches, individual ranches and individual parcels, being the individual parcels that emerge from the dissolution of group ranches. The group ranches ranges have big grassland areas that the livestock can depend on for pasture. Fluctuations in livestock and migratory wildlife populations are closely correlated. Both population fluctuations are also closely correlated to amounts of antecedent rainfall. It may be concluded that livestock and wildlife are entrained ecologically by pasture and water availability as they share a common ecosystem.

Land Sub-division: The Group Ranches are being subdivided at a rapid pace throughout Loitokitok District. Subdivision has already been completed in most parts of the Kimana group ranch, followed by others. Kuku Group Ranch has allotted parcels of two acres to individual group ranch members in Inkisanjani, Langata Enkima, Olorika, Ilchalai and Olpusare. In some other areas people have allocated themselves land without consulting the group ranch governing authorities and ended up closing animal corridors. Meanwhile, the current livestock husbandry and farming infrastructure is generally poor and need upgrading and rehabilitation. The farming techniques are also not well coordinated and organized as irrigation of crops is carried out at any time of the day.

Rainfed Agriculture: The principle land use change in the ecosystem over the past three decades has been land clearing for cultivation. Rain-fed agriculture is practiced on Kuku GR especially in the following villages; Centre, part of Kuku, Samai, Enkutoto and Olkaria. The land allocation is done by few people close to the executive for the benefit of rewarding the political cronies. In some areas more land is under lease by individuals. The expansion of agriculture is

causing an increased probability of human-wildlife conflict and is not practiced in a sustainable manner.

Irrigated agriculture: The amount of land under irrigation has increased dramatically during the last decades. The natural vegetation has been removed from vast areas close to most rivers and water sources on Kuku Group Ranch. Pumps are extracting water from these water sources for irrigation and leave a desiccated and polluted environment. The high-intensity production of produce such as tomatoes and onions is generating impressive per-hectare return to land leasers coming from outside the group ranch, while the pastoralist land owners only receive a minor lease ranging from Ksh 7000 to 12000 per acre per season. Abstraction of water from streams has become very attractive within Loitokitok sub-county, leaving no water for the downstream use and no underground water recharge resulting in wells drying up. Meanwhile members of Kuku Group Ranch continue to lease their land to people coming from outside the group ranch for a (relatively small) short term gain, unaware of the associated risks to the land and ecosystem health in the long term. Moreover, the livestock they own are languishing due to the lack of water caused by few beneficiaries. Upstream and downstream farmers are in regular conflict about the distribution of water. Meanwhile, community rangers are trying to assist the pastoral community and wildlife by monitoring water abstraction and removing unauthorized water pumps.

Wildlife Conservation:

A main advantage of the traditional Maasai livestock production system is its relatively high tolerance to wildlife. Incidences of human-wildlife conflict can be addressed through traditional conflict resolution structures. However, modern aspirations, a declining number of livestock per capita due to human population growth, livestock diseases, land use changes, land fragmentation and rangeland degradation have caused changes in culture and economy that are less compatible with wildlife.

Kuku Governance and Management structure: Kuku is governed by an elected executive committee of Group Ranch members. The committee consists of **10 key people and 15 others to work as area representatives in any decision making.** This elected committee has powers over land use planning and any other relevant management issue pertaining land management. In addition to the elected executive committee, there are also government-employed Chiefs within Kuku Group Ranch. They who work towards achieving government goals, and work closely with the executive committee of Kuku Group Ranch. Since the establishment of the partnership between Campi ya Kanzi, Maasai Wilderness Conservation Trust and the community of Kuku Group Ranch, capacity has been built in different areas, employment has

been provided, hospitals and other development aspects that has improved the well-being of the inhabitants of Kuku GR.

More fundamental drivers:

Modern aspirations: Modernization and adoption of the western culture has reduced the status of livestock herding within the pastoralist society. The responsibility of livestock herding is increasingly left to younger children, who are less willing and capable of taking the animals to far pastures. This has caused livestock herds to stay for long periods on pastures close to the settlements. Here, the animals continue to bite the same plants on a daily basis causing the plants to die and eventually creating more bare land. The more one allows the individual herder to make his own decisions on where to graze, the more scattered grazing is taking place. Without a communal grazing plan animal impact cannot be controlled and managed in a sustainable way..

Modern aspirations and Education: Traditionally, herders were highly valued members of the community, in whose hands the wealth of the community was entrusted. Modern aspirations have had an effect of decreasing the value and therefore the desirability of herding. Most of those who went to school as pioneers, later left the community to work elsewhere and became role models in cultural norms. In fact they encouraged the community to abandon the traditional cultural norms. At the same time, the government was of the opinion that the livestock sector was the cause of all land degradation. Children grew-up with a negative mind-set towards herding and as a result would only look after livestock if instructed by parents. In this way parents started to lose power over herding as their children spent time in schools and receiving education. Eventually, proper herding got lost and undisciplined, scattered grazing emerged as a result. This consequently led to overgrazing, bare land and decreased wealth.

Scattered Settlement: The loss of traditional cultural norms and leadership within the community also influenced the development of settlements on Kuku GR. Individuals started to decide for themselves where to move and establish a permanent boma or homestead on the group ranch. In the past the Maasai community used to be nomadic and community elders decided where families could establish a temporal boma for a specific season. This sedentarisation is generally agreed to be having a highly negative impact on land and vegetation health and productivity. The key lies in allowing decreased recovery time for plants, especially near those permanent settlements, as will become evident in this report.

Population Pressure, Poverty and Land Degradation: Human population numbers have increased significantly; and poverty is solidifying within the community as the amount of livestock per capita decreased. As a result, almost 50% of the pastoralist community have

turned to alternative livelihoods such as agriculture (rain-fed and irrigated farming) as well as charcoal and commercial wood production. These practices have led to large scale bush clearing and land degradation. These practices have removed natural vegetation from the land leaving fertile areas susceptible to erosion and encroachment by new invasive species.

Specific changes in Rangeland Health

The following significant rangeland health changes are evident from the community's experience and/or the rangeland surveying conducted under this initiative. Bringing the community to understand what is driving these changes, constituted a significant part of training under the Mobilization phase of this initiative. The following brief notes are included here to indicate focus of trainings. In addition, an overview of relevant core principles can be found in Section 2 of this report.

- Bare land ('olpura') has increased considerably from insignificant levels to high levels in the past 20-30 years, and continues to increase. According to a recent rangeland survey conducted on Kuku Group Ranch, approximately 50% of Kuku's land is now bare, reaching up to levels of 70-80% in some of its 11 zones. The primary cause is most certainly overgrazing, caused by excessive numbers of livestock *herds* (rather than total livestock *numbers* as is commonly perceived). Gully erosion has also become a significant related issue, and is estimated by community to now affect 20% of their land.
- Quality of remaining vegetation has declined, with arrival and/or increase of 'less useful' plants (grass, shrubs, trees). One primary example cited is 'Oiti' (*Acacia mellifera*), which is perceived to 'kill grass'. Certainly it can be associated with bare land, but plenty of discussion was held as to whether Oiti was creating bare land, or whether bare land (caused by overgrazing) was 'creating' Oiti, which thrives in such conditions i.e. reversal of perceived cause-and-effect; although many examples exist of Oiti with good grass cover beneath the shrubs..).
- Decrease of 'palatable grasses' (from descriptions, these are the broad-leafed perennials with wide plant bases); While an increase has been seen in non-permanent annual grasses (generally less productive and nutritious).
- Water availability has declined – rivers run for shorter periods of time, springs have dried-up and the grasses grow less tall. A common perception is that this is caused by 'less rain' but previous trainings showed the tremendous impact of bare land on declining water availability (up to 20-30 percent less water available for plants, livestock, people and rivers mainly due to high run-off and high rate of evapotranspiration).

- As a result, certain areas previously traditionally reserved for dry-season grazing have now become wet season grazing areas by default, since the only time plants will exist in those areas is during the rains (eg Kuku zone).
- Certain other areas previously used in the dry season can no longer be used effectively due to a decrease in water availability near the grazing area.
- All of which over time has resulted in a fundamental change in grazing regimes, with increasing use, dependence, and pressure on good grazing areas; particularly towards the Chyullu Hills section of the group ranch, and into the adjoining National Parks; which also includes significant, repeated burning to encourage grass growth – which is at least cause for concern since such high fire frequency is an unnatural phenomenon.

Overview of Holistic Planned Grazing (HPG) as a Solution

HPG concerns the grazing management aspect of the wider Holistic Land Management (HLM) approach.

Three qualities of the wider holistic land management approach are worth highlighting:

1. **Land regeneration know-how:** The HLM approach focuses on recognising the 4 basic processes that determine ecosystem health and productivity; out of which it becomes relatively simple to evaluate which conditions enhance versus harm their function. In terms of available tools to create whichever desired conditions, a significant contribution of the HLM approach is to include 'animal impact' and 'correct grazing' as two additional tools alongside other more conventional management tools of fire, rest and technology. Similarly, the livestock management implications flow. Management thus applies basic biological principles to increase rangeland health and productivity, thereby regenerating ecosystems rather than simply sustaining their current relative poor health, and consequent low densities of animals (domestic and wild).
2. **The 'Triple Bottom Line' management approach:** The HM approach emphasizes adoption of actions that simultaneously consider the environmental, economic and social dimensions of any given management setting – as necessary for true sustainability.
3. **User driven approach:** The process is wholly owned by the owners and users of the resources. This sense of ownership combined with new knowledge and the communities resources at hand, present an opportunity to the owners of the communal rangelands to

draw on their own wealth base and culture as a tool to restore rangeland productivity, and by extension healthy livelihoods.

What are the anticipated benefits of the approach?

Holistic Management enables the utilization of resources and tools people already own to:

- Improve forage yield, quality and plant diversity
- Enhance effective ecological processes - water cycle, mineral cycle and energy flow
- Increase carrying capacity
- Maintain or improve wildlife habitats
- Significantly improve available water for plants, livestock, humans and rivers-springs
- Enhance resilience and reduce effects of droughts
- Reverse dryland degradation (desertification)
- Increase carbon sequestration
- Create more biologically-active soils and therefore fertility
- Enhanced soil carbon sequestration for climate change mitigation & adaption
- Enhance profits and livelihoods
- Reduce costs
- Improve broad quality of life for communities

Practical aspects required for success going forward

1. Develop the management grazing plans that enhance good grazing practices and correct the problem of land degradation

- Grazing strategies (a grazing strategy represents the annual plan, and sets the basis for detailed day-to-day management within each season).
- Grazing plans (detailed day-to-day management within each season).
- Grazing by-laws that also apply to visitors from other areas.
- Specific rehabilitation interventions where needed e.g. bush control where excessively thick and preventing use, gully healing, reseeding limited areas etc.

2. Building institutional capacity (Governance)

- Authority and decision-making bodies (traditional and modern).
- Grazing management bodies, coordinators.
- Users and Implementers (livestock owners, managers, herders).
- Roles and responsibilities of all entities relevant to grazing.
- Involvement in and/or awareness of all bodies + community-at-large of upcoming season's grazing plan.

- Develop a land use plan for Kuku GR control adverse land use changes, and enhance chosen areas.

3. Build natural resource management capacity of grazing managers

- Basic land principles - how land functions: Ecosystem Processes .
- Available tools for Management & how they affect the ecosystem.
- Basic components of planned grazing.
- Practice their roles and responsibilities.

4. Monitoring and Learning

Put in place a simple monitoring protocol to be implemented by the community. This involves livestock condition and soil impact monitoring on daily basis; and biological monitoring over the longer term. All of which should be internalized within the community so that they can adjust their management accordingly.

PART 2: KNOWLEDGE FOR SUSTAINABLE GRAZING

- 'Reading' the land health and understanding the ecosystem interactions
- Tools for the alteration or managing of the ecosystems
- Grass management

[this is a short summary of relevant background technical material, covered in trainings and previously reported, but included here in Annex 1 as reference]

PART 3: GRAZING PLANS & IMPLEMENTATION

- Objectives
- Scope of the grazing management plan
- Developing the plan: principles and processes involved
- Identifying Pilot zones to implement Grazing Strategies & Plans
- Management units & responsibilities

Objectives

The principal objectives of this section under the consultancy were to:

- A. Incorporate the principles of ‘correct grazing’, which the community were exposed to in Phase 1 (refer to Section 2 above), into the development of a Grazing Management Plan in each of the 3 pilot zones, namely Iltital, Kuku and Oltiasika.
- B. This includes specific grazing plans for the upcoming dry season - starting July to October – in each zone, developed with each zone’s grazing committee.
- C. Carry out as much training as possible to provide capacity and prepare each zone’s grazing committee to implement the plan, come July (note: ongoing training and mentoring during that time by this consultant is planned under ‘Year 2’ engagement).
- D. Confirm the viability of each plan for dry season July – October; and identify any relevant issues / problems that need addressing during that period.

Scope of the general Grazing Management Plan

The plan borders three group ranches mainly Kimana to the west, Mbirikani to the north, Rombo to the south and Tsavo West and Chyulu National Park to the east. The area is generally arid to semi-arid with limited variation in its agro-ecological zones. This grazing management plan covers both Kuku and Kuku A Group Ranches (together referred to as Kuku GR). Kuku GR has been divided into 10 grazing zones for managing pasture and improving land health. The community of each zone has elected 9 Group Ranch members to serve as a grazing committee to spearhead the grazing planning and the management of the grazing areas. The geographical scope of the plan primarily focus on Natural Resource Management, especially to improve rangeland management and condition, whilst enhancing capacity of the grazing institution to be competent to undertake good decisions that correct the poor practices that have led to land degradation.

Overview of Holistic Planned Grazing (HPG) principles and process

Grazing is a natural disturbance to which many rangeland plants are adapted. The effects of grazing depend—like those of other disturbances—on timing (when they happen), intensity (how severe they are) and frequency (how often they recur). Grazing can be managed in these three terms.

HPG is a grazing planning procedure that helps to get the livestock to the right place at the right time and for the right reasons. Grazing planning involves the manipulation of time (of grazing), area (of land) and numbers (of animals), while catering for numerous variables related to management and weather. Planning is critical to achieve sustainable grazing and to avoid overgrazing. Not only does good planning improve management, it also provides a greater sense of control over one's livelihood, which can be an important boost to morale in a business characterized by uncertainty and risk.

When managing holistically, one is using grazing as a 'planned event' that is enhancing one's desired social and economic ecosystem. When interlinked with the tools of technology, rest and animal impact, it is a powerful tool for changing landscapes. When properly executed, grazing will encourage the development of living organisms and enhance biodiversity, leading to true profits for an entity. A grazing plan is drawn up by livestock owners and herders together to discuss moving animals to the right place, at the right time for the right reasons. It helps to meet the needs of livestock, of wildlife, soil, plants and people.

Benefits of planned grazing

- Healthier land, healthier cattle
- Elimination of overgrazing of plants
- Increased grass / plant cover i.e. new plants
- Increased forage / biomass production
- Improved water supply to streams and springs
- Sequestration of atmospheric carbon into community soil
- Moving closer to a community's desired future
- People work together in decision-making and planning
- Better decisions, planning, implementation, and results

Developing of a grazing plan

Growing season / Wet season / Open plans

The Growing season / Wet season / Open plan is developed before the end of the long dry season or short dry season ends. During the Open plan the forage grown must meet two requirements: first, it must appropriately meet the feed demands of the animals on hand, and second, it must allow the farmer to build a stockpile of forage for consumption during the following closed plan. Recovery period, maybe shorter and longer recovery periods, reflect the length of time that severely bitten plants need to recover. The faster a plant grows, the shorter the recovery period it requires. The slower a plant grows, the longer the recovery period the plant needs to recover from grazing. By putting the animals together and concentrating animals onto small sections of land other grazing blocks can be given enough time to recover. The increased recovery period will increase the health of the grasses in the grazing blocks.

Dry season / Non-growing / Closed plans (ie the current plan)

The Dry season / Non-growing / Closed plans starts when plant growth stops due to either the normal end of the growing season or to an early end of the growing season because of impending drought. In this time animals will remove feed from the forage pool, whilst little or no new forage is in production. Eventually, the available forage may run out. Running out without a plan is a recipe for disaster, so the closed plan is designed to ensure the animals can be maintained throughout an extended period of slow or non-growth.

The most important purpose of planning the movement of animals in the dry season is to make sure they get the best available forage at the times when they need it most (such as giving birth, and late in the dry season when it starts to get hot) and to trample the soil crust and dead plant material to the ground. This helps to fertilize the soil with plant litter and the seeds are sown by the hooves of the animals before the rain starts.

Closed plans are made to match both stock numbers and time to the total forage available in the non-growing season. The available forage is the one factor that cannot be varied, except downwards—one has what is available at the time when growth stops! The variables in the equation show how long one must manage the forage available, so that it will last until a seasonal break can be expected, hence how many animals can be kept for that time.

The Closed plan allows one to accurately assess, block by block, how much forage physically exists. One then uses a proven process to calculate how long the forage reserves must last, so that one and whatever stock one holds will make it safely to a new growing season. At the end

of this process one will have calculated how many animals can safely be held for various lengths of time. When calculating time, the expected period before a 'normal' return to active growth plus a safety valve which is referred to as the 'drought reserve' should be taken into account.

The process: 10 steps of planned grazing

These '10 steps' outline the process of developing and implementing HPG, which was followed in the zones.

1. Set a goal for what one wants the land to look like (covered ground, good plants, many types, rivers flowing etc.), and how the community wants to work together (who is involved, their roles, how will they organize themselves etc.)
2. Control use of the area
3. Divide the area into grazing blocks (as many as possible).
4. Only one block to be used by all herds at any one time.
5. Calculate the number of days the herds will spend in each block according to:
 - *Available forage in each block (for dry season)*
 - *How much land is to be grazed & how many times (for wet season)*
6. Decide the sequence the herds will move through the blocks.
7. If possible, combine as many herds together.
8. Graze a different section of the used block each day.
9. Do not come back into a block before the grass has recovered.
10. Monitor one's animals and soil impact daily, monitor one's land every 6-12 months

Difficulties of planned grazing

Planned grazing may require a paradigm shift away from conventional grazing regimes. Having larger herds of cattle working together can require changes to management, infrastructure and animal husbandry techniques. There is a large network (local, national and international) of people who have met these challenges successfully and overcome them using a variety of solutions under a range of conditions.

Zonal Grazing Strategies & upcoming Dry Season Plans

A Zonal Grazing Strategy outlines the annual strategy i.e. main parameters dictating grazing. A Grazing Plan is made each seasonal, within the strategy.

Zone 1: Iltlal Zone Grazing Strategy & upcoming Dry Season Plan

➤ **Grazing Strategy 1: Deciding the grazing areas and time for grazing.**

During the course of the dry season livestock from the zones Oyarata, Samai, Kuku, Enkutoto, Langata and Inkisanjani joins the Iltlal zone. Subsequently, the livestock moves from the Iltlal zone into the Chyulu Hills.

Proposed Iltlal Grazing areas

1. Wet grazing areas: Mukao, Endooto and Osinoni
 2. Dry grazing areas: Enkusero, Olkiloriti, Olkeri and Loongiito
 3. Grazing banks (Olopololi) for calves: Eluai , Singila and Lolosho
- Usual Animal Units: Shoats 4000, Donkey 150 and Cattles 4500.

Calendar of the proposed time and area

- | | |
|---|---|
| 2 month short wet grazing strategy | from Nov 16 th '14 to Jan 14 th '15 |
| 2.5 month short dry grazing strategy | from Jan 15 th to Mar 30 th '15 |
| 3.5 month long wet grazing strategy | from April 1 st to June 30 th '15 |
| 4 month long dry grazing strategy | from July 1 st to Nov 15 th '15 |

Grazing Committee: The grazing committee is in place and is trained on basic grazing management principles and they are ready to start working towards the goal of sustainable grazing as agreed by the community during the HPG workshops. The grazing committee requires further training, especially on planned grazing and leadership. This is planned for 'Year 2' of the project.

➤ **Grazing strategy 2: Control livestock movement from other zones to watering points that will affect the plan.**

To achieve the above strategy Iltlal zone needs to raise awareness by holding meetings with the other zones that they share grazing with:

- **Enkaroni-Eluai grazing area:** arrange meetings with Oyarata and Kuku zone to discuss where to graze during the dry season and wet season.
- **Enkaroni-Olkeri grazing area:** arrange a meeting with the community of Oltiasika, Olorika and Kuku and discuss a plan to develop joint grazing areas.

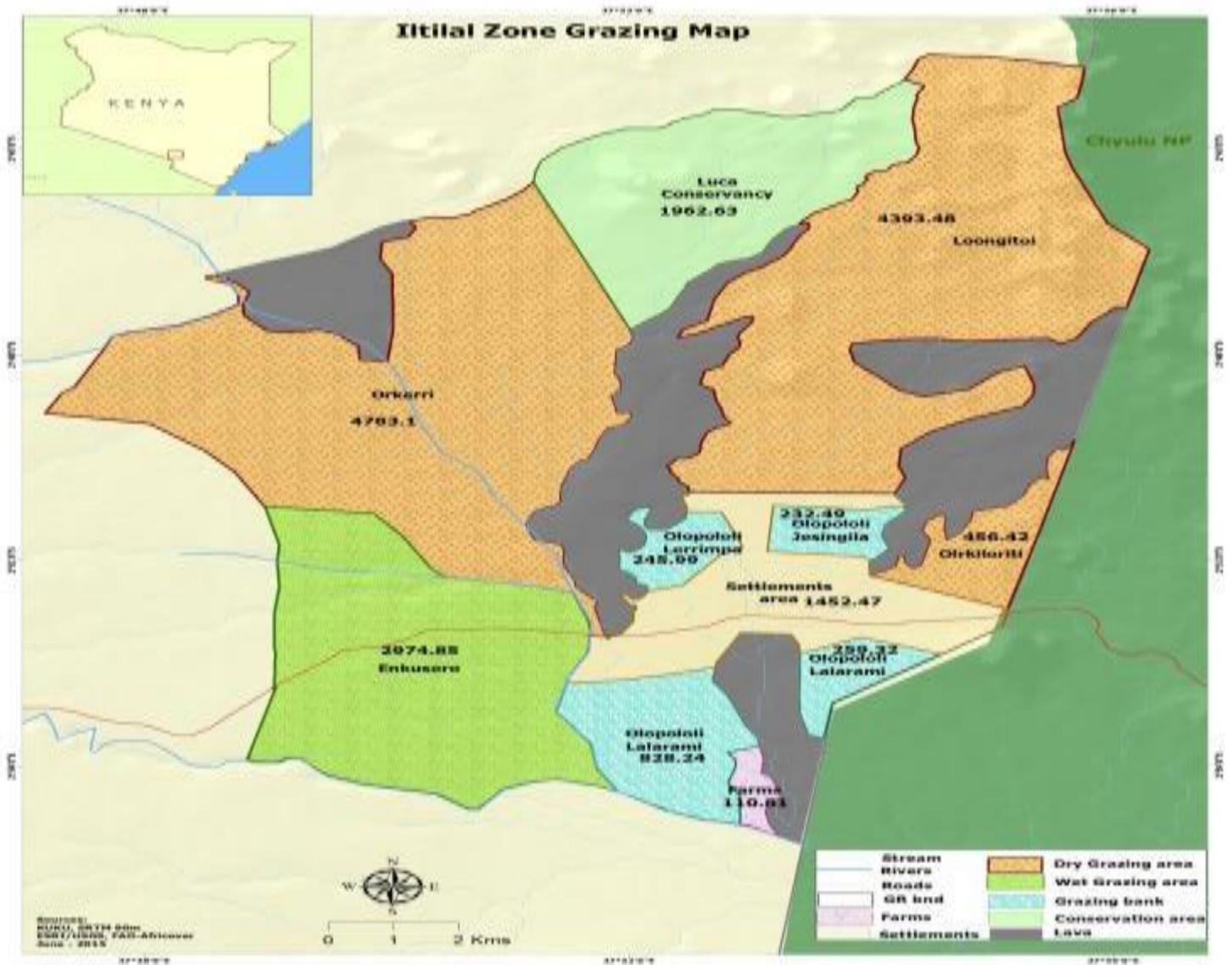
➤ **Grazing Strategy 3: Establishing settlement areas.**

People have constructed new bomas inside the former grazing areas and especially *Olopololi* (grass banks for calves, sick and local animals), because of an increase of the human population, an increase of individualism and poor land use planning. According to the grazing committee: “We are in discussion as a community on how to best relocate those who have settled in the grazing areas”.

➤ **Ittilal zone Grazing Map & upcoming Dry Season plan.**

The map below was developed together with the Ittilal grazing committee and community members. The map indicates the main 4 zones that exist: dry season blocks, wet season blocks, settlement zones (no controlled grazing) and permanently reserved grass banks (*olipololi*).

ILTILAL ZONE GRAZING BLOCKS MAP



ILTILAL DRY SEASON GRAZING PLAN July – November 2015

	Parameter	Block		
		Loongiito	Olkerri	Olkiloriti
1	Length of the season (days)	150	150	150
2	Number of grazing rounds	1	1	1
3	Size of area for 1 animal day of grazing (AD in sq m)	52	56	14.4
4	Size of the blocks (hectares)	2975	4783	456.4
5	Total animal days (ADs) of grazing available per block	572,115	854,107	316,944
6	Number of animal units (AUs): Total 8000	4000	4000	4000
7	Actual number of days grazing available per block the herds	143	214	79
8	Community visual assessment (days)	120	180	30
9	Planned number of days per block this season	120-143	71-120	30-79
10	Sequence of block use	1=	3	1=

The dry season is expected to begin June 26 and end November 15 ie 150 days. Herds will move through each block only once during that time. The area required to adequately feed one animal for one day is significantly smaller in Olkiloriti, although from experience the figures indicate that, overall, forage quantity is relatively good across all Ittilal dry season blocks. 8000 animal units (bulls, cows, steers, calves) are catered for in the plan: 4000 of Ittilal herds and 4000 visitor herds (expected to be relatively high this season due to forage shortage elsewhere).

There is some divergence between the physical forage assessment demonstrated by the consultants with the grazing committees, and traditional visual assessment: 143 days grazing for the respective herd number vs 120; 214 vs 180; and 79 vs 30 respectively across the blocks. This does not present a problem, however: the advantage is with making available an additional assessment method, and the two can be compared vs actual implementation, and lessons learnt.

In terms of implementation, 50% will start and finish in Loongiito (120-143 days grazing anticipated depending on which assessment method), whilst the other 50% will start in Olkiloriti and shift to Olkerri after an anticipated 30-79 days (again, depending on assessment method). If indeed the community assessment is accurate, there will be a need for the

Loongiito herd to shift into Olkerri with the others for the last 30 days of the plan, before the onset of the rains. That does not present any issue according to the estimates, since Olkiloriti and Olkerri combined are holding more than adequate excess grazing days. Only cattle are included in the plan; shoats will use the settlement / sacrifice zones.

In terms of daily implementation, the herds will follow the principles presented in Steps 7 and 8 of the '10 steps of HPG' i.e. combining of herds / herds grazing together; and use of a different section each day: these principles are already practised within the community's traditional method.

Overall, no major issues are seen with the plan, except possibly the issue of daily 'trailing' back from fresh grazing zones to bomas and/or water over previously grazed ground for a period of up to a month, before the line of bomas is moved forward once again. This is an aspect to be monitored and reviewed with the grazing committee in the next dry season plan design period.

The main issue that came to light, however, is that the community abandons the discipline of lumping herds together causing smaller herds to graze independently in the wet season; although not the specific topic of dry season planning, this practice causes overgrazing of plants (i.e. plants are grazed too frequently) and this will continue to degrade wet season blocks. This practice by the community is adding pressure to the dry season blocks to perform longer as wet season blocks are getting exhausted. This aspect needs attention in the period leading up to wet season plan design (October-November).

Zone 2: Kuku Zone Grazing Strategy

➤ Grazing Strategy 1: Deciding the grazing areas and time for grazing.

The community of Kuku zone has 4 grazing strategies: two wet season strategies and two dry season strategies each year.

Proposed Itilal Grazing areas

1. Wet grazing areas: Olalalei, Empere papa and Esamatet
 2. Dry grazing areas: Lootaa, Esamate and Lekiporoi
 3. Grazing banks (Olopololi) for calves: Lenkaroni, Lenechan and Olopololi
- Usual Animal Units: Shoats - 3500, Donkey - 100, Cattle - 3150.

Calendar of the proposed time and area

- 2 month **short wet grazing strategy** from Nov 16th '14 to Jan 14th '15
- 2.5 month **short dry grazing strategy** from Jan 15th to Mar 30th '15
- 3.5 month **long wet grazing strategy** from April 1st to June 30th '15

4 month **long dry grazing strategy** from July 1st to Nov 15th '15

Grazing Committee: The grazing committee is in place and is trained on basic grazing management principles and they are ready to start working towards the goal of sustainable grazing as agreed by the community during the HPG workshops. The grazing committee requires further training, especially on planned grazing and leadership. This is planned for 'Year 2' of the project.

- **Grazing strategy 2: Hold meetings with neighbouring zones to ensure they understand the grazing plans of Kuku zone and to ensure the control of animal movement when entering Kuku zone.**

To achieve the above strategy they need to take some measures of awareness by holding meetings with other zones that share grazing areas and work closely with Kuku grazing committee and leaders.

- **Enkaroni-Ololalei grazing area;** Discuss the grazing plan of Kuku zone with the communities of Enkolili, Langata, Maralal and Samai; the aim of the meeting will be to convince those communities to respect the grazing plan of Kuku zone and to ensure that their animals will take water at Elerai dam.
- **Enkaroni-Ormoshono dry grazing area;** Discuss the Kuku zone grazing plan with the community of Iltlal and Oyarata to ensure they understand the plans and inform them not to water their animals at Noogumumwani dam.
- **Grazing area of Esamatet;** Meetings required with Neiti, Samai, Oyarata and Lorkine to agree how they can share the grazing area and how to increase the grazing areas.
- **Sake Borehole;** the community from Kuku zone decided to close the Sake borehole, which is an individually sunk borehole, during the wet season. This borehole is in the centre of a dry grazing area. The grazing committee will open the borehole during the dry season.

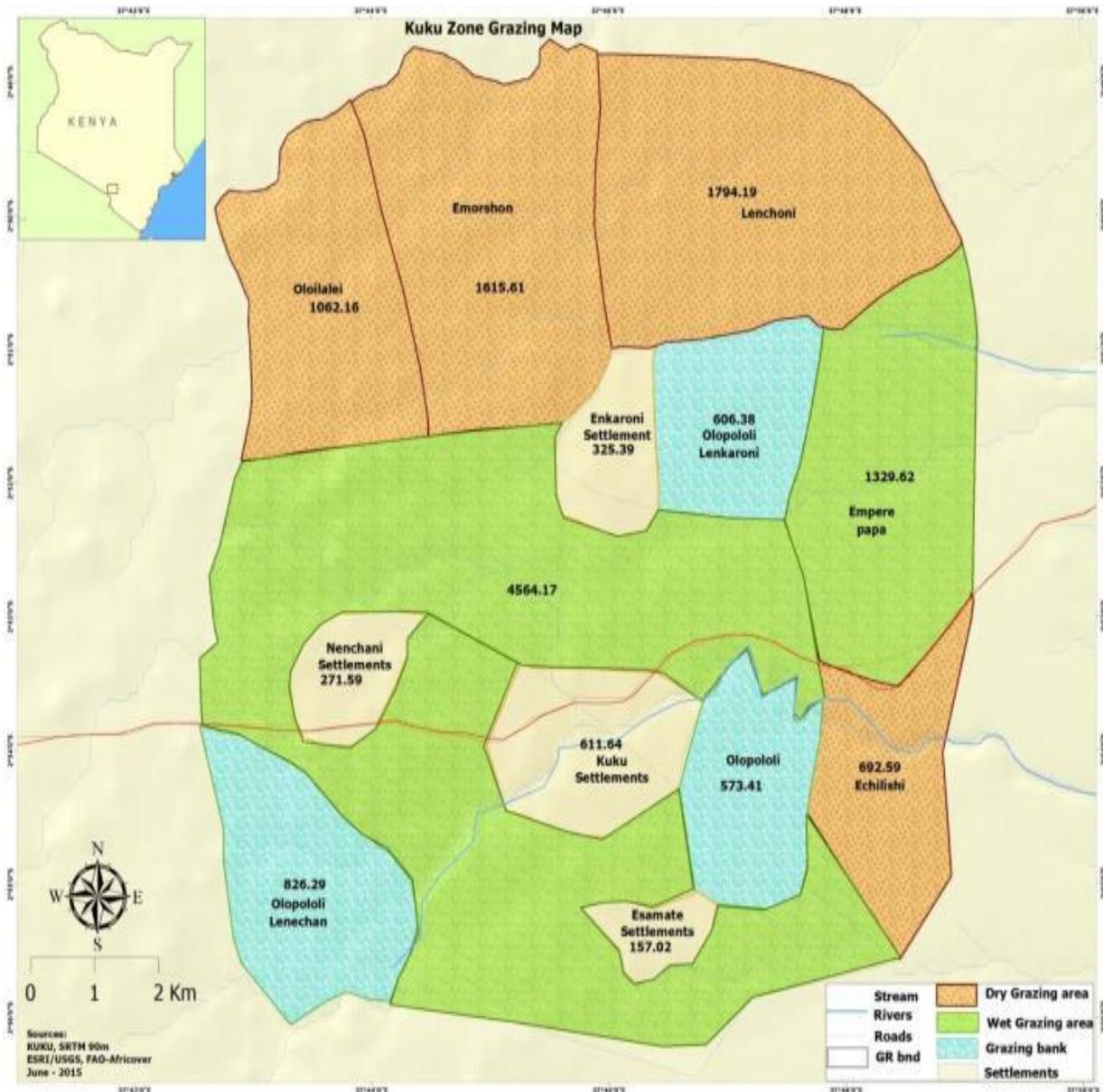
- **Grazing Strategy 3: Establishing settlement areas.**

The community has evaluated the *bomas* which have affected the grazing areas. They found some bomas in each grazing area: Oloilalei - 3 bomas, Elmoshono - 2 bomas and Esamatet - 15 bomas. The community of Kuku has planned several meetings together with the group ranch leadership to explore the possibilities for settlement planning and relocation of the bomas from the grazing areas.

➤ **Kuku zone Grazing Map & upcoming Dry Season plan.**

The map below was developed together with the Kuku grazing committee and community members, and shows the main 4 existing zones: dry season blocks, wet season blocks, settlement zones (no controlled grazing) and permanently reserved grass banks (*olipololi*).

KUKU ZONE GRAZING MAP



KUKU DRY SEASON GRAZING PLAN July-November 2015

	Parameter	Block				
		Erimoshon	Oloilalei	Lenchoni	Empere papa	Echilishili
1	Length of the dry season (days)	123	123	123	123	123
2	Number of grazing rounds	1	1	1	1	1
3	Size of area for 1 animal day of grazing (AD in sq m)	46	46?	46?	154	?
4	Size of the blocks (hectares)	1616	1062	1794	1330	677
5	Total animal days (ADs) of grazing available per block	351,304	230,870	390,000	86,363	?
6	Number of animal units (AUs)	3740	3740	3740	3740	1300*
7	Actual number of days grazing available per block the herds	94	62	104	23	?
8	Community visual assessment (days)	120	50	90	30	30
9	Planned number of days per block this season	43	29	48	30	30
10	Sequence of block use	2	1	3	2= & 3=	1=

The dry season is expected to begin July 15 and end November 15 i.e. 123 days. Herds will move through each block only once during that time. The area required to adequately feed one animal for one day is significantly smaller in Empere Papa – due to the fact that it has been 50% grazed in the wet season, and unknown in Echilishili – due to lack of sampling since this was added later as a dry season block on the map. Otherwise the sample from the other, larger blocks indicate good forage quantities (AD figure is the same since they were sampled as one block, later split into 3 by the committee). 3750 animal units (bulls, cows, steers, calves) are catered for in the plan: 1750 of Kuku zone herds and 2000 visitor herds (expected to be relatively high this season due to forage shortage elsewhere). In addition, 1300 separate animal units will use Echilichili throughout the season. These consist of 700 cows and 3000 shoats based in that area. Otherwise all other shoats will use the settlement / sacrifice areas.

There is relatively little divergence between the physical forage assessment demonstrated by the consultants together with the grazing committees and the traditional visual assessment done by the community.

In terms of implementation, the main herd of 3740 will start in Oloilalei, moving eastwards to Erimoshon, then Lenchoni for the days indicated in Line 9 above. Empere Papa is used in

parallel, as animals trail back daily to water at the hand dug *lugga* wells in the 'Kuku Settlements' zone. Overall, the estimate based on samples is that grazing can last for 260 days; therefore there is adequate grazing according to the estimates taken, based on the grazing committees guidance on representative sample sites.

In terms of daily implementation, the herds will follow the principles contained in Steps 7 and 8 of the '10 steps of HPG' i.e. combining of herds / herds grazing together and the use of a different section of a grazing block each day. These principles were already part of the community's traditional method of daily use. The major current constraint to the dry season plan is the severely restricted availability of water and the large distance between the dry season grazing blocks and the water points. Water is only found in Kuku Settlements zone. This allows livestock to only water every second day in shifts.

Overall, the main issue of the community with the plan is the 'trailing' back from fresh grazing zones to bomas and distant water sources through designated wet season grazing zones on a daily basis. The easy answer is to "supply water in / nearer the dry season blocks", however, new water supply contains inherent dangers that need to be thoroughly assessed in advance by all concerned. It may well be that cheaper alternatives can be found e.g. realigning of block boundaries that allow better balancing of water & forage in addition to assessment of new water supplies. This is an aspect to be monitored and reviewed with the grazing committee in the design period for the plan for the next dry season.

As with Iltlal, the main issue that came to light is that the community abandons the discipline of lumping herds together causing smaller herds to graze independently in the wet season. As with Iltlal, this practice causes overgrazing of plants (i.e. plants are grazed too frequently) and this will continue to degrade wet season blocks. This practice by the community is adding pressure on the dry season blocks to perform longer as wet season blocks are getting exhausted. This aspect needs attention in the period leading up to wet season plan design (October-November).

Specific challenges cited by Kuku grazing committee during implementation:

1. Animals trailing to/back from water.
2. Position of the dam – means dry season blocks are used in wet season; and some wet season blocks are used in dry season when travelling.
3. Position of wells / water – far from dry season blocks.
4. Some herds go for grazing ahead of agreed time (9.30 am).
5. Neighbours zones invade dry season blocks during wet season.
6. Ignorance/ indiscipline – people don't respect plans.
7. Degradation of wet season blocks.

Zone 3: Oltiasika Zone Grazing Strategy

Grazing Strategy 1: Deciding the grazing areas and time for grazing.

Oltiasika grazing is more complex because it is depending for most of the grazing time on grazing areas in the Chyullu Hills. Heavy rains in the Chyulu Hills negatively affects the condition of the calves and forces the livestock owners to take the animals to the lower plain areas of Oltiasika. There are 2 permanent settlement areas: Oltiasika and Centre. The community proposes Mukao and the Chyulu Hills to be wet season areas to graze all the grass before fires break out in the month of August. Only few animals will be allowed to graze around the bomas and nobody will be allowed to bring herds down to the villages and plains before meetings are held and it is agreed to bring the animals. The proposed dry grazing areas are Empouti and Olrmania.

Proposed Itital Grazing areas

1. Wet grazing areas: Mukao and Olrmania
 2. Dry grazing areas: Impouti, Lenkijape and Noorkurupeni
 3. Grazing banks (Olopololi) for calves: Noorkurupeni, Impoouti, Olrmania and Mukoa
- Usual Animal Units: Shouts - 5500, Donkey – 100, Cattles 4150.

Calendar of the proposed time and area

- 3.5 month **short wet grazing strategy** from Oct 1th '14 to Jan 30th '15- Mukao/Endoto
- 2 month **short dry grazing strategy** from Feb 1th to Mar 30th'15 -Olrmania
- 3 month **long wet grazing strategy** from April 1st to June 30th '15- Mukao
- 3.5 month **long dry grazing strategy** from July 1st to Oct 15th '15- Empouti

Grazing Committee: The grazing committee is in place and is trained on basic grazing management principles and they are ready to start working towards the goal of sustainable grazing as agreed by the community during the HPG workshops. The grazing committee requires further training, especially on planned grazing and leadership. This is planned for 'Year 2' of the project. It is the committee's responsibility to be pro-active in ensuring that people follow the grazing plan, and in ensuring that no outsiders from other zones are allowed to enter the Oltiasika zone during the wet season.

➤ **Grazing strategy 2: Work closely with Imbirikani Group Ranch as a neighbour.**

Some Imbirikani members also live in the Oltiasika area and will be encouraged to adopt the grazing plans. In the event an Imbirikani member does not want to follow the proposed grazing plan, they have the right not to so. However, in such a case the Imbirikani member will be requested by the grazing committee to let their livestock graze on Imbirikani GR.

- **Enkaroni-Empouti grazing area;** the grazing committee will meet with people living in Orbili and Olorika to ensure they plan together and join the grazing plan.

➤ **Grazing Strategy 3: Establishing settlement areas.**

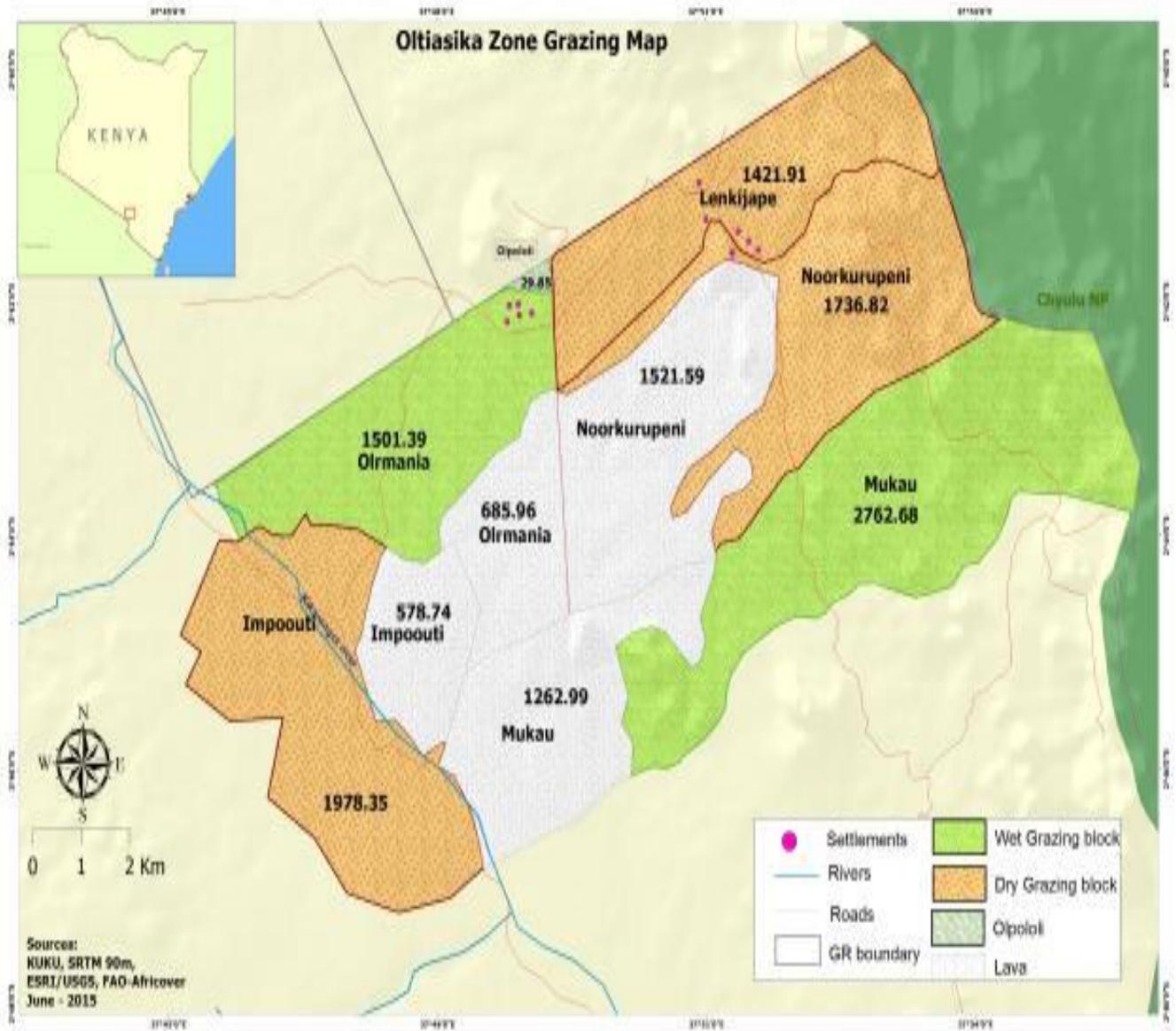
Community members of Oltiasika have seen a rapid increase in the number of bomas in the area in recent years. These new bomas pose a threat to the movement of livestock and existing animal corridors. In the last few years people living in Centre have started farming in the periphery of the village and on the slope of the Chyulu Hills. These new farms are closing grazing routes and reducing grazing areas. As a result meetings need to be held together with the executive to develop a land use plan to define the settlement and farming areas.

Challenge of implementing the strategy: The challenge the community of Oltiasika faces to successfully implement the wet season grazing strategy is the lack of water in the Mukao wet season grazing block. The community identified two options to solve this: either construct a dam or open up Orpakai water point.

➤ **Oltiasika zone Grazing Map & upcoming Dry Season plan.**

The map below was developed together with the Oltiasika grazing committee and community members, and identifies the main 4 zones that exist: dry season blocks, wet season blocks, settlement zones (no controlled grazing) and permanently reserved grass banks (*olipololi*).

OLTIASIKA ZONE GRAZING MAP



OLTIASIKA DRY SEASON GRAZING PLAN July-November 2015

Parameter						
		Lenkijape	Noorkur upeni	Empouti	Mukao	Olrmania
1	Length of the dry season (days)	150	150	150	150	150
2	Number of grazings rounds	1	1	1	1	1
3	Size of area for 1 animal day of grazing (AD in sq m)	66	60	73	50	est 70
4	Size of the blocks (hectares)	1422	1737	1978	2763	1501
5	Total animal days (ADs) of grazing available per block	215,454	289,500	270,959	552,600	est 214,428
6	Number of animal units (AUs)	est 2600	est 2600	9200	9200	est 4000
7	Actual number of days grazing available per block the herds	83	111	29	60	est 54
8	Community visual assessment (days)	120	90	30	45	?
9	Planned number of days per block this season	75	75	30	45	75
10	Sequence of block use	3=	3=	2	1	3=

The dry season is expected to begin June 18 and end November 15 ie 150 days. Herds will move through each block only once during that time. The area required to adequately feed one animal for one day are consistent across blocks, and indicate good forage quantity. 9200 animal units (bulls, cows, steers, calves) are catered for in the plan: roughly, 50% Oltiasika and 50% visitors – mainly from Imbirikani – who traditionally share this area; and whose rains have been less good in their northern alternate areas. Otherwise shoats will use the settlement / sacrifice areas, which are relatively large in Oltiasika.

There is relatively little divergence between the physical forage assessment demonstrated by the consultants with the grazing committees, and traditional visual assessment.

In terms of implementation, the herds will start in Mukao and move down to Empouti for days indicated in Line 9 above, then split up into 3 groups, each of which will use one of the remaining blocks for the balance of the dry season. The Mukao and Empouti area will take up the bulk of dry season. This plan indicates people prefer to split up as dry season progresses. Interestingly, Oltiasika plans to use all its wet and dry season blocks in this plan, unlike other zones. Forage samples have not been taken in Olrmania block since at the time of sampling grazing this area in the dry season was not part of the plan. The grazing plan was adjusted by

the grazing committee and the community after the sampling period. Hence estimates have been used to determine the available grazing in the Olrmani area.

In terms of daily implementation, the herds will follow the principles contained in Steps 7 and 8 of the '10 steps of HPG' i.e. combining of herds / herds grazing together; and the use of a different section of a grazing block each day. These principles were already part of the community's traditional method of daily use. The grazing committee indicates water is a constraint.

Overall, the plan of the Oltiasika zone has no major shortcomings. As in the other zones, the daily 'trailing' back of livestock from grazing zones to bomas is a concern. This is an aspect to be monitored and reviewed with the grazing committee in the design period for the next dry season grazing plan.

As with Iltlal and Kuku, the main issue that came to light is that the community abandons the discipline of lumping herds together causing smaller herds to graze independently in the wet season. As with Iltlal, this practice causes overgrazing of plants (i.e. plants are grazed too frequently) and this will continue to degrade wet season blocks. This practice by the community is adding pressure on the dry season blocks to perform longer as wet season blocks are getting exhausted. This aspect needs attention in the period leading up to wet season plan design (October-November).

Management units, roles and responsibilities

Management Units

1. **Grazing committee:** Supervise development and implementation of grazing plans.
2. **Group Ranch executive:** Provide overall oversight and broad guidance to grazing planning and implementation.
3. **Livestock owners and herders:** Implement the plan.
4. **Administration:** Solve disputes emerging from the implementation of the grazing plans and offer government support.
5. **County Government:** Support by developing relevant policies.
6. **NGOs / consultants:** Provide technical support and guidance.

Implications for developing grazing by-laws going forward

1. Kuku group ranch has created 10 zones which operate under the group ranch committee with 10 grazing committees –Kuku Zone, Iltlal Zone, Oltiasika Zone, Olorika Zone, Enkii Zone, Langata Enkima Zone, Inkisanjani Zone, Enkutoto Zone, and Samai Zone.
2. Each zone should develop a grazing plan for each season and share this with the other zones to make them aware of the plan. This will allow people living in other zones to understand and follow the plan of a neighboring zone when entering the zone with livestock.
3. Zones with shared grazing areas should agree on grazing terms and develop one mutually agreed upon seasonal grazing plan for those areas.
4. Each zone shall discuss the grazing areas and develop a grazing plan with defined blocks and share this with the other zones.
5. The movement of livestock from one zone to the other should be authorized by the grazing committee in consultation with chiefs and the group ranch committee.
6. Neighboring group ranches must follow the grazing plans developed for Kuku GR and respect them. Before entering the group ranch with livestock they should request for permission from the group ranch committee and the area chiefs.
7. Temporary settlements are only allowed within the grazing zone as described and recommended by the group ranch executive and the grazing committees.
8. During the dry season bomas should relocate every 7 to 14 days to boost the productivity of the areas through animal impact.

Roles and responsibilities

Herders:

1. The work of the herders is very important. They are responsible for observing the animals and the grazing, and making decisions that benefit both the rangeland and the livestock.
2. Advise the grazing committee on the best way to prepare the grazing plans.
3. Report to the grazing committees the people stealing livestock or people with livestock entering the closed grazing blocks.
4. Ensure grazing takes place according to the plan.

Livestock owners:

1. Every livestock owner in a village must let their animals graze according to the grazing plan of the particular zone.

2. Every livestock owner has the right as well as the obligation to participate in the grazing meetings to provide input for the grazing plans within his zone.
3. Every livestock owner has the right to utilize all the grazing areas within their zones, however, the grazing plan should be followed at all times.
4. Livestock owners can request permission to graze in other zones. This permission should be requested from the relevant grazing committee and the grazing plan of that zone must be followed and respected.

Grazing Committees:

1. The grazing committee will organize the grazing areas within their zones in consultation with the group ranch leadership.
2. The grazing committee will work with the zonal livestock owners to produce the grazing plans.
3. Each grazing committee member has the obligation to oversee and manage all grazing issues, including implementation of grazing resolutions.
4. The grazing committee is to meet at least on quarterly basis but preferably on a monthly basis to evaluate and execute the plan.
5. The grazing community will conduct annual assessment to measure progress, forage availability, watering points and discuss the offenders and give feedback to the landowners and the group ranch committee.
6. Members of the grazing committees are in charge of daily surveillance along all grazing banks (Ololopoli) and any other areas of interest.

Group Ranch Committee:

1. The group ranch executive on behalf of the members hold the rangeland within the group ranch in trust for the good of all members and other communities in line with their constitution and group ranches (Cap 283).
2. The group ranch executive remains the supreme body, and for any matter affecting land use and management, consultation is a MUST”.
3. Annual assessment is carried out to measure progress by the group executive together with the grazing committee: who did what? why? why not? Etc.
4. Any disputes arising within Kuku GR and/or with neighbouring group ranches will be taken care of by the group ranch executive committee.

Chiefs:

1. Support both the executive and grazing committee by offering enforcement.
2. Resolving any emerging issues internally.

3. Give guidance to the grazing committee during the planning season and during implementation.

Grazing Monitoring

The goal of planned grazing is to manage the grazing pressure and rest in different grazing blocks. This includes when the grazing will occur, at what intensity, and for how long. The planning process is not completed until provision is made to monitor the effects of management actions and thereby learn from them. Without monitoring, mistakes may go unnoticed until it is too late to minimize the consequences, while successes may be misinterpreted.

What is Monitoring?

Monitoring is the orderly collection, analysis and interpretation of resource data to evaluate progress towards meeting management objectives such as increased livestock production. This process must be conducted over time in order to determine whether or not management objectives are being met.

Why Monitor?

Monitoring, while labour intensive, is an important component of any grazing management plan. It provides measurable statistics that allow one to determine whether the objectives of the plan have been met. Without monitoring, one is unable to determine what effect grazing has had on the health of pastures. This includes determining the trends, or changes, occurring in the condition of grazing areas.

What do I Monitor?

Determining what to monitor depends on the goals and objectives set in the grazing plan e.g. optimize livestock production, land health, wildlife, aesthetics etc.

The following parameters are generally used for monitoring purposes:

1. Livestock health (can be recorded weekly).
2. Implementation of the grazing plans (actual vs planned; replan if necessary) - daily.
3. Biological monitoring: standard indicators include: grass / plant density, soil condition, plant species, plant age, plant form (overrested / overgrazed /normal) – every 6 months.
4. Herds' soil impact – daily / weekly.
5. Animal performance (eg weight gain, milk production, % calving, breeding success, etc. if records are kept).

PART 4: CONCLUSIONS AND RECOMMENDATIONS

1. Start preparing the grazing committees to be ready for implementation starting at the end of June.
2. Continue the mentoring support by Natural Capital East Africa to the grazing committees of the pilot zones periodically through the dry season, to build their competence, confidence and commitment (i.e. capacity). This includes review of plans and implementation, including identifying and addressing issues.
3. Mentor grazing committees to design and implement grazing plans for all future grazing seasons to commence at the beginning of October 2015 (wet season).
4. Critical to the development of a successful grazing plan for the remaining seasons is awareness-raising on the issue of overgrazing in wet seasons as historically grazing practices became undisciplined in this period. This should be part of another round of community training.
5. The Executive Committee of both Kuku & Kuku A and MWCT need to work together to build momentum around the adoption of the grazing plans, and to address any issue of the community i.e. the community perceives the grazing committees as MWCT working groups and not independent local authorities.
6. MWCT to facilitate the development and expansion of the holistic grazing management plan across all Kuku GR zones.
7. The Group Ranch Executive Committee needs to be encouraged to adopt the programme e.g. by supporting it through providing goats to slaughter for meetings etc.
8. MWCT should choose one person or even the whole team to be trained on planned grazing to be able to support the programme when the consultants are gone.
9. Enhance grazing governance by drawing up community-designed grazing by-laws that are cognizant of traditional laws and conventional laws to govern grazing implementation.
10. Continue reviewing the accuracy of grazing maps, as these maps serve as a highly effective communication tool.

ANNEX 1

Knowledge for healthy grazing: technical overview

(by John Oitaos, Community Trainer)

Reading the land

Looking at soil:

Different areas have different kind of soils, each perform its work according to the way nature operates. All plants need good soil for them to grow well. If it is loose and mixed with dead plant matter (leaves, stalks, pieces of wood) then water and air can enter into the soil and be held there for use by plants, by animals that live in the ground and by the micro-organisms that decompose dead plant and animal matter. If the soil is hard and has a crust, water will not seep into the ground easily, and will run off. The most valuable soil is the top soil – that thin layer where sand, clay, stones and dead plant materials meet the air above the ground. It is the ‘skin’ of the earth, and like the skin of a person, it is sensitive to changes in the environment and can easily be damaged. Like a wound on a human body, it takes a lot of good care and time to heal the surface of the soil if it has been damaged or unprotected for a long time.

Indicator of unhealthy soils



Sheet erosion



Capped soil



Gullies

Looking at grass:

By looking at which grasses grow where and how individual grass plants grow, livestock owners can learn how to increase the forage production of their grazing land. The differences between annual and perennial grasses are important in this regard. Grasses that are mainly stalk and produce seeds quickly are called annual grasses. They only live through one growing season and then the whole grass plant dies. The seeds of this grass will only germinate and start growing again in the next growing season if the rainfall is sufficient. Big tufts of grass with many leaves are called perennial grasses.

Indicators of loss of grass cover



Bare land is enemy no 1 – death

What are the Consequences of the natural processes alteration?

There are four ecosystem processes: community dynamics, water cycle, mineral cycle, and energy flow. It is essential for all these four ecosystem processes to function effectively together for long term sustainable productivity of the ecosystem. Interfering with one of these processes may affect the balance of the natural processes and may cause harm to the productivity of the ecosystem and decrease biodiversity. Subsequently, this will lead to land degradation and impoverishment of communities.

Indicators of unhealthy land:

Land indicators

1. Bare ground
2. Soil erosion
3. Deep gullies
4. Decrease of water table that results in drying up of springs, dams, boreholes and rivers
5. More floods, more droughts, more bad fires
6. Increase in invasive species, loss of vegetation cover, increase in bad weeds and pests

People and Livestock indicators

1. Poverty
2. Unhappy people
3. Increase of diseases (i.e. allergies, waterborne diseases)
4. Skinny and weak animals –lack of pasture
5. Low milk production

How does overgrazing occur?

Overgrazing:

Overgrazing is a function of time, NOT animal numbers. Damage from overgrazing occurs when a plant is grazed (defoliated) severely in the growing season and is grazed a second time before it is able to store energy captured by the leaves. This forces the plant to continually draw energy from its roots to recover and grow. Plants use their green leaves to draw energy from the sun and grow (through a process known as photosynthesis). If they do not have enough green leaves they can only continue to grow by using energy stored in their roots. When the energy stored in their roots is exhausted, the plants will die.

Overgrazing occurs when: Animals stay too long on fast growing plants or animals return too soon to slow growing plants.

Tools for restoring ecosystem processes or ecosystem management

All tools are equally useful, it depends on the situation on the ground as to which tool to use best in order to have the desired effect. Appropriate use therefore depends on knowledge of the effects of the tool, given the situation at hand. One tool should never be used all the time. Use a tool or combination of tools best suited to reach the desired holistic goal for the landscape by using the tools available on the ground. The state of the land determines what tools should be used to restore the condition of the land. The ecosystem dynamics (interactions of animals and plants) should be taken into consideration to help create desired outcomes. Keep in mind all tools require resources such as people, knowledge and money.

Tools for landscape restoration:

1. **Technology:** Bull-dozers, fences, water pumps, herbicides and all other man-made items.
2. **Fire**
3. **Rest:** Rest depends on the brittleness of the land; in some cases rest can cause the deterioration of land, as grazing and fertilization by animals can stimulate plant growth. Plants can die in absence of grazing.
4. **Grazing:** correct grazing can improve the land, as it is the primary method that sustains nutrient cycling in dry rangelands, without which the productivity of grasslands would be stalled or decreases. Correct grazing refers to correct timing, neither overgrazing (i.e. grazing too frequent) or overresting (i.e. insufficient grazing).
5. **Animal Impact:** The animals' hooves knock down old grasses and shrubs and turn the soil, increase water infiltration, planting and germination of new seeds, add litter and dung. The higher the densities of animals the greater the beneficial effect.

Grass Management

Managing grazing pressure is the most important aspect of grazing management. It directly impacts the pasture resource, animal performance and profitability. Excessive grazing pressure reduces the vigour and density of preferred pasture plants resulting in more bare ground and a decrease in desired plants.

Healthy grazing and animal impact at the right time prepare the soil and plants for abundant growth of grass. Good soil and plant preparation in the dry season includes: Breaking capped soils, breaking down dead leaves from perennial grass plants through grazing and trampling; creating soil cover with grass litter; preventing animals from licking up the grass litter, leads to an increase in grass growth.

Herding in communal areas is the cheapest and most effective method to increase the productivity of the land. The herders should be trained on to herd livestock within the grazing blocks. The main purpose of moving the animals according to a grazing plan in the growing season is to protect perennial grass plants from overgrazing, and to make sure animals get the best forage when they need it most.

Animal performance is affected because they have less opportunity to select higher quality plants and parts of plants. Poorer pasture productivity and animal performance leads to lower reproductive performance and growth rates of livestock.

The four factors that influence grazing:

- **Grazing Intensity** - The proportion of the current season's forage production that is consumed or trampled.
- **Grazing Frequency** – Number of occurrences of herbage removal over a certain period of time. Certain preferred plant species will be grazed first and animals will frequently return to forage on species during a grazing period. The grazing frequency of such plants (loosely referred to as "ice cream plants") is higher compared to grazing less preferred plant species.
- **Grazing Season** – The period at which grazing occurs in relation to the vegetation's state of growth. The season of defoliation determines the response of the plant and this varies widely among different plant species.
- **Animal Selectivity** – The degree to which animals consume plants or plant parts in different proportions of the total amount of forage available to them.

The Distribution of Water and Nutrients

The way plants respond to grazing depends on various external factors in the area such as the presence of other plants, the topography, the soil and rainfall.

In arid and semi-arid rangelands there are two ecological processes that strongly determine the vigor and composition of vegetation namely the water and nutrient cycle. Put simply, the plants in an area— species composition and how well the plants grow— are a reflection of these underlying ecological processes. The goal is to develop means of managing grazing for improved water and nutrient availability.

Plants require water and nutrients for growth. These are not static quantities: they increase and decrease, sometimes rapidly, and they move around. The issue is not simply how much moisture or nutrients there are, but whether they are available to plants when they need them. In arid and semiarid regions, small changes in the availability of water and nutrients can have dramatic effects on the vegetation. Therefore, rangelands need to be managed in a way that effectively uses the available water and diligently recycles the nutrients in the soil and plants.