REPUBLIC OF KENYA

MINISTRY OF AGRICULTURE—NATIONAL AGRICULTURAL LABORATORIES

KENYA SOIL SURVEY

PRESENT LAND USE OF THE NAROK AREA

(NAROK DISTRICT)

by
S.Mwichabe

MISCELLANEOUS REPORT No.M31,1986.

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1 INTRODUCTION

The present land use survey was carried out as part of the land resource data collection by the Kenya Soil Survey for the land evaluation of the Narok area. Present land use is published separately from the main soils report[1)] firstly to provide a data base for land evaluation and secondly to present the results as shortly as possible after the survey. The land use data will also be incorporated in main soils report whose compilation is in progress. The survey area covers quarter degree sheets Nos. 145, 146, 159 and part of 158. This includes nearly two thirds of the Narok District excluding the Transmara Division and the Olulunga-Meliil-Mau Narok area. The survey was carried out between March and May 1985.

The area covers a diverse climatic gradient from wet highlands in the North and parts of the Loita Hills to hot plains (Loita plains). This gradient is reflected in the diversity of vegetation types ranging from wet forests, grasslands to dry bushlands, and the diversity of present land uses.

The author participated in the field work with Mr. N.M. Achieng (land classification officer). The author wishes to acknowledge the help and cooperation by Mr. Onyimbo (DAO, Narok District), Mr. Ngurare (DLDO, Narok District), Mr. Karani (Branch Manager, KGGCU Ltd, Narok), Mr. Munyoki (Warden, Maasai Mara Game Research Station), Mr. Kinyanjui (Site Manager, Narosura Irrigation Scheme) and Mr. Ole Karbuolo (Assistant Project Manager, Ilkerin Loita Maasai Integral Development Project).

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1) W.W. Aore, P.F. Okoth and S.N. Wanjogu - Soils of the Narok area. Report No. R15, Kenya Soil Survey, Nairobi (in prep).

2 METHODOLOGY

A mosaic of aerial photographs was superimposed onto topographical maps both at a scale of 1:50,000 both obtained from the Survey of Kenya. This gave a general impression of the various land uses through vegetation patterns. These photos, flown in 1960, were obsolete in those areas now under cultivation.

A preliminary aerial photo-interpretation map was prepared by a stereoscopic study of the aerial photos. The photo-interpretation units were transfered to the topographical maps to form the base maps in the field on which observations were indicated.

Most observation sites were made along roads. Data collected included vegetation types (physiognomy), animal types, percent cultivation, crop types and combinations and notes on herd numbers, soil erosion, grazing etc. Boundaries of the preliminary photo-interpretation units were rectified where changes in land use were apparent.

The final map was derived from a compilation of a base map from Survey of Kenya map SA-36-8 at scale 1:250,000 annotated with land use boundaries from the reduced 1:50,000 photo-interpretation maps.

3 PRESENT LAND USE

3.1 Previous work

Agatsiva and Mwendwa (1982) have mapped at scale 1,000,000 five land use types in the survey area. The major part of the Loita plains and some uplands are mapped as "unimproved grazing land (Rangeland)" with the code "6", part of the Loita Hills are mapped as "Mixture of bushes and woodlands", and "Dense natural forests" on the southern part of the Loita Hills, "Arable

cropland under wheat" around Ngore Ngore and the "Maasai Mara Reserve".

Not enough details of the various components of the broad land uses could be obtained due to the small scale of the map and lack of enough ground truth checks of the satellite imagery used in the analysis.

3.2 Cultivated land

This is land under large scale rainfed arable farming with deferred seasonal grazing (after harvesting) on group ranches in the Ngore Ngore area and the northern part of the Ol Choro Orogwa ranch.

Mapping unit CC1

This unit is used for large scale arable farming with high technology of mainly wheat and barley and some portions under sunflower and maize. The actual land under cultivation is about 95% of the total land unit. 5% is covered by hedges, tracks and rivers. Ploughing, harrowing, and planting is done by tractor. Weeding is done chemically by spraying of herbicides by aeroplanes. Fungicides too are sprayed by aeroplane. Harvesting is done by combine harvestors. The farmers use improved seeds and fertilizer. The farms are fenced with barbed wire to keep out game. There is deferred grazing of local cattle, sheep and goats after the harvest, mostly on straw. This unit was observed around Ngore Ngore.

Mapping unit CC2

This unit is used for large scale arable farming of mainly sunflower and at times wheat. The sunflower produce is sold solely to the East African Industries (EAI Ltd), which provide extension services and other incentives to the farmers. The actual land under cultivation is about 95% of the land

unit. All farm operations are mechanised. The farmers use improved seeds and fertilizer. There is deferred seasonal grazing after harvesting by local cattle, sheep and goats. The unit was observed around the Olchoro Orogowa ranch towards Emarti market on the left bank of the Mara river.

3.3 Mixed farming

This type of farming involves smallholder farmers in those parts settled by sedentary families such as the parts north of Narok town at high altitudes which are rainfed and lower and drier parts along perennial rivers (Narosura, Kanunga and Maji Moto) which are fed by gravitational furrow irrigation. Crops are mainly annuals with few perennials. The animals are mainly indigenous breeds except at high altitudes where some farmers keep exotic types for milk. Grazing is mainly on land under rotation or on ley pastures.

Mapping unit CG1

To the north of Narok town along the Narok-Mau Narok road, at high altitudes, rainfed cultivation of wheat, irish potatoes, maize and beans occurs. The farmers use improved seeds and fertilizer. Most of them use tractors but some depend on ox-power. The average farm size is 2.5-6 hectares though some plots may be larger or smaller. Total land under cultivation is about 65%. Fallow lands cover upto 35% which are used for grazing of cattle (mainly local zebu, Borana and in places exotic cross breeds of Jersey and Friesian types), local goats and sheep. This type of land use was also observed around Emarti market on the right bank of the Mara river where the main crop is maize while the cattle consists of local breeds (Zebu and Borana) only.

Mapping unit CG2

This unit is used for small scale irrigation of citrus fruits (oranges and lemons), onions, tomatoes, maize, nappier grass (as fodder) and sugarcane. The average farm size ranges from 0.5-2 hectares under irrigation (40-65%). With the exception of maize, bananas and sugarcane (subsistence crops) the rest of the crops are produced for sale in Narok and Nairobi. Local breeds of cattle, goats, sheep and some donkeys are grazed extensively mainly on the adjacent extensive grasslands or on fallow lands during the dry period. There is a planned future expansion of irrigation especially in the Narosura and Kanunga Schemes. Construction of canals and furrows in the first is in an advanced stage.

3.4 Grazing (and browsing)

This land use is a complex of extensive grazing and in some parts (on ranches) controlled grazing and browsing of both domestic and wild animals on natural pastures on group ranches. This is the most extensive land use in the survey area covering over 2/3 of it. It also covers an array of vegetation types from open bushlands on the hills and uplands to pure grasslands on the plains.

Mapping unit GG1

This unit covers all of the Loita, Kailorit and Posee plains which extend into the Maasai Mara National reserve and on hill tops of the Loita and Naderogu hills where as on the plains occur near pure grasslands where hundreds of ungulates were observed grazing. There is overstocking on some parts of the plains especially on depressions where temporary swampy conditions provide drinking places and a source of green forage during the

wet and dry periods respectively. The grass cover is over 95% with mostly herbs and isolated Acacia shrubs.

Mapping unit GG2

On denudated parts of the plains on the footslopes of hills around the Posee and Lorogoti plains and Narosura respectively, there is a bushed grassland which supports grazing animals mostly and a few browsers which feed on the shrub component of the vegetation. There is thus a mixture of mostly grazing and browsing of domestic and wild animals. The grasscover is over 70%, shrubs <20% with the remainder under bare soils. Grazers include the cow, sheep, gazelle, buffalo, topi, eland and wildebeest, while browsers include the giraffe, goat, elephant etc.

Mapping unit GG3

This land use type concides with the open bushlands whose main shrubs are Commiphora, Cordia and Acacia species. The bushlands having 45% bushes and about 55% grass stretch from the area south of Narok town along the area between the Ewaso Ngiro river and the Loita plains, east of the Loita Hills, and the east-west stretch from Olmesutye through Ilgerin to the Siana plains giving way northwards to the bushed grasslands of Naikara.

Browers (giraffe in particular) are more present than in the grasslands. This too seems to be an ideal habitat for the impala which occurs in large herds. Local cattle, goats and sheep also graze on this unit. The tsetse-fly risk is higher than in the grasslands.

Mapping unit GG4

This land use type is restricted to those areas formerly under cider forests but due to grazing pressure over the years, the forest has given way to a secondary vegetation of a dense bushland of Tarcónanthus comphoratus (a white leaved shrub) with nearly no grass cover below. There are relics (stumps and aging) cider trees within this bushland. The unit covers the area around Narok town and Ewaso Ngiro market and is found along the northern part of the Loita Hills(Moridjo to Maji Moto). There is extensive grazing of mainly domestic livestock with a few antelopes (impala) though lions are not rare. The grass cover is less than 30%. This unit could be under serious sheet erosion as >60% of the ground is bare soil.

Mapping unit GG5

This is an extensive form of grazing on swampy grasslands during the dry period of mainly domestic animals and a few antelopes (wildebeest, gazelle) on the Kisenitet-Osasiruai swamp north of Entasekera.

Mapping unit GG6

This land use falls under commercial ranching using a high level of management dealing with cattle (Sahiwal),goats (Gala),sheep (Doper) mainly to provide breeding stock to local farmers as well on marketing the produce (meat, hides and skins, leather products and eggs) to the local population, at Narok and Ngong and to the Kenya Meat Commission.

The ranch covers 1240 hectares of which 40 ha is under residential use and 1,200 under ranching. The land is owned by the local Maasai and the capital provided by the Catholic Diocese of Ngong and the Netherlands Government. The cattle stock is 400 head of which 100 heads are sold per

year. The average milk production is 4 litres per cow per day. The ranch breeds 120 cows/year and curls 100/yr. There is stock of 350 goats and 350 sheep each of which the ranch breeds 100/yr and curls 100/yr. There are 1000 chicken producing 700 eggs per week.

The ranch is fenced and posesses a petrol station, cars, lorries, horse race, dip spray, a dam and drinking troughs by pipe and several dips on the periphery of the ranch for use by locals. The ranch has a carrying capacity of 450 cattle, 350 sheep and 350 goats. Apart from ranching, other activities include a tannary, bead work, training and co-operative services to local people.

Mapping unit GG7

This is an old ranch deteriorating due to poor management as can be observed from mismanaged dips, broken machinery, damaged fence wire and bush encroachment. Cattle wander in large herds (consisting of Maasai Zebu, Borana and a few Sahiwal) together with local goats and sheep. The ranch (Ol Choro Orogwa) is located in the north-western part of the survey area astride the Aitong-Emarti road. The land use differs from GG6 mainly on level of technology and diversity of produce apart from livestock breeds kept.

3.5 Forestry

Mapping unit F1

These are natural forests ranging from the montane Cider-Podo semi-evergreen forests north of Narok town around Mutunyi hill, on top of the Loita Hills especially the Engumatisho-Entasekera-Namanguseri area; upland semi-evergreen

olive forests north of Lemek (Ngore'Ngore-Oldonyo Damat-Giribwet area) and riparian types along perennial rivers mainly consisting of Dyospyros sp.

Most of them are conserved although cutting and burning is evident around Narok town where pressure on land is pushing cultivation into the forest. There is controlled felling in the forest around Entasekera. Most riparian forests are the least disturbed (where only firewood is collected from dead trees) except where cultivation has been introduced in such places as Narosura, Kanunga etc.

3.6 Bushland thickets

These are thick to very thick bushes (shrub crowns are touching) mainly along steep hill slopes.

Mapping unit Tl

Thickets of Croton dichogamus where shrubs cover upto 70% with crowns touching. Movement by animals is nearly impossible. The grasscover is minimal (about 15%). The thickets are evergreen and ideal habitats of Baboons and a variety of birds. Of late local people collect roots of a shrub of the Alloe family (Alloe volkensii) whose juice is used in brewing of local beer.

3.7 Wildlife conservation and tourism

This land use covers the parts demarcated for conservation of the famous East African ungulates, carnivores, scavengers and birds in the Maasai Mara National Game Reserve. The reserve is also one of the most popular tourist attractions in the country. Hunting is controlled mostly as a cropping excercise particularly ungulates or for restricted parties as a hobby.

The game reserve, a trustee land, is administered by the County Council of Narok which collects revenue through gate charges, provides tour guide personnel and general ecological monitering through the game warden. Research is done by the Department of Wildlife in the Ministry of Tourism and Wildlife.

3.8 Badlands

This unproductive type of land use is located on the lower course of Ewaso Ngiro and Enkare Siapei around the Enkorika area where there is severe gully erosion leading to removal of the top soil. The banks are rarely vegetated with isolated shrubs but with no grasscover. The sharp gorge like banks with vertical walls may probably be due to a rejuvenated erosion cycle due to earth tilt, but millions of hoove prints imply over-stocking of animals (domestic) as having aggravated the top soil loss.

4 RESULTS AND DISCUSSION

The present land use in the survey area is strongly influenced by not only the environmental factors (climate, in particular rainfall averages and patterns and to a lesser extent temperature) but also sociological virtues of the local people as well. High rainfall areas (>1300 mm) not only support forests but are also cultivated with cash and subsistence crops such as wheat, potatoes and maize north of Narok town. Lower altitude areas (Maji Moto, Narosura-Ewaso Ngiro-Lemek) have lower rainfall (<700 mm) and cannot support rainfed arable farming.

Although the Moridjo-Entasekera-Olmesutye-Naikara area has enough rainfall to sustain arable farming (1000 mm) the local Maasai people prefer to keep cattle and leading a migratory semi-nomadic life with semi-permanent

homes. However with infiltration of more sedentary ethnic groups (Kikuyu) cultivations are now observable especially around Entasekera and Olomesutye. Some Maasai people are building semi-permanent houses and cultivating small plots too.

Preservation and protection of both wild animals and vegetation is done by both the central and the local governments. This is done through reserves such as the Maasai Mara Game Reserve and various forest reserves in the District. Killing of animals and felling of trees is controlled by law.

It is also evident that apart from the game reserves and the protected forests, the present land use types are not the most optimal. The extensive semi-nomadic grazing on group ranches could produce more if the level of management is improved. An example is the Ilkerin/Loita integral project in which the breed of animals, pasture management and well co-ordinated infrastrature produces more than five times than on ordinary ranches. As in the case of those pasture lands on land suitable for arable farming, it would be more profitable to put the plains around Moridjo under commercial wheat farming utilizing incentives now being provided by the A.F.C. (Agricultural Finance Cooperation) and the K.G.G.C.U. than the present extensive grazing of domestic animals and wildlife.

It should be noted that land under grazing is on the decrease because of bush encroachment. While burning reduces bushes there is over-stocking in some areas which leads to reduction of grasscover and increase of shrubs through selective grazing. This is the case for the vast Tarconanthus bushes around Narok town, Ewaso Ngiro and now extending into surrounding pasture lands. On the Loita plains, large herds of grazing animals have depleted the grasscover leading to serious soil erosion

especially in the area north of Maji Moto where large patches of bare soil were observed.

Major soil types play a vital role in some of the land uses. Deep, poorly drained black soils on plains are covered by expansive grasslands which are good natural pastures. The shallow, rocky and excessively drained soils on steep hillslopes are covered by thickets which are useless for grazing but ideal Baboon habitats. The well drained deep soils support a natural forest or are cultivated for wheat[1)] and maize.

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1) A different variety of wheat is grown on poorly drained soils at Ngore Ngore where temperatures are higher and rainfall lower than in the highlands.

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APPENDIX 2

ILKERIN/LOITA INTEGRAL DEVELOPMENT PROJECT

(Excerpts from interview with Mr. Mark Ole Karbwolo[1])

The project is financed by the Catholic Diocese of Ngong and the Netherlands Government. The project is a private ranch (non-governmental or individual) which involves local people in the management. It operates in liason with local DDC and other government departments. The land was a contribution of the local farmers to the project.

The project aims at:

(a) improve, upgrade and provide breeding stock to local farmers,

(b) induce development.

There are nine departments in the project i.e. ranching, livestock breeding, tannary, bead work (women), dipping, dispensary and mobile clinic for local people, training farmers, co-operative activity and maintenance and construction of dips with and ~~without~~ use of machines. There is also a shop run by the project.

The project covers 1240 ha (which are fenced) of which 1200 ha are under ranching and 40 ha are for residential use.

Animals

Animals kept on the ranch are:

(a) Cattle - Sahiwal (Cross breeds of Sahiwal and Zebu)

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1) Assistant Project Manager, Ilkerin/Loita Integral Development Project.

(b) Goats - Gala

(c) Sheep - Doper

(d) Donkeys and horses

(e) Chicken - exotic layers

(f) Geese

(g) Wildebeest

The ranch has a carrying capacity for 450 head of cattle, 350 goats and 350 sheep. The animals are watered by troughs supplied by pipes connected to a nearby dam where a diesel pump is situated.

Infrastrature

The ranch employs skilled manpower (management staff, veterinarian breeder, and extension staff). Most roads are murram surfaced except for some which are loose surface. There is a fuel pump and an airfield on the ranch. Watering points and dipping are well distributed on the ranch. There are dips (4) outside the ranch but run by the project to enable farmers on the periphery of the ranch to curb diseases lest they spread to the ranch. The project organises seminars and workshops as well as actual training once a year for thirty local farmers lasting for a week as part of the extension programme. The farmers also send in stock for development.

Economic benefits

There is a stock of 400 head of cows. They breed 120 per year and thus curl 100 per year. For sheep and goats, there is stock of 350 each. They breed 100 and curl 100 per year each. There are 1000 chicken layers.

In terms of produce:

Cows produce: (i) Beef - 100 cows/yr @ 3,000/cow = KShs. 300,000/yr

(ii) milk - 4 litres/cow/day @ KShs. 4.00/litre (which is variable per year).

Sheep and goats: - 200 @ 250/head = KShs. 125,000 year.

Chicken lay 700 eggs/week approx. 33600 egg/yr @KShs. 1.00/egg = 33,600.

Aged chicken are sold as broiler @ KShs. 30.00 per chicken.

Market

The market is mainly local especially milk and meat. Others include Narok town, Ngong abattoir and Kenya Meat Commission. The animals are transported live by lorry or people trek them as far as Ngong town.

Drawbacks

A number of drawbacks affect the general running of the ranch. They are:

(a) Predators - lions occasionally break the fence and kill animals within the ranch. Protection by Game Warden is not very vigilant.

(b) Tick borne diseases - especially - anthrax (locally known as "Omilu").

- East Coast fever

- Black water.

There are flukes on young sheep.

(c) Pests - such as wildebeest and zebra which graze within the ranch. Some were enclosed in the ranch during fencing, others invade.

(d) Soil erosion and related problems -

(i) there is severe soil erosion along cattle paths only.

(ii) there is silting of the dam because of the road near by and outside cattle tracks.

Future

The prime target of the future is to decentralize into sub-centres more or less at the village level.

APPENDIX 3

NAROSURA IRRIGATION SCHEME

(Excerpts from interview with Mr. Kinyanjui[1])

The scheme is assisted by the Provincial Irrigation Unit (P.I.U) in the Rift Valley Province. The scheme is to provide both irrigation and domestic water supply. The scheme covers an area of 5 kilometres long and about 1 km wide. The scheme is in blocks i.e. an old block (0.3-15 ha/person) and a new block (1 ha/person) which covers 8-12 hectares. The crops are both subsistence (maize, bananas and beans), cash crops, onions, tomatoes kale, cabbage and fruits (oranges, mangoes and paw paw).

The weir is situated 5 km upstream from Narosura market. It has a reservoir capacity of 8 million litres. Narosura river has a discharge of 114 litres/sec. (non fluctuating). There is a canal linking the dam and the market through farms with a discharge of 80 litres/sec. Old farmsteads have well established canals but new ones have to be developed. The canal is on the left bank.

Land is on group ranches where two people hold title deeds for the irrigated part only. Land ownership is mostly amongst family members though leasing is also practised.

The scheme intents to irrigate a total of 38 ha on the left bank upto Narosura market. Below the market are traditional irrigation canals

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1) Site Manager, Narosura Irrigation Scheme

covering about 40 ha. The total acrage under traditional irrigation on the left bank is 19.6 ha. The distribution of irrigable and irrigated land in old and new blocks is shown in table 1.

Table 1. Distribution of irrigated land in Narosura Scheme

BLOCK	TOTAL IRRIGABLE LAND (ha.)	ACTUAL IRRIGATED LAND (ha.)	PLOT SIZE (ha/FAMILY)	NO. OF FAMILIES
OLD BLOCK	16.00	8.00	0.5-10	7
Enkong Enkare	10.5	7.3	0.02-2.5	15
Ole Kisaika	1.5	1.5	0.02-0.6	5
Block A	2.4	2.0	0.4	5
Block B	4.0	4.0	0.4	10
Block C	3.2	3.2	0.25	8
Block D	4.0	4.0	0.04	11
Block E	4.0	4.0	0.04	11
BANK	19.6	14.0	0.02-2.5	30

Another scheme is expected to cover the Kanunga area which has two sub-schemes. (Kanunga A is on the right bank of the Kanunga river inhabited by farmers of the Kikuyu ethnic group and is a part of the Narosura group ranch). Kanunga B is about 500 metres below Kanunga A on the left bank of Kanunga river. Kanunga A covers 12 ha, 5 of which are under irrigation. Kanunga B covers 15 ha, 5 of which are under irrigation.

The farmers don't use fertilizer but manure. There are two maize crops in a year. Inputs are mainly certified seeds (onions, tomatoes) from middle men (shopkeepers) who also provide pesticides and transport of produce.

Drawbacks

(a) night frost felling onions seedlings

(b) aphids on onion leaves

(c) tomato fruit borers

(d) tomato and onion fruit larvae

(e) stock borers on maize

(f) fungal attack on onions

(g) soil problems i.e. salinity and cracking on the surface.

The response of the local people is mixed. Some have appreciated by planting crops and irrigating napier grass as fodder during the dry period. Some are non-commital.

APPENDIX 4

MAASAI MARA GAME RESEARCH STATION

(Excerpts from interview with Mr. F.K. Munyuoki[1])

The Maasai Mara Game Reserve covers 1671 sq. kilometres. The objectives of the Maasai Mara Research Station (MMRS) are as follows:

- to identify major land use pressures within the Mara ecosystem.
- to identify the present threats, conflicts and other problems facing the game reserve.
- to investigate wildlife habitats, changes during the dry period in terms of present vegetation as fodder, condition of some mammals, crowding of perennial rivers by livestock (domestic and wild)
- find out future impacts of peripheral land use pressure to the game reserve.

Land use pressures

These are conflicting land use pressures pushing towards the game reserve. They are:

- Agriculture especially cultivation now 25 km away from the reserve in Lolgorein and Loita (Ngore Ngore).
- Livestock (domestic) densities which are high especially around settled areas where overgrazing is evident. Some parts of the game park are also over grazed. Whenever there is a dry year, forage production is low leading to vegetation destruction as local pastoralists wander into the game parks. This was the case for the 1983/84 dry season.

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1) Warden, Maasai Mara Research Station

- predator game (lions, cheetah, hyenas and leopards) attack and kill cattle, goats and sheep. Elephants and buffaloes attack people.
- There is disease transmission from wildlife to domestic animals and vise versa e.g. malagnant cataract fever attacks cattle when wildebeests give birth.
- starting of fires from settled areas which spread into the game park.

Habitats and animals

Major animal communities are carnivores, herbivores, birds reptiles and insects. The dominant animals are: buffalo, topi, wildebeest, giraffe, impala and elephants. The leopard and cheetah are vulnerable because of man's interference with their habitats.

Decreasing species are: leopards, rhinoceros, cheetah, reed buck, bush buck and roan antelope.

The highly poached species are elephants and rhino. The endangered species are the rhino, leopard, cheetah, bush buck and the roan antelope. The rare species is the roan antelope (now concentrated at the Oloololo Escarpment).

Rainfall increases from the east (766 mm) to the west (1025 mm) falling mainly in March-May (80%). The vegetation consists of vast grasslands (Themeda-Loudetia-Microchloa), bushlands on hills mainly Croton dichogamus, woodlands along rivers (Warbugia-Diospyros) and shrubs on the termite mounds.

Tourist value of the Game reserve

- high species diversity in the country.
- high flora diversity especially on Loita plains and Lolgorien area
- viewing of lions, cheetah and leopards is possible during the day because of suitable habitats (as compared to other reserves).
- presence of rare species in Kenya i.e. the roan antelope.

Management problems

(a) Habital destruction by wanton driving of tourist cars.

(b) Non-optimal migratory wildebeest i.e. too many for optimal carrying capacity due to blockage of immigratory corridor to the northern woodlands by wheat farms in Ngore Ngore.

(c) Game harassment by tourists especially lions by photographing and being surrounded as they feed. Balloon safaris scare animals some of which break limbs in the stampede.

(d) Elephants destroy woody and forested habitats.

(e) Roads are not well maintained leading to off-the-road driving into habitats. Also there are unofficial tracks opened by tourist guides.

(f) Firewood collection by locals and lodges for evening fires for visitors which leads to depletion of woody habitats.

(g) Plastic bag litter thrown along roads and picnic sites kill animals when eaten.

Recommendation for future action

- reduce agricultural land pressure around the reserve.
- research on tourist carrying capacity of the reserve.
- control of domestic livestock numbers.

- reduce wildebeest population and other grazers.
- Game reserve boundary be re-located to include more land to form diversity for maximum natural diversity preservation.
- introduce a buffer area around the reserve to filter the effect of agricultural land use from without
- local people be educated on value of wildlife conservation
- more surveillance to protect threatened and endangered species.
- visitors be restricted to official roads
- reduce the number of habituated baboons in the north western part of the reserve.

Conclusions

(a) Human influence (encroachment) in the reserve is felt every where.

(b) Large herds of cattle, goats, sheep and donkeys have invaded the game reserve.

(c) There is an urgent need to conserve plants both as forage source and catchment protectors.

(d) The main purpose of conservation should focus on preservation of vegetation, wildlife, water source, soils/geology and terrain for the benefit, advantage and enjoyment of the general public.

Check list of mammals in Maasai Mara Game Reserve

1. Aardvark
2. Baboon
3. Banded mongoose
4. Bat eared fox
5. Buffalo
6. Bushbuck
7. Cheetah
8. Dik-dik
9. Eland
10. Elephant
11. Grant's gazelle
12. Giraffe (Maasai reticulated)
13. Genet
14. Hippopotamus
15. Impala
16. Jackal (black back)
17. Jackal
18. Lion
19. Porcupine
20. Reedbuck
21. Rhinoceros
22. Roan antelope
23. Squirrel
24. Spotted hyena
25. Thomson's gazelle
26. Topi

27. Vervet monkey

28. Water buck

29. Warthog

30. White tailed mongoose

31. Wildebeest

32. Zebra

APPENDIX 5

DATA ON KENYA GRAIN GROWERS CO-OPERATIVE UNION LTD

(Exerpts from interview with Mr. Karani[1])

The overall aim of the Union is to provide everything that a farmer needs, i.e. a farmers "duka" or supermarket. The union offers services varying from farm inputs, consumer goods, extension and credit facilities to farmers.

The duka has the following inputs in stock:

(a) certified seeds of wheat, maize, onion and cabbage

(b) fertilizer

(c) pesticides, fungicides and insecticides

(d) herbicides

(e) livestock inputs such as acricides, salt, dewormers and grass seeds.

Extension

There are extension officers who visit farmers to identify problems and give advice on what chemicals the farmers should use. There are sales representatives who do 'target product selling' to farmers at various shopping centres. Research on potential production is done by producer companies such as the Kenya Seed Company on wheat and maize.

Credit facilities

These facilities are available to enrolled members only though of recent it has been reduced to minimal dealing with good and concrete cases

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1) Branch Manager, Kenya Grain Growers Co-operative Union Ltd, Narok.

only. The exact number of enrolled members was not available at the time of interview.

APPENDIX 6

DATA ON LARGE SCALE WHEAT, SUNFLOWER, MAIZE AND BARLEY FARMING

The farm size is >50 hectares. The local Maasai lease their group ranches to individual farmers or companies such as East African Industries, Kenya Breweries etc. The farms mainly grow wheat but the EAI grows sunflower for its oil products. Maize too is grown on less acrage. Barley is grown for use at the breweries (malting).

Farming is highly mechanized (use of tractor for ploughing, harrowing and planting) weeding is done by spray of herbicides by aeroplanes (hired). Harvesting is by combine harvestors. Ther is intensive use of fertilizer (about 250 kg/ha). The yield too is high (approx. 1900 kg of grain per ha).

The produce is sold to the National Cereals Board (wheat and maize), East African Industries (sunflower) and Kenya Breweries (barley).

The farmers obtain credit facilities from the Agricultural Finance Coperation (AFC), the East African Industries (seeds and fertilizer for sunflower) and other commercial banks. The land lease is usually 1-7 years although it could be longer.

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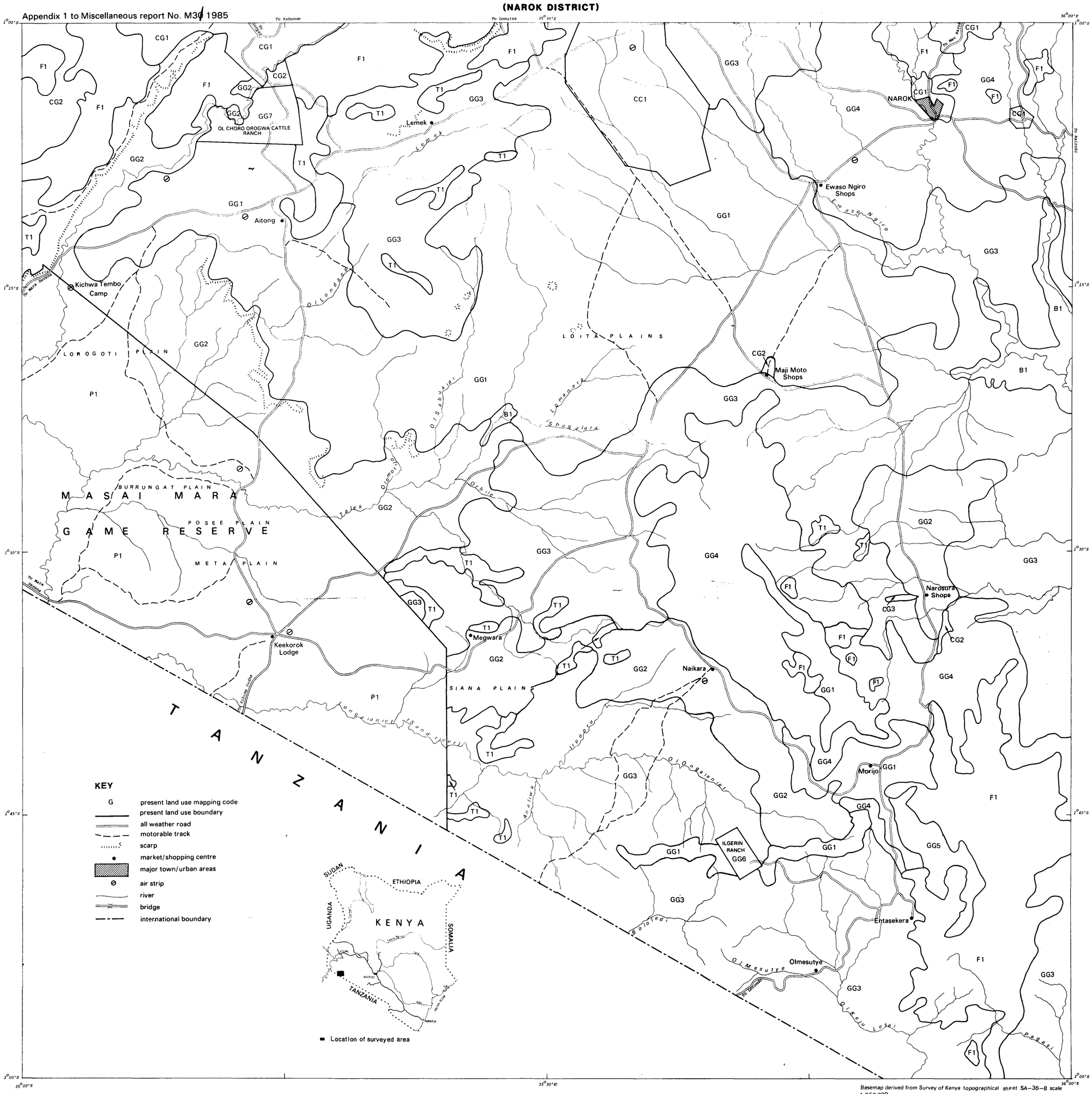
PRESENT LAND USE MAP (1985) OF THE NAROK AREA

(NAROK DISTRICT)

Appendix 1 to Miscellaneous report No. M30 1985



CC ARABLE LAND

Large scale rainfed arable farming with deferred seasonal grazing

CC1 large scale cultivation of wheat, barley, sunflower and maize covering over 95% of the unit

CC2 large scale cultivation of mainly sunflower and/or wheat covering upto 95% of the unit

Small scale irrigated farming with deferred seasonal group

CC3 irrigation of citrus fruits, onions, tomatoes, bananas, maize and fodder (nappier grass) Cropland covers 40-60% of the unit

CG MIXED FARMING

Small scale rainfed mixed farming

CG1 cultivation of wheat, potatoes (Irish), maize and beans covering 65% and extensive grazing of cattle [1], goats, sheep and donkeys

GG GRAZING (AND BROWSING)

Extensive unimproved grazing and browsing on group ranch

GG1 grazing [2] of domestic and wildlife stock on extensive grasslands along plains and uplands; grass cover > 95%

GG2 grazing and browsing [3] of domestic [4] and wildlife [5] stock on bushed grasslands; grass cover > 70%

GG3 browsing and grazing of domestic and wildlife stock on open bushlands; grass cover > 50%

GG4 extensive grazing and browsing of mainly domestic stock within dense Tarconathus bushlands; grass cover < 30%

GG5 seasonal (dry period) grazing of domestic and wildlife stock on swampy grasslands; grasscover > 95%

Ranching

GG6 commercial beef (sahiwal) goat (gala) and sheep (doper) ranching with high [6] level of management (Ilgerin ranch)

GG7 commercial beef (Zebu, Boran, Sahiwal) goat (E. African) and sheep (Masai and E.A. long tail) with low to medium level of management (Ol Choro Orogwa ranch)

F FORESTRY

Natural forests under conservation and/or tapped

F1 lower montane, upland and riparian forests

T BUSHLAND THICKET

Thick bushlands on steep hill slopes

T1 croton thickets primarily primate (Baboon) habitat

P WILDLIFE CONSERVATION AND TOURISM

P1 Maasai Mara National Reserve

B BANDLANDS

Land unsuitable for arable and grazing; vegetation cover < 20%

B1 severe gully erosion along the lower courses of the rivers Ewaso Ngiro and Engare Seyapei; barely vegetated

1) cattle types are mainly Masai zebu with few Nandi zebu, Borana and at times Jersey and Friesian
2) grazing is here restricted to feeding on grass foliage only
3) browsing refers to feeding on non-grass foliage such as shrub leaves, twigs, barks and fruits, etc
4) domestic stock refers to cattle, sheep, goats, donkeys and in rare cases chicken
5) wildlife stock includes all major E.A. ungulates, carnivores, scavengers and primates
6) high level of management means provision of dip (horse spray race) vaccines, improved breeds (Sahiwal zebu), drinking water, well tended natural pastures, mechanised processing and handling of produce, adequate infrastructure, high skilled manpower and effective market outlets

PRESENT LAND USE SURVEY AND MAP PREPARATION 1985

present land use survey..... S.Mwichabe and N.M.Achieng'
map compilation ..... S.Mwichabe
map correlation ..... P.J.K.Kanake and P.T.Gicheru
cartography ..... P.M.Malingi

Basemap derived from Survey of Kenya topographical sheet SA—36—8 scale 1:250,000

SCALE 1:250,000

KILOMETRES 5 4 3 2 1 0 5 10 15 20 25 30 35 40 45 KILOMETRES

Drawing N