

Table 1. Inches of precipitation in the Kajiado District during the last drought year and the following year.

Location	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Kajiado	1960	0.55	0.06	2.55	3.93	0.85	0.06	0.19	0.00	0.13	0.73	1.08	0.88	11.01
	1961	0.16	0.33	0.06	4.55	1.39	0.56	0.04	0.05	0.37	2.10	12.11	13.71	35.43
Loitokitok	1960	5.51	0.56	4.77	5.51	0.00	0.00	0.00	0.00	0.00	0.74	3.34	5.16	25.59
	1961	1.06	5.88	1.92	4.74	0.31	0.00	0.00	0.00	0.26	6.72	14.62	5.41	40.92

more rain which begins in November and lasts until May (Griffiths and Gwynne, 1963). Yearly differences are great and a serious drought occurred between 1959 and late 1961. Western Masailand is generally above 5,000 feet elevation while most of the eastern part lies between 2,000 and 4,000 feet. Topographic features include vast areas of gently rolling plains and striking terrain such as the Rift Valley, Mount Kilimanjaro on the south, the Mau and Enkurman Escarpments to the north, and recently formed volcanic cones. Vegetation is grassland with brush and trees of various densities, and occasional dense forests in riverine situations or on other favorable sites. The grassland is frequently burned (Glover and Gwynne, 1961) where overgrazing has not "fireproofed" it by removing herbaceous fuel (Fig. 2). A more

complete description of range conditions has been published by Heady (1960).

Herding Methods.—The Masai herds follow grass and water according to seasonal availability. Each Masai family builds a circular corral or boma of thorny branches from acacia trees and locates his huts around the inner perimeter. During the day the herds are taken to water or to grass where they are allowed to graze, always in close formation. At night they return to the bomas. Close herding and concentrated trampling near the bomas results in a network of trails and denudation of the land even though the landscape is relatively level. Cattle are normally taken to greater distances than flocks of sheep or goats.

Herding and enclosing became traditional and must still be used as protective measures against

raiding tribes and carnivorous animals. African cattle, when left unherded in fenced areas, take a year or more to break their habit of being close together at all times.

When grass or water become scanty, people and animals move to new locations. Movements are normally coordinated between higher and lower elevations in the wet and dry seasons. When the family leaves for new pastures, a boma may be burned, either by accident or to rid the location of parasites and pathogenic disease-causing agents.

Forage Values. — Abundance of poor condition livestock suggests that East African forages may be low in nutritive values. Chemical analyses and digestibility trials partly substantiate this conclusion for animals on dry coarse grass. However, high crude protein values of browse and green plants indicate that poor condition in animals is more likely due to lack of carbohydrates and total digestible nutrients than to low crude protein percentage in the forage (Heady, 1960). Estimates of nutritive values (Glover and Dougall, 1961) showed that pasture forages containing 11 to 14 percent crude protein were most efficient for milk production. As milk is one of the most important food items for the Masai, management of their ranges should aim for both high quality and quantity forage.

French (1956) found that watering cattle once every three days, as done by Masai herds-men during the dry season, instead of daily, reduced the intake of crude protein and starch equivalent as well as water.



FIGURE 2. Masai cattle grazing in the dry season on overused range in the Rift Valley. Sound grazing management and nutrient supplementation are topics still unknown to the average Masai livestock raiser.

While these are obvious advantages for survival in a severe climate, development of water and its proper management will promote improved animal nutrition.

Livestock Numbers. — In 1957 the 68,000 Kenya Masai owned 1,000,000 cattle, 460,000 sheep and 200,000 goats (Table 2). These

Table 2. Pre- and post-drought livestock numbers (thousands) in Kenya Masailand by District.

District	Year	Cattle	Sheep	Goats
Kajiado	1957	550	60	100
	1961	250	50	100
Narok	1957	450	400	100
	1961	400	400	100

are probably close to the highest numbers ever attained in the region. War and raiding are largely eliminated. Annual precipitation was reasonably good for several years prior to 1959, and effective work had been done to control livestock diseases. The Veterinary Department had reduced mortality rates due to Rinderpest, Contagious Pleuro-Pneumonia, and certain protozoa and tick-born diseases. Failure of the Masai to accept a regular destocking program also contributed to the gradual increase in numbers.

Although counts were not made after the drought, Payne and Hutchison (1963) suggest that 300,000 cattle died during 1960-1961 in the Kajiado District. This amounted to 7 million dollars worth of livestock and was a severe blow to the District's economy. The catastrophe rivaled the historic Rinderpest outbreak of 1890.

Previous to the drought there was one stock unit (5 goats or sheep equivalent to 1 cow) for approximately 9 acres. This figure, as an average for the whole Masailand, has general descriptive value only. Stocking rates vary widely because of irregular climate, unequal distribution of

water, and fluctuating diseases. Large areas are denuded because of higher stocking rates, and other locations show signs of progressive deterioration in quality and quantity of grass cover. However, abundant grass is still present on a large portion of Kenya Masailand, especially in the years of favorable rainfall. Brush invasion and thickening of brush cover have contributed to irregular distribution of grazing pressure and to deteriorating range conditions. Water developments in the past have done little to solve the distribution problem of uneven grazing because livestock limitations were not imposed. Therefore, new areas of range deterioration rapidly developed around the new water supplies.

Grazing Schemes and Ranches. —The Kenya Veterinary Department, in cooperation with the Masai African District Councils and the Department of Agriculture, established several grazing schemes beginning about 1956. The schemes included boundary establishment, development of water with wells and dams, brush control in a few places, and controlled grazing. Grazing control included efforts to set allowable numbers of animals, prevent trespassing, and rotational use of land on a seasonal basis. Previous to 1960, progress was apparent in range improvement and well-being of the animals.

A severe drought between 1959 and 1961 and a gradual slip of discipline at the same time resulted in failure of the schemes. Ranges were overgrazed and concentrated trampling around water developments resulted in accelerated erosion. The schemes were not at fault, but they were abused by the Masai who took the opportunity to increase the number of cattle rather than to increase growth and production from fewer animals in better condition. The principles of lim-

ited livestock numbers and seasonally rotated grazing must be continued. However, they can be successful only if the Masai will impose the necessary regulations upon themselves.

Although a few ranches have been established under private Masai ownership, especially in the Kajiado District, organized ranching has developed slowly. The Masai fear that ranch establishment is more for the purpose of land grabbing than for efficient land management. Much basic ecology is yet to be learned before blocks of 10,000 or more acres can be adequately demarcated and practices recommended for range improvement and settlement schemes. Failures of original schemes also indicate that the people must be convinced of the values to be received in changing their traditional systems and taught to use the new techniques.

Livestock-Game Relationships. —Recent investigations on game populations, bioenergetics and growth, efficiency of range utilization, and carcass yield suggest that in the semi-arid savannah grasslands, the potential productive capacity of indigenous fauna is higher than that of domestic animals. A mixed population of wild herbivores has been shown to utilize a much greater range of grass species than cattle, sheep or goats. Some game animals have been found to be superior to domestic livestock in the conversion of rough fodder into edible animal protein, but not in the conversion to animal fat. Concentrations of herded stock do more damage than their wild game counterparts, although damage by game has appeared in some places. These points and the need for game preservation have resulted in the suggestion that game cropping is a desirable practice for Kenya Masailand, especially where tsetse fly infestations prevent livestock grazing (Pereira, 1961).

The feasibility of large-scale game cropping in Masailand is questionable. Problems of harvesting, transportation of game meat, and sale of game meat have not been solved in Kenya's developing economy where few facilities exist. If game meat were to replace meat from domestic animals, fewer domestic animals would be slaughtered. Their reproductive rate would probably remain the same, and it would result in further overgrazing and continued destruction of habitat for both domestic animals and wild game. The problem is compounded by tribal tradition and attitudes toward domestic animals. The number of domestic animals a man owns is a form of status symbol and he is reluctant to see these animals killed even if they are no longer serving a useful purpose. In addition, the tribal traditions of the Masai place restrictions on the amount of game meat which may be utilized for food. Thus, the most important livestock-game problems are sociological and educational in nature. These are followed closely by technical problems of management and marketing, and by scientific problems of improving the nutritional quality of the forage crops and genetic strains of the present livestock breeds.

A Suggested Management Program

Any range development must be aimed at the twin problems of balancing range feed production with needs and obtaining even distribution of grazing pressure over the whole area. In order to solve these problems, several factors must be attacked at the same time. Success will depend upon sound biological recommendations, willingness on the part of the Masai to change their traditional animal husbandry practices, and development of an enlarged market for the products. This program demands additional knowledge of soil, vege-

tation, water resources, nutritional requirements of animals, diseases, and many other items in the soil-plant-animal complex. Effective educational and extension programs are necessary to develop an awareness of the values and need for quality production. Finally, government must lend its support through programs that raise the standard of living and level of hygiene, hasten economic stability, and promote agricultural development throughout the country. Range and pasture developments in Masailand are parts of the over-all agricultural improvement in Kenya, and are interdependent with economic development throughout the country.

The immensity of the problem and scarcity of trained personnel suggest that the best chances for success lie in concentrated effort on small areas rather than diffused work throughout the region. Therefore, the following seems to be a reasonable approach:

1. By ecological survey, one or more areas of not less than 10,000 acres and preferably up to 50,000 acres should be selected for development with full cooperation of the Masai concerned.

2. Range improvements such as pasture boundaries, water development, brush control, dip tanks and spray pumps for ectoparasite control, and tsetse fly control should be established to increase forage production and to obtain even distribution of animals.

3. In order to ensure even growth of animals, and to prevent drastic loss of condition during the dry season, attempts should be made to produce and conserve fodder.

4. Control of livestock numbers and intensity of forage use are absolutely essential, otherwise improvements will be destroyed or reduced in effectiveness. Any proceeds from a destocking program and selling of

livestock must be returned to the owners of the animals or handled for them through the Masai District Councils. The development program should be supported by the livestock owners and by government or council subsidy.

5. The development scheme should initiate private or cooperative land holdings among the Masai, and regulate livestock management and marketing in order to enhance chances of success.

6. Livestock production should evolve toward a commercial enterprise based on year-long, wet and dry season, balance of feed needs and supply. Small, well-managed areas can be the educational tools which promote economic development as well as the proving ground for the management practices.

7. While these suggestions are not new, past failures indicate that considerably greater efforts need to be made in coordinating all economic aspects of rangeland management.

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