SETTLEMENT REORGANIZATION FOR THE PRODUCTION OF AFRICAN WILDLIFE IN MIOMBO FOREST LANDS: A SPATIAL ANALYSIS

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PREFACE

This thesis is concerned with analyzing the response of animal populations to the removal of human settlement in miombo forest lands. In particular, the Selous Game Reserve in Southern Tanzania is the focus of this study.

Over time the one significant variable in the study area has been the removal of the human populations. As a result of a change in this variable, higher animal populations exist now than previously. The magnitude and direction of this animal population change will be shown to have a qualitative basis in established theories drawn from several disciplines. It is suggested that the river valleys formerly occupied by humans were critical areas for the wildlife of the surrounding miombo uplands. The miombo forest's wildlife productivity was dependent on the full complement of the river valleys. This complementarity was accomplished by the removal of the people and their disturbing activities.

The planning implications of the findings of this thesis are considerable. It is suggested that land-use zoning in miombo forest areas, in order to include wildlife, should have a macro-scale approach. Rather than assigning all of the fertile river valleys to agricultural activities, large contiguous areas of all land types must be reserved for animal production. On the other hand, the areas reserved for people need not include wildlife preservation as an adjunct purpose. The wildlife populations are assured maintenance in

wildlife areas while the human occupance of agricultural zones will preclude the development of significant trophy animal production.

I would like to take this opportunity to express my appreciation for the guidance of my faculty advisory committee: Dr. Richard Hecock, Mr. James Stine, and Dr. John Barclay. All of these men gave generously of their time in order to provide both suggestions and direction to this thesis. In addition, Mr. Douglas McDonald's help and advice in the cartography laboratory greatly assisted my work.

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CHAPTER I

INTRODUCTION

The Broad View

The twentieth century has thrust many changes onto Africa and Africans. One of the changes that has been a focal point of concern for many people has been the demise of the once numerous animal populations. Some observers speculate that upwards of ninety per cent of the herds resident in East Africa at the turn of the century no longer exist.

Paradoxically, while the herds have been diminishing, there has been an ever increasing migration of people from Europe and America to Africa in order to view the remnant fauna. This tourist flood has enabled some newly independent states to capitalize on their wild heritage at a time when prices for most of their primary export commodities are dropping. The revenue from the wildlife centered tourist trade has already become Kenya's second largest income producer, and it doubles every three years.[1] The expanding usage coupled with a shrinking resource base will inevitably cause stresses which will limit further expansion of this aspect of the tourist industry.

Many tourist game viewing areas are already feeling the pressure

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[1]Harm J. de Blij and Donald L. Capone, "Wildlife Conservation Areas In East Africa: An Application of Field Theory in Political Geography." Southeastern Geographer, Vol. 9, 1969, p. 95.

of heavy traffic. This is especially true in the most easily accessible parks, for example, Nairobi National Park. With improved access, the now unused hinterland park areas will accommodate increasing numbers of visitors. The picture taking tourists can be accommodated at quite high densities with good roads, improved accommodations, and obliging animals.

There are more immediate pressures on East Africa's trophy hunting areas. Trophy hunting areas can tolerate relatively low densities of hunting tourists. This activity has, from the beginning, been an important part of the East African tourist picture. However, heavy hunting pressure, especially in the absence of good research on range productivity, can easily decimate the hunted herds' numbers, or their ability to produce trophy sized individuals. It has been found that higher values per head can be realized by selling animals to sport hunters than by any other method of animal harvesting.[2] Therefore, in areas not gazetted for game viewing, or agricultural activities, hunting will remain an economically productive option for resource utilization. If the increasing demand for hunting is to be met, areas in addition to the 10% of Kenya and Tanzania now included in parks and game reserves might be needed.[3]

The decision to place additional sections of Africa into administrative jurisdictions aimed at producing wildlife for tourists and hunters must be made by politicians. However, the political arena will

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[2]Robert Davis, "Prospects for Joint Production of Livestock and Wildlife on East African Rangeland: The Case of Kenya", Research Paper No. 4., Bureau of Resource Assessment and Land Use Planning, The University College Dar Es Salaam, Tanzania, p. 11.

[3]Ibid., p. 3.

act upon recommendations presented to it by resource planners. Hopefully these planners will have an eye to the past when "the decision underlying the proclamation of British East Africa's wildlife sanctuaries were not always made with adequate knowledge of the local situation."[4]

There are many areas in East Africa where extensive research is currently being undertaken on various aspects of the problems associated with the wildlife resource. In Tanzania, this research has already provided resource planners with invaluable information. However, it has been centered almost exclusively on the areas in the northern sections of the country that include the traditional tourist routes. These places are generally short grass and high altitude savanna areas. Many of these are tsetse free and consequently suffer from competition with cattle grazing activities. (Figure 1). More importantly, however, the supply of such ideal game areas has nearly been exhausted. Furthermore, the competition with human rights in these areas makes further extension of game sanctuaries in such localities difficult and perhaps undesirable.

The Focus

There are extensive areas of bushland in Tanzania that contain within them the potential for being of value in trophy animal production. Currently, not all are reserved by law for such purposes. In particular, the lightly forested tsetse infested areas of the southern and western sections of the country should be considered as areas of

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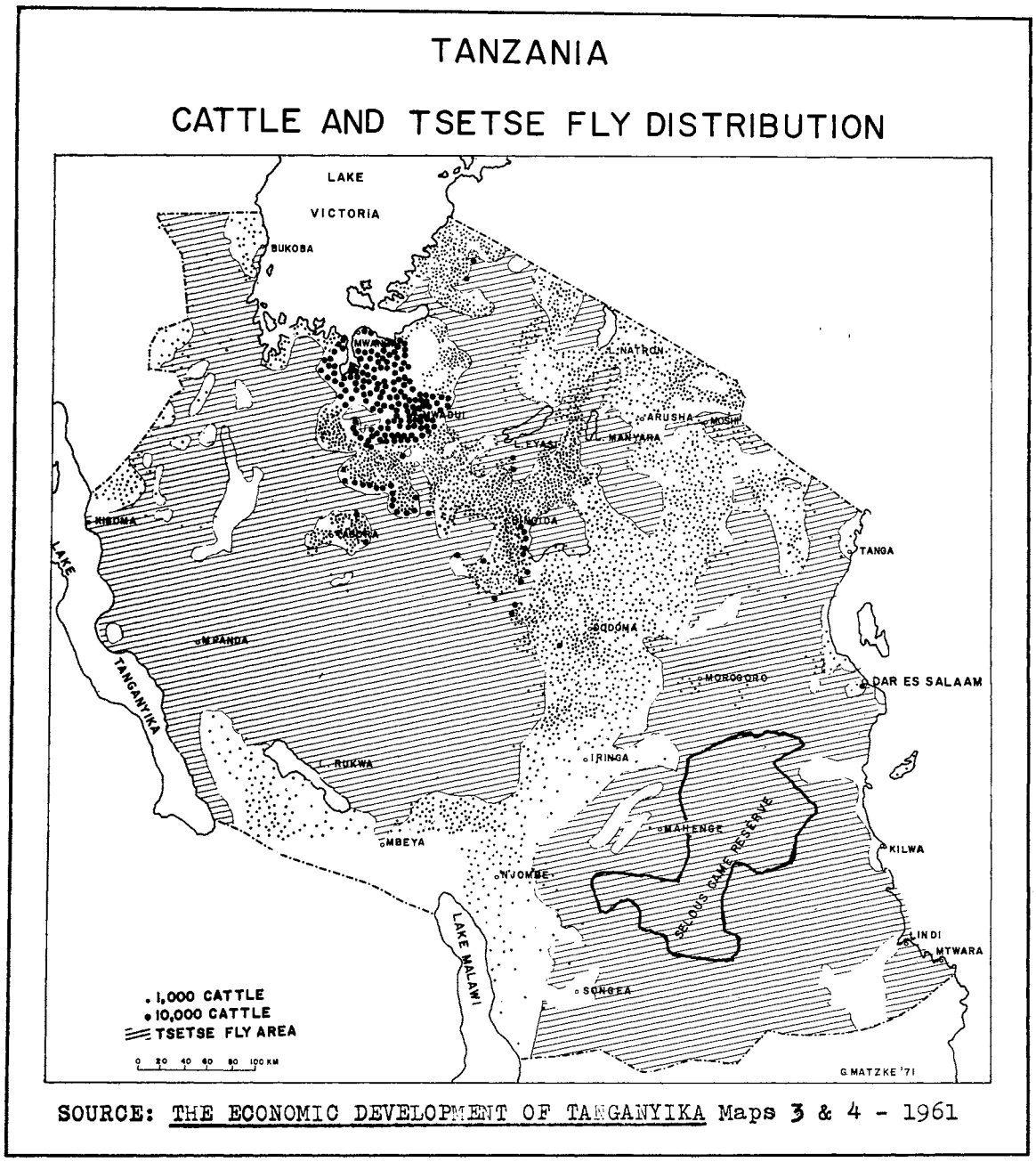
[4]Harm J. de Blij, Southeastern Geographer, Vol. 9, 1969, p. 98.



SOURCE: THE ECONOMIC DEVELOPMENT OF TANGANYIKA Maps 3 & 4 - 1961

Figure 1. Tanzania Cattle and Tsetse Fly Distribution

potential opportunity because of their low populations. There is no significant research available to guide resource planners in making decisions about the future of such areas. It is the goal of this paper to help fill this void.

In order to do this, the author will focus on the transition of one particular piece of forest country in Southern Tanzania (Called Tanganyika prior to its union with Zanzibar in 1964) from an area of scattered human settlements to an area designated by government to be entirely free from human occupance. (Selous Game Reserve - Figure 2). To construct a comprehensive picture of this transformed space, the author seeks answers to the following questions:

1) What was the original settlement situation in the study area?
2) What forces fostered the restructuring of settlement patterns in the study area?
3) What was the nature of the flora and fauna at the time of human occupance?
4) What economically productive purpose was served by the original development of an exclusively "animal area"?
5) What changes have occurred in the flora and fauna as a result of the removal of the human population?
6) How does the new situation improve production of trophy sized animals?
7) How does the separation of people and wildlife aid species production and diversity?
8) Does the new configuration include any changes disadvantageous to wildlife production?
9) What are the administrative efficiencies gained in closer

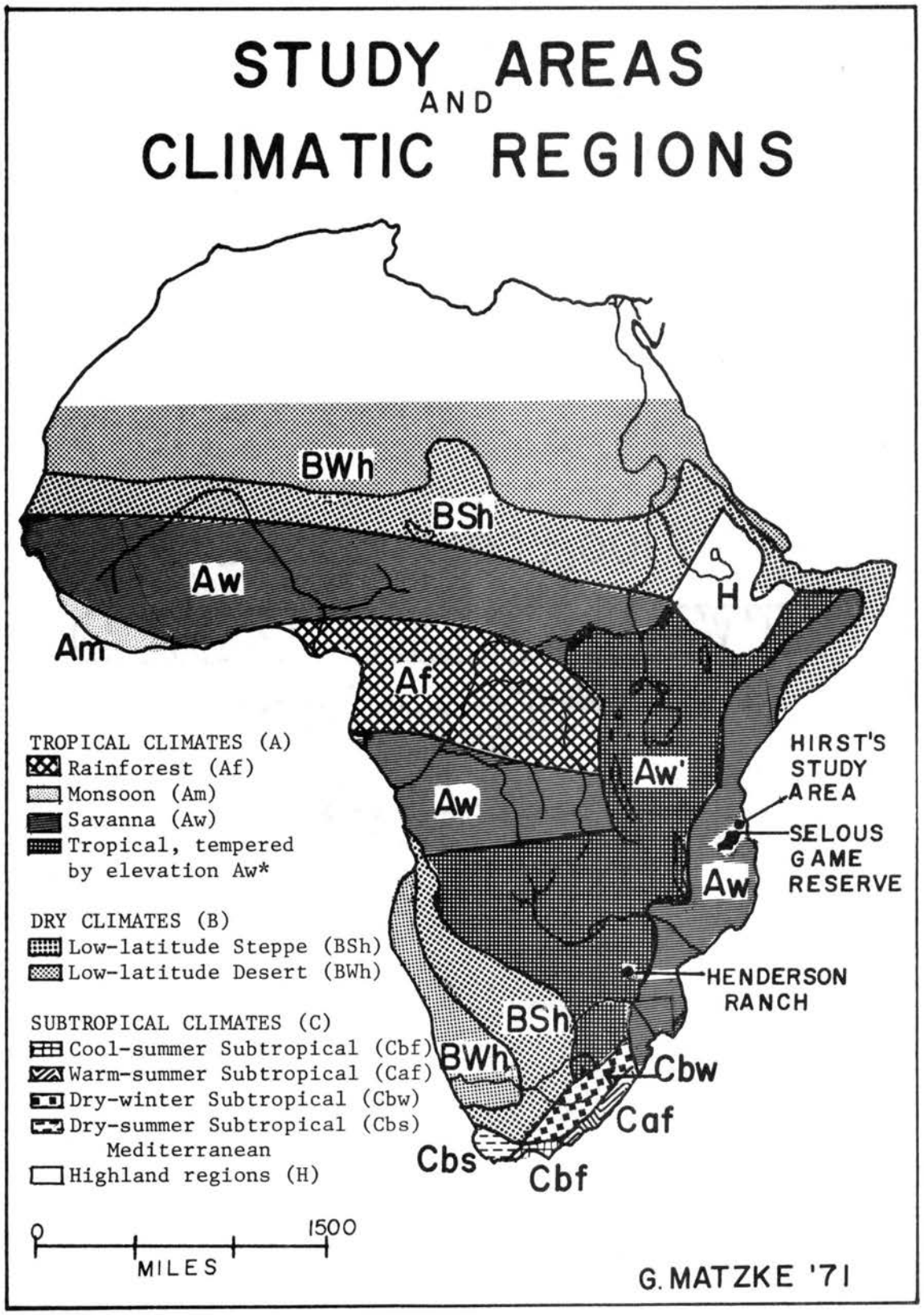


Figure 2. Study Areas and Climatic Regions

settlement arrangements for resource managers?

10) Are the animal populations in a spatial association useful for tourist game viewing?

11) Is the wildlife distributed in a way that will facilitate hunting safaris?

12) Can the Selous Game Reserve development experience offer significant clues to useful game reserve development elsewhere?

The basic objective in answering these questions is to establish that animal populations respond positively to the removal of human inhabitants from miombo forest lands. This response is traced in the study area and explanations are offered for its directions. The implications for the tourist industry are pointed out.

Methodological Statement and Literature Review

The African scene has been receiving a growing amount of attention from academics of every discipline. Geographers, and their journals, have devoted increasing attention to studies focusing on specific African areas and problems. A review of these writings indicates that regardless of the subject they are limited in two ways by data availability.

In the first place, the authors have responded to the data void by limiting their subject area to a very small place and within the confines of that place, and the time available, doing a case study. This case study has overcome the problem of the absence of data by generating its own. However, the narrow scope of such inquiries often limits the usefulness of the resultant publications. In contrast to most African governments' data, these have some degree of reliability,

but this has been gained at the expense of scale.

On the other end of the scale, one finds numerous publications making broad overviews on the basis of inaccurate, or limited, data. A case in point is the 1922 soils map of the entire continent that was constructed on the basis of only a dozen soil samples taken in Africa.[5]

This author has attempted to strike a different course utilizing the background of extensive field observation in a particular area as an organizing agent for the analysis of this area's biographical evolution. These observations were made while working on road development projects within the Selous Reserve between May 1968 and December 1969. Figure 3 shows the general extent of both ground and air travels made by the author during that period. Much of the area, especially in the southwestern section of the reserve, was closely observed on foot and during low level air flights aimed at locating road routes.

The area in question is located in the southeastern section of Tanzania and is now included within the boundaries of the Selous Game Reserve. The author has included in his study such empirical evidence as is available from the area. The F.A.O. study of the Rufiji Basin is perhaps the most notable.[6] In addition, the annual reports of the provincial commissioners give background information throughout the time of the transition from a settled area to one completely devoid of people. Aside from these sources, the observations of several long time employees of the Tanganyika Game Department have proved invaluable.

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[5] L. Dudley Stamp, Africa: A Study in Tropical Development, John Wiley & Sons, Inc., (New York, 1965), p. 88.

[6] The Rufiji Basin Tanganyika, Food and Agricultural Organization of the United Nations, Expanded Technical Assistance Program, Rome, 1961.

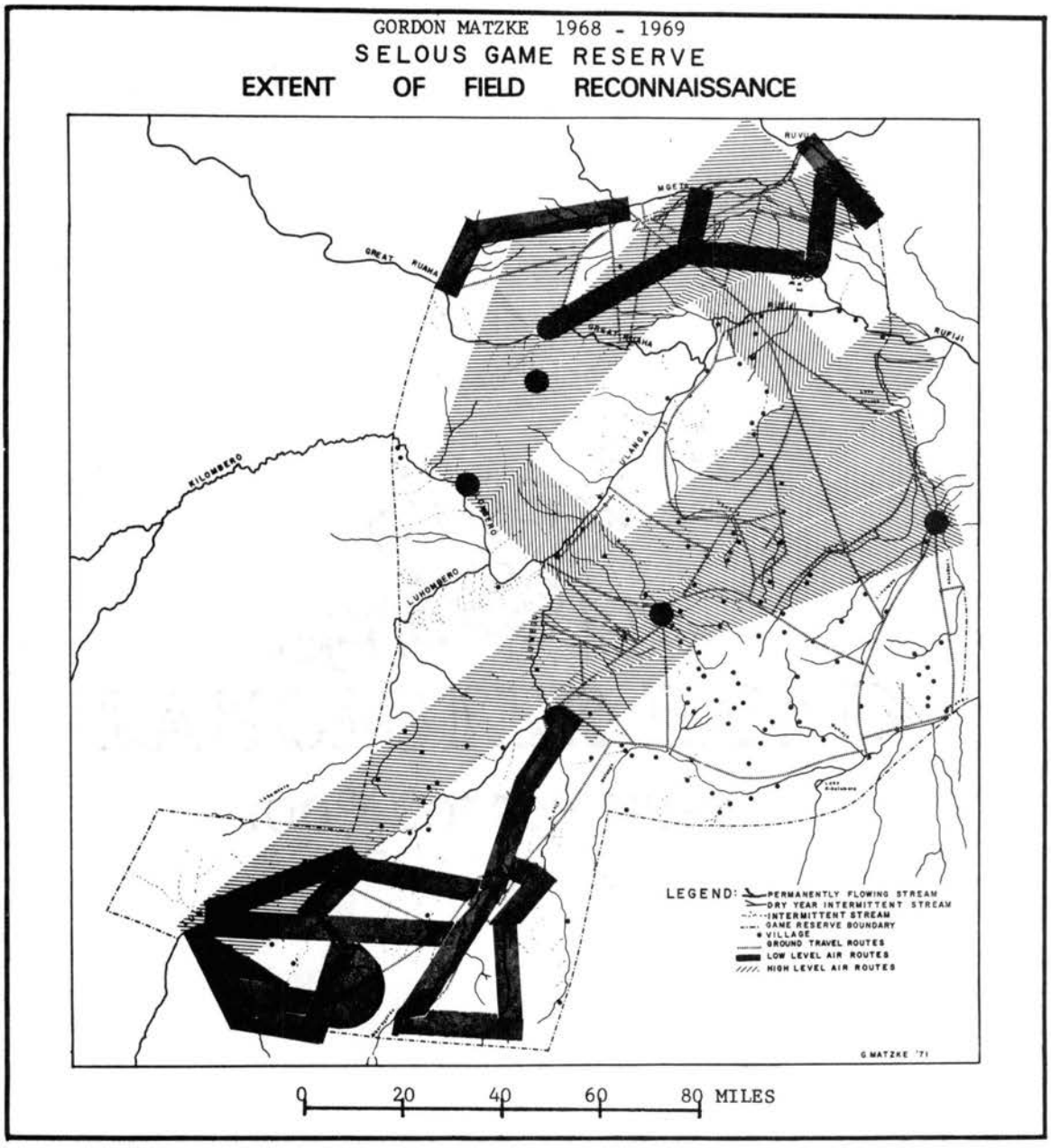

Figure 3. Extent of Field Reconnaissance

The publications of C.J.P. Ionides and Brian Nicholson provide an unbroken view of the area as seen by these game officers-in-charge from February 1934 until the present.[7] Also, an unpublished manuscript of Mr. Nicholson outlining the policy of the Tanzania Government in administering the Selous Game Reserve has been most useful.[8]

In addition to the scant writings concerned directly with the study area, the literature review has contributed substantive studies that have been done in other African situations and give corroborating evidence to the thesis of this paper. With the notable exception of Harm J. de Blij, Donald L. Capone,[9] and the Bureau of Resource Assessment and Land Use Planning under the direction of Robert Kates,[10] geographers have not published significant studies on East African wildlife areas. Therefore, the writings of people from other disciplines have been used extensively. The insightful ecologist Hugh F. Lamprey's work on the ecological separation of certain animal species in the Tarangire Game Reserve has inspired and supported much of the thinking on animal-vegetation type correlations.[11] Trapnell's extensive review of woodland burning research in Rhodesia has been useful

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[7] C. J. P. Ionides, Mambas and Man-Eaters: A Hunter's Story, Holt, Rinehart and Winston, (New York, 1965), p. 59.

[8] Brian D. Nicholson, "The Selous Game Reserve", (unpub. mimeograph copy of a speech to the Second Annual Meeting of Game Conservation International, San Antonio, Texas), May, 1969.

[9] Harm J. de Blij, Southwestern Geographer, Vol. 9, 1969.

[10] Robert Davis.

[11] Hugh F. Lamprey, "Ecological Separation of the Large Mammal Species in The Tarangire Game Reserve, Tanganyika," East African Wildlife Journal, 1:63-92, August, 1963.

since it was done in a similar forest type over a period of nearly 30 years.[12]

This thesis has drawn on the numerous observations and studies noted above, as well as others, and placed elements of them in the context of such theory as has been found useful in explaining the phenomena in question, namely the responses of the animal populations in the Selous area to the removal of its human occupants. In so doing, it is in line with Stuart's view of zoogeography which "is primarily concerned with the synthesis of concepts and data from a variety of other fields."[13]

Over time the one significant variable in the study area has been the removal of the human populations. It will be hypothesized that change has taken place in the direction of higher animal populations as the result of the evacuation of humans. The magnitude and direction of the change will be shown to have a qualitative basis in established theory drawn from several disciplines. Engineering theory will contribute the "worst case" approach to problem design and is used to show that the magnitude of change was inordinate to that expected to occur in uniform space. Geographical theory helps to interpret the possible influence of distance on the inhabitant's environmental disturbance potential. Ecological theory and principles will suggest ways in which the newly evolved spatial arrangements have accounted for the direction and magnitude of change since the settlement reorganization.

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[12] C. G. Trapnell, "Ecological Results of Woodland Burning Experiments in Northern Rhodesia", Journal of Ecology, March, 1959, Vol. 47, No. 1.

[13] L. C. Stuart, "Animal Geography", American Geography Inventory and Prospect, (Preston James & Clarence Jones, edts.) Syracuse University Press, 1954, p. 448.

The goal of this paper is to use the spatial bias of a geographer, together with the theories and data provided by other disciplines, to reconstruct and clarify the happenings in the study area. The forthcoming construct is a synergism of the two more common approaches referred to above. Its focus on a particular spot gives it tangibility while its emphasis on theory gives it broader relevance. The focus begins with a close look at the original settlement situation in the forest lands of the study area.

CHAPTER II

THE INDIGENOUS SCENE

Miombo Forest

An observer of the African vegetation patterns will be immediately struck by the relatively small amount of land area covered by the "jungle," or rainforest, that has played such an important role in the American stereotype of Africa. There are much greater areas covered by desert than there are with canopy enclosed rainforest. (See Figure 2). Most of Africa, however, lies in between these extremes. These areas of intermediate precipitation have a wide variety of vegetation types ranging from short grass savanna to thick forest. Somewhere in the middle of this regime is a mixed forest and long grass savanna that covers

> a compact area of some three million square miles (7,750,000 hectares) in central and south central Africa — probably one of the largest compact areas of one forest type in the world. It occurs between latitudes 5°S. and 25°S. and hence is practically wholly in the southern tropics. From west to east at its greatest width it stretches almost from the Atlantic Ocean to the Indian Ocean. It occurs in Southern Tanganyika, Nyasaland, Northern Rhodesia, Southern Rhodesia, the Congo, Mozambique to the east, and Angola to the west. It also extends in a modified form into South Africa.[1]

This type of dry Brachystegia forest is usually referred to as miombo after the Swahili name for one of its more common trees.

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[1] "Wildlife Conservation and Management," Unasylva, V. 15, No. 1, 1961, p. 15.

In spite of its extent, the value of its produce is low. Varying locally, it is used for stoking the furnaces of the Congo and Zambian copper belt as well as providing balking for the mines.[2] In the country of this paper's concern, Tanzania,

> with no mining industry, these miombo forests have been developed for beekeeping (as is the case with the dry forests in southern Greece) and today Tanganyika is one of the largest exporters of honey and beeswax in the world. Most of the export goes to the Far East, particularly to Japan.[3]

It seems unlikely that miombo forest will ever produce really valuable wood products. It has a low proportion of valuable trees in what is normally a light forest cover.[4]

Miombo woodland covers about 35 per cent of Tanzania's total area.[5] (See Table I). It is characteristically only sparsely populated and generally is not suitable for agriculture. The tsetse fly, the unreliability of rainfall, the intensity of the rainfall, and poor quality of the soils all combine to discourage agriculture.[6]

The British colonial experience with the "ground-nuts scheme" looms large in history as a monument to the pitfalls of agriculture attempted in miombo country. That scheme had scheduled 1,650,000 acres for clearing and planting in Tanganyika's Southern Province. The first cut in the bush for this grandoise operation was made on

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[2]"Wildlife Conservation and Management," Unasylva, V. 15, No. 1, 1961, p. 16.

[3]Ibid., p. 16.

[4]Ibid., p. 16.

[5]Gilbert Rutman, "An Analysis of the Economy of Tanganyika with Special Reference to the Role of the Government," (unpub. Ph.D. dissertation, Duke University, 1965), p. 25.

[6]Ibid., p. 28.

April 30, 1947. By January, 1951, the British government was forced to abandon, in its original form, the whole project. An estimated 36 million pounds were lost in the venture.[7] The first crops were said to be less than the seed put in the ground. The discouraging factors cited above overwhelmed even the considerable inputs of men, money and machinery that were made available by colonial Britain.

TABLE I

TANZANIA
TYPES OF VEGETATION
(AS OF DECEMBER 31, 1959)[a]

Types of Vegetation	Total Area Covered (Square Miles)	Percentage of Total Area Covered
Closed Forest	4,270	1.3
Forest Woodland, Intermediate	1,680	.5
Woodland, Miombo	118,420	35.2
Woodland, Bushland Intermediate	14,740	4.4
Bushland and Thicket	40,050	11.9
Wooded Grassland	91,830	27.3
Grassland	33,870	10.1
Desert and Semi Desert	2,030	.6
Vegetation Actively Induced by Man	29,900	8.9
Total Dry Land	336,800	100.0

[a]A different classification of the dry land of Tanganyika is presented in Europa Yearbook: 1963.

Source: Tanganyika, Statistical Abstract, 1962, p. 3.

Thus it is that Southern Tanzania's miombo forest has survived virtually intact until today. While it has survived major attempts at altering its essential vegetational character, a significant rearrangement of human settlement patterns has taken place within the area. The aboriginal situation of scattered human settlements located throughout the miombo forest has evolved until today a situation exists whereby both humans and their settlement rights have been systematically excluded from an area of some 20,000 square miles included in the Selous Game Reserve.[8]

It is hypothesized that the space occupied by these people had a limiting influence on the animal populations that was inordinately large for the small size of the occupied areas. There was something more than amorphous space that was not available to animals with human occupance in selected localities.

Settlement Pattern

The best available evidence indicates that the settlement pattern in the early part of this century for the area in question approximated that shown in Figure 4. These villages were noted on British Ordinance Survey maps published in 1942. The sources for these maps were earlier German East Africa and Tanganyika Government surveys and the result probably accurately reflects the settlement pattern before the onset of settlement resuffling that began in the 1930s. As further evidence of the map's validity, the author visited numerous former village sites

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[8] B. D. Nicholson, "The Selous Game Reserve," Speech delivered at the Second Annual Meeting of Game Conservation International (mimeographed), San Antonio, Texas, May, 1969).

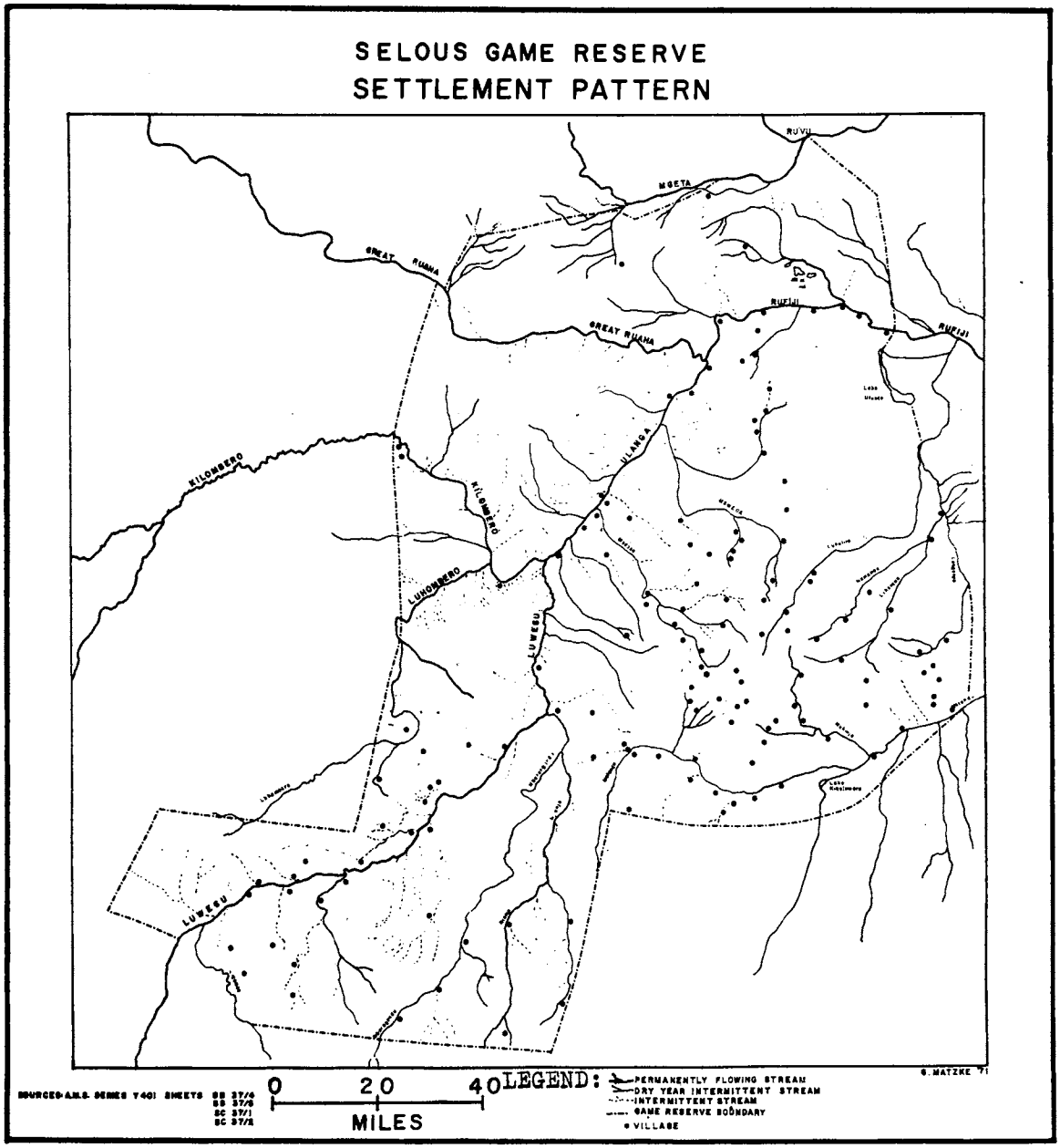

Figure 4. Selous Game Reserve Settlement Pattern

in the field and every one has been found to be recorded on the Ordinance Survey maps.

It can be seen that most of the 144 villages were located along one, or other, of the numerous water courses dissecting the area. The inhabitants of the area were of varying tribal backgrounds (See Figure 5), but most followed the traditional river valley slash and burn agricultural practices still in evidence in the Southern Tanzania today.

This pattern of rural settlement consists of small scattered groups of dwellings within easy walking distance of the fields (shamba). In a limited survey taken in five villages near Dar es Salaam, (See Figure 2) Hirst found that no fields more than two miles distant from the villages were cultivated (See Table II).[9] Since Von Thunen's Der Isolierte Staat appeared in 1826, geographers have recognized the influence of increasing distance on agricultural land use. This principle is illustrated in the site selection of fields in Southern Tanzania. However, over time the temporary nature of the dwellings allows farmers to be much more footloose than would normally be the case in temperate zone situations.

Von Thunen assumed that the plain which supported his town was uniform in fertility.[10] Implicit in this assumption is another which says fertility will remain uniform over time, in spite of the differing land uses postulated to evolve. In reality, this is not the case for the study area. Consequently, the land usages around the isolated

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[9]M. A. Hirst, "Rural Settlement and Land Use: A Note on Tanzania," Professional Geographer, Vol. XXII, Number 5, September, 1970, p. 259.

[10]Johann Heinrich Von Thunen, Von Thunen's Isolated State, tr. Carla M. Wartenberg, (Pergamon Press, 1966), p. 7.

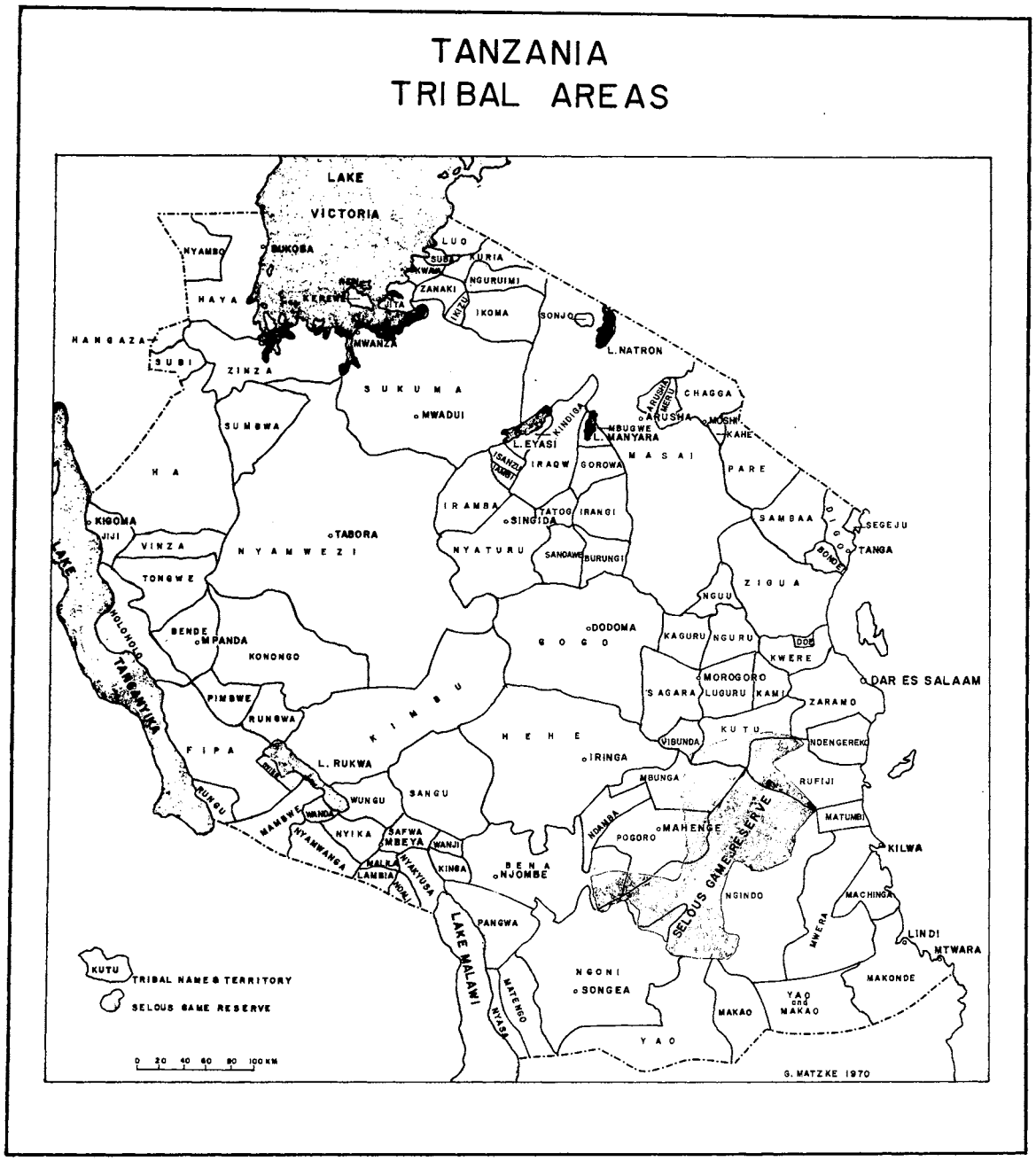

Figure 5. Tanzania Tribal Areas

TABLE II

DISTANCE TO SHAMBA
DAR ES SALAAM SUB-REGION, 1967

Distance From Village in Miles	Number of Families Having a Shamba
0.5	9
0.5 to 1.0	10
1.0 to 1.5	18
1.5 to 2.0	8

villages in question do not follow concentric zone patterns. If they did, the fields surveyed and recorded in Table II might be located as represented by the dots in Figure 6 B & C. This allows for a considerable range of choice in field site selection as well as adequate space to either support a large village population on fertile soil, or a lesser population on not so fertile soil with adequate space to allow for fallow fields. The fields in the study area follow a later Von Thunen suggestion and "consider not only the varying distance between different plots and the farmstead, but soils of different physical quality and at different levels of fertility."[11] The increasing cost of distance provides a threshold of no more than two miles from the village beyond which no fields are tilled. Yet, within this area, edaphic conditions are prime determinates of land usage.

[11] Ibid., p. 6.

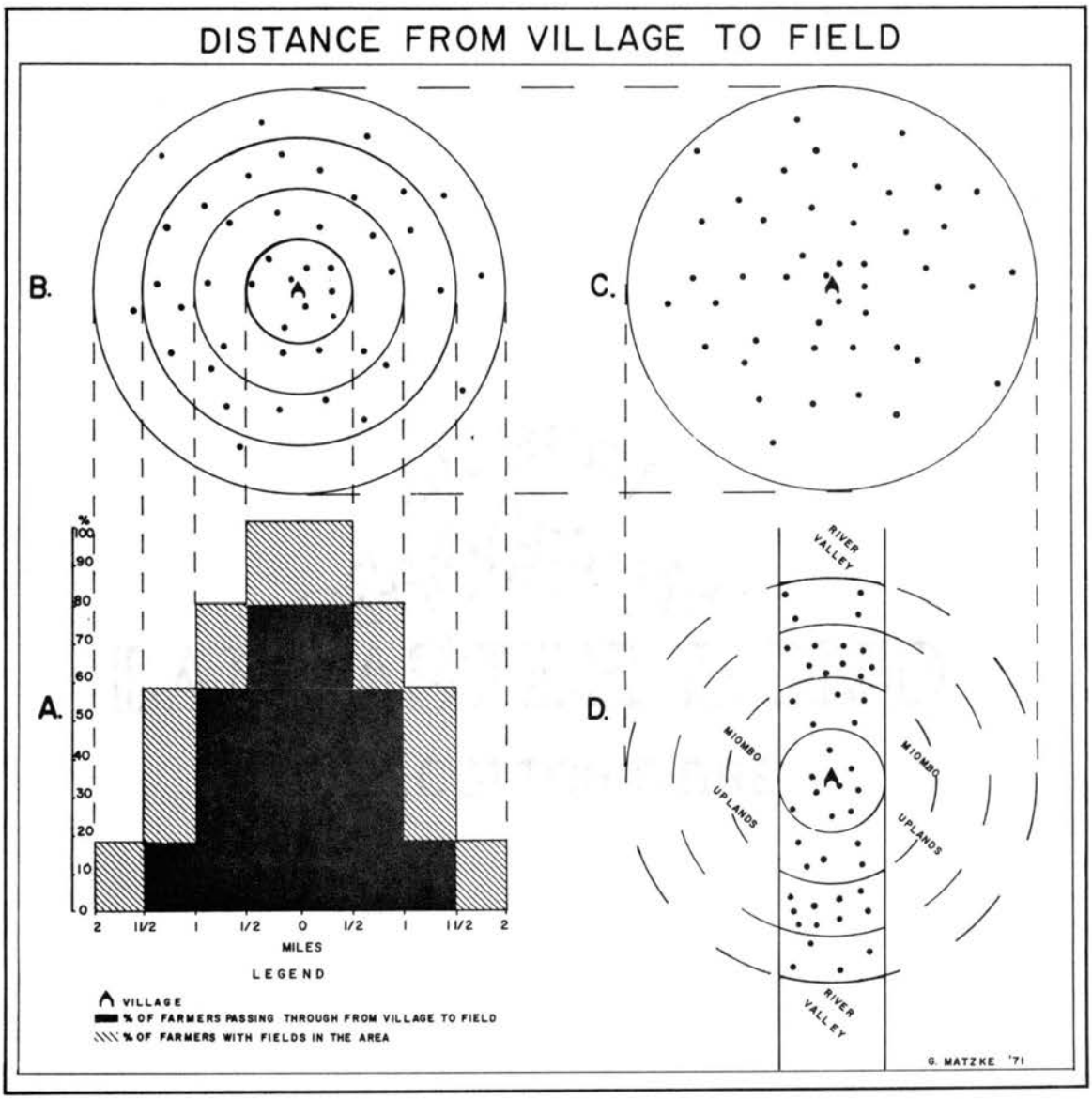

Figure 6. Distance From Village to Field

The fields follow the relative fertility of the elongated river valleys and shun the non-alluvial soils of the interfluves. (See Figure 6D). By so doing, the areas of highest fertility are set aside by man to meet his peculiar priorities and insofar as these priorities conflict with the needs of the animal population, they deny these areas to animals.

Disturbance Area

The areal extent of the lands cultivated by the original Selous inhabitants is of concern if one is to postulate reasons for the marked increase in animal populations that was noted after the cessation of cultivation and the removal of people. Figure 7 shows the maximum total possible extent of land that would have been disturbed by cultivation if all lands within a two mile radius of the villages were under cultivation. Since it has already been stated that the valley floors contained most of the cultivation, the two miles in reality would only extend up and down the river from the village as in Figure 6D. Furthermore, within this area much land would be unuseable, or unused, because of inadequate demand or unsuitable edaphic conditions. This map, therefore, represents the maximum theoretical amount of tillable land as limited by the threshold distance of a two mile walk from home to field.

A visual examination of the map immediately shows that there was only a relatively small portion of the total land area of the reserve within a two mile radius of one of the 144 villages known to have existed in the game reserve. Using a mathematical analysis it can be shown that this area was approximately nine per cent of the total game

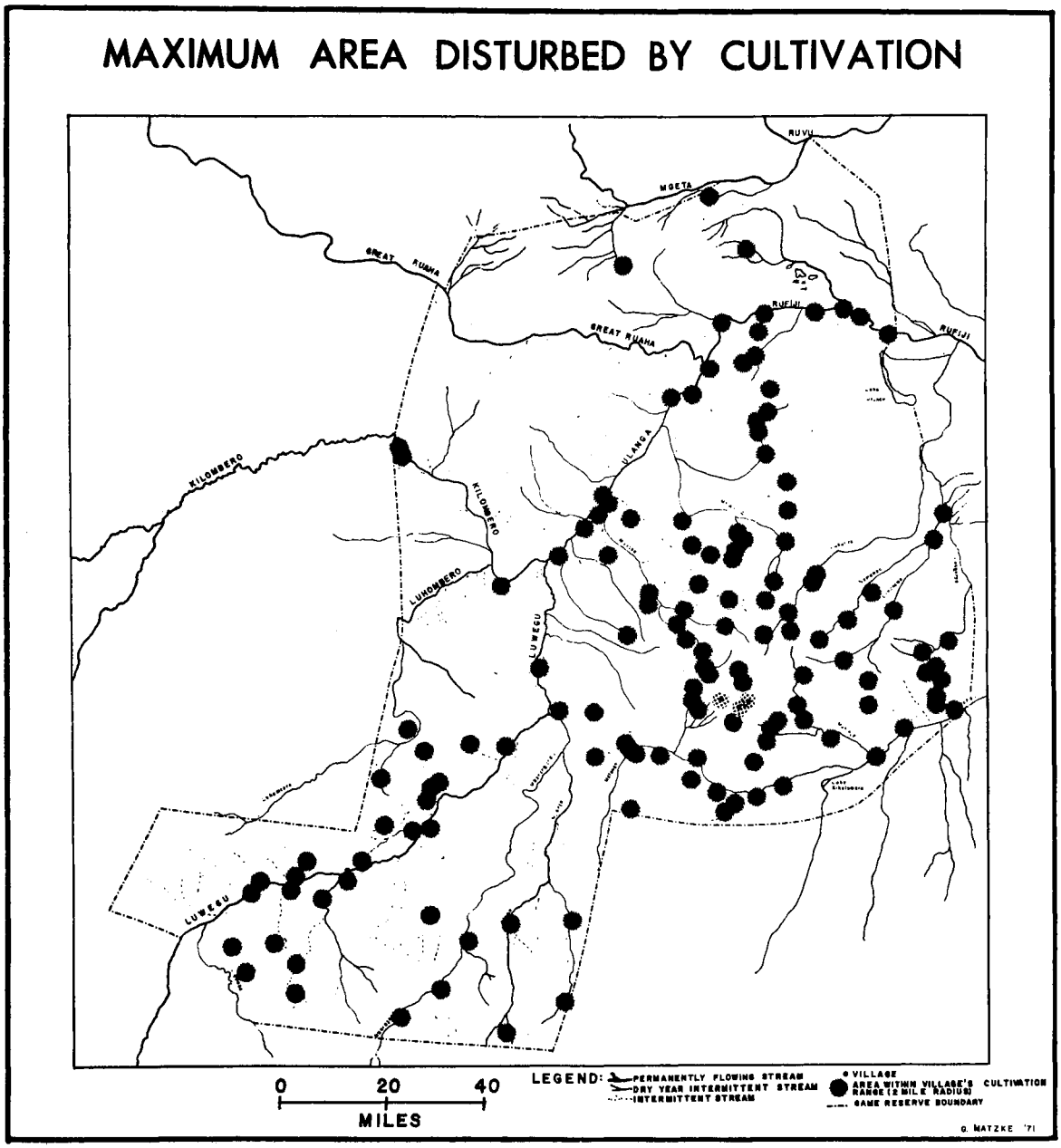

Figure 7. Maximum Area Disturbed By Cultivation

reserve. That is:

$$\text{Area} = \pi r^2$$
$$\pi = 3.14$$
$$r = 2\ M$$

$$\text{Area} = (4) \times (3.14)$$
$$\text{Area} = 12.56\ M^2 \text{ per village}$$

$$\text{Total Area} = (12.56\ M^2 \text{ per village}) \times (144 \text{ village})$$

$$\text{Potential cultivation area} = (1{,}808\ M^2) / (20{,}000\ M^2)$$

$$\text{Potential cultivation area} = 9\%$$

Since it has already been shown that all areas within two miles of any given village were not cultivated, a more accurate estimate of the area under cultivation might be found by estimating the amount of land actually utilized by people living in scattered settlements.

The first step necessary in attempting such an estimate is to determine the number of people resident in the area now included within the game reserve. Since no complete census of the population of Tanganyika was taken until the late 1948, it would be impossible to state exactly how many people were living in the area prior to that time.[12] However, the 1934 report of the provincial commissioner for the Southern Province gives useful information.

He estimated that the Liwale Administrative District which included the southeastern 1/4 of the game reserve had a native population of 26,000 residing within its 10,000 square mile area.[13] Since this is the area of the reserve that had the most villages, its 2.6

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[12] East African Royal Commission, 1953-1955 Report, "Population Characteristics in East Africa", London: Her Majesty's Stationery Office, 1955, p. 31.

[13] Annual Reports of the Provincial Commissioners on Native Administration for the year 1934, Tanganyika Territory, Government Printer, Dar Es Salaam, 1935, p. 22.

people per square mile average could safely be extended over the 20,000 square miles of the game reserve without underestimating the population of the reserve. This being the case, it would be safe to say that no more than 50,000 people were residing within the present day boundaries of the game reserve just prior to the time when resettlement programs began.

A check on the accuracy of this estimate can be made by dividing this total by the 144 villages known to exist in order to give an average village size for the study area. The village size so obtained is 340 people. This would be an extremely large village for the area in question even today. The author has personally examined the remains of number of these now abandoned villages and has rarely found more than the foundations of a dozen or so houses. This is no doubt due in large part to the independent nature of the people in question. Mr. W. B. Tripe, the District officer for the Liwale District in 1934, commented on these people's distaste for centralization by saying:

> Scattered throughout the valleys and bush of Liwale's 10,000 square miles the inherently independent and unconstructive Ngindo is inclined to regard the growing power of his recognized headman with distaste and even alarm. Rather than do something which they dislike the more intransigent of the people will often forsake the comparative security of these little settlements for the hazards of the bush; they abandon everything—houses, fruit trees, cassava and sometimes even crops about to be reaped. . . and they acknowledge the authority of no one save their own clan head.[14]

Using the above population estimate for these clan centered villages it is possible to approximate the extent of the land they cultivated. The same study cited above showed that the scattered

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[14] Annual Reports, 1934, p. 26.

villagers in the study area cultivated between 1 and 3 acres per family.[15] Using the higher figure and assuming a family size of three (a very small African family) it is realistic to assume an average of one acre of cultivated land per capita. The fifty thousand inhabitants would then have directly disturbed no more than 50,000 acres by cultivation in any one year. This is approximately 79 square miles of territory, or .4% of the total area of the reserve. Since the slash and burn agricultural techniques necessitated a periodic movement of field location, the area disturbed over a period of time would be somewhat larger since it would take a while for the land to recover. For example, if a field were abandoned every five years, over a period of twenty-five years a total of 2% of the game reserve area might have been disturbed.

The two approaches suggested above for the estimation of the amount of space actually disturbed by cultivators are both "worst case" approaches to the problem. That is they don't show the exact amount of space occupied, but rather show maximum amounts that could have been occupied. In either case, the conclusion must be reached that the amount of space returned to animal production with the removal of people was not sufficient to explain the magnitude of the animal increase that has been recorded. There was something in the nature of the space returned that differentiated it from a uniformity. The inordinate influence of these relatively small areas suggests one must go beyond a quantitative analysis of the space involved, and to seek answers in the qualitative nature of these places and the activities taking place

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[15] Ibid., p. 258.

in these areas. This can best be done by looking at the history of the study area and its inhabitant's activities.

CHAPTER III

THE SETTLEMENT REORGANIZATION

The original settlement scene described above is not at all unusual for Tanzania. Although there are marked differences from place to place according to tribal customs, edaphic conditions, and the degree of development, the country as a whole is characterized by "scattered" settlements rather than "gathered" settlements. Hirst estimates that 95% of the country's population live in small groups of homesteads similar to the ones in the study area.[1]

The peculiar feature of this area's settlement pattern was not the size of the nucleations, but rather the distance between them. The 144 villages located in 20,000 square miles of territory were in most cases quite far apart. Even more unique, however, was the complete evacuation of the area that took place in the first half of the twentieth century. An examination of the evolution of this area from one of scattered villages to one completely uninhabited is necessary if its applicability to other areas is to be assessed.

The area now included in the Selous Game Reserve has only entered recorded history as a sidelight in writings dwelling on other subjects. Mention is made of an early slave route crossing its northeastern

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[1] M. A. Hirst, p. 259.

corner from Zungomero to the ancient coastal city of Kilwa.[2] A German surveyor was killed by an elephant around the turn of this century on the Rufiji River and a magnificent river gorge near this spot bears his name to this day.[3] Aside from such historically trivial incidents, the area's earliest accounts come from wars fought over its river dissected terrain.

Wars

The German colonial government faced an extensive uprising against its authoritarian rule early in this century. From 1905 to 1907, insurgent Africans wrested control of much of Southeastern Tanganyika from effective German rule. This uprising began and ended in villages now within the game reserve. The detailed Swahili account of the Maji Maji Rebellion provided by E. B. M. Barongo tells of numerous villages in the study area being the scene of battles as armies of both the Askari wa Mungu and the German government crisscrossed the area.[4] Reinforced German troops only succeeded in quelling the rebellion after the implementation of a scorched-earth policy with the resulting famine in Southern Tanganyika killing hundreds of thousands.[5] War became the first significant influence for the removal of people from the

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[2]Judith Listowel, The Making of Tanganyika, Chatto & Windus, London, 1965, p. 7.

[3]F.A.O. of the United Nations, The Rufiji Basin of Tanganyika, Expanded Technical Assistance Program, Rome, 1961, Vol. 1 p. 5.

[4]E. B. M. Barongo, Mkiki Mkiki wa Siasa Tanganyika, East African Literature Bureau, Dar Es Salaam, 1966, pp. 13-28.

[5]David F. Clyde, History of the Medical Services of Tanganyika, Government Press, Dar Es Salaam, 1962, p. 122.

Selous area.

A mere ten years after the Maji Maji, war again reached into the bushlands of Southern Tanganyika. This time both sides in the fighting were foreigners as British forces under General Smuts pursued German General Von Lettow-Vorbeck from Kisaki south across the Rufiji and finally across the Ruvuma to Mozambique. Although attempts were made to recruit porters in the area, they met with little success. "The numerous inhabitants, to whom the war and the many askaris (soldiers) were something quite new, lost their heads and ran away into the bush."[6] As this war passed through, its legacy was not so much one of a decimated population of local people, but in the death of Captain F. C. Selous, the famous African explorer who was shot and buried in the game reserve now bearing his name.[7]

Following WWI, the Selous area was given little attention until it was discovered that sleeping sickness was an endemic disease in 1924.[8] For the next two decades this was to prove to be one of the prime motivators for settlement reorganization in the region.

Crop Protection

About the same time, the Tanganyika Game Department was established and inherited a 1,000 square mile game reserve called "Shamba la Bibi" by the local Africans. The "Woman's Land" was so named because it was said that this game area had been a present from the Kaiser to

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[6]Brian Gardner, German East, Cassell, London, p. 111.

[7]Ibid., p. 140.

[8]David F. Clyde, p. 122.

his wife.[9] This embryonic reserve was to eventually be joined with other sections to become the Selous Game Reserve.

Initially the Game Department entered the area to provide crop protection services for the villagers. However, by 1934

> it was clear that, with limited staff, the Game Department could not give adequate protection to all the scattered settlements throughout the District. It was therefore agreed with the Administration that the sparsely populated areas in Western Liwale would receive no crop protection services other than in selected settlements. The strategy behind this was that scattered villages would be attracted to these settlements, which would be adequately protected, leaving the rest of the country free of habitation, where the great numbers of elephant could remain undisturbed.[10]

The case for consolidation of settlements had been put forth as a way of offering one elementary amenity, crop protection, to the populace. In this regard Chisholm has observed

> the more scattered the populace the more costly is the provision of these amenities. Consequently the more remote spots are the last to receive these modern benefits; and as these external links become more important, the advantages of concentrating a dispersed population are becoming greater than formerly was the case.[11]

The administration recognized the potential in agglomerated settlements for tax collection, etc., but junior District Officers gave way to demands for crop protection by many of the numerous settlements outside the prescribed areas and the hoped for concentration of peoples did not quickly evolve. It was obvious that without the force of law the original agreement was not very meaningful.

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[9] Brian D. Nicholson, "The Selous Game Reserve", p. 4.

[10] Ibid., p. 5.

[11] Michael Chisholm, Rural Settlement and Land Use; An Essay on Location, Hutchinson & Co., Ltd., London, 1968, p. 109.

Sleeping Sickness

The impetus for the necessary legal means to withdraw crop protection services came with the serious efforts undertaken in the years 1936-1945 to stamp out the sleeping sickness epidemic. In order to protect against spread of the disease, "concentrated settlements" were created at Mliwasi, Madaba, Lukuliro, Ngarambe, and along the foot of the mountains in the west near Mahenge.[12] In such places bush could be cleared in a wide strip around the village and fields to prevent encroachment of the tsetse fly while medical treatment was made available to the people. An airstrip was built at Madaba in 1937 to facilitate medical services,[13] yet one administrator acknowledged the people's unwillingness to concentrate in such places by observing,

> The political and sociological difficulties of concentrating a people who for generations have lived a life of the most extreme independence in the bush will be very considerable and will only be solved by tactful and patient negotiations with the natives themselves."[14]

By 1940, the Game Department managed to include most of the central section of today's game reserve into a large reserve contiguous to the old German "Shamba la Bibi". Although people were not immediately removed from villages within the area, a

> policy of no protection against raiding animals was adhered to, and the administration had stepped up its efforts to concentrate settlements as a counter to the spread of sleeping sickness. During 1941 to 1943 severe damage was caused to cultivated lands within the Game Reserve, and in

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[12] Brian D. Nicholson, "The Selous Game Reserve", p. 6.

[13] Annual Reports of the Provincial Commissioners on the Native Administration for the Year 1937, Government Printers, Dar Es Salaam, 1938, p. 58.

[14] Annual Reports of the Provincial Commissioners for the Year 1938, Government Printer, Dar Es Salaam, 1939, p. 66.

> the latter year the last of the villagers voluntarily abandoned their lands and moved out of the Reserve. This brought about the ultimate objective of an area completely free from human rights, and the law forbade any movement back into the area.[15]

The closer settlements earlier mentioned proved incapable of stamping out sleeping sickness so the administration finally ordered the evacuation of the entire area. In 1945, 1,200 families were relocated to a closer settlement far to the south and east near Njinjo while another 700 families chose to return to their own tribal areas outside the infested region.[16] By 1951 these new areas were officially added to the game reserve although they were uninhabited since the removal of the people in the middle and late 1940's.[17] Since that time smaller, but important, additions have been made to the Selous Reserve, but the essential character of the reserve was intact by 1951. It was an extremely large area completely free of human rights of occupance.

Modern Economy

From the overview presented above, it would appear that heavy handed administrative pressures alone forced readjustments in the original settlement pattern. It would be a mistake, however, to reach such a conclusion. Already in 1938, one administrator after the opening of the first road in the area observed, "The manner in which native settlements are now establishing themselves alongside

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[15]Brian D. Nicholson, "The Selous Game Reserve", p. 5.

[16]Annual Reports of the Provincial Commissioners for the Year 1945, Government Printer, Dar Es Salaam, 1946, p. 70.

[17]Brian D. Nicholson, "The Selous Game Reserve", p. 5.

the roads throughout the province is one of the most remarkable developments of recent years."[18] The inevitable forces of the modern economy were reaching even the remotest of areas. In their own way, settlements began to respond to their increasing ties to the outside world. Government collected taxes, but it also provided services. The commercial economy demanded money for salt and clothing, but it also provided a market for the sale of cash crops and beeswax.

Chisholm says, "The more important these external transactions are, the greater significance attaches to access to land, river or sea routes, and the greater the advantage of a location with good external communications."[19] In this light, it might be argued that the directed efforts of the government that finally achieved a relocation of the villages in question only hastened and completed a process that was already at work toward that same end. In 1946 the provincial commissioner glimpsed such change and recorded:

> As I close this report there is on the horizon a glimpse of a shining future for this neglected, "isolated and backward" Province, in a project which if successful cannot fail to bring in its train great social and economic benefits not only to its inhabitants, but to many more outside its boundaries. This project, which almost exceeds the limits of a dream, is the scheme for the mass production of groundnuts, in which progressive health, nutrition, housing, welfare and labour policies will all play an integral part and will raise the standard of living of all concerned to a higher level than has yet been contemplated. It will bring permanent benefit to an area which can almost be described as having been blasted and lain moribund since its people were decimated by the Germans in the Maji Maji rebellion of 1905-1906.[20]

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[18] Annual Reports, 1938, p. 67.

[19] Michael Chisholm, p. 108.

[20] Annual Reports, 1946, p. 52.

The development envisioned by this man never occurred. Nevertheless, the entire populace had evacuated the area now within the game reserve. The faunal response to the removal of these humans is the next subject of concern.

CHAPTER IV

THE POACHER HYPOTHESIS

The creation of the Selous Game Reserve was largely the result of a series of decisions made by government over a period of some fifty years. Whatever the motivation for these decisions, the end result was 20,000 square miles of Southern Tanzania completely free from human rights by 1950. Moreover, this land was contiguous and it soon was to have "a game population many times greater than it was when the first Europeans penetrated the country."[1]

The suggestion that there should be a substantial increase in animal numbers after the establishment and consolidation of the game reserve needs closer analysis. The amount of real space occupied by the dislocated people was inconsequential in comparison with the total area included within the reserve. A reasonable estimate of the amount of land disturbed by cultivation over any 25 year period in the study area has been shown to be less than 2% of the total area. Intuitively, one would say that the return of this relatively small proportion of land to animal production would not, by itself, account for an increase in animal populations several times that present with the indigenous settlement situation. It is certain that the additional acreage has provided something much more than additional space.

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[1] B. D. Nicholson, "The Selous Game Reserve", p. 3.

Animal Productivity

The most obvious explanation for the inordinate amount of influence wielded by the people occupied acres would suggest that the hunting activities of these people reduced animal populations to minimum levels. However, the potential production of wild African ungulates on their own range has been shown to be quite high. In all probability, in an area as sparsely settled as the aboriginal Selous it is unlikely that there was a demand for meat sufficient to match the production potential of the area in question.

The animal production as measured in pounds of biomass per square mile for several areas of Africa is recorded in Table III.

Although there is considerable variation in these data, it would be reasonable to assume that the potential production of the Selous area is no less than the actual production measured on the Henderson Ranch in Southern Rhodesia. (See Figure 2). These data were gathered in an area with an average yearly rainfall of only 12 inches, or about one-third the Selous average. These are the lowest values of any measured area and there is every reason to assume that they are far below the expected values for an area with the lush vegetation of the Selous. Nevertheless, the data from the Henderson Ranch will be used as a conservative measure for calculating the potential production of the Selous area.

TABLE III

COMPARISONS OF WILD UNGULATE POPULATIONS
IN SEVERAL AREAS OF AFRICA

Area and Authority	Number of Species in Area	Population Density in Animals Square Mile	Biomass Pounds Weight of Animals Sq. Mile	Size of Area in Census Sq.Mile
Southern Rhodesia Henderson Ranch (Dasmann-Mossman)	16	76	18,700	50
Wankie National Park (Dry-season concentration area) (Dasmann-Mossman)	17	195	153,000	?
East Africa Serengeti-Mara (Stewart-Talbot)	8+	94	28,000	15,000
Nairobi National Park (Bere)	18	174	76,000	116
Queen Elizabeth National Park (Bere)	11	—	107,000	1,670
Congo Albert National Park (Bourliere-Verschuren)	11	44-224	32,000 to 135,000	675

Source: Raymond F. Dasmann, African Game Ranching, The MacMillan Company, New York, 1964, p. 61.

The data in Table IV show a total recommended harvest of 118,300 lbs. of dressed meat for the 50 square mile area. Discounting the two species, warthog and bush pig that are the objects of Moslem taboos, one is left with 112,000 lbs. of usable meat for the 50 square mile area, or an average of 2,240 lbs. of meat per square mile. This recommended harvest is a conservative estimate of the surplus produced in the study area. It is a sustained yield that can be removed on a yearly basis without reducing the animal population.

Consumption of the People

Table V shows the per capita meat consumption of a number of countries. If the Selous inhabitants ate meat on a par with the highest per capita consumers in the world, they would not have been able to consume the potential natural surplus meat production in the game reserve. With a yearly consumption of 224 lbs. of meat per capita (as in New Zealand), the 2,240 lbs. of surplus meat per square mile could have supported an average population of 10 people per square mile. It has already been shown that the human population of the area was significantly less than this figure. Although hunting activities probably reduced animal populations in localized areas, it is unlikely that outright killing by semi-subsistence hunting alone is a satisfactory explanation for substantially reduced average animal populations over an area as large as that of the Selous. The local demand, even if hunting methods were good enough to meet it, was not sufficient to foster extremely large scale decimations of the ungulate populations over wide areas.

TABLE IV

GAME POPULATIONS AND YIELD FROM THE HENDERSON RANCH, SOUTHERN RHODESIA

Species	Estimated Numbers	Recommended Crop	Weight of Dressed Carcass (Adult) (lb)	Total Meat Yield (lb)	Gross Value (£)
Impala	2100	525	65	34,125	2133
Zebra	730	146	255	37,230	1168
Steenbuck	200	40	12	480	36
Warthog	170	85	70	5,950	297
Kudu	160	48	225	10,800	540
Wildebeest	160	32	260	8,320	416
Giraffe	90	15	1000 e.	15,000	600
Duiker	80	28	20	560	42
Waterbuck	35	7	200 e.	1,400	70
Buffalo	30	5	570	2,850	119
Eland	10	2	600 e.	1,200	60
Klipspringer	10	3	14	42	3
Bush Pig	10	5	70 e.	350	17
Total to nearest 100 pounds weight and five hundred pounds (£) value:				118,300	5500

e. - estimated; not weighed.
FIGURES APPLY TO MEAN NUMBER OF ANIMALS SUPPORTED ON FIFTY-SQUARE-MILE STUDY AREA THROUGH A YEAR

Notes: The ranch also supports elephant, grysbuck and bushbuck though the numbers were too low to appear in the strip counts. The above estimates are to some degree misleading in that they refer to only the fifty square mile area. If there were actually only ten eland or thirty buffalo in an area, no cropping would be recommended. However, on the ranch there are an estimated two hundred buffalo and one hundred eland moving in several large herds. The study area provides about 10 per cent of the support for the eland and 15 per cent for the buffalo hence it could be said to yield a crop of two eland and five buffalo.

Source: Raymond F. Dasmann, African Game Ranching, The MacMillan Company, New York, 1964, p. 58.

TABLE V

WORLD PER CAPITA MEAT CONSUMPTION

Nation	Total Meat	Beef, Veal	Pork	Lamb, Goat
New Zealand	224	107	30	87
Argentina	220	189	17	14
Uruguay	218	144	17	57
Australia	204	93	27	84
United States	183	113	66	4
Canada	158	94	58	6
France	150	77	62	7
United Kingdom	138	53	61	24
West Germany	133	52	81	X
Belgium-Luxembourg	132	58	65	2
Austria	128	49	78	X
Paraguay	128	99	27	2
Switzerland	122	56	63	2
East Germany	121	X	X	X
Czechoslovakia	112	42	70	X
Denmark	111	44	66	1
Netherlands	111	47	60	1
Ireland	108	26	58	24
Sweden	103	44	56	1
Poland	94	34	57	2
Bulgaria	92	29	39	24
Hungary	84	18	63	2
Norway	80	33	37	9
USSR	79	41	31	7
Finland	76	37	37	X
Greece	75	31	12	32
South Africa	71	46	7	18
Spain	68	24	34	9
Italy	65	42	20	2
Venezuela	53	44	8	1
Yugoslavia	53	17	31	5
Brazil	51	36	14	1
Chile	51	33	12	6
Colombia	46	42	4	X
Portugal	45	19	20	6
Mexico	40	24	13	3
Peru	32	17	7	8
Philippines	28	6	22	X
Japan	18	4	11	2

X - Negligible or included in total

Source: Luhman H. Long, Editor, 1971 Edition The World Almanac, Doubleday and Co., Inc., 1970, p. 130.

Special Cases

It is possible that demand was generated for meat and animal products from areas outside the game reserve. Without a doubt this had a marked impact on high value and non-perishable trophy producing species. Elephant and rhino horns have always had a high market value. The demand for these easily transportable products had detrimental effects even in places far removed from population centers.

The Selous area was not immune from such depredations. One East African historian records the early genesis of an ivory marketing trade at Kisaki on the northern edge of the present day reserve.

> The impetus to an ever-deeper inland penetration came as the ivory-producing regions near the coast were denuded of elephants to supply the ever-demanding markets of India, America, and Europe. With this penetration a need developed for Arab centres along the central routes to serve as collection points for ivory and slaves, and as provisioning depots for the increasing number of caravans. An early centre was founded at Zungomero (near present-day Kisaki) in the territory of the Khutu, but bases farther inland were soon required.[2]

The early hunting pressure of market hunters was followed by the crop protection measures of both the colonial and independence governments. Even with the restructuring of settlement patterns, constant efforts are necessary to keep elephant populations at bay. In the productive miombo country of Southern Tanzania, 2700 elephants were killed by game scouts during cropping operations in one recent year. "Today, there are 50 to 60 elephants shot every week in the Southern

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[2] N. R. Bennett, "The Arab Impact," Zamani: A Survey of East African History, B. A. Ogot and J. A. Kieran, ed. (Longmans of Kenya, 1968), p. 220.

Region alone."[3] This toll is representative of that taken yearly even after a full century of heavy hunting pressure. Although the less resistant rhino nearly disappeared by 1950,[4] there still appeared to be no dimunition in the elephant herds.[5]

The value of an elephant herd is not to be found in its numbers, but rather in the tusk size of the bulls. Since tusk size is proportional to age, it is possible to have a large, but youthful, elephant population without having valuable sized tusks within the group. Such was the case with the study area which had an elephant population under regular harassment for a long period of time. "Few of the bulls ever reached old age with the result that Southeast Tanganyika had the reputation of a land of small ivory."[6]

In addition to rhino and elephant, crocodile population also suffered from extra-territorial demand for their products. They had the further disadvantage of being largely localized along waterways which in the case of the Kilombero and the lower reaches of the Rufiji could be reached from outside the reserve by canoe. Their salted skins had high value and could be transported great distances without spoilage.

Aside from the three species mentioned above, cheetah, lion, and leopard produce high value non-perishable products. However, the difficulty and dangerous task of bagging these animals in the miombo and

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[3] C. J. P. Ionides, p. 113.

[4] B. D. Nicholson, "The Selous Game Reserve", p. 10.

[5] C. J. P. Ionides, p. 123.

[6] B. D. Nicholson, "The Selous Game Reserve", p. 10.

associated long grasses of the Selous has kept the efforts of members of the poaching fraternity directed toward the more vulnerable elephant. The most influential controlling factor on these carnivores' population was the availability of prey ungulate species.

It was the ungulate species that probably were least effected by demand centered outside the Selous area since the meat they produced was of relatively low value by bulk and could only be transported by human porterage after it was dried. In the absence of transport other than porters, a two-day journey by foot from human settlements would probably be the maximum range of meat hunters. Since only the highlands to the north and west of the present day reserve had high human populations close to the reserve boundaries, it was here that poachers took their heaviest toll.[7] The remoteness of the rest of the reserve gave it a measure of protection against outside meat hunters. With large sections of the miombo country isolated from heavy poaching, and very little space occupied by cultivators, one must go beyond these simple answers to explain Nicholson's observation that "in 1948, when the last of the people were evacuated, the game population was at an all time low.[8] An examination of the peculiar spatial arrangements of both the vegetation and topography of the study area will aid to understanding this phenomenon.

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[7] B. D. Nicholson, "The Selous Game Reserve", p. 10.

[8] Ibid.

CHAPTER V

WILDLIFE PRODUCTION ON THE VACATED LANDS

The best way to gain an understanding of the reasons for the phenomenal increase in animal numbers that has been observed in the Selous is to closely examine the history of land use plus the hydrology, physiography, and plant geography of the area. In particular, it is essential that the nature of the locations formerly chosen for human habitation be scrutinized. Since the removal of settlers is the prime variable over time, an examination of the space which they occupied can provide clues to the essence of their perturbative function.

The Hydrology

The Selous area is located midway between the high rainfall strip along the coast and an even higher rainfall area in the mountains to the west. Consequently, the eastern edge of the reserve receives an average annual rainfall of about 30 inches which tapers to something under thirty as one heads westward and then increases to nearly 40 inches as the foothills of the western mountains are approached.[1]

These rainfall figures must be understood to be approximated averages. As such, they do not reflect two essential features of the rainfall in the study area. First, the annual rains are not evenly

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[1] F.A.O. of the United Nations, The Rufiji Basin of Tanganyika, Vol. II, Part 2, Map No. 14.

distributed throughout the year, but rather are seasonal with no rains between June 1 and November 15 in most years. A shorter dry season often occurs between January 1 and March 15. Secondly, the rains show considerable variation from year to year in both time and amount.

Table VI shows rainfall data from a representative station located just east of the Selous. It is at once obvious that the seasonality of the rains is tempered by their erratic nature. Nearly every month has been at one time wet and another time dry. This adds to the precarious nature of agricultural undertakings in the area.

TABLE VI

AVERAGES, MAXIMUM, AND MINIMUM INCHES OF OBSERVED MONTHLY RAINFALL AT UTETE, TANZANIA - 1922-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Average	4	3	6	8	3	0	0	0	0	1	2	4
Maximum	10	14	14	14	11	2	1	2	2	4	10	9
Minimum	0	1	2	2	0	0	0	0	0	0	0	0

Source: F.A.O. The Rufiji Basin of Tanganyika, Vol. II, part 2, Map 3.

The geology of the area does much to regularize the availability of surface water, in spite of the erratic rainfall.

> The sedimentary rocks . . . are of importance as far as groundwater is concerned. The sandstones (some of which contain kaolin) and marly strata and overlying soils are pervious, so that many perennial streams occur in this large area which, at present, is uninhabited or very thinly populated. The soils in general are probably poor.[2]

The result of this is a permanent water supply that is quite well distributed throughout the reserve, even in the driest of years. Although only the very largest of streams have surface water flowing throughout every year, water can be obtained in select locations along the intermediate sized streams even in the driest of years. Elephants are particularly adept at creating their own wells by digging in sandy river beds.

The Physiography and Plant Geography

The well dissected sedimentary deposits are characterized by broad interfluvial areas of gently undulating terrain. These areas have infertile untransported sandy soils throughout. This, together with the rainfall, has created a rather homogeneous miombo forest over most of the interfluvial sections that make up an estimated 80-90 per cent of the total area. The low stocking of trees in the miombo forest allows adequate sun and space for long perennial grasses to grow in association with the trees. Although these upland areas have standing water during the rains, it soon disappears with the onset of the dry season.

The miombo forest is broken up by the imposition of water courses at irregular intervals. Figure 8 shows such a hypothetical river

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[2] F. M. Coster, Underground Water in Tanganyika, Department of Water Development and Irrigation, Government of Tanganyika, p. 15.

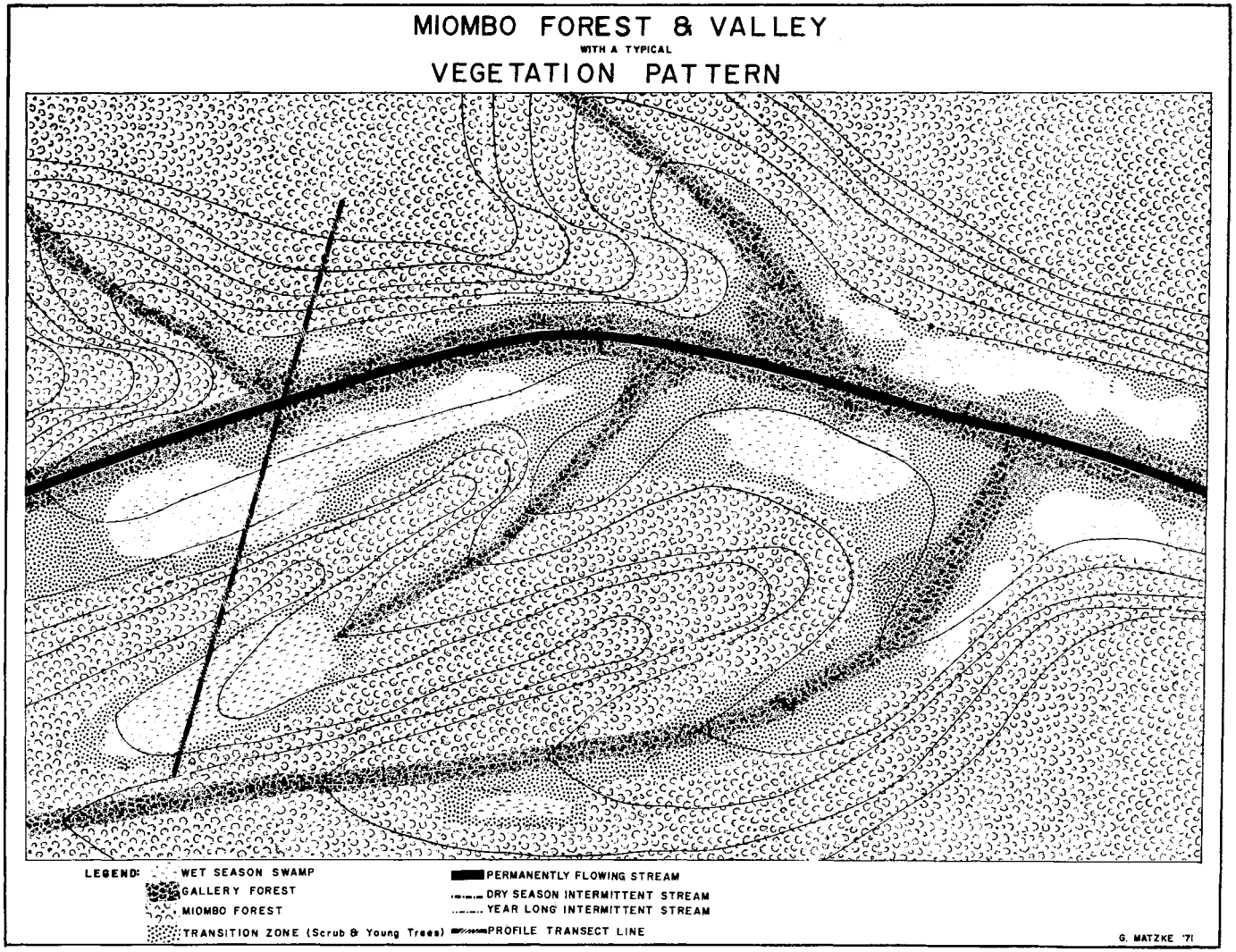

Figure 8. Miombo Forest & Valley with a Typical Vegetation Pattern

valley in miombo forest. The gently sloping valley sides are transition zones as the miombo grades off into smaller shrubs and denser grasses. The poor soils of the eroded hillsides are replaced by fertile alluvial deposits in the flooded areas of the river valleys. The richness of the soil and the availability of moisture combine to produce an unparallelled proliferation of tall grasses. One WWI soldier advancing through such a place near Kisaki observed, "The grass was so thick and high that it was difficult to see what was happening. . . even the sky was blotted out."[3]

Near the river itself is usually found a gallery forest of very tall trees and tangles of vines. This riverine "jungle" is a ground water forest quite distinct from anything found on the miombo uplands. The pattern created along the valley floor of the larger streams is interrupted at regular intervals by the entrance of numerous tributaries into the major stream. As each of these water courses cross the flats, its own lateral zones of vegetation intersect that of the larger stream giving rise to a great deal of interspersion and diversity of vegetative types in the valley. This is in stark contrast to the more homogeneous nature of the miombo covered interfluves.

The Site Selection of the Scattered Villages

The villages throughout the Selous area were not randomly located with reference to the resource base needed to provide sustenance. In addition to physical resource pre-requisites, certain socially desirable requirements were weighed in the decision-making of the village

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[3]Brian Gardner, p. 110.

locators.

Chisholm saw five factors of importance in locating subsistence villages; they were: 1) Grazing land, 2) Water, 3) Building Materials, 4) Fuel, 5) Arable land. He called these the universal economic needs of an agricultural economy.[4] The relative importance of each of these needs was shown by assigning each an index number according to its relative cost. For example, the frequency of use and difficulty of transport gave water an index of 10 while the spasmodic nature of the demand for building materials gave them an index number of 1. The most desirable site could be chosen by multiplying the distance each item was from the site by that item's index number and summing the results for each of the alternative sites. The one with the lowest total would be the logical choice for a village site.

An analysis such as that of Chisholm has only limited usefulness since it already assumes that the choices have somehow been narrowed to several select locations. In order to understand the process involved in site selection over an area with as many possibilities as the Selous, some additional conceptualization is necessary. It is suggested here that there are two major categories of factors influencing village site selection in conditions similar to those of the aboriginal Selous area. First, there is a set of macro-determinant items which will be weighed in order to select a particular river valley. Secondly, there is a set of micro-determinants which will affix within that river valley the exact location for the village in question. A useful categorization might be as follows:

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[4]Michael Chisholm, p. 102.

Macro-determinants in Village Location

1. Social-spiritual constraints.
2. Permanent water.
3. Fertile soil.
4. Wildlife abundance.
5. Relative location of externalities.

Micro-determinants in Village Location

1. Social-spiritual constraints.
2. Edaphic physiography.
3. Security needs.
4. Firewood
5. Building materials.

The distances separating villages in the study area were much greater than would have been necessitated by the available resource base alone. The Madaba locality, for example, had an area suitable for settlement that was eight miles long.[5] However, before it was selected as a place for a closer settlement, its small population never even approached full utilization of its arable land. As has already been noted, the social group preferences of the inhabitants were such that they preferred clan-sized agglomerations. Consequently, many villages were established long before older locations reached their maximum densities based on the human carrying capacity of the arable land.

Just as social considerations were of prime importance in spawning

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[5] Annual Reports of the Provincial Commissioners for the Year 1938, Government Printers, Dar Es Salaam, 1939, p. 66.

the need for a new village, they were of the first order of importance as a macro-determinant in selecting that village's location. For instance, a matter of prime importance would be the boundaries of the tribal area in question. Normally a move would not be made outside the area understood to be the domain of the tribe. Even within these areas, such places as were considered to be religious taboos would be eliminated. A large forest section south of the Matandu River and the Kingombechimo area east of Madaba had special taboos that are still of concern today.[6]

The permanent water and fertile soil requirements are most likely to be found within river valleys for reasons previously discussed. Without these, the village cannot exist. However, a variety of locations fit the requirements of the first three "must have" macro-determinants. In order to further narrow the range of choices, the abundance of wildlife and the relative location of external places such as other villages with relatives, tax collectors, or shops are the final macro-determinants that select a particular valley location.

Once the valley is selected, the actual site selection is influenced by micro-determinant factors. First of all, religious and cultural taboos rule out certain areas. For instance, many people will not locate in the darkness of a forest, or near the site of a baobab tree. Next, the edaphic physiography is of importance since floods and malarial areas must be avoided. Security needs are better met by an open ridge top site than in a thicket criss-crossed with elephant trails. After all of these things have been considered, a

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[6]E. B. M. Barongo, p. 16.

purely least cost Chisholmian economic analysis using firewood, building materials etc. can be considered to have some bearing on the final site selection.

An understanding of the nature of the site selection considerations is vital to gaining a proper perspective of the role of the settled areas in limiting wildlife production. First, these considerations tended to maximize, rather than minimize the number of villages needed for a given number of people. Secondly, several of these considerations are identical to those which will make the sites chosen very essential to the wildlife in the area.

The Meanderings of Animals

Although environmental determinism is out of vogue in the study of human geography, it remains the core of zoogeography. Grinnell went so far as to say, "Animal populations are by these shifting (environmental) barriers, as it were, herded about."[7] That is to say that the movements of species spatially are but the manifestations of various shifting environmental constraints. As the limiting, or constraining, environmental factors change their spatial character animal populations influenced by these factors must also change or face extinction. In understanding this concept, it is most important that the movements of any individual must not be equated with the movements of the species. "To the individual animal these invisible barriers may be no check at all, as is illustrated by kinds capable of free locomotion—volant ones;

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[7]Joseph Grinnell, "Presence and Absence of Animals", University of California Chronicle, October, 1928, p. 434.

but the species is affected."[8] The survival of one elephant in the proximity of cultivation is not necessarily a categoric affirmation of cultivable areas as environments capable of supporting the species.

It is with this in mind that the vegetation patterns of the Selous must be examined. Together with the water, the character of the vegetation is largely responsible for the distribution of the game species.[9] The general movement of the animals is into the miombo uplands with the first rains which are accompanied by a flush of grass and the budding of trees. Throughout the rainy season the uplands have sufficient water, grazing and browse to support the game populations. At this time the river valleys are often hopeless quagmires and are generally avoided. As the desiccation of the dry season sets in, the miombo areas are the first to dry. The standing water disappears, but more importantly, the grasses dry up and become quite unpalatable to most species. The boggier headwater swamps and meadows of the numerous smaller tributary watercourses furnish sustenance until they also dry out. At this time the herds respond to the shifting constraints of their environment and seek refuge in the river valley with its long lasting swamps which dry out only toward the end of the dry season, if at all, and provide succulent grasses at a time when they are no longer available elsewhere.

The extent of these dry season food supply areas is not large in comparison with the total area of the reserve. However, their importance is disproportionate to their size since for a critical time of

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[8] Ibid., p. 432.

[9] B. D. Nicholson, "The Selous Game Reserve", p. 1.

of the year they are the very lifeblood of the herds. Furthermore, a glance at the hypothetical vegetation and soils profile shown in Figure 9 is to demonstrate that the swampy valley areas have the most fertile soil. Ecological studies have clearly shown that good soils yield the best crops, both in quantity and quality, of practically everything that lives upon them.[10] Hence, these areas are capable of supporting for the period of time in question large numbers of game animals and the vast expanses of the relatively infertile uplands have animals enough returning to them with the onset of the rains. It is quite possible that adult animals could survive if denied these river valleys, but the species would be endangered nevertheless. "Proper food is the key to the ability of birds and mammals to breed and rear their young."[11] These crucial areas with their fertile soils are capable of returning comparatively large numbers of highly productive individuals to restock the remainder of the range.

The Conflicts of Man and Beast

The availability of water and fertile soils have made both man and animal choose the same locations. This is especially true when one views the situation during the driest time of the driest years. Water is then available in only select locations, even in the river valleys. If its availability should coincide with a sufficient expanse of fertile soils, it is a very likely possibility that human settlement would occur there. Likewise, this same area would be a critical holding area

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[10] Durward L. Allen, Our Wildlife Legacy, Funk & Wagnalls, New York, 1962, p. 20.

[11] Ibid., p. 21.

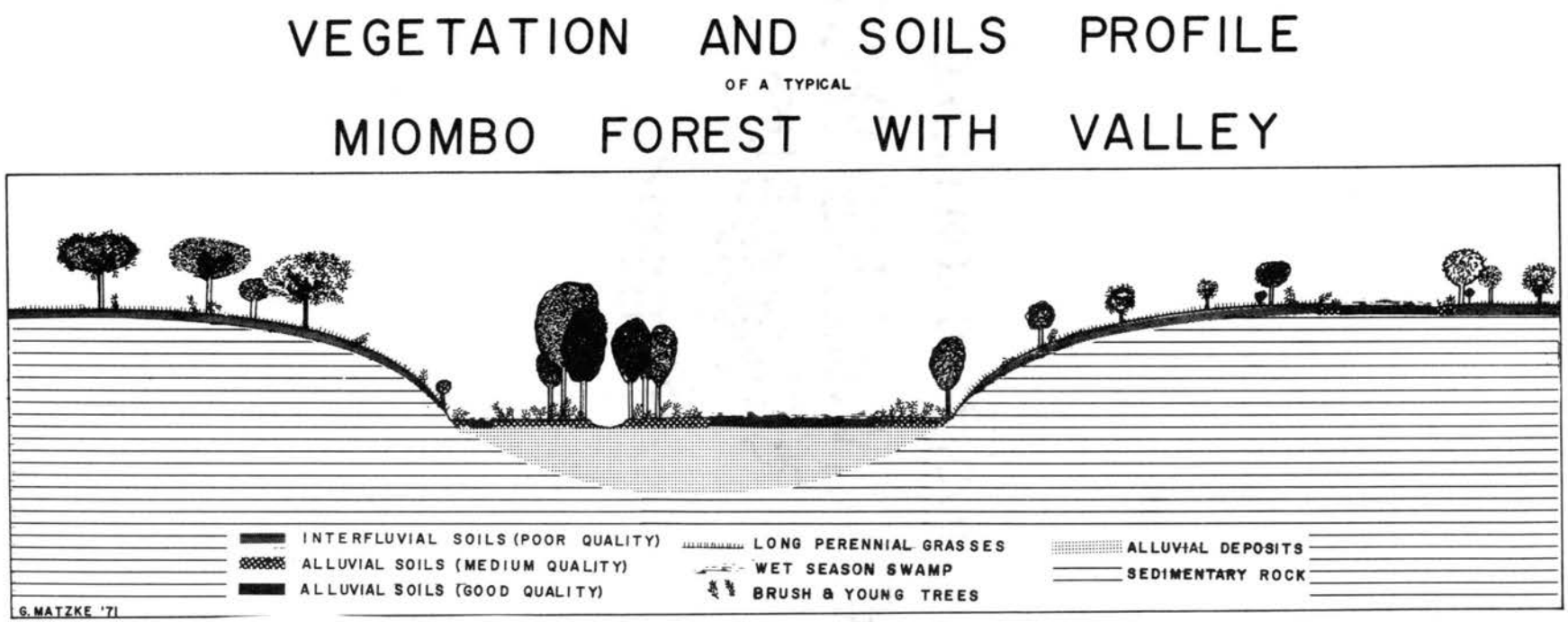

Figure 9. Vegetation and Soils Profile of a Typical Miombo Forest and Valley

for the surrounding animal populations, especially during the latter part of the dry season. Conflicts are a certainty in an agrarian society.

Nicholson comments on the elephant's fondness for mtama (sorghum--a staple crop in the study area) by saying,

> Fondness for mtama is shown up in the dry weather, when . . . bulls will carry their depredations to the village ngokwes or granaries where all the harvested mtama is stored: They simply pull off the roof and tuck into whatever is inside.[12]

Such conflicts necessitated the regular shooting of elephants that kept the average of tusks far below the trophy size.

While elephants gained the special attention of government hunters, the villagers in Southern Tanzania had evolved numerous methods of their own to deal with other animals. Besides the normal poison arrows, stakes, pits, snares and old muzzleloaders that killed animals directly, the use of fires and noisemakers kept the areas under protection sufficiently disturbed to limit their effectiveness in supporting many species of animals. Even the elephant's fondness for Magugu grass which grows in proximity to water would not often overcome his fear of the populated areas.[13] Although many decimated fields attest to individual exceptions, the occupance of critical areas by isolated homesteads "sterilized" many times more land than was actually needed for homesteaders to live.[14] The tendency of the people in the

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[12] Brian D. Nicholson, "The African Elephant", African Wildlife, 8(4):1954 p. 321.

[13] Ibid., p. 318.

[14] Leslie Brown, "The Destruction of Eden", Audubon, September/October, 1967, p. 44.

study area to establish small isolated settlements is thought to have made their influence on the animal populations far in excess of what would otherwise be expected of an equal number of people in a single agglomeration. Although direct mortality undoubtedly accounted for the demise of numerous individuals, the removal of certain critical areas from the free access of the herds might well have surpassed direct mortality as the factor most important in restricting animal numbers.

It has been argued that the fertility of the soil, the availability of the grasses, and the localization of water supplies made certain river valley locations extremely important to the maintenance of game populations. However, ecological studies done in other parts of the world offer one more clue to the importance of these areas.

In 1936, Aldo Leopold formulated the Law of Interspersion that asserted game was a phenomenon of the edges between differing vegetation types. It occurs where the types of food and cover which it needs come together.[15] He observed that this is especially true for animals of low mobility. It would not, therefore, necessarily apply to the many African ungulates noted for their annual migrations from dry season to wet season feeding areas. However, Lamprey's studies in Masailand showed that the contact zones between the various botonical types had significantly higher occurrences of many species than did places within the main vegetation blocks. He proposed that this phenomenon be called the boundary effect. It differs from the edge effect in that it describes the preference many species show for ecotonal areas (transition zone between two diverse communities), even though they are not

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[15]Aldo Leopold, Game Management, Charles Scribner's Sons, New York, 1936, p. 131.

confined to them.[16]

The importance of this observation when applied to the Selous can easily be seen when looking at the cross section along the transecting line of the hypothetical river valley and its associated vegetation types. Most of the significant edges occur in river valley locations. Figure 10 shows a hypothetical graph (after Lamprey) of animal sightings along the transect route. If the species exhibited the boundary effect, a count taken over a long enough period of time should have frequency of occurrence peaks corresponding to those edges between vegetation types which it frequents. In contrast to the graphed occurrences, it is unlikely that any one species would prefer all edges. Rather, the grazers might prefer the edge between two grass types, while the browsers might prefer the edges between two forest types.

The occupance of the river valley by humans would eliminate 8 of the 12 edges along the transect line for those animals that are not able to coexist with the human activities. Insofar as this might be true, it would have corresponding deleterious consequences on habitat desirability for those species. It is suggested that this effect aids in explaining the inordinate influence of the places occupied by humans on animal numbers.

It must be noted that human agricultural activity actually increases the total number of the edges in an area. The geometry of numerous small fields adds additional miles of "edge" that might aid in wildlife production. Indeed, the manipulation of cropland design

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[16] H. F. Lamprey, "Ecological Separation of the Large Mammal Species in the Tarangire Game Reserve, Tanganyika", East African Wildlife Journal, August, 1963, p. 74.

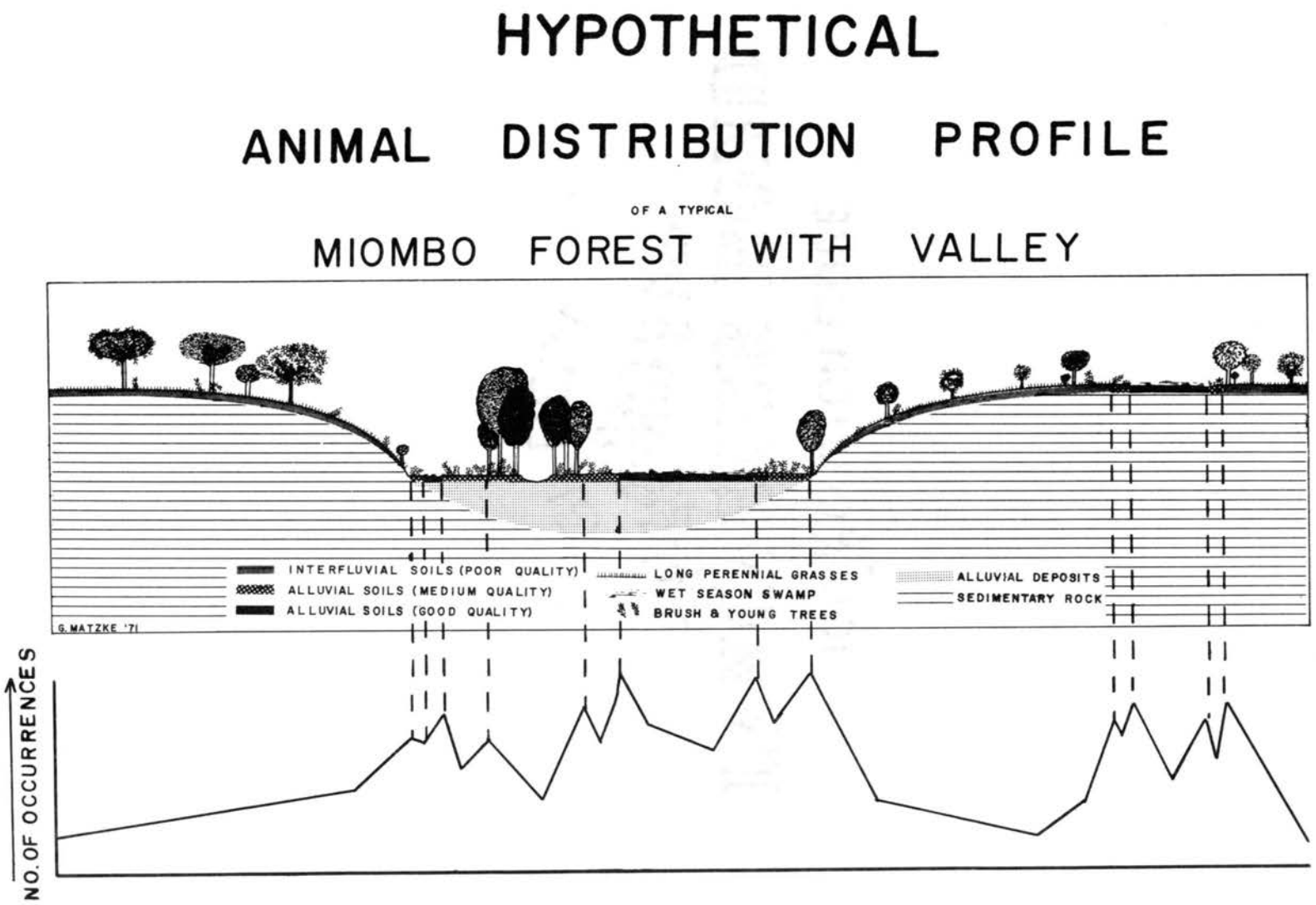

Figure 10. Hypothetical Animal Distribution Profile of a Typical Miombo Forest with Valley

for maximum edge is a common practice recommended for increasing wildlife production in North America.[17] However, the kind of species that might be benefited by the agricultural edge in the study area are of the smaller non-trophy variety. From observation in agricultural areas, the author expects these edges to aid the pestilent animals like the bush pig, baboon, monkey, bushbuck and reedbuck. These are in turn preyed upon by the leopard. It constitutes the lone trophy species likely to benefit by river valley settlement by humans.

Wildlife Gains from Settlement Evacuation

An examination of the river valleys, the vegetation patterns, the human disturbance factors, and the requirements for game production has indicated that the resource base in the study area is not spatially uniform for wildlife production. Furthermore, the small but widely dispersed areas chosen for human habitation are coincidental with areas that are of disproportionate importance to the maintenance of wildlife in the miombo forest zone.

It can be deduced that the removal of the villages from the study area had monumental consequences for the ecology of the region. Properly understood, the limiting nature of the human occupants can be seen to be much more complex than the outright killing of the animals. The spatial association of the soils, water, and vegetation types peculiar to these areas is fundamentally different than that of the miombo forest itself. It is in the nature of this difference that the reasons for the criticalness of these places for wildlife production can be seen.

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[17] Robert H. Giles, Jr., Editor, Wildlife Management Techniques, The Wildlife Society, Washington, D. C., 1969, p. 231.

CHAPTER VI

WILDLIFE DISTRIBUTION ON THE VACATED LANDS

Throughout the present day Selous Game Reserve, the removal of the people and the subsequent increase in animal numbers is an accomplished fact. The history of the occurrences has been traced and suggestions have been advanced that help to explain the phenomenon. Insofar as there are considerable numbers of large mammals inhabiting the Selous, it differs little from many of the other game areas in East Africa. However, the distribution of the mammals in the Selous is considerably different than that found in the open plains areas such as the world renowned Serengeti National Park.

The Ubiquity of the Animals

The attraction of large numbers of animals to particular locations is something that could have been observed in the aboriginal grasslands of North America and elsewhere. It still can be seen in select areas of Africa as seasonal migrations mark the periodic departure and return of the animals to particular localities.[1] In the Selous this is not the case.

Nicholson comments: "Scarcity of water and pasturage are the two factors mainly responsible for game migration. These problems do not

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[1]Eugene P. Odum, Fundamentals of Ecology, W. B. Saunders Company, Philadelphia, 1959, p. 201.

arise in the Selous Game Reserve, consequently the movement of game is limited and brings about a fairly even distribution of game species all the year round."[2]

The remarkably uniform distribution of animal numbers and species throughout the expansive reserve is not accomplished in the absence of game movements. However, the interspersion of vegetation types brought about by the frequent imposition of watercourses on the miombo landscape makes mass movements of entire populations unnecessary. Those animals that shift from dry season forage to wet season forage are able to accomplish this within a localized environment by taking advantage of the dichotomy of vegetation and soil types that is evident between the watercourses and the miombo interfluvial areas. In like manner, with the desiccation of the interfluves during the dry season, animals are able to find permanent water in the nearby watercourses. Therefore, the migrations that cross hundreds of miles of territory elsewhere are replaced by movements of only several miles in the Selous.

This can best be seen by two hypothetical illustrations in Figures 11 and 12. Figure 11 shows the migration routes of a population of animals that respond to the need for pasturage that varies in locality from season to season. All of the dry season forage is located in one quadrant. It can be seen that the animals are concentrated in only one of the quadrants during the dry season. Figure 12 shows the situation in a hypothetical miombo forest and valley location. Although the same sized area supports an identical number of animals, it can be seen that their distribution is much more wide spread than in Figure 11. Since

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[2] B. D. Nicholson, "The Selous Game Reserve", p. 1.

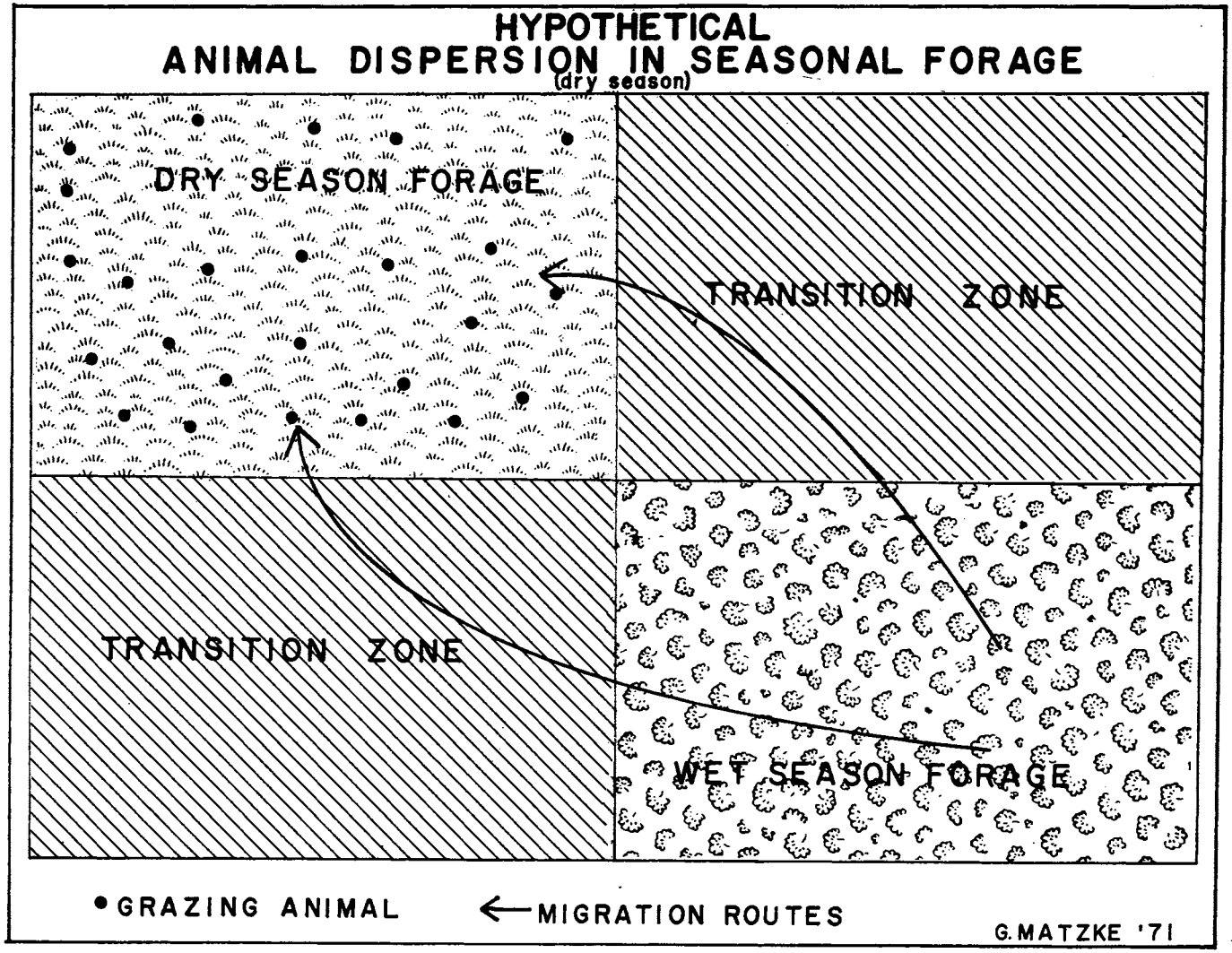

Figure 11. Hypothetical Animal Dispersion in Seasonal Forage

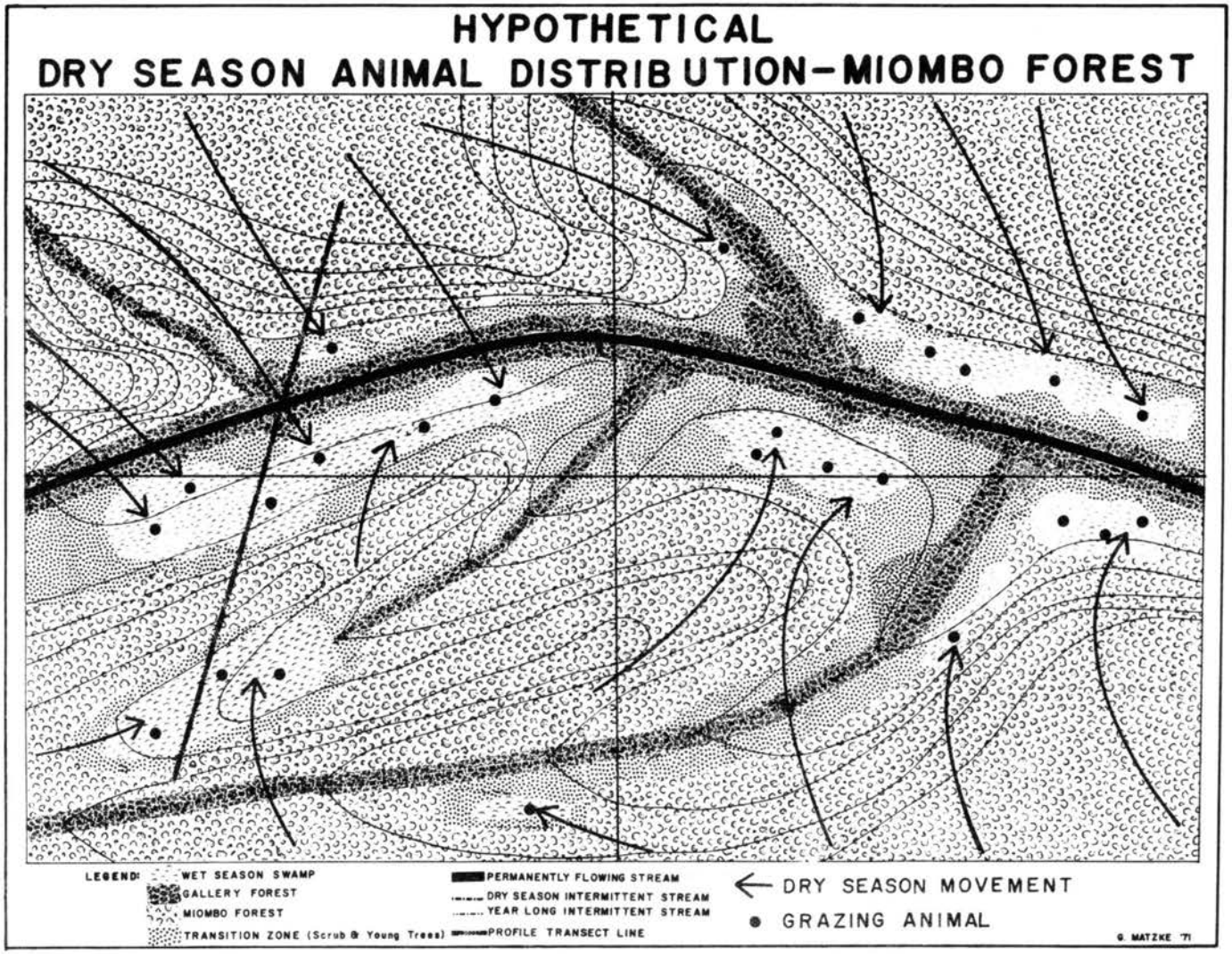

Figure 12. Hypothetical Dry Season Animal Distribution - Miombo Forest

their seasonal movements are small, each quadrant has some individuals within its bounds at all times of the year.

The vegetation pattern of the dissected miombo forest in the study area not only fosters a fairly even distribution of individuals, it also accounts for a remarkably wide variety of species within a particular area. Nature has evolved numerous ways of maximizing animal production in a given place. Although they may coexist in the same general biome, species are ecologically separated by a number of factors which limit interspecies competition. Lamprey found six such factors in his study in Masailand:

1. the occupation of different vegetation types and broad habitats;
2. the selection of different types of food;
3. the occupation of different areas at the same season;
4. the occupation of the same areas at different seasons;
5. the use of different feeding levels in the vegetation;
6. the occupation of different dry season refuges in the Masai area when the competition for food is greatest (zebra and wildebeest).[3]

Most of the factors cited above have some element of spatial separation attached to them. With close interspersion of vegetation types, ecological separation is achieved with a minimum of distance involved in the spatial separation. Consequently, the ubiquity of individuals as illustrated in Figure 12 is matched by an equally uniform distribution of species. In practice this has been found to be true. Of the 43 hunting blocks established within the Reserve, 42 have the full range of game species recorded in the Selous Game Reserve.[4] The general preference for habitat types of a number of species resident

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[3] H. F. Lamprey, p. 63.

[4] B. D. Nicholson, "The Selous Game Reserve", p. 12.

in the study area is shown in Figure 13. Since all of these species spend some of their time in at least two different cover densities, the closeness of these cover density associations found in the study area contributes to the parochialism of the wildlife.

The Predator Types

The preponderance of open woodland as a cover type in the miombo forest helps to explain the important role of the lion and leopard as predator species. Studies have indicated that it is not the number of prey animals that support large lion and leopard populations; rather, it is the vulnerability of these animals that is largely the determinate of the predator populations size. Since predation must be maintained, as the cover type switches to short grass plains the predator lion and leopard are replaced by predator cheetah and hunting dog.[5] Since even the open grassland sections of the study area are not far from the edge of some protective denser cover, the lion and leopard are probably more numerous here than any place left in East Africa.[6]

It has been demonstrated that the removal of people from the study area created a situation whereby high animal populations can be maintained. These populations are quite uniformly distributed throughout the reserve. Furthermore, the great variety of cover types made available within close proximity to each other has allowed a situation to evolve whereby the high animal populations are matched by a high degree of species diversity.

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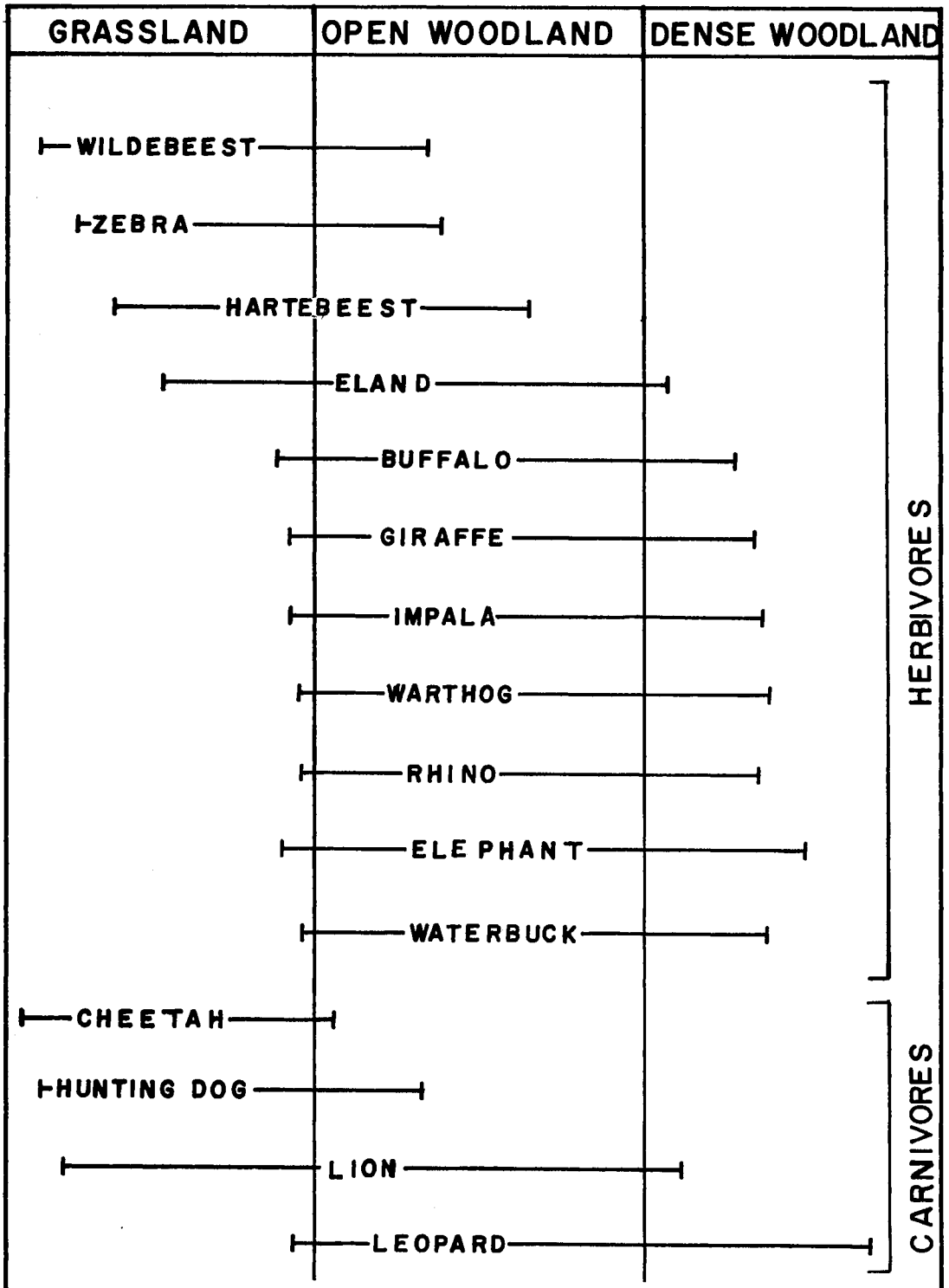
[5] B. S. Wright, "Predation on Big Game in East Africa", Journal of Wildlife Management, 24, 1960, p. 13.

[6] B. D. Nicholson, "The Selous Game Reserve", p. 11.



Habitat preferences of some large herbivores and predators resident in the Selous. The approximate percentage frequency of each species (in relation to overall frequency) in each of the three vegetation divisions is indicated by the proportion of the horizontal line lying in each. Lamprey p.65

Figure 13. Habitat Preferences of Selected Animals

The Utilization of the Animals in the Selous

This unique distribution of animals has provided the government of Tanzania with a special opportunity to exploit this resource for the economic benefit of the country as a whole. It has divided the 20,000 square miles of reserve into a number of hunting blocks. Within each of these blocks is contained an adequate number of trophy sized animals of a wide variety of species. Since the remoteness of the area, the presence of the tsetse fly, the scattered nature of the animals, and the discouraging photographic environment all contribute to discouraging the average tourist, hunting has been chosen as the method of using the animal resource for economically productive purposes.

The hunter on safari in the Selous enjoys several advantages over hunters in other areas. These advantages include the presence of adequate numbers of a variety of species. Also, the distribution of the animals assures him of a degree of solitude.

The dry season is the only time when most African safaris are possible; other places often find a concentration of hunters not unlike the concentrations of animals which they hunt. The man who paid dearly to leave the congestion of home can find himself faced with another sort of congestion. In order to avoid this, hunting blocks reserved for an individual safari are purchased. However, in areas subject to migration of game, it is quite possible that forage conditions are such that the animals have left the area. If animals are in the hunting block, the variety of species may be limited and additional blocks hundreds of miles distant may have to be visited.

The hunting blocks created within the miombo forest regions of the Selous offer safaris within their bounds all of the trophies

desired without competition from other hunters. Even though the hunts are all taken during the dry season, the spread of game in the area allows a wide distribution of successful hunters. They are able to see something of an Africa that is basically unrepresentative of the 20th century. In the process, their expenditures assure the government of Tanzania a financial return from an area that prior to settlement reorganization was neutral stuff to the modern economy.

CHAPTER VII

THE UTILIZATION OF THE VACATED LANDS

The change that has occurred in Southern Tanzania's wildlife production and distribution has been closely associated with the prime variable considered in this paper. The removal of people has initiated a period of ecological readjustment that has included an increase in both numbers and trophy sized individuals of many species within the Selous Game Reserve.

It has been suggested that the activities of the former residents limited animal production in wide expanses of territory. Furthermore, direct decimation of animals, though important, could not fully explain the enervating influence of the relatively small number of humans on the fauna in the study area. It has been suggested that these people occupied a maximum number of locations for their numbers. These locations were not amorphous areas, but were areas chosen for their particular resource characteristics. Some of these characteristics, in turn, were identical to those which made these select locations essential to the wildlife populations. Insofar as these areas were denied to the animals, their numbers were suppressed because:

1. the occupied lands had permanent water supplies needed especially in extremely dry years.

2. the occupied lands were extremely fertile areas with a capability of supporting much higher populations than equal amounts

of land elsewhere.

3. the occupied lands had green grass at a time when other areas were barren. Without this sustenance, individuals returning to the uplands would be less productive.

4. the occupied lands had many of the edges between vegetation types which have been shown to be especially productive for wildlife.

5. the productivity of the expansive uplands could not be utilized without complementary access to the river valleys at critical times.

The distribution of species and individuals within the miombo forest is a result of the vegetation patterns that exist there. These patterns make year around sustenance available within relatively localized areas. It therefore negates the necessity for large scale migration as often occurs elsewhere. The interspersion of cover types in association with the watercourses supports some individuals of every game species in each section of the reserve.

The Planning Implications

The implications of the findings of this research for development planning in miombo forest areas are considerable. For

> in planning the development of wild lands the potential economic productivity of wildlife should be taken into account, to be made use of either during a transitory period towards some other intensive form, or as a main objective in a sole or a multiple form of land utilization.[1]

This is so that man might benefit. Benefit to "man--his well being

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[1] A. J. Mence, "The Role of Wildlife Management in Savanna Development", Report of the Meeting on Savanna Development, Khartoum, Sudan Oct. 25 - Nov. 6, 1966, F.A.O. of the United Nations, p. 186.

now and in the future--is the starting point as well as the ending point of land planning."[2] It is impossible to plan well for man's benefit in the absence of good information. The information provided by this study indicates that considerable management is necessary in miombo lands if wildlife is to serve man. The center of this management is proper zoning.

> Every government in Africa has the difficult task of zoning its land. Some of it must be used for agriculture, some for livestock, some for settlements, some for towns, and some for other forms of development.[3]

This study has shown that the nature of the zoning in the miombo forest should not be of the kind often practiced elsewhere which classifies small acreages of land into different categories, usually according to varying fertility.[4] If the small river valley acreage was reserved for farming, the consequences for wildlife would be considerable. The total numbers would be considerably reduced and the number of species would be limited to those capable of surviving in the homogeneity of the miombo uplands. Additionally, the interspersion of people and wildlife would maximize conflict to the detriment of both.

Clearly, if wildlife production is a factor to be considered in land planning decisions in miombo areas, a new approach must be devised.

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[2]Robert A. McIntosh, Wildland Planning Procedures with Special Emphasis on Recreational Land Use in the Tahquamenon-Picture Rocks Region, Upper Penninsula of Michigan, unpub. Ph.D. dissertation, University of Michigan, 1955, p. 15.

[3]"Wildlife Conservation and Management", Unasylva, V. 15, No. 1, 1961, p. 1.

[4]Harold Titus, "The Land Nobody Wanted", Special Bulletin 332, Michigan State University, East Lansing, 1945, p. 26.

This new approach would be based on the belief that certain areas of East Africa would yield a more profitable return to the country as a whole under wild fauna than under domestic livestock, or other agricultural uses.[5] The findings of this study would suggest that maximum production and diversity of trophy-type wild fauna occurs in the absence of the disturbing influence of cultivators in the game area. Therefore, a proper approach to zoning in miombo forest areas, if it is to include wildlife, would operate under the assumption that agricultural people and wildlife cannot coexist. Areas must be designated as people zones, or as wildlife zones.

Ideally, the wildlife zones would be ecologically complete units that could sustain the faunal populations without necessitating movements outside of the areas reserved for wildlife. The examination of the study area has shown that the miombo uplands alone cannot constitute ecologically complete game areas. They are complete only in association with the fertile watercourse areas. Therefore a micro approach to land zoning that reserves the fertile areas for cultivation is not consistent with a proper development plan that purports to include the wildlife resource.

A macro approach to land zoning would include within the areas designated for people large expanses of uncultivable lands. Likewise, the wildlife reserves would include lands quite suitable for cultivation, but essential to the maintenance of the fauna. Ideally, these areas would be large contiguous units whose geometry would provide the

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[5]Noel Simon and George Treichel, "Wildlife Challenges in East Africa", Transactions of the Twenty-Fourth North American Wildlife Conference, Wildlife Management Institute, Washington, D. C., 1959, p. 467.

opportunity for efficiency in management.

The advantages of concentrating the populace into particular areas has been thoroughly discussed in the literature of regional and settlement planning. Essentially, the relative ease with which services and education can be provided in such situations makes the concentration of people a priority item in some areas.[6]

The management of the bigger East African mammals also is enhanced by large contiguous game units. The borders that must be patrolled for poachers and crop raiding animals are much shorter than would be the case with an equal amount of area divided up into numerous management units. The amount of staff needed to secure the area is proportionately smaller. Likewise, the relative importance of any animals leaving the reserve and being killed by hunting or crop protection practices would be considerably less in larger reserves. Additionally, since wildlife survival is assured within the game reserve, the necessity for expensive anti-poaching work outside of the reserves is lessened. The ill feeling engendered in the local populace by such activities is eliminated since protection of wildlife is reserved for wildlife zones.[7]

The removal of people from large areas of miombo forest is not without its dangers.

> The ecological problem is fundamentally one of the balancing resources against human needs, both in the short and in the long terms. It thus must be related to a proper evaluation of human needs, and it must be based on resource conservation of the habitat.[8]

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[6] Julius K. Nyerere, Socialism and Rural Development, The Government Printer, Dar Es Salaam, 1967, p. 20.

[7] B. D. Nicholson, "The Selous Game Reserve", p. 4.

[8] F. Bourliere, "The Vanishing Herds", The UNESCO Courier, Sept. 14, 1961, No. 9, p. 9.

If it is decided that the optimum use of the land includes maximum faunal production, people in that area must endure the hardships of dislocation.

Tanzanian leaders have recognized that national needs sometimes conflict with the "particular interests of any one locality or any particular group of farmers."[9] In such cases of over-riding national concern, they have found it essential that there should be positive Government action. Such action has supported the Selous Game Reserve experiment with both authority and funds for use in integrating its wildlife into the national economy.[10]

The incorporation of the reserve into the national tourism development plan does not assure its continued usefulness as an area capable of producing wildlife. The removal of people has created a new ecological situation that could modify the habitat. "There is already evidence in Africa to show that, on a long-term basis, changes in habitat are the most powerful of all factors for increasing or decreasing populations of wild animals."[11]

The original Selous inhabitants, as most African people, used fire as their prime instrument of habitat modification. The flora and fauna resident in the area evolved under the influence of fire and its elimination "means eliminating one of the principal factors which have, over the last few thousand years, shaped the parks as we

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[9] J. K. Nyerere, p. 14.

[10] Second Five-Year Plan for Economic and Social Development, 1st July, 1969 - 30th June, 1974, Government Printers, Dar Es Salaam.

[11] Thane Rinley, "Development of the Wildlife Resource in Africa", Unasylva, F.A.O., V. 18, No. 4, 1964, p. 37.

know them."[12] While most animals can avoid being caught in fire,[13] the vegetation bears the imprint of conflagration. The open miombo forest itself can only be maintained with fire.[14] Consequently, the evacuated areas must have fire incorporated into their proper management. Only in such a way can the type of vegetative environment be maintained as it was when the original fauna evolved. Without such an environment, it is quite possible that the gains that have accrued with the removal of people will be offset by losses resulting from habitat changes. Such was the case in the Parc National Albert where 25 years of fire protection reduced topi populations 90%.[15]

The Selous Experience in the Broader Context

"Perhaps, more often than not, the colonial administration fostered circumstances which, upon independence, left the newly independent state with serious difficulties."[16]

Many would argue that this statement holds true for Tanzania. It cannot, however, be said of the resettlement program which ended in the creation of the Selous Game Reserve. Although the colonial government did nothing to integrate the area into the economy of Tanganyika, its

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[12] H. A. Osmaston, Uganda National Parks Handbook, Kampala, 1962, 3rd Edition, p. 100.

[13] B. W. Langlands, "Burning in Eastern Africa", East African Geographic Review, No. 5, April, 1967, p. 31.

[14] C. G. Trapnell, p. 167.

[15] J. H. Blower, "Topi", Uganda Wild Life and Sport, Vol. 1, No. 5, 1959, p. 19.

[16] Harm J. De Blij, "Cultural Pluralism and the Political Geography of Decolonization: The Case of Surinam", The Pennsylvania Geographer - reprint July, 1970, p. 1.

very existence was a significant achievement. Its incorporation into the money economy awaited independence. With independence, it was unrealistic to assume that the new government should bear the expenses of caretaking such a vast area without financial return. As cited above, hunting safaris are now taking advantage of the unique array of fauna in the Selous and are providing foreign exchange earnings from the produce of the area. An analysis of these operations are outside the scope of this paper, but these activities give added import to the findings of this study. Furthermore, they suggest direction for further research.

Although it is still too early to pass final judgment as to its economic success, the rearrangement of settlement patterns and the subsequent capitalization on wildlife gains offers opportunities for a melding of a wide variety of interest groups. The administrators assigned the responsibility for game protection find their task considerably easier when only specific areas are set aside for strict game law enforcement. Those responsible for crop protection can carry out their operations without undue fear of decimating the entire game herds. Rural development is aided by the concentration of humans into serviceable places. Hunters find their sport much improved and conservationists are able to ally themselves to the plan since it insures the preservation of wildlife.[17]

The broad potential base for the support of miombo development projects modeled after the Selous example suggest that new areas suitable for such development be outlined as early as possible. This

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[17]Leslie Brown, p. 46.

study's reconstruction of the Selous scene prior to reorganization of the settlements, together with its analysis of the change that has occurred, should aid planners in attempting to research and delimit new areas for consideration. These areas would include the following characteristics:

1. miombo forest vegetation interrupted by varying vegetation types occurring along water courses.

2. permanent water supplies located within the area, preferably regularly interspersed.

3. large expanses of territory with sparse human settlements.

4. tsetse infested thus avoiding pressures from cattle raising interests.

5. areas currently contributing little or nothing to the money economy.

Suggestions for Further Research

This study has suggested that scattered settlements seriously depress animal populations over wide areas of miombo forest. The next step needed is to search for present day analogues to the original Selous situation. After selecting appropriate villages, an attempt should be made to quantify a zone of negative influence around each village. This zone would ideally show the degree and distance away each village negatively influences the surrounding animal populations. It would be especially valuable if villages could be monitored before, and after, their evacuation and incorporation in a game reserve.

Figure 14 shows a postulated zone of negative influence for a hypothetical village situation. The inner zone is the cultivation

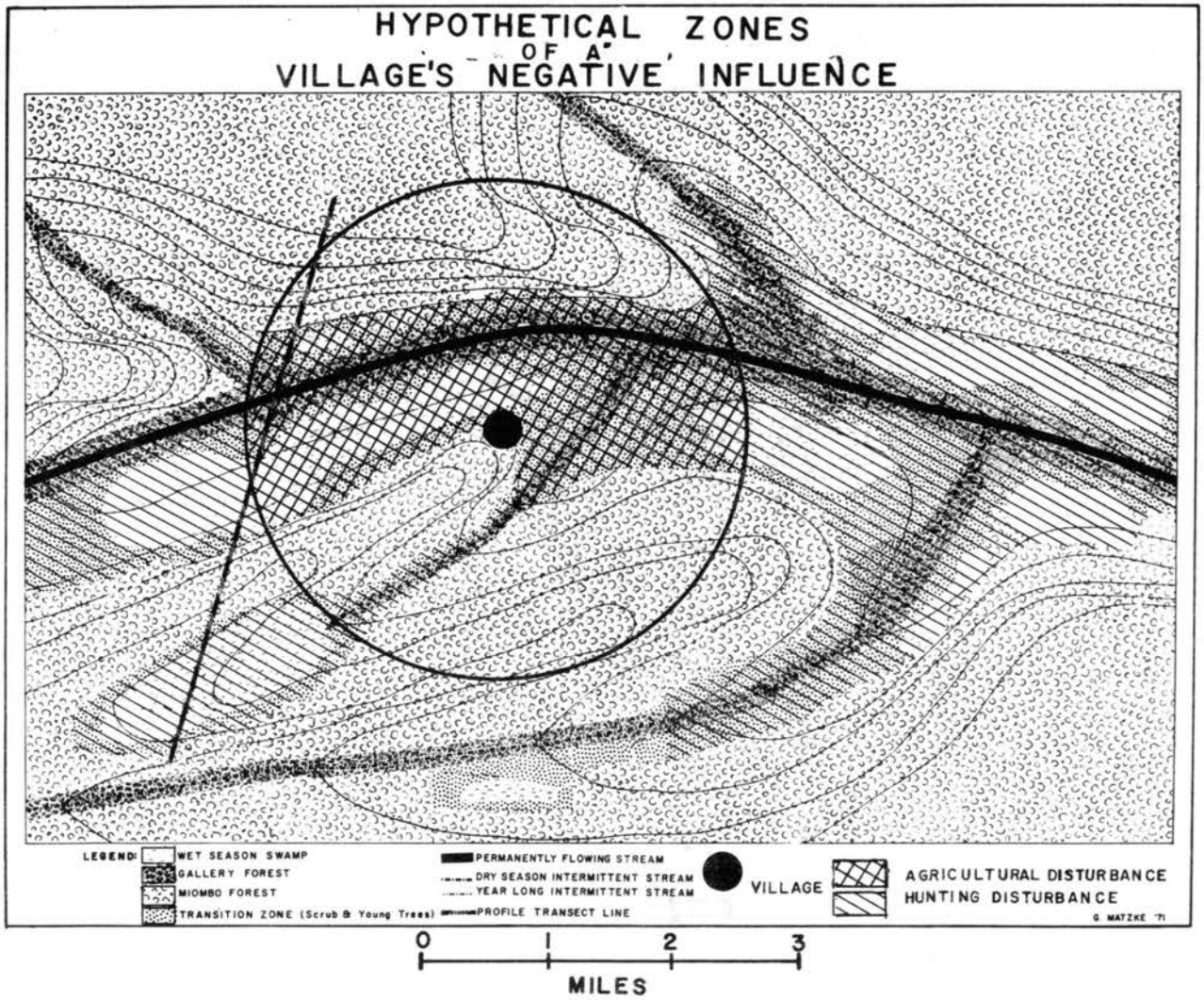

Figure 14. Hypothetical Zones of a Village's Negative Influence

zone elongated along the river valley alluvium for a distance limited by a two mile radius from the village. The outer zone is the hunting zone that includes the area needed to produce an annual animal surplus sufficient to feed a village with a population of 340 people. This map assumes productivity on a par with the Henderson Ranch study and a meat consumption rate equal to that shown for South Africa in Table V. The elongated configuration of the zones suggests that the river valley is ideal for hunting as well as farming. It is here that man, the predator, can take advantage of the available water and edges to await his prey, set his snares, or otherwise kill the game. A study as is suggested here would give quantitative support to the thesis of this paper.

East African biogeographical research should place the delimitation of potential wildlife areas at the top of its research priorities. As population increases and remaining wildlife diminishes, opportunities will increasingly disappear. If, however, geographers provide the decision makers with adequately researched information, they will have rendered an important service to wildlife management.[18] If interests are allowed to develop in a haphazard fashion, the flora and fauna which are the basis for tourist development will disappear.[19] Its disappearance might well be avoided with properly implemented resettlement modeled after the Selous example.

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[18] L. C. Stuart, p. 449.

[19] Carleton Ray, Marine Parks for Tanzania, The Conservation Foundation, New York Zoological Society, 1968, p. 29.

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VITA

2

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