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THE BIOTIC ENVIRONMENT IN THE PRECOLONIAL HISTORY OF THE SAMBURU OF NORTH-CENTRAL KENYA

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ABSTRACT

Just as it is difficult to reconstruct the physical environment of pre-colonial Samburuland, its entomology and wildlife, or what such facts meant to the herdsmen, present an equally insurmountable challenge as no records to that effect exist. Those who have attempted to delve into the era towards that end, have done so simply to show that herdsmen lived at the mercy of such harmful insects like ticks and tsetse flies. Even when such scholars invoke the immunity of livestock to insect-borne diseases, they always argue that the disease made livestock a pitiable sight. Wild animals on the other hand, have been shown to have been beyond man's capability to control them and hence constituted another scourge. Therefore, this paper, attempts a survey of the Samburu precolonial entomology and wildlife, with a view to showing that, not only were these ardent herdsmen aware of the challenges posed by their biotic milieu, but they did design strategies to mitigate their effects on their pastoral economy. Equally, they endeavoured to maintain a critical balance between their economic activities and the natural environment within which these harmful insects and wildlife thrived.

Keywords: Biotic, Entomology, Ecology, Precolonial, Samburu

1. INTRODUCTION

Precolonial entomology is one field that historians need to turn their attention to. Colonial writers, administrators and many of our today's western based conservationists have asserted that precolonial herdsmen lived at the mercy of harmful insects and that wildlife posed an unsurmountable challenge to people and their economic activities The tsetse fly, for instance, has been described by many western scholars as the 'African bane' that accounted for the 'backwardness' of pre-colonial economies since it rendered large tracts of viable land uninhabitable. The main line of argument has been that pre-colonial environment has been harsh and unmanageable hence has had the effect of slowing down the economic advancement of the African peoples.

However, it is important to point out at this juncture that the basic requirement for human environmental control is first and foremost the knowledge that man has on the ecosystem within which he lives This is crucial because, the success of whatever economic alternative a society may adopt will primarily depend on the ecology of the region. This is exactly what Marx and Engels meant in their assertion that:

The way in which men produce their means of subsistence depends first of all on the nature of the actual means of subsistence they find in existence[1]

For example, fumagalli[2] asserts that pre-colonial people co-existed with the tsetse flies. He claims that the samburu did little in terms of controlling the fly and that trypanosomiasis made their cattle "remain in a stunted or unproductive condition. This

[1]K,Marx, and F, Engels, F. Selected Works, Vol. 1.(Moscow,1966),p.23

standpoint is not only uncharacteristic of a people well-versed in their physical environment but also too simplistic, if not totally unacceptable. The ecology of samburuland is a complex determinant that defies a climatic generalization which would suffice to describe the district as one ecosystem. As one scholar observed, the district "presents a rather diversified physical configuration that along with the geographical location carries important implications for its climate, rainfall vegetation and land potential".

Contrary to the views of Fumagalli, Spencer[3] avers that the Samburu people possessed a vast knowledge of both their physical and biotic environments and the challenges that these posed to their pastoral economic advancement. Such knowledge not only made them get well adapted to her habitat, but it also elevated them beyond the level of adaptation, to one where they became capable of manipulating their environment for their material existence. It was the utilization of this knowledge and its application in ecology control that led the Samburu to develop their pastoral economy, between 1840 – 1880, to a level still nostalgically remembered to date.

2. PRECOLONIAL ENTOMOLOGY

2.1 Tsetse flies

The tsetse fly (*Glossina* spp.) is one insect that has received an undue publicity as a symbol of precolonial African underdevelopment. According to Tweedie:[4]

If an insect had to be selected as symbolic of Africa, a suitable if rather macabre choice, would be tsetse.

Another writer has claimed that the tsetse has been responsible for delaying the "progress of civilization" in Africa, while at the same time sarcastically asserting that, by the tsetse rendering vast areas unfit for stock rearing, the African "propensity" for destroying the environment has also been checked.[5]

While the economic drawbacks of the fly cannot be doubted, it is erroneous to assume that the fly reigned supreme at the expense of human advancement. The very idea that both 'tsetse' and 'nagana' are African terms (in fact of Xhosa origins) would indicate that people's knowledge of this blood-sucker goes back many centuries. European knowledge of the tsetse fly and its associated human and animal trypanosomiases is as recent as the first decade of this century.[6] Accounts depicting the fly as rampant and hindering economic development, ignore or downplay the knowledge and experience gained by African herdsmen and farmers throughout the centuries they have kept cattle and cultivated. As it has already been shown, herdsmen knew the link between the tsetse, game, bush and the survival of their livestock wherever they were. Even when African detractors have found it fit to portray the pastoralists as naive in ecological knowledge, some readily admit that it "shows considerable intelligence on the part of natives --- to have correctly associated the fly with the [*nagana*] disease."[7]

Perhaps the question that begs for answers is that of how rampant the tsetse fly was. The question needs to be addressed because, as shown above, the tendency to associate the insect with the alleged 'backwardness' assumes that the fly menace was endemic. Tackling this issue cannot be done by just a vehement denial, rather, the ecology of the tsetse fly must be established. This is because there is an intimate relationship between the nature of the ecosystem with the epidemiology of trypanosomiasis.[8]

Like all organisms, the tsetse fly has an optimum environment within which it thrives. It has been established that the fly is a sensitive insect to climatic changes like heat, increased desiccation and that it requires vegetational shade for breeding. The National Atlas of Kenya [9] puts it thus:

> The distribution [of the tsetse] is patchy at an altitude ranging from sea-level of approximately 6,000 ft (1,800 m). Tsetse flies are not found in the higher country neither do they occur in very arid areas. The presence of the tsetse flies depends on the occurrence of certain woody plants which provide them with a suitable environment for shelter, resting and breeding

The above description of tsetse ecology is very well reflected in today's and past distribution of the fly in Samburu County. Given the low level of moisture and the sparse vegetation, as already shown, it makes a lot of sense to find that, of all the many species

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[2]C.T.Fumagalli, C.T. *A Diachronic Study of Change and Social Cultural Processes among the Pastoral Samburu* Ph.D Thesis, University Microfilms International, Ann Arbor, Michigan.1977
[3] P,Spencer, *The Samburu.* (London,1965),p.25
[4]M.Tweedie, M.*Atlas of Insects*. (London,1974).p.68
[5] T.W. Kirkpatrick, *Insect Life in the Tropics.* (London, 1957),p.193
[6]C.M. Ealand, *Insects and Man*. (London, 1914), p.129
[7]Kirkpatrick, p.193.
[8]R.S.Desowitz, *Epidemiological-Ecological Interactions in Savanna Environments" in Harris*, D.R. (Ed.) Human Ecology in Savanna Environments. (London,1980), p.47
[9]The National Atlas of Kenya (Nairobi,1970), p.44

of tsetse, only two are found in the entire county namely, *Glossina Longipennis* and *Glossina pallipides.*[10] Whereas the entomological maps of the county depict Lorroki Plateau and most of the south-eastern parts of the region as tsetse-infested, oral testimonies of the Samburu, on tsetse distribution in their country during the precolonial era, gives a picture that is in agreement with the known tsetse ecology, but one that differs with the entomological maps in as far as the distribution of the fly is concerned. According to oral sources, the tsetse fly, *Lajong'anyi* was restricted to a very small area to the south-western parts of the county and specifically around Malaso, Losuk and Tinga areas.[11]

The ecology of these areas, was, as it still is, conducive to the fly's breeding habits. These areas were not only well watered, but also had good vegetation cover whose shade gave the fly a cosy habitat for its reproduction. On the distribution of the tsetse, most of our informants asserted that other areas of their country were not infested with this fly, *Lajong'anyi,* whose bite was known to be very poisonous and at times fatal to cattle.

On human trypanosomiasis (sleeping sickness) there is no evidence, written or oral, to suggest that it was known to the Samburu. While it is documented that the disease killed hundreds of thousands of Africans in such places as Busoga in Uganda and in Malawi between 1890 and 1911, nothing of this is remembered by the Samburu. This is not surprising because as Sindiga[12]notes, sleeping sickness was first recorded in Kenya in 1902 and it appears to have been a spillover from the 1900 to 1902 Busonga-epidemic. This spillover on the other hand, only affected the Kenyan part of the Lake Victoria basin and did not spread much to other regions. It should also be noted that while West Africans had experienced human trypanosomiasis for some 600 years ago, the same cannot be said of East Africa. For the latter region, the disease was introduced in 1888 when Morton Stanley entered Uganda. We are told that, "in Stanley's retinue were natives [from Congo] infested with *T.gambiense* [the organisms that cause sleeping sickness] who probably bore the seeds of the epidemic that was to decimate the region's population for the next ten years."[13]

From the above, it becomes clear that the story of the tsetse fly and particularly its description as the "African bane" is not only distorted but also highly exaggerated. We have laboured to show that Samburu country, before the advent of British imperialism, had its own share of nagana-infecting tsetse flies, but on the other hand, we made it clear that the localities of such tsetse species were known to the Samburu. We have also shown that human trypanosomiasis was not known in Samburu country for the simple reason that, while the vectors (flies) were there, the disease-causing organisms (trypanosomes) were lacking. The Samburu knowledge of the localities for the nagana-infecting flies, was crucial, as we shall see later, in devising methods or means of combating the tsetse menace.

2.2Gadflies

As stated above, entomological maps of Kenya tend to show that tsetse flies are widely distributed, and this seem to be at variance with oral sources such as those from the Samburu. This anomaly, most probably, stems from the fact that those who draw up such maps, do so with preconceived ideas of the alleged ecological requirements of the flies, that is, wherever conditions seem to reflect those befitting the fly, then such regions are automatically labeled "tsetse infested". Most of the maps give no recognition of the presence of insects called "gadflies", perhaps because such flies are also regarded as tsetse. In a personal communication with the authors, the Samburu District Tsetse Officer admitted that it is still difficult to determine, with any accuracy, the distribution of both tsetse and gadflies in the district.

Gadflies are scientifically termed *tabanids*. According to the earliest and most recent research, *tabanids* have a wider distribution than tsetse flies. *The North Frontier District Official Handbook*, published in 1917 depicted tabanids as agents of animal trypanosomiasis (*nagana*), and this probably explains why there is no distinction between the tsetse and the gadflies in the official (colonial and postcolonial) documents.[14]

However, the Samburu distinguished between the tsetse fly, *Lajong'anyi*, and gadflies, locally identified as two types inhabiting different ecological regions. The two types are namely, *sanambur* and *lupupoi*. The former inhabits the higher and cooler regions locally referred to as *supuko* which, during the precolonial era, acted as dry season grazing areas. The fly, according to our informants, is big-bodied compared to the tsetse and appeared seasonally; just before the onset of rains but ceased when the rains intensified. In fact, the fly was regarded as a harbinger of rains.

[10]C.T.Fumagalli, C.T.A Diachronic Study of Change and Social Cultural Processes among the Pastoral Samburu Ph.D Thesis, University Microfilms International, Ann Arbor, Michigan.1977

[11]Siamanda Leshoranai O.I, March 1991 and Letende Lekaaso, O.I, April, 1991
[12]Sindiga, I., *European Perceptions in Degrading Maasai Ecology* M.A. Thesis, Ohio University.1986, p.93

[13] Desowitz.p. 471
[14] KNA/[PC/NFD7/1, *The North Frontier District Official Handbook,1917*

The *sanambur* caused no known disease to either people or livestock but due to its painful bite, it made cattle run amok leaving behind them unexploited pastures. In short, the fly was more of a nuisance than a problem. The seasonality of it ensured that the community exploited the pastures frequented by the fly during the period it was absent. With the onset of rains, the *supuko* region was temporarily abandoned together with the *sanambur* menace.

The *lupupoi* on the other hand, inhabited the low and dry regions. It was easily identified from its characteristic 'long mouth' (elongated proboscis). According to most informants, this fly, just like the *sanambur*, had a very painful bite that caused a lot of distress to both herdsmen and their livestock. The main difference between the two was that, the *lupupoi* did not have to land on the host, but could use its proboscis to pierce the host for a blood meal from a safe distance. It also caused no disease and could therefore be tolerated.[15]

A closer look at the research done on tabanids confirms the accuracy of Samburu accounts. It has been observed that these flies are much less important as vectors but the severity of their biting have influenced both man and animals. At the same time, their seasonality makes it possible for herdsmen to avoid them (Askew 1971:54). *Lupupoi* is biologically termed *Pagonia longirostris* and its habitat is no different from that identified by the Samburu.

It would, therefore, seem as suggested above that the maps that show the distribution of tsetse flies combine them with gadflies, which as we have just found, are of no significance in as far as livestock diseases are concerned. The Samburu identification of the disease-causing vectors, *lajong'anyi,* and distinguishing them form the gadflies, reflect the deep knowledge and understanding of their physical environment which is borne out of experience in space and time.

2.3Ticks

Today, tick-borne diseases constitute a major challenge to East African pastoralists. While precolonial records on the extent to which ticks constituted a menace are nowhere with us, oral traditions of the Samburu downplay their significance. Ticks, locally termed *masheri*, were reportedly there but cannot be compared to their situation today in terms of numbers, variety and subsequently livestock fatality.[16] In fact, the most remembered tick, by most of my informants was a type simply described as 'a small reddish-brown tick' which preferred lodging in the ears and perineum of cattle.[17]

Most of the informants pointed out that, while the tsetse was known to cause *ndigana* (nagana) to cattle, the tick caused no serious problems except for the destruction of the hides and making the animal 'appear thin.'[18] The Samburu pastoralists had also established that their low lying and drought stricken region to the north of their country, known to the Samburu as *Lpurkel,* had fewer ticks than the higher and cooler regions like *Lorroki* Plateau.[19]

Any map of Kenya showing tick distribution tends to agree with the Samburu observation that ticks diminish with increasing aridity. *The National Atlas of Kenya*[20]confirms it by showing that ticks in Samburu land are mainly found in the relatively moist *Lorroki* Plateau. While it is difficult to identify the "small reddish-brown" tick of the precolonial Samburu fame, it could be any of the five common ticks found in Kenya namely, Brown Ear Tick (*Rhipicephalusappendiculators*), Red legged Tick (*Rhipicephalus evertsi*), Blue Tick (*Bovine decoloratus*), Bont Tick (*Amblyomma spp*.) and Bont legged Tick *(Hyalomma spp.)* However, according to an authoritative publication by a leading manufacturer of tick-killer drugs (acaricides), *Welcome Eastern Africa Limited*, most ticks seem to thrive in relatively wet areas with an exception of Bont-legged Tick (*Hyalomma spp*.) which is found in drier areas and common in Rift Valley[21] On the other hand, if we were to go by the description of colour, site of attachment and the geographical location, then the Brown Ear Tick (*Rhipicephalus appendiculatus*) would be the probable contender. The Samburu way of identifying the tick has also received scientific backing from the *Wellcome*group, provide useful back-up evidence that identification is correct.[22]

The problems of tick-borne diseases, as the Samburu informants stressed, were limited and like the case of *bovine trypanosomiasis* (nagana), the cattle through the centuries of co-existence with the ticks and their hosts, domestic or wild, had acquired considerable immunity. This immunity and the sound management of their (Samburu) environment, ensured that ticks did not negatively affect the distribution of livestock in Samburu land. During the precolonial era, the pastoralist, his cattle and their ticks lived together in a state of equilibrium:

[15] Saritoi Lemorogo, O.I. February 1991
[16]LebaaLebarsoloi, O.I., March 1991.
[17]Kirima Leleina, O.I., March 1991.
[18]Mary Lewoso, O.I., March 1991.
[19] Sango Lengoiboni, O.I; February 1991.
[20]*The National Atlas of Kenya,* 1970.
[21]Wellcome Eastern Africa Limited *The Control of Cattle Ticks in East and Central Africa. (* Kabete Kenya.1980).p.12
[22] Ibid,p.10

> His cattle had, over generations, developed a degree of resistance to ticks and to the diseases they carried. Young calves would contract the disease early in life, recover, owing to an inherited resistance and become immune. It wasn't a perfect situation of course--- but the devastating losses, which came later were not experienced.[23]

That today ticks constitute a serious threat to the pastoralists is due to colonial policies which upset the delicate ecological equilibrium that the herdsmen had all along maintained with admirable success. Importation of new breeds of cattle and semen to up-grade livestock of colonial settlers or ranchers, brought in its wake ecological imbalances hitherto unknown in many regions. White settlers established ranches in Laikipia District, to the south of Samburu land, which not only kept the Samburu out of such grazing areas, but the new breeds of cattle in the ranches also introduced diseases previously unknown. Dipping facilities, though glorified as important steps towards tick control, proved ineffective quite early. The Maasai, for example, showed enthusiasm for a dipping tank as early as 1913. When finally, the tank was constructed in 1914, they found out that the introduced acaricides only played havoc with the immunity of their cattle and particularly the calves which died of East Coast Fever (ECF) in great numbers. On this we are told that:

> That high mortality among calves persisted and the Maasai continually complained of losses from East Coast Fever. Their complaints were so frequent, and their reluctance – and refusal in many instances – to dip so persevering, that the administration decided that dipping of stock should be optional.[24]

Colonial policies only brought impoverishment to the herdsmen and this explains why most of them pointed out that their past was not only glorious but one of plenty.

2.4 Wildlife

Game, together with domestic animals through which the Samburu exploited their physical environment for production, constituted an important component of the ecosystem. The role of herbivores in any ecological zone is as varied as the animals themselves. As an essential component of the Samburu ecology, they have certainly played an important role in the evolution of the region's ecosystem.

Although we lack records to indicate the biomass of wildlife during the precolonial era, a scrutiny of the European travelers' accounts during the second half of the nineteenth century reveal that the region was rich in game. Some research findings have also indicated that the East African savanna supported large herds of ungulates than it does today.[25] However, abundance of wildlife during the precolonial era have tended to be misconstrued to mean that the African husbandmen had little control, if any, of game. Fratkin[26], for example, claim that the Samburu co-existed with wild animals with little conflict.

The proposition that wildlife, and particularly herbivores, posed dangers to man and his livestock obscures the simple fact that like man and his livestock, herbivores are subject to ecological limitations. On the other hand, just like the domestic ungulates, they differ in their dietary specialization which consequently affect their distribution and impact on the environment. This dietary specialization ensures that the exploitation of the habitat by wild herbivores goes far in promoting ecological balance. In fact,

> Most grasslands have evolved under the impact of grazing animals and the vegetation is as much in balance with their presence as it is with the climate, soils and other factors of the environment.[27]

In any given ecosystem, it has been observed that wild herbivores are evenly distributed making them very efficient users of their habitat and hence reducing competition among themselves on the one hand, and domestic animals on the other. This phenomenon of reduced competition due to herbivore distribution is termed *Ecological Separation*, and it has received the attention of many scholars.[28]

In a survey of wild and domestic herbivores carried out in 1970 in Samburu District, it was observed that wild herbivores were evenly distributed throughout the district while domestic ones were not.[29] While this survey cannot be said to be representative of the precolonial picture, it however demonstrates the principle of ecological separation and more than anything else, confirms the assertion by a Samburu informant that:

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[23] Wellcome,p.VII.
[24] KNA/PC/NFD5/5/6.
[25] P.A.Jewel, ,*Ecology and Management of Game Animals and Domestic Livestock in African Savanna Environments.* (London,1980),p.12
[26] E.M. Fratkin, *The Organization of Labour and Production among the AriaalRendille* Ph.DDissertion, The Catholic University of America, Washington, D.C. 1987 See also C.T.Fumagalli, *A Diachronic Study of Change and Social Cultural Processes among the Pastoral Samburu*Ph.D Thesis, University Microfilms International, Ann Arbor, Michigan.1977
[27] R.F. Dasman, R.F. et all., *Ecological Principles for Economic Development* (London,1973),p.81
[28] Ibid,p.83.
[29] C.T. Fumagalli, *A Diachronic Study of Change and Social Cultural Processes among the Pastoral Samburu* Ph.D Thesis, University Microfilms International, Ann Arbor, Michigan. 1977

Every wild animal knows where to eat grass.[30]

This assertion was in response to the question, posed to informants, as to whether wild herbivores during the precolonial era competed for food with their herds. On the other hand, Samburu country tends to support less total biomass of a combined domestic and wild herbivores, put at 6514.39 kg per square kilometre due to ecological limitations of the district. Further, this stated biomass shows that, unlike other savanna ecosystems such as Amboseli, the wild herbivores constitute only 30.38 percent compared to 69.62 for domestic animals.[31]

However, wildlife to the Samburu herdsmen did not end at the pasture and water level. Carnivores such as lions, leopards and hyenas were also a potential threat to livestock. While, in most of the times, carnivores thrived on wild herbivores, they sometimes turned against the domestic animals. This would happen when the animals that constitute their prey migrated to other regions on account of drought. When such carnivores started attacking livestock, then man-carnivore conflict ensued, which inevitably led to the beasts being killed or driven all together from the vicinity.

It would be appropriate to add that experience had taught the Samburu that carnivores, like herbivores, inhabited certain localities and not others. Equipped with this knowledge, it was easier for them to avoid such areas or clear thickets which acted as the beasts' lairs. The wild herbivores, on the other hand, were usually associated with certain known diseases. According to our informants, ungulates such as wildebeests, buffaloes, elands and wild pigs contaminated pasture. It was widely held that the saliva, urine and dung of such game made cattle contract a disease identified as *boroto*, if they happened to graze in such contaminated pastures.[32]

While such ideas would be dismissed by uncritical scholars and veterinarians as "the highest level of absurdity", it should be noted that a parallel has been observed among the Maasai.[33] According to these legendary pastoralists who are linguistically related to the Samburu, the wildebeest was known to cause a certain kind of fever to cattle. Today, courtesy of the Kabete researchers in Kabete Veterinary Laboratories, this fever has been identified as *Malignant Catarrhal Fever* (MCF). According to Karstadt and Grootenhuis[34]:

> The association of cattle, wildebeest and the virus for malignant catarrhal fever is an example of the incompatibility [of wildlife and pastoralism]and wildebeest will never be welcomed on the grazing lands of the Maasai.

The research and subsequent identification of the MCF virus was based on Maasai knowledge. Further, the fact that it was finally found that wildebeests, through their nasal secretions particularly from calves in their first three months of life, caused the disease only makes us believe the Samburu fashion. If nasal secretions can cause such fever, what will then stop metabolic waste such as urine and dung of game from contaminating pasture with disease causing organisms? The problem, in our view, has always been that in most of the research done on livestock diseases, the contribution of the herdsmen has never been sought.

In the analysis we have made above, it can be argued that the presence of game did not greatly affect Samburu pastoralism during the period under consideration. We have seen that, wildlife, owing to their dietary specialization, were evenly distributed which eased the problem of competition with domestic animals. On the other hand, game impact on the environment was checked by ecological limitations. The distribution of herbivores also greatly affected that of carnivores which depended on the former for food. However, the Samburu had elaborate mechanisms through which they controlled wildlife if they (wildlife) were deemed to pose any dangers.

3. CONCLUSION

From the foregoing, we have shown that the Samburu biotic environment did pose a great challenge to these ardent pastoralists. The Samburu ecosystem had well known threats to the Samburu pastoral economy. Equally,lands such as the one the Samburu have occupied in the course of their history, being marginal and limited by such factors as diseases, ticks, tsetse flies, gadflies and wildlife, show the futility of the raging debates by "modernizers" and "conservationists" on whether pastoralists keep herds for prestige or subsistence. The precolonial life of the Samburu herdsmen was not of the "Cowboy-on-horseback" fame, but one that

[30] Charles Lenalongoito, O.I, March 1991.
[31] Fumagalli,p.65 .
[32] Mutian Loipokopenyi, O.I. April 1991.
[33] L.M.Talbot, *Ecology of Western Maasailand* Ph.D Dissertation, Berkeley, University of California.1982
[34] L.Karstadt, and J.G. Grootenhui ,*Research in Wildlife Diseases at Veterinary Laboratories*, Kabete 1967 – 1977 in Republic of Kenya, Ministry of Environment and Natural Resources, Wildlife Research Priorities in Kenya.1981

involved a very thorough and careful planning, within the society's technological level and meagre resources. We have demonstrated that the community was well-versed with their natural environment and had, during the precolonial era, managed to maintain a delicate balance between their economic activities and the dictates of nature. The advent of British imperialism, towards the end of the nineteenth century, did alter, for the worse, the ecological balance that the Samburu herders had painstakingly maintained. The colonizers introduced policies that made it impossible for pastoralists in Kenya to continue with their well-tried methods of environmental control. The colonizers had no respect for nomadic pastoralism which was viewed as backward, uneconomic and deleterious to the soil. The establishment of fixed ethnic boundaries and the implementation of conservation measures that put forests and game reserves out of the reach of the Samburu and other nomadic pastoralists, meant an end to ecology control. The forests and wildlife sanctuaries became no go zones for the pastoralists and their livestock thereby creating environmental niches whose control now lay with the colonial administration.

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