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The Possibility of Using Wild Animals for Animal Production on East African Rangeland Based on a Comparison of Ecological Requirements and Efficiency of Range Utilization by Domestic Livestock and Wild Animals.

By

Lee M. Talbot

(Ecologist, Wildlife Research Project; financed jointly by United States National Academy of Sciences-National Research Council; Government of Kenya; and New York Zoological Society).

H.P. Ledger, and W.J.A. Payne

(Animal Husbandry Division, East African Agricultural and Forestry Research Organisation).

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In East Africa the greatest deficiency in human diet is animal protein, and throughout most of the world's semi-arid tropics a need for protein and other animal products exists (Gale, 1960). To date, most attempts to meet this need have involved the use of domestic livestock. These attempts have not been entirely satisfactory, due, largely to the nature of the available rangeland. This paper surveys the possibilities of augmenting domestic livestock production with animal production from wild animals. The area considered is East Africa, although the general principles involved may apply to other parts of the semi-arid tropics.

East African rangeland is characterized by low precipitation, high temperatures and high evaporation. In terms of rainfall this rangeland is in areas which have a high probability of receiving less than 20 inches a year, i.e. roughly one third of the total land area of East Africa. Although the average annual rainfall in this area may be as much as thirty-five inches, the irregularity and uneven distribution of that rainfall, combined with high probability of low rainfall, high temperatures and evaporation, produce vegetation and pasture conditions usually associated with

much lower annual rainfall. These lands are particularly vulnerable to overgrazing-induced desiccation with consequent lowered production, and even with the best of existing economical management the production obtained from domestic livestock is quite low compared with European or American standards yielding at the maximum a gross return of about 10 shillings per acre. (Ledger et al, 1961).

The forage produced on these rangelands is in the form of herbs, grasses, and woody plants which range from low bushes to tall trees. Grasses are the preferred forage and most efficient source of nutrition for the domestic cattle, sheep, and goats. However, except under stringent range management the grasses only form a part of the total available plant food. Of the two to three dozen grass species usually present in this range area, less than ten percent provide the bulk of the preferred, economic livestock feed (Heady, 1959). Thus, only a small portion of the total available vegetation supports the domestic livestock crop.

Further limitations on domestic production come from water needs and disease. Dry season water points are often so few and far apart that much of the range is denied to animals requiring water once each on one or two days, while the pasture areas near the water points receive disproportionately heavy and destructive usage. At the same time cash yields per acre expected even from intensive management are so low that provision of sufficient improved water points is often economically unfeasable (Ledger, et al, 1961). Disease is another important livestock limiting factor. For example, large areas of East Africa are still denied to most domestic livestock due to the presence of tsetse fly. As a consequence, these are among the few areas of East African rangeland which do not show moderate to very severe damage from overgrazing.

Attempts to increase animal production from this rangeland must fall into two categories; improvement of the range for the presently used forms of domestic livestock, and utilisation of animals better adapted to the existing range conditions. Improvement and management of the existing range usually involves bush clearance, disease control, provision of water, stringent grazing control, fencing, and occasionally reseeding. All of these operations are expensive. In many of the East African rangelands the necessary capital for such improvements is not available, and even if it were available, the low yield per acre expected from these lands often does not justify such expenditure.

One therefore looks toward animal species better adapted to animal production under the existing conditions. The indigenous or native breeds of cattle, goats and sheep are better adapted to the existing conditions than the exotic or improved breeds (Williamson and Payne, 1959). However, even the local breeds in East Africa were imported in relatively recent times and the limitations mentioned above apply to them as well as to more recent imports. The truly indigenous livestock are the wild animals which presumably have evolved along with or within the environment, and which therefore should be best adapted to living in it. The present studies have shown that this is indeed the case, and that the yield of meat and other animal products per acre may be potentially much greater from wild animals than from domestic livestock. The evidence supporting this conclusion comes from comparisons between domestic livestock and wild animals' diets, apparent digestive efficiency, growth rates, liveweight gains, water requirements, disease relationships, and standing crops and carrying capacities. These are discussed in turn below:

Diet: In East African rangelands it is not unusual to find some twenty species of wild herbivores living and feeding in the same area. These animals range in size from the twelve pound dik dik (Madoqua kirkii) to the three to five ton African elephant (Loxodonta africana). From the standpoint of potential harvest in these areas, the principal species are the following: wildebeest (Gorgon taurinus), Burchell's zebra (Equus burchellii), eland (Taurotragus oryx), Grant's gazelle (Gazella granti), Thomson's gazelle (Gazella thomsonii), kongoni (Alcelaphus buselaphus), African buffalo (Syncerus caffer), and impala (Aepyceros melampus). Other animals regionally important could include giraffe (Giraffa camelopardis), topi (Damaliscus korrigum), oryx (Oryx beisa), hippopotamus (Hippopotamus amphibius), and elephant.

Where a variety of these species are found in the same area the present study has shown that the food preferences of the various species are strikingly different and complementary. As an example, wildebeest, zebra, topi and kongoni are basically grass eaters, yet there is relatively little overlap between each with regard to grass species and stage of growth eaten. Impala, Grant's and Thomson's gazelle are mixed feeders, utilizing grass, herbs, and woody plants depending on the season and stage of growth. Their grass preferences are complementary to those of wildebeest, zebra,

topi and kongoni. Buffalo are mixed feeders, yet their grass preferences are entirely different from the antelope and zebra. Rhinocerous (Diceros bicornis) and giraffe rely mainly on woody shrubs and trees for their feed, and their preferences do not conflict with each other or the antelope. Thus, where such a mixed population of East African wild ungulates exists, virtually all the vegetation growth of an area provides nutrition for the animal mass living on it. Where cattle, goats and sheep graze a similar area, only a very small part of the total vegetation growth provides preferred and efficient nutrition to the animals involved.

Digestive efficiency based on killing out percentage and visceral weight: The efficiency of nutrition of a mixed population of wild ungulates apparently is matched by the nutritional efficiency of the individual species involved. The killing out percent (butcher's carcass weight expressed as a percent of liveweight) of Thomson's gazelle averages 56.3% Grant's gazelle averages 63.2%; topi, 53.6%; kongoni, 52.5%; impala, 59.5%; wildebeest, 50.6%; eland, 58.6%. These may be considered minimum figures, as the relatively few animals involved were collected during the dry season and all were in poor to moderate condition. In comparison, the killing out percent of the majority of African owned cattle seldom exceeds 50%; the long legged tropical meat goats average about 45%; and the indigenous sheep about 44% (Williamson and Payne, 1959). This differential killing out percentage between domestic livestock on this rangeland and wild animals is not a matter of fat, in fact, the wild animals have far less fat than the domestic livestock (ledger et al., 1961). Rather, it is due to the weight of the viscera and digestive tract fill. Most wild animals require a substantially smaller total digestive tract per unit of liveweight than the domestic livestock on the same range, indicating that their digestive systems are more efficient in utilizing the available nutrients than those of domestic livestock.

Water Requirements: In general, cattle in East Africa are watered at least once every one or two days, but at the height of the dry season they may be watered only once every three days. Although the water in forage satisifies some of the body water requirements all domestic livestock require additional water at more or less regular intervals.

The wild animals, on the other hand, have quite flexible water requirements. Oryx, Grant's and Thomson's gazelle and apparently impala can go long periods with no free water at all. Oryx and the gazelles live for weeks in areas totally devoid of surface water. Kongoni, topi, wildebeest, eland and buffalo all drink frequently where water is available, but they are able to go waterless for several days and to travel dozens of miles to find water if necessary, with no apparent adverse effects on maintenance of life or growth rate. A large and vigorous wild ungulate population, therefore, can be supported yearlong on a range where short water supply renders only a limited population of domestic livestock possible.

Growth rates and liveweight gains: The average liveweight gain of cattle on East African rangeland is 0.3 lbs. per day (Ledger et al, 1961), and that of sheep in Tanganyika over an 18 month period is 0.115 lbs. per day (Williamson and Payne). The liveweight gains of some of the principal species of wild animals (c.f. Table I) range from 0.13 lbs. a day for ten months for the Thomson's gazelle to 0.54 pounds a day for four years for the eland. The liveweight gain per day increases with the size of the animal involved, but with a given poundage of domestic livestock and mixed wild animals, there is substantially greater liveweight gain per day from the latter. As a consequence the wild animals reach marketable or economically harvestable size at an earlier age than domestic livestock. Masai cattle, under Masai management in East Africa reach marketable size in five to seven years. Under more efficient management this stage may be brought down to about four years. Sheep and goats require one and a half to two and a half years. Thomson's gazelle require roughly fifteen months, Grant's gazelle and impala about eighteen months, topi and kongoni about two years, wildebeest two and a half to three years, and eland three to four years.

Age of reproduction: The average range cow in East Africa will breed when about three and a half years old, and improved ranching management may bring this down to two and a half years. Sheep and goats may breed first when just under a year old (Williamson and Payne, 1959). The gazelles and impala will breed when under a year old; topi, kongoni and wildebeest when just over one year old. Eland and buffalo probably breed first when two to three years old. The birth rate of most wild animals is very high. In the wildebeest herds of the

TABLE I

Liveweight gains per day, domestic livestock and wild ungulates on East African rangeland.

Species	Liveweight gain per day lb.	(kg)	Period (mths)	Average adult weights lb.	(kg)	Approx. age when adult weight reached (mths)
Thomson's gazelle	0.13 0.08	(0.06) (0.04)	10 15	41- 53	(18.6- 24.0)	18
Impala	0.26 0.20	(0.12) (0.09)	10 18	101 131	(45.8- 59.4)	24
Grant's gazelle	0.26 0.22	(0.12) (0.10)	10 18	101- 146	(45.8- 66.2)	24
Topi	0.44 0.34	(0.20) (0.15)	12 24	252- 292	(114.3- 132.4)	30
Kongoni	0.50 0.39	(0.23) (0.18)	12 24	270- 332	(122.5- 150.6)	30
Wildebeest	0.52 0.44 0.41	(0.24) (0.20) (0.19)	12 24 30	360- 460	(163.3- 208.7)	45
Eland	0.54	(0.24)	48	625- 830	(283.5- 376.5)	?
Domestic sheep (1)	0.12	(0.05)	18	44- 100	(20.0- 45.4)	18
Domestic cattle (2)	0.30	(0.14)		350- 1000	(158.8- 453.6)	60

(1) Williamson and Payne (1960); (2) Ledger et al (1961).

Serengeti-Mara region, for example, over 95% of all adult females in the population produce a calf each year.

Disease relationships: Disease is one of the most important factors adversely affecting domestic livestock production in East Africa. While relatively little is known yet regarding the disease picture within wild animal populations, many diseases appear to affect game to a lesser degree than they affect domestic livestock. This situation is particularly true with regard to trypanosomaisis.

Standing crops and carrying capacity: Carrying capacity of a given rangeland is extremely difficult to state with accuracy. It varies from year to year depending on the climate and condition of forage vegetation. The most suitable index is the actual condition of the range (Heady, 1959). When the range is deteriorating the carrying capacity has been exceeded by the standing crop, and this is true throughout much of East African rangeland. The standing crop of domestic cattle on moderately well managed grasslands is about the equivalent of one 1,000 pound animal per 20 to 30 acres, or 31,000 to 32,000 pounds per square mile (Henderson 1950; Ledger, et al; 1961; Petrides, 1956). In Masailand acacia-savannah land outside of grazing schemes, the stocking rates of domestic livestock determined by this study range from 11,200 to 16,000 pounds per square mile, i.e. the equivalent of one animal per 20 acres, where the animal averages from 350 to 500 pounds. In bush country denied access to cattle because of tsetse fly, the standing crop of goats and sheep range from 2,100 to about 8,000 pounds per square mile. In contrast identical acacia savannah land grazed by wild animals and a few sheep and goats supports a standing crop of from 66,000 to 90,000 pounds per square mile, and the bush country grazed by wild animals exclusively supports a standing crop of 30,000 pounds per square mile (c.f. Table II). In all cases the high standing crops of wildlife appear well within the carrying capacity of the rangeland while in virtually every case the standing crops of livestock under existing management conditions exceed the rangelend's carrying capacity, judging by vegetation deterioration.

Magnitude of the potential wildlife harvest.

As seen from Table II, the standing crop of wild animals on acacia savannah land may be two to eight times that of domestic livestock, and the crop of wildlife on bushland may be from four to fifteen times that of goats and sheep. Since