MANAGEMENT OBJECTIVES AND THE STATUS OF NATURE PRESERVATION IN THE YANKARI GAME RESERVE, NIGERIA

By

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ABSTRACT

MANAGEMENT OBJECTIVES AND THE STATUS OF NATURE PRESERVATION IN THE YANKARI GAME RESERVE, NIGERIA

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This study was carried out in Yankari between December 1976 and May 1977. It involved the determination of the degree to which the Reserve had been effective in maintaining the native biota, and the evaluation of its management. The study covered the Yankari vegetation, animals and the attitudes of the local people to the Reserve.

The vegetation was analysed using the "three step method of range analysis."

All the vegetation types except the Pteleopsis habeensis woodland were in good condition. Erosion and overgrazing did not constitute major problems.

Enumeration of the animals in the different vegetation types was carried out using the modified Hahn's census method on four major census transcets. The population of the ungulates and that of the predators were observed to have

increased.

The attitude of the local people toward the Reserve was obtained using a questionnaire, and the effects of private rights and privileges on nature preservation were reviewed. The major tourist attractions in Yankari were determined to be game viewing and swimming in the warm springs.

An evaluation of the progress made in Yankari and the limitations to further progress were considered. Recommendations were made for the Reserve's continued success.

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GENERAL INTRODUCTION

The Game Preservation Unit of the Forestry Division was formed within the former Ministry of Agriculture and Animal Resources in 1956. This followed a visit to the Republic of Sudan by the first Minister of Natural Resources of the then Northern Nigeria, Alhaji Mohammadu Ngeleruma. While in the Sudan, he was taken up the White Nile where he was surprised and interested to see elephants, giraffes, buffaloes and other game feeding along the river banks. The animals, he was told, were not frightened by the steamer because the area was a game reserve.

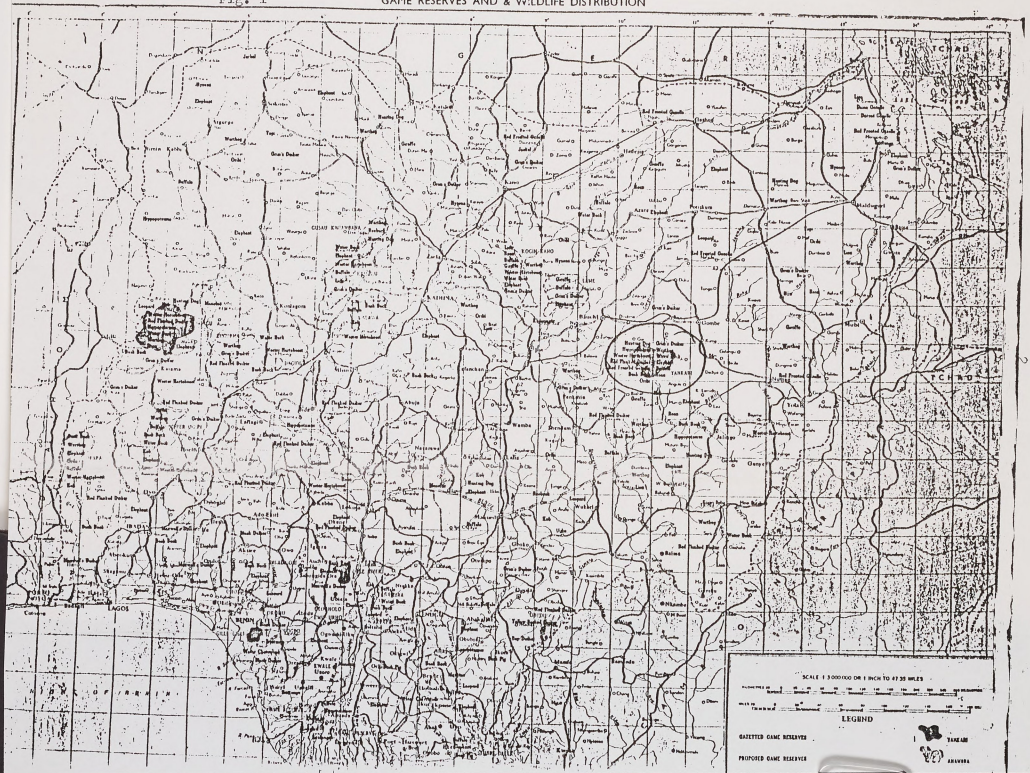
On his return to Northern Nigeria, he suggested that a game preservation unit be formed which would establish a Reserve where Nigerians could see large animals in their natural state. When this unit was finally formed in 1956, its first task was to select a suitable site for development.

The Yankari bush, then being constituted as a forest reserve was selected. After 7 years of protecting the wildlife, developing jeep tracks and building a visitor's camp, the Yankari Game Reserve was opened to the public on

Fig. 1

NIGERIA

GAME RESERVES AND & WILDLIFE DISTRIBUTION




SCALE 1 3 000 000 OR 1 INCH TO 47 35 MILES
LEGEND
GAZETTED GAME RESERVES
PROPOSED GAME RESERVES
TANGIER
ARKANSAS

1 December 1962.

When in 1967, 12 new administrative states wered creaded in Nigeria to replace the earlier three regions, the Reserve came under the control of the North Eastern State Government. In March 1976, upon the creation of seven additional administrative states, the Yankari Game Reserve came within Bauchi State (Figure 1).

The Yankari Game Reserve lies roughly between latitudes 9° 34'and 10°00' N and longitude 10° 17'and 10° 45' E (Figure 2). It forms part of the shallow Gaji river basin and lies between 241 and 366 meters elevation. Covering an area of 2275 square kilometers, it is located in the Dugari, Fali and Gwana districts of the Bauchi Emirate. An all-season tarred road approximately dividing the Reserve into two equal parts starts from the Gar Mainamaji base camp and extends to Wikki where there are about 500 chalets for visitors.

The Yankari Reserve, a former woodland, earlier was not habitable because of water shortages and the prevalence of both river-blindness and sleeping sickness. It is now, however, surrounded by a number of villages established by local hunters and cattle-rearing nomads of Fulani origin.

The vegetation is intermediate between guinea savanna and savanna woodland (Geerling, 1973) The trees have a generally open canopy with a continuous ground cover of

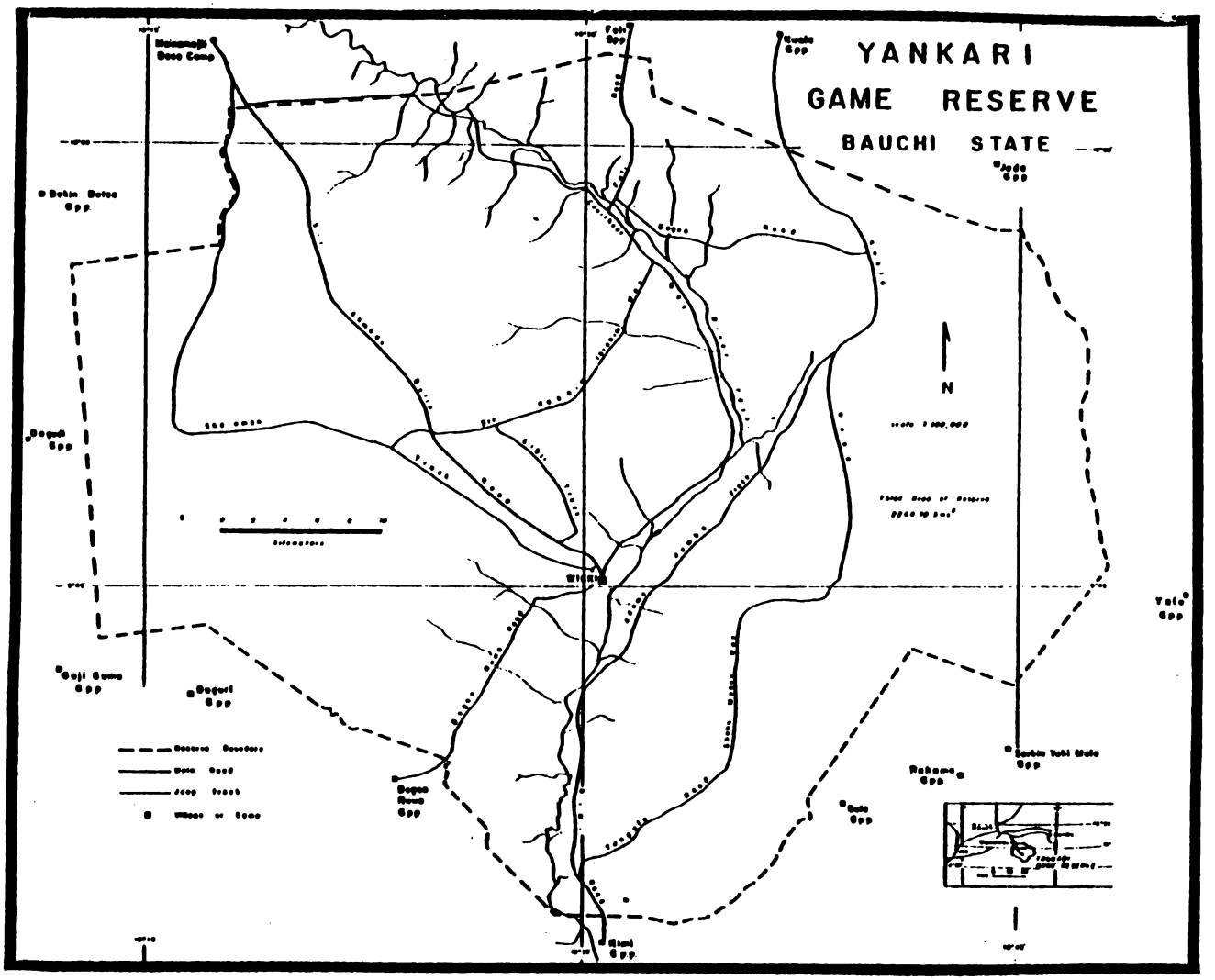


Fig. 2 Outline of the Yankari Game Reserve showing the boundaries

shrubs, tall annual forbs and tussock forming grasses. On the banks of the all-season Gaji and Yashi rivers occur relict broad-leaved evergreen forests. On the swampy flood plains, a mosaic of riparian vegetation types occurs.

The main source of water in the Reserve are a number of warm springs plus the Gaji and Yashi rivers. The Gaji river follows a non-ferruginished sandstone escarpment up to 30 meters high (Geerling, 1973). At eight points on the riverside sandstone cliff, perennial springs of clear, tasteless and slightly acidic (PH 5.4) waters emerge the year round at a temperature of 31° C (88° F). Of these only the Dimil warm spring shows much iron content (Sikes, 1964; Thomas and Sikes, 1971). Away from the rivers, waterholes occur. Normally these are dry between November and May.

The relative humidity may drop to under 10 percent during January. Between March and April temperatures range from 36° C to 38° C, with the mean maximum temperature of 19° C occurring in January, with a range of between 11° C and 14° C (Geerling, 1973).

In general, the soils of Yankari are deep and well-drained red sandy loams. Udo (1970) states that the Reserve lies on cretaceous rocks overlain by Teritiary sandstones and shales. Though sometimes described as

red ferralitics (Tomlinson, 1965), Bawden et al (1971) described the soils as leached ferriginons. Klinkenberg and Higgins (1970) reported them as undifferentiated ferrisols.

Soil erosion in Yankari at the time of study was not considered excessive. Vegetative destruction by animals, however, especially by elephants and warthogs, has resulted in sheet erosion in some areas and this may worsen so as to affect the habitats of the bigger ungulates. These include the western hartebeest (Alcelaphus major), West African savanna buffalo (Syncerus Caffer brachycerus), waterbuck (Kobus defassa), roan antelope (Hippotragus equinus), warthog (Phacochoerus aethiopicus), elephant (Loxodonta africana), and hippopotamus (Hippopotamus amphibus). Medium-sized ungulates in the reserve include the red flanked duiker (Cephalophus rufialatus), bushbuck (Tragalephus scriptus), gray duiker (Sylvicapra grimmia), and oribi (Ourebia oribi). The lion (Panthera leo), spotted hyena (Crocuta crocuta), side-striped jackal (Canis adustus), caracal (Felis caracal), hunting dog (Lycoan pictus), and leopard (Panthera pardus) are among the resident carnivores. Primates are represented by the baboon (Papio anubis) and the patas (Erythrocebus pata) and tantalus (Cercopithecus aethiops) monkeys.

Objectives Of The Study

As the first Game Reserve in Nigeria, the Yankari was selected for study in order to appraise the results of efforts to protect the biota. The investigation was undertaken:

a.) To measure range condition and trend in important wildlife habitats and thus provide a basis for later comparison.

b.) To determine whether wildlife had increased under protection and to ascertain current abundance levels and their relationships to vegetation.

c.) To study the attitudes of local residents towards the Game Reserve and to appraise the Socio-political aspect of management in the Yankari. It was also hoped to find out if poaching and other minor acts of vandalism evident in the area were related to public attitudes.

d.) To evaluate the overall success of the Yankari Game Reserve. This assessment would involve working with the constituted authorities of the Reserve and learning their attitudes, objectives and future plans.

The study was carried out in the Yankari Game Reserve between November 1976 and late May 1977. Participating in achieving the fourth objective were the Chief Game Preservation Officer, Alhaji Jibrin Jia;

Deputy Conservator of Forests, Mr. Abdul Lassan; Resident Game Warden, Stephen Haruna and the Anti-poaching Officer Mallam Mujinyewa.

CHAPTER I

VEGETATIVE STUDIES

Basically, the vegetation of the Yankari Game Reserve may be described as Burkea africana-Combretum glutinosum savana woodland. Trees typically attain heights of 13 to 20 meters, while grasses cover most unshaded soils. Keay (1949, 1959) classified the Yankari vegetation as Sudan savanna while Clayton (1957) referred to the region as the Sub-Sudan zone. Using Geerling's (1973) categories, seven different types were identified:

1. Afzelia Savanna Woodland:

   Involving the eastern and western portions of the Reserve (map 3), this type occupied about 40-50 percent of the total area. Trees ranged between 15 and 18 meters tall with girths of 0.7 to 1.0 meter. Afzelia africana and Burkea africana formed the upper tree stratum with the middle layer, dominated by Detarium microcerpum and Combretum glutinosum. At ground level, the perennial grasses Cymbopogon giganteus, and Andropogon gayanus during

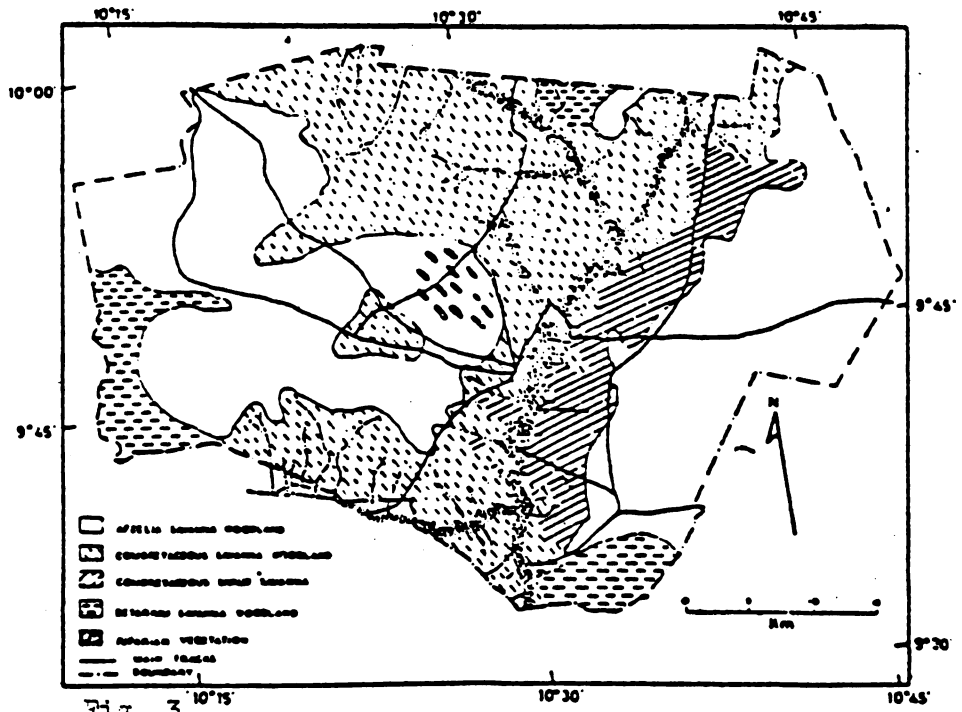


Fig. 3 : Yankari Game Reserve: Generalized Vegetation Map,

Source: Geerling,Chris,1973. The Vegetation Of Yankari Game Reserve,Nigeria:Its Utilisation And Condition.

the rainy season grew as tall as three meters. The major annual grass was Hyparrhenia involucrata.

2. Combretaceous Savanna Woodland:

Adjoining the western-most portion of the Afzelia africana woodland this open-canopy type extended from about ½ to 1 kilometer east of the Gaji river and to continue west of the river. The common trees were Burkea africana and Crossopteryx febrifuga. The canopy trees attained heights of 12 to 15 meters. Other trees included Anogeisus leicarpus, Detarium microcarpum, Terminalia avicennoides, Terminalia laxiflora, Combretum glutinosum and Combretum nigricans. In the lower stratum the dominant grass was Hyparrhenia involuerata with the grasses Andropagon ascinoides, Digitana gayana, Laudatia and Ctenium also present.

3. Combretuceous Shrub Savanna:

Found west of the Gaji river and bordering the Combretaceous savanna woodland, the dominant shrub was Combretum nigricans. Other tree species were Boscia salicifolia, Balanite aegyptica and Lannia spp. The tallest ones ranged between 6 and 9 meters. Hyparrhenia invobeerata and

Andropogan gayanus were the common grasses.

4. Detarium Savanna Woodland:

A more open savanna having Detarium microcarpum as the common tree, occupied the south-western portion of the reserve. Also found here were Combretum glutinosum, Crossopteryx febrifuga, Lannea, and Vitex spp. The trees attained heights of only 1.8 to 3 meters. The grasses were similar to those in the other areas but also included Andropogon ascinoides, Ctenium and Laudatia spp.

5. Pteleopsis habeensis Woodland:

Found in parts of the Combreteceous Savanna woodland along guillies and steep slopes, near rivers and along temporary tributaries were areas where Pteleopsis habeensis dominated. Co-dominant tree species included Adansonia digitata, and Diosporus mespiliformis. Dominant trees were 10-20 meters tall and formed an unbroken canapy. Croton zambesicus, Boscia senegalensis and Gardenia sokotoensis dominated the middle stratum. Grass density was extremely low. Only the shade-tolerant Digitaria longiflora occurred on the woodland floor along with Sanseviera liberica.

6. High Forest

Small areas of constantly wet soils supported broad-leaved evergreen trees, 25 to 35 meters tall. Forming an unbroken canopy was Uapaca heudelotti, Elasis guineensis, and Nesogordonia papaverifera. Middle stratum trees included Khaya ivorensis, Raphia Sudanica and Coffee spp. Because the forest floor was completely shaded no grasses occurred. Seedlings of Nesorgordonia papaverifera and Coffee spp. could be found on the forest floor.

7. Riparian Vegetation

Four vegetative sub-types occurred on the banks of the rivers Gaji, Yashi and the warm springs:

a. The aquatic herbs Marsilea spp, Azolla africana, Nymphaea lotus and micrantha, and Euphorbia spp were found in shallow marshes.

b. Considerable portions of the Gaji Valley were covered by tangles, 1 to 2 meters tall of Mimosa pigra and Jardinea congoensis.

c. Large areas of the Gaji river valley were predominantly covered by the sharp-leaved and nearly-impenetrable sedge Cyperus exaltatus. On the outer fringes of Cyperus

stands, the fern Cycloserus striatus and the sedges Rhychospora corymbosa and Fuirena umbellata were common.

d. An evergreen fig swamp along the Gaji river valley included Ficus congoensis and Alchornea cardifolia, along with major climbers Culcasia esculensis and Paulina pinnata and ferns Nephrolepsis and Pteris spp.

Methods

The vegetative study was conducted in accordance with the three-step method of range analysis (Parker, 1951). The stages involved were (a) the establishment of a series of transects in clusters, in selected characteristic areas representative of the vegetation types, with summarizations of data both from each transect and from the areas immediately adjacent, (b) an analysis of the entire clusters, with determination of the current vegetative condition and trend, (c) the photographic recording of (1) the general area of the plot to enable locating it later for comparison and range trend analysis and (2) the transect close-up showing plant details. Between three and eight permanently-located 100 meter line transects were established in each of the seven vegetation types. The photographic slide recordings of the vegetative conditions in 1977 in the different vegetation types can be obtained from the author

or in the departmental library of the Federal Department of Forestry in Ibedan, Nigeria.

The line transects were each marked by permanent cement beacons placed at their starting points. All transects in a cluster were laid in the same general compass direction. The maximum number of line transects in a cluster was four while the minimum was two. All transects were laid during the month of January 1977, and all data were tallied on the field after all necessary observations were made on a transect.

A 100-meter chain was stretched tightly between stakes and as close as possible to the soil surface. A metal ring 1.09 mm (3/4 inch) in circumference was dropped at each meter loop of the chain. At each of the 100 observation points, the ground cover was classified and tallied as vegetation, litter, rock, erosion pavement or bare ground.

Perennial grasses and weeds were recorded as 'hits' if the root crown or a portion thereof fell within the ring. In the rare cases where two or three plants of different species occurred within the ring, all were recorded. Recording was assisted by the use of species symbols.

After recording the presence of plants on a transect, the lengths of ten well formed leaves from dominant trees were taken as a measure of species vigor. These

were obtained from a 30.48 by 45.70 meters (100 X 110 feet) plot established around each transect, with the transect line forming the center-line of the plot.

Figure 3 shows the vegetation distribution and extent of each type in the Game Reserve. The locations of the transects by vegetation types are listed and marked on Figure 4.

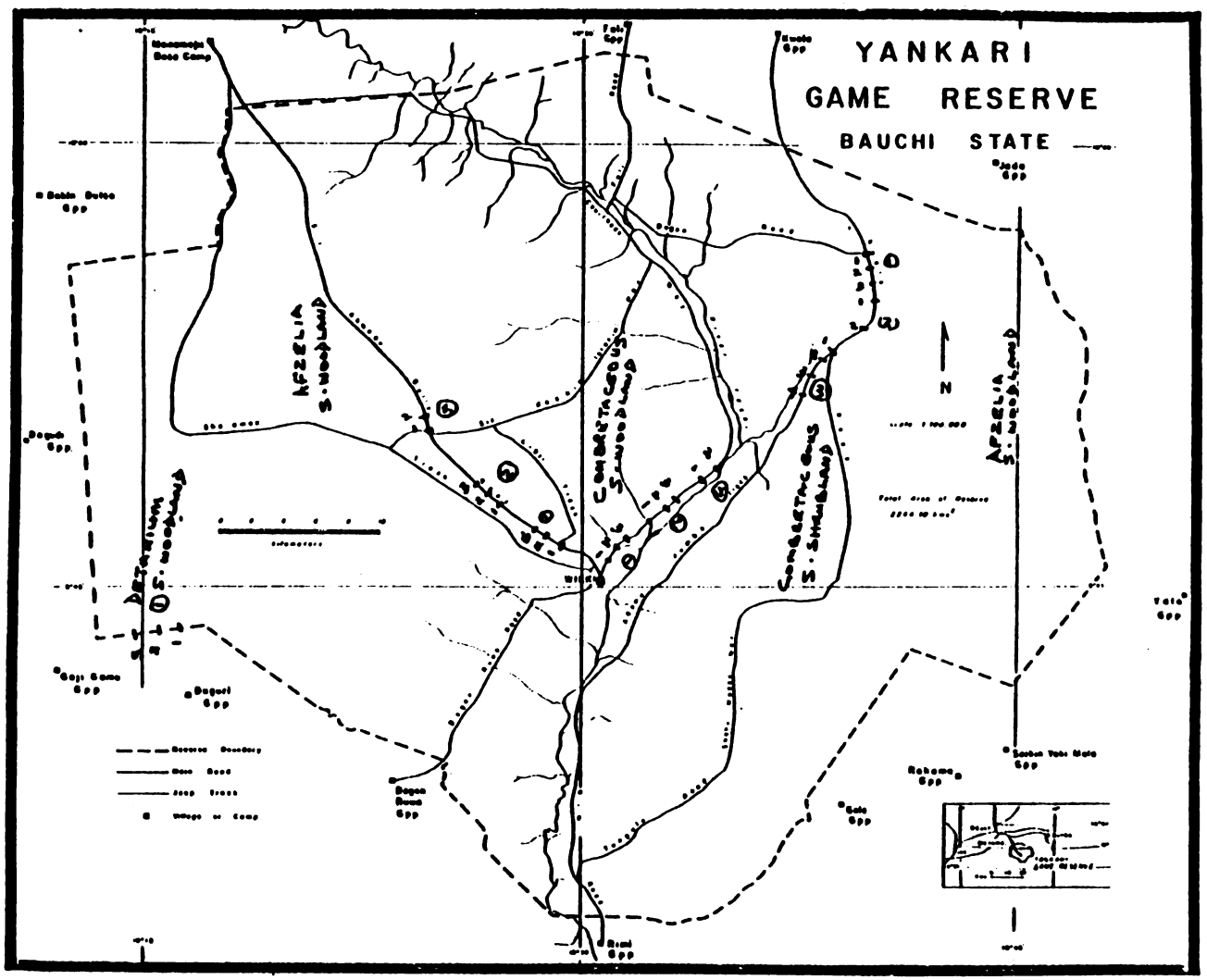
Afzelia Savanna Woodland

Eight permanently marked transects were established in three clusters, each transect being successively further north on Ahmadu Bello Way from Wikki camp.

Cluster	Transect Number	Starting distance (north of Wikki Camp)	Compass bearing
1	1	4.3 km	260°
	2	5.0 km	260°
	3	6.0 km	260°
2	1	9.0 km	98°
	2	10.0 km	150°
	3	11.0 km	120°
3	1	16.0 km	215°
	2	17.0 km	165°

Combretaceous Savanna Shrubland.

Eight transects were established in three clusters while moving successively south along Kwala/Adamu Jumba roads. The first transect was established at the intersection of Duguri and Kwala roads:



Map 4 Location of Transects and Their Starting Positions in Afzelia
Fig.4 Savanna, Combretaceous Savanna Woodland, Combretaceous Shrubland, and Detarium Savanna Woodland vegetation Types.

Cluster	Transect number	Starting distance from intersection	Compass bearing
1	1	0.0 km	300°
	2	3.0 km	320°
2	1	4.0 km	138°
	2	5.0 km	305°
3	1	7.0 km	311°
	2	8.0 km	311°
	3	9.0 km	235°
	4	10.0 km	235°

Combretaceous Savanna Woodland

Eight transects were established in three clusters while proceeding northward on Coulthad Way from the junction of Coulthad and Ahmadu Bello Ways. All transects began 100 meters from the road edge:

Cluster	Transect number	Starting distance from junction	Compass bearing
1	1	1.0 km	102°
	2	2.0 km	102°
	3	3.0 km	100°
2	1	5.0 km	350°
	2	6.0 km	312°
	3	7.0 km	337°
3	1	8.0 km	141°
	2	9.0 km	150°

Pteleopsis habeensis woodland:

Because this vegetation type had identical plant species in the several places it occurred, the only series sampled was sited two kilometers from Wikki Camp, east of Coulthad Way along Dabbon Maje track. Four transects all lying parallel to the woodland edge were established in the single cluster.

Cluster	Transect number	Starting position from woodland edge	Compass bearing
1	1	100 meters	150°
	2	200 meters	150°
	3	300 meters	150°
	4	400 meters	150°

Fadaman Maka (Riparian)

Three transects were established in this type using a common heading and starting from the eastern edge of the marsh.

Cluster	Transect number	Starting position eastern edge of fadaman	Compass bearing
1	1	100 meters	152°
	2	200 meters	152°
	3	300 meters	152°

Fadaman Barkono (Riparian)

This marshy waterway was near the Mawulgo warm spring. The first transect was started 200 meters from the eastern edge of the fadaman along a bearing of 216°. The other parallel courses were 300 and 400 meters respectively from the edge of the fadaman.

High Forest

The one sample of gallery rain forest surveyed was on the banks of the Gaji river, near the Guruntu bridge on the Macallacin Gaude track. Three transects were

established while moving north along this tract and starting from it.

Cluster	Transect number	Starting position from bridge	Compass bearing
1	1	200 m. So. of bridge	212°
	2	100 m. So. of bridge	238°
	3	200 m. No. of bridge	280°

Detarium Woodland

Three transects in one cluster were established. Each was located successively further south-west along Duguri Road and following a common compass bearing. They were sited as follows:

Cluster	Transect number	Starting position from Wikki on Duguri Road	Compass bearing
1	1	25.0 km	4°
	2	26.0 km	4°
	3	27.0 km	4°

Having collected all necessary data from the transects, the vegetation types were classified as either fair, good or excellent from the dual standpoints of forage production and soil stability. The vegetative condition was obtained from the following:

1. Composition (Vegetative)

The average percentage of the total plant density for each species in each cluster (Appendix 1A - 8) was determined and used in calculating the percentage of occurrence of plant species in each cluster.

Desirable species were those eaten by animals and forming a significant part of their diet. They had to have good soil-holding characteristics. Desireable species were identified from observations of feeding animals as supplemented by comments of Geerling (1973), and the GPU staff members who helped in this study. See Appendix 1A - 8 for the list of desirable species. Points for rating composition were assigned as follows:

a. Desirable perennials trees, shrubs, grasses and weeds made up to 70 percent and above of plant cover = 13-15 points.

b. Desirable perennials dominant and made up to 50-69 percent of cover = 9-12 points.

c. Desirable perennials formed between 30-49 percent of cover with intermediate group of perennials constituting over 60 percent of cover = 6-8 points.

d. Desirable perennials form between 5 and 20 percent of cover, with more intermediate species than desirable and both collectively making up from 35 to 60 percent of cover = 3 - 5 points.

e. Desirable perennials form less than 5 percent while low value undesirable species make up at least 65 percent of cover = 0.5 points.

(Source: Parker, 1951)

2. Forage Density Index

A forage density index was established to indicate the percentages of available forage. A score sheet was used in assigning points.

55-65 hits on a transect	= 9 - 10 points
45-54 hits on a transect	= 7 - 8 points
35-44 hits on a transect	= 5 - 6 points
20-34 hits on a transect	= 3 - 4 points
19 - 0 hits on a transect	= 0 - 2 points

(Source: Parker, 1951)

3. Vigor

The growth vigor of several tree specimens was obtained for dominant trees found near each transect. These were measured on 30.48 by 45.78

meter plots which were established with the transects as the center lines. The lengths of ten well formed leaves from each selected tree were measured and averages obtained. The minimum and maximum lengths of leaves for each species were used to form the rating bases. If the measured average leaf length of a species like Afzelia africana was 10 centimeters, and the minimum/maximum obtainable lengths were 10.1 and 15.24 cm respectively, then the leaf was rated at five points. Examples of the ratings of some leaves for the purpose of assessing vigor follow:

Combretum glutinosum Minimum/Maximum leaf length = 5.08 cm - 12.70 cm

15.24 cm +	= 9 - 10
12.70 cm - 15.24 cm	= 7 - 8
10.16 cm - 12.70 cm	= 5 - 6
7.62 cm - 10.16 cm	= 0 - 1

Detarium microcarpum Minimum/Maximum leaf length = 5.08 cm - 12.70 cm

15.24 cm +	= 9 - 10
12.70 cm - 15.24	= 7 - 8

10.16 cm - 12.70 cm	= 5 - 6
7.62 cm - 10.16 cm	= 3 - 4
5.08 cm - 2.54 cm	= 0 - 2
0.00 cm - 1.27 cm	= 0 - 2

Burkea africana Minimum/Maximum leaf length

= 1.27 cm-5.08 cm

5.08 cm +	= 9 - 10
3.81 cm - 5.08 cm	= 7 - 8
2.54 cm - 3.81 cm	= 5 - 6
1.27 cm - 2.54 cm	= 3 - 4
0.00 cm - 1.27 cm	= 0 - 2

Afzelia africana Minimum/Maximum leaf length

= 5.08 cm -15.24 cm

15.24 cm +	= 9 - 10
12.70 cm - 15.24 cm	= 7 - 8
10.16 cm - 12.70 cm	= 5 - 6
7.62 cm - 10.16 cm	= 3 - 4
5.08 cm - 2.54 cm	= 0 - 2

4. Current Soil Erosion

After critical observations in each plot, ratings were given for the prevailing status of soil erosion:

a. No evidence of soil movement = 13 - 15 points

b. Soil movement slight = 10 - 12 points

c. Soil movement moderate = 7 - 9 points

d. Soil movement advanced = 4 - 6 points

e. Soil movement severe = 0 - 3 points

(Source: Parker, 1951)

The index values obtained for erosion hazard and current erosion were summed to obtain soil stability ratings. Classes of stability were:

Excellent = 27 - 30 points

Good = 21 - 26 points

Fair = 15 - 20 points

Poor = 9 - 14 points

Very Poor = 0 - 8 points

Rating of Vegetation Types:

Having determined index values for composition, forage density and growth vigor for desirable and intermediate species, the sums of these data were used as a measure of vegetative condition in each type (Appendix 1A - 8). The classes of vegetative condition that were established were:

Excellent = 30 - 35 points

Good = 25 - 29 points

Fair = 20 - 24 points

Poor = 15 - 19 points

Very Poor = 0 - 14 points

Classification of Current Soil Stability

Current soil stability was judged upon two factors.

1. Erosion Hazard Index

   Defined as 100 minus the number of hits on erosion pavement, rock, litter, moss and vegetation. The basic data for the above were obtained from the ground cover index (Appendix 1A - 8).

   (Erosion hazard index; rate from 0 - 15 bases of ground cover index)

90 - 100 hits	= 14 - 15 points
77 - 89 hits	= 12 - 13 points
64 - 76 hits	= 10 - 11 points
50 - 63 hits	= 8 - 9 points
37 - 49 hits	= 6 - 7 points
24 - 36 hits	= 4 - 5 points
10 - 23 hits	= 2 - 3 points
0 - 9 hits	= 0 - 1 points

   (Source: Parker, 1951)

Using the values obtained for both the current vegetative condition and the current soil stability, the condition and trend in clusters were obtained. The results obtained from all clusters in a vegetation type were assumed to reflect the condition and trend of vegetation for the type. Analysis of the vegetation and

soil for each vegetation type enabled points and condition ratings to be assigned to each vegetative type.

The summarized data constitute Appendix I - 8 and the detailed observations are listed in Appendix II.

Results and Discussions

Afzelia Savanna woodland (Appendix 1A - 1C)

Cluster	Vegetative condition	Soil condition
1	30.0 (Excellent)	29.0 (Excellent)
2	31.0 (Excellent)	25.0 (Good)
3	30.0 (Excellent)	25.0 (Good)

Analysis indicated that the Afzelia vegetation type was in healthy status. The variation in soil condition was probably brought about by annual fires. Erosion pavement was absent here and other aspects of erosion did not constitute a problem. Both browse lines and invading non-indigenous plants were absent.

Combretaceous Savanna woodland (Appendix 2A-2C)

Cluster	Vegetative condition	Soil condition
1	27.5 (Good)	30.0 (Excellent)
2	32.0 (Excellent)	28.0 (Excellent)
3	27.5 (Good)	24.0 (Good)

The vegetation score showed a generally good condition, but signs of grazing and browsing by wild ungulates were evident. Some soils close to the Gaji river, showed signs of encrouching erosion pavement and early gully formation. No browse lines had been established and no evidence of invasion of bare ground by exotic species were seen.

Combretaceous Shrub Savanna (Appendix 3A - 3C)

Cluster	Vegetative condition	Soil condition
1	23.0 (Fair)	27.0 (Excellent)
2	25.0 (good)	26.0 (Good)
3	32.0 (Excellent)	27.0 (Excellent)

The wide range of vegetative scores indicated variation, within the type and was due to the lack of shrubs and a few grasses in some areas and their relative abundance in others. Tall grasses offered good soil protection. Erosion pavement was absent and there were no signs of colonisation by invading non-indigenous species. There, however, was evidence of a browse line on the shrubby Combretum nigricans, probably caused by roan antelope.

Detarium Woodland (Appendix 4)

Cluster	Vegetative condition	Soil condition
1	30 (Excellent)	28 (Excellent)

Shrubs and grasses provided adequate litter on the woodland floor. Erosion was absent. Browse lines also

were lacking, and there was no evidence of non-indigenous plant invasion.

Pteleopsis habeensis woodland (Appendix 5)

Cluster	Vegetative condition	Soil condition
1	20 (Fair)	13 (Poor)

The soil surface in this type was little vegetated. The well-drained, leached and loose sandy soil was susceptible to erosion, and erosion pavement was frequent. There were no browse lines, however, and no signs of invading non-indigenous plants.

High Forest (Appendix 6A - 6B)

Cluster	Vegetative condition	Soil condition
1	24 (Fair)	20 (Fair)

The large trees shaded the forest floor with their unbroken canopy. Despite the paucity of understory vegetation, the soil was stable. The tree canopy protected the soil, and the litter-covered forest floor showed no signs of erosion. Neither browse-lines nor exotics were present.

Fadaman Barkono (Appendix 7)

Cluster	Vegetative condition	Soil condition
1	35 (Excellent)	30 (Excellent)

Dominant grasses afforded excellent protection to the water-saturated soils and there were no signs of erosion or exotic plants. Browse lines were apparent,

however, especially on the dominant Jardenia Congoensis, induced by the large ungulates mainly.

Fadaman Maka (Appendix 8)

Cluster	Vegetative condition	Soil condition
1	32 (Excellent)	30 (Excellent)

Plant density, especially of the dominant Mimosa pigra, was high and contributed to the stability of the water-logged soil. There were no evidence of erosion nor of invading plant species. Browse lines were present on Mimosa pigra, a preferred forage of several species (see Chapter II).

BURNING PRACTICE

The vegetation of the Yankari is burned annually except for the floodplain which is moisture-laden the year around. Keay (1961) interpreted the vegetation of Yankari as a formally stable woodland degraded by fire. Burned-out trees, degenerating grass cover and burned-back stumps were indicative of severe and frequent fires. This is in contrast to the situation years ago when sparse population caused only occasional blazes.

After 1955, the administrative policy of the GPU was to burn late in the dry season in order to open up the vegetation. A few years later, however, this practice was changed to early burning (Keay, 1961; Riney and Hill, 1967), and this continues to be the practice. Under this

policy, the vegetation is burned while the browse and grasses are still partly green. The resulting mild fire does not adversely affect the woody vegetation but does impair food transfer and nutrient storage in perennial grasses.

When fires become a yearly event, as they are now, their eventual replacement by woody vegetation is encouraged.

The GPU has three reasons for burning the vegetation early and every year:

1. to make observation of animals easy during peak tourist seasons;
2. to stimulate the early growth of green grasses, and
3. to control animal parasites.

Controlled burning as a tool in careful vegetative management is not practiced in Yankari. Fires are allowed to burn uncontrolled and this results in vegetative degradation and in soil erosion, though not serious yet in Yankari.

Watershed Protection

The destruction of vegetation occurs naturally around water sources. It also is now induced on some hilly areas of the Reserve to make way for buildings and roads. This already constitutes a serious problem in the Reserve.

Silting in the Wikki warm spring and in the Gaji/Yashi rivers has become apparent. Erosion, though not yet serious and not considered a problem is becoming noticeable in areas where vegetation is sparse and in some portions of the Combretaceous savanna woodland where the soil is unstable.

Effects of Tourists

While driving into the Reserve, tourists are accompanied by game guards. They also are forbidden to walk in the Reserve, primarily to ensure their safety. To date they have had no evident effects on the vegetation.

Yankari is basically a forested landscape and vehicles can only move on the established game-viewing tracks. The GPU also forbids the removal from or introduction into the Reserve, of any plants whether indigenous or exotic.

Conclusions and Recommendations

The vegetative cover in most areas was found to be adequate and erosion is not considered to be a problem at this time. Isolated cases of erosion, particularly in the Combretaceous savanna woodland should be controlled, however, by planting the affected areas with more of the indigenous grass, tree or shrub species.

Vegetative destruction is highlighted by the pushing down of trees by elephants and possibly other animals. These changes plus the cutting of firewood is making forest alterations more apparent. These factors could have a serious effect on the vegetation in not distant future.

The Riperian vegetation, an essential part of the Yankari ecosystem and an important source of food for most of the local animals, is still in a relatively stable status, though exhibiting signs of optimum utilisation. The overall condition of the vegetation in the Reserve seems satisfactory and there is no immediate or emergency need for applying intensive range improvement practices. The indigenous plant species are doing well and no exotic plants were seen.

Control of fires during the late dry season should be intensified. Uncontrolled burning constitutes a danger to the vegetation of the Reserve. If fire-control measures continue to be lacking, the destruction that could ensue may be irreversible.

The GPU should establish a fire-fighting force and organize patrols and lookouts so as to spot and stop accidental fires. To stop possible further degradation of the vegetation and to ressucitate threatened areas, it might be advisable to stop wild fires and even to suspend controlled buring for a period of two to three

years. This will help to improve percolation and reduce surface soil run-off and erosion. If it is thought necessary to burn the vegetation, early burning in late November or mid-December would benefit both perennial grasses and woody plants. Fire breaks should be established and maintained especially during the dry season and before any burning starts.

To effectively utilize most of the vegetation of the Reserve and relieve the annual pressure on the Riparian vegetation every dry season, artificial waterholes and salt licks should be established away from the permanent water source. These should be established in such a way, however, that they do not lead to overuse of upland areas. Provision must also be made so that salt does not penetrate soils and so that impoundments can be drained.

CHAPTER II

ANIMAL STUDIES

INTRODUCTION

Despite the fact that animals were few when active protection started in 1955, many large and medium sized mammals were seen in large numbers during the Yankari study. The herbivores found in groups of 10 - 300 included the West African savanna buffalo, waterbuck, warthog, western hartebeest, roan antelope and African savanna elephant. Other common herbivores included the bushbuck and red-flanked duiker. These two species were nearly always seen in pairs and in river valleys. The hippopotamus also occurred in small water bodies and in tributaries of the Gaji and Yashi rivers.

The larger carnivores found in Yankari included the lion and spotted hyena. Somewhat smaller were the side-striped jackal and caracal. Though Geerling (1973) reported that hunting dogs occurred in small numbers, none was seen during this study. Neither were cheetah nor leopards seen nor were their tracks observed.

Animal Distribution

The Game Reserve can be divided into two major sections with respect to its animal inhabitants. The river valleys were wet all year and the Riperian vegetation was flooded during the rainy season. The uplands were dry during the rainless months from October to May.

During the rainy season, most animal species were widespread throughout the Reserve. Only waterbucks, hippopotami and bushbucks remain close to the flooded valleys. No portion of the vegetation was subjected then to heavy browsing or grazing. The grasses grew up to 3-4 meters tall.

During the dry season, the uplands became prone to fire. The grasses and other woody plants dried out and became vulnerable to the animals moving down to the river valleys in search of food and water. Despite the dryness, fire and inadequate food supply, animals like the roan antelope, baboons and warthogs tended to remain in this zone. A few western hartebeests, oribi antelopes and gray duikers also were seen. Because of their water and shade requirements, however, elephants and buffaloes did not generally stay in this zone during the dry season, but rather occurred in the river valley and surrounding areas.

Objectives:

The objectives of the animal study were:

1. to estimate the densities of each animal species observed by vegetation type;
2. to identify which animal species were associated with each of the various vegetation types, and
3. to determine the adequacies of food supplies for the animals.

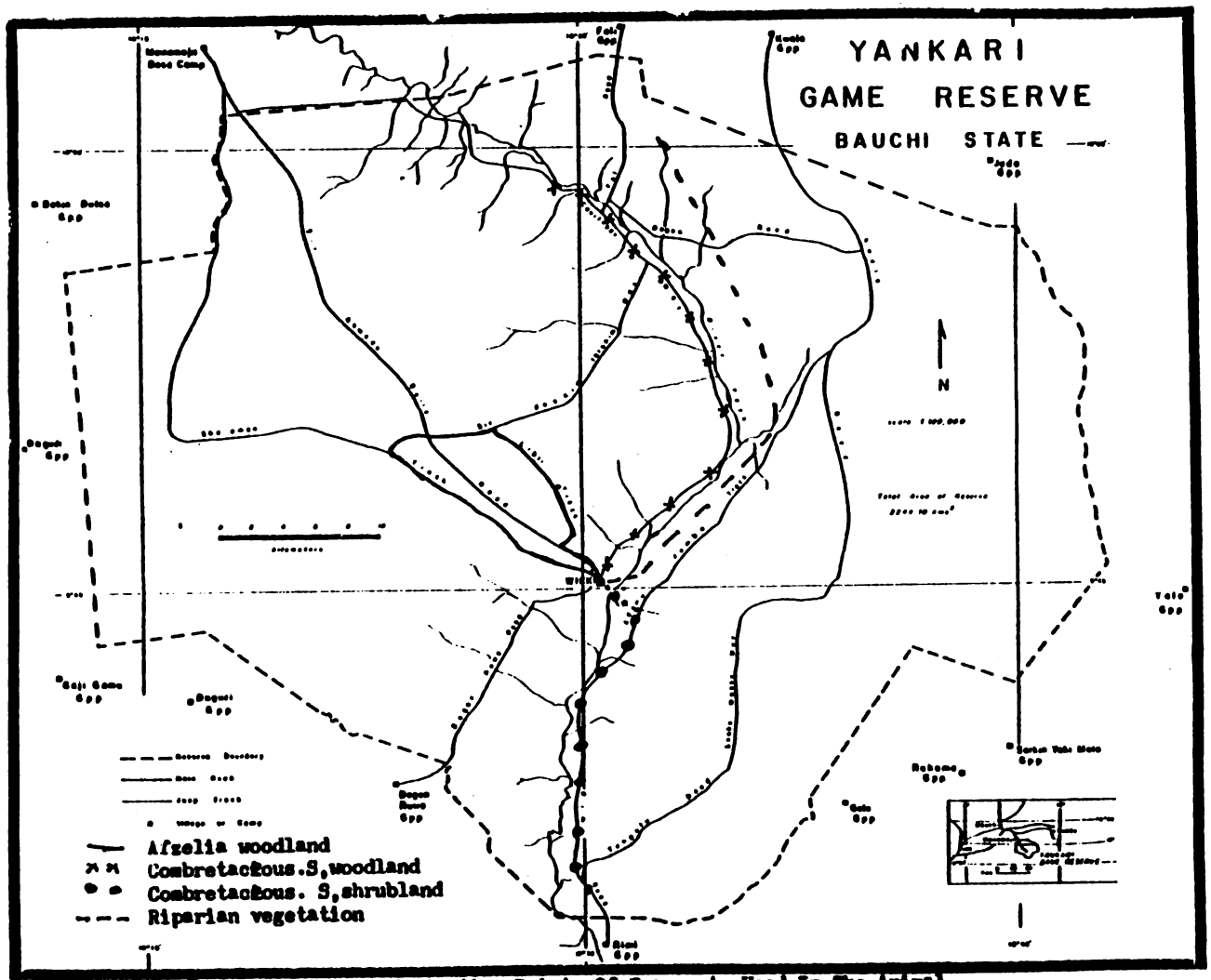
Methods

The animal survey was conducted over a period of three months on four transects each 30 kilometers long. Together, they traversed four major vegetation types. Each transect was followed on four different days and on each day one census count was made in the morning and another in the afternoon.

The transects were established after a reconnaissance survey of the Reserve. This survey was carried out morning and evening over four days in a vehicle cruising at 10 kilometers per hour.

Having determined the pattern of animal distribution and movement in the Reserve, four game-viewing transects were chosen:

1. Sherman/Kashim Ibrahim/Libji tracks - to cover the Afzelia savanna woodland east of the Gaji river.



Map 5. Location And Starting Points Of Transects Used In The Animal Study In Yankari Game Reserve.

2. Coulthad Way - to traverse the Combretaceous savanna woodland.
3. Dabbon Maje Track - to sample the Riparian vegetation and including some areas of high forest.
4. Macallacin Gaude/Rimi Road - initially to survey Riparian and Combretaceous savanna shrubland for about 5 kilometers, but after that to pass through Combretaceous savanna shrubland.

The modified Hahn's census method which involved cruising along a transect of predetermined width (see beyond) at 10 kph and counting the animals seen on both sides of the road was used.

Enumeration was carried out from the back of a Volkswagen Kombi which was provided with a platform elevated 2 feet from the floor of the vehicle. Standing on this platform increased the sighting distance by about 100-300 meters, thus making it possible to see 1000 meters on each side of the road in open areas and 500 meters in moderately open areas.

Transect counts were made between the hours of 7:00 to 10:30 a.m. and 3:30 to 7:00 p.m. (sunset)

Estimation of Transect Width

Determining strip widths involved stopping every 200 meters and having an assistant walk perpendicular to

the transect into the vegetation. Movement was continued in this direction, aided by a compass, until the white handkerchief carried in the hip pocket of the moving man was just visible. The distance between the starting and turning around points was measured by chain. This exercise was also carried out on each side of the transect over the entire 30 kilometer of each transect. The following average disappearing distances and areas were obtained for each of the transects.

Transect	Lengths (km)	Average disappearing distances (m)	Area
1	30	800	48 km^2
2	30	400	24 km^2
3	30	350	21 km^2
4	30	800	48 km^2

Counting the Animals

Buffaloes, waterbucks, western hartebeests, elephants and other gregarious species often moved in large groups that were difficult to enumerate. In such cases, the group was divided by imaginary lines into sections and each of the six crew members enumerated a section. If the group did not move off too quickly, attempts were made by each enumerator to obtain the total number of animals, after which counts were compared. This made it possible

to count accurately, even groups exceeding 200 animals without omissions or double counting.

The average number of animals seen per transect was determined for each vegetation type. The square-kilometer areas for each vegetation type were measured from a vegetative map (Map 3).

Afzelia savanna woodland (east of Gaji river)	= 560 sq. km.
Combretaceous savanna woodland	= 688 sq. km.
Combretaceous savanna shrubland	= 250 sq. km.
Riparian vegetation	= 130 sq. km.

The densities and population estimates for each animal species per vegetation type was obtained. The population estimate was obtained by multiplying the densities of the animal species with the area of the particular vegetative type where they occurred.

TABLE 1: NUMBERS OF ANIMALS SEEN, AND THEIR DENSITIES PER KM^2 IN THE AFZELIA SAVANNA WOODLAND, YANKARI GAME RESERVE, NIGERIA, 1977.

SHEHMAN/KASHIM IBRAHIM/LIBJI TRACKS. (TRANSECT 1)

DATES	8 FEBRUARY		7 MARCH		21 MARCH		4 APRIL		Density/km^2	
SPECIES	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
Baboon	18	0	22	0	0	0	18	5	0.30	0.03
Buffalo	0	3	5	3	6	0	4	0	0.08	0.03
Gray Duiker	2	1	3	3	1	1	0	2	0.03	0.04
Roan Antelope	5	10	6	10	5	14	9	7	0.13	0.21
Warthog	5	4	11	13	5	12	3	6	0.13	0.18
Waterbuck	0	5	1	0	0	0	0	0	0.01	0.03
Western Hartebeest	15	21	8	8	3	10	5	14	0.16	0.29

Census periods: Morning 7 a.m. - 10 :30 a.m.; Afternoon 3:30 p.m. - 7 p.m.

Areas: Transect 48 km^2; Vegetation type 560 km^2

TABLE 2: NUMBERS OF ANIMALS SEEN, AND THEIR DENSITIES PER Km^2 IN THE COMBRETACEOUS SAVANNA WOODLAND, YANKARI GAME RESERVE, NIGERIA, 1977

COULTHAD WAY (TRANSECT 2)

DATES	9 FEBRUARY		8 MARCH		22 MARCH		5 APRIL		DENSITY/km^2	
SPECIES	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
Baboon	29	35	45	29	25	18	32	45	1.36	1.29
Buffalo	6	5	482	0	150	2	5	151	6.68	1.65
Bushbuck	1	0	0	0	0	2	3	0	0.04	0.02
Elephant	0	4	0	0	0	0	6	0	0.06	0.04
Gray Duiker	2	0	0	0	1	0	1	0	0.04	0.0
Lion	1	0	0	0	0	0	0	0	0.01	0.0
Oribi Antelope	1	2	2	3	0	0	2	0	0.05	0.05
Red flanked duiker	0	1	0	0	0	2	0	0	0.0	0.03
Roan Antelope	3	10	6	4	15	16	10	10	0.36	0.44
Serval Cat	0	0	0	1	0	0	0	0	0.0	0.01
Spotted Hyena	1	0	0	0	0	0	0	0	0.01	0.0
Striped Jackal	0	0	0	0	0	0	0	1	0.0	0.01
Warthog	10	8	9	7	2	10	6	17	0.28	0.44
Waterbuck	24	0	41	44	57	41	61	46	1.93	1.36
Western Hartebeest	14	16	16	13	19	22	15	33	0.67	0.88

Census periods: Morning 7 a.m. - 10:30 a.m.; Afternoon 3:30 p.m. - 7 p.m.

Areas: Transect 24 km^2; Vegetation type 688 km^2

TABLE 3: NUMBERS OF ANIMALS SEEN, AND THEIR DENSITIES PER Km^2 IN THE RIPARIAN VEGETATION, YANKARI GAME RESERVE, NIGERIA, 1977

DARBEN MAJE TRACK (TRANSECT 3)

DATES	10 FEBRUARY		9 MARCH		23 MARCH		6 APRIL		DENSITY/Km^2	
SPECIES	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
Baboon	66	31	83	135	0	120	54	85	2.42	4.42
Buffalo	53	220	177	227	127	96	341	265	8.30	9.63
Bushbuck	3	0	6	8	4	0	2	1	0.18	0.11
Elephant	42	20	0	0	12	5	27	75	0.97	1.19
Gray Duiker	0	0	0	1	0	0	0	0	0.0	0.01
Hippopotamus	0	6	7	3	0	0	3	1	0.12	0.12
Lion	0	1	0	2	0	0	0	0	0.0	0.04
Red Flanked Duiker	1	1	0	4	0	0	0	0	0.01	0.06
Roan Antelope	0	0	4	0	8	3	10	0	0.26	0.04
Warthog	8	11	9	33	10	35	27	40	0.64	1.42
Waterbuck	33	68	4	132	24	182	74	200	1.61	6.91
Western Hartebeest	20	14	31	29	19	98	40	79	1.31	2.62

Census periods: Morning 7 a.m. - 10:30 a.m.; Afternoon 3:30 p.m. - 7 p.m.

Areas: Transect 21 km^2; Vegetation Type 130 km^2

TABLE 4: NUMBERS OF ANIMALS SEEN, AND THEIR DENSITIES PER Km^2 IN THE COMBRETACEOUS SHRUB SAVANA, YANKARI GAME RESERVE, NIGERIA, 1977

MACALLACIN GAUDE/RIMI ROAD (TRANSECT 4)

DATES	11 FEBRUARY		10 MARCH		24 MARCH		7 APRIL		DENSITY/km^2	
SPECIES	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
Baboon	43	35	25	45	35	50	50	55	0.80	0.96
Buffalo	34	157	40	23	63	25	12	122	0.78	1.70
Bushbuck	0	0	4	0	0	0	3	0	0.04	0.0
Elephant	0	0	0	0	18	36	7	50	0.13	0.45
Lion	3	0	0	0	0	0	0	0	0.02	0.0
Red Flanked Duiker	2	2	0	2	0	0	0	2	0.01	0.03
Roan Antelope	13	13	11	6	15	16	13	5	0.27	0.21
Gray Duiker	0	0	1	0	0	0	2	0	0.02	0.0
Warthog	2	9	8	5	11	10	10	3	0.16	0.15
Waterbuck	31	68	13	92	9	95	13	158	0.34	2.15
Western Hartebeest	22	10	26	30	11	14	18	22	0.40	1.15

Census periods: Morning 7 a.m. - 10:30 a.m.; Afternoon 3:30 p.m. - 7 p.m.

Areas: Transect 48 km^2; Vegetation Type 250 km^2

TABLE 5: TOTAL NUMBER OF ANIMALS COUNTED IN ALL TRANSECTS IN FOUR MORNING CENSUSES IN YANKARI GAME RESERVE, NIGERIA, 1972

	TRANSECTS				
SPECIES	1	2	3	4	TOTAL
Baboon	58	131	203	153	545
Buffalo	15	643	698	149	1505
Bushbuck	0	4	15	7	26
Elephant	0	6	81	25	112
Grey Duiker	6	4	0	3	13
Hippopotamus	0	0	10	0	10
Lion	0	1	0	3	4
Oribi Antelope	0	5	0	0	5
Roan Antelope	25	34	22	52	133
Serval Cat	0	0	0	0	0
Spotted Hyena	0	1	0	0	1
Striped Jackal	0	0	0	0	0
Red Flanked Duiker	0	0	1	2	3
Warthog	24	27	54	31	136
Waterbuck	1	184	135	66	386
Western Hartebeest	31	64	110	77	282

Totals are $\pm$ 2 standard deviation

TABLE 6: TOTAL NUMBER OF ANIMALS COUNTED IN ALL TRANSECTS IN FOUR AFTERNOON CENSUSES IN YANKARI GAME RESERVE, NIGERIA, 1977

	TRANSECTS				
SPECIES	1	2	3	4	TOTAL
Baboon	5	124	371	185	685
Buffalo	6	158	808	327	1299
Bushbuck	0	2	9	0	11
Elephant	0	4	100	86	190
Gray Duiker	7	0	1	0	8
Hippopotamus	0	0	10	0	10
Lion	0	0	3	0	3
Oribi Antelope	0	5	0	0	5
Roan Antelope	41	40	3	40	124
Serval Cat	0	1	0	0	1
Spotted Hyena	0	0	0	0	0
Striped Jackal	0	1	0	0	1
Red Flanked Duiker	0	3	5	6	14
Warthog	35	42	119	27	223
Waterbuck	5	131	582	413	1131
Western Hartebeest	53	84	220	76	433

Totals are $\pm$ 2 standard deviation

Results and Discussions

A few animal species especially the roan antelope, warthog and western hartebeest were found all over the Reserve in similar densities (Tables 1 - 4), indicating that they had no well-marked habitat preferences. Though a few buffaloes, elephants and waterbucks were seen in the drier areas of the Game Reserve, they were observed to prefer the wetter portions owing to their shade and water requirements.

More animal species were represented in the wetter area (for example Combretaceous savanna woodland and Riparian vegetation) than in the drier Afzelia woodland and the Combretaceous shrub savanna (Tables 1 - 4). This was likely due to the season of study. At that time, the dry area was completely burned and without forage except for small portions. The large numbers of waterbucks and buffaloes found in the Combretaceous shrub savanna (Table 4) was a result of water from the Yashi river being close for the first 5 kilometers of transect.

Generally, there were more animals seen in the afternoons than in the morning (Tables 5 and 6).

In the upland dry Afzelia savanna woodland, the animal species with the highest densities per square kilometer included baboons, warthogs, roan antelopes and western hartebeests (Table 1). On moving closer

to the water body in the Combretaceous savanna woodland buffaloes, waterbucks, bushbucks and elephants became frequent as the Riparian vegetation increased (Tables 2 and 3).

The animal population in Yankari Game Reserve evidently was on the increase. This seemed apparent from the vegetation in the fadaman areas which, though still in good condition, showed signs of increased grazing and browsing. In addition, more animals were seen during this study than during earlier visits by the author in 1972 and 1974. Beliefs that ungulates had increased in recent years also were expressed by the GPU staff and the villagers residing close to the Reserve (see beyond in Chapter III).

Animal Use Of Vegetation

Both the quantity and quality of food available in the Reserve depends on the season. During dry months, most of the grasses are burned and the unburned ones become dry. The deciduous trees shed their leaves and remain leafless for about 1 to 2 months. Only the perennial grasses maintain growth at this time. The annuals and most herbs do not appear until the rainy season is well underway (Geerling, 1973).

In the savannas, continuous growth occurs only on the deeper and well-developed soils generally on flat

lands of the Afzelia and Combretaceous savannas (Geerling, 1973). In the Combretaceous savanna shrubland, lack of moisture prevents the growth of plants, especially the grasses, during the dry season. Long before the rains start in May/June, however, new grasses flush and the trees produce new leaves.

During the dry period, the larger herbivores and especially the buffaloes ate much dry grass and also the young shoots of green grass which grow after burning. Aromatic grasses which included Gymbopogon giganteus were often unpalatable at this time (Geerling, 1973). Balanite egypticus, found in both the savanna shrub and woodlands and young succulent leaves of Afzelia africana, were extensively consumed by elephants and roan antelopes. Andropogon gayanus tussocks also were extensively utilised by large herbivores. Andropogon ascinoides and Laudetia arundinacea which occurred in large quantities in both the Combretaceous shrub and woodlands seemed to be preferred foods of the western hartebeest.

In the floodplain, where the moisture content of the soil was high all year round and fire had no regulating influence on the vegetation, the most extensively utilized plant species were Jardinea congoensis and Mimosa pigra. Animals seen feeding in tangles of these species included elephants, waterbucks, western hartebeests, roan antelopes,

warthogs, bushbucks and hippopotamus.

Both Jardinea and Mimosa continued to do well despite heavy browsing and grazing pressure. This may have been helped by the annual floodings during which these plants were not used.

Aquatic plants contributed considerably to complement the diet of large herbivores. The aquatic sedge Rynchospora corymbosa was intensively grazed by buffaloes, which also were observed feeding on the herb Potomageton octandrus and the grasses Sacciolepis africana and Acroceras amplectens. Warthogs extensively utilized the aquatic fern Marselia spp and in the sedge meadows a mixture of fine-leaved sedges were eaten heavily by waterbucks, warthogs, buffaloes, baboons and tantalus monkeys (Geerling, 1973)

Predator Abundance

From historical accounts, the Game Reserve had been moderately stocked with several species of carnivores. Most of these were ultimately reduced to near-extinction by hunters who valued animal skins like those of lion, leopard and cheetah. Men who killed the large predators were and still are regarded with awe. They thus established respected position in their communities. The skins of lions, leopards and cheetahs are highly prized possessions

in Nigeria and are in great demand.

Of the carnivores assumed to occur in the Reserve, the lion is not often seen. The largest number seen in a pride during the study was three. Leopard activities were reported often by the villagers, but neither the animal nor its tracks were observed. Cheetahs were reported to be present, but none was seen. Hunting dogs were known (Geerling, 1973) to occur in four parks of seven individuals each and civets were believed to be relatively common near Rimi village. The hyena population was reported by villagers to be on the increase. Both striped and spotted hyenas were said to be relatively common.

Coulthad, the first manager of the Reserve, undertook a trek in 1956 that covered both the northern and southern sides of the Gaji river. He wrote then (in Sikes, 1964) a report that "no lion or leopard tracks were seen, which is rather surprising, considering that there is ample food for them in the way of bushbucks, duiker and warthog. I do not think that either lion or leopard are common at all in this reserve." In his April to June 1960 report (Sikes, 1964) he remarked that 14 sheep had strayed into the Reserve near the village of Fali and had emerged unscratched ten days later at Dogon Ruwa village. Later unpublished observations by other workers and visitors to

Yankari also advised that the population of carnivores was low in relation to the amount of available food. The situation in 1977, however, seemed to have improved. During the period spent in Yankari, calls of carnivores identified as lions, hyenas, jackals and hunting dogs were clearly heard during the night. Lion footprints were seen early one morning. The footprints observed on that occasion far outnumbered the number actually recorded during the later censuses.

Sighting lions in the Reserve during the dry season was difficult because their fur blended completely with the golden brown colors of the grasses and dried leaves. Fresh kills of both young and old buffaloes, waterbucks, warthogs and roan antelopes were encountered often during the study, however, and indicated the probable considerable increase in the large carnivores, especially lions. Reports from the villagers of increased sighting of hyenas and jackals closely also indicated that the Yankari predator population is increasing.

While the provision of artificial dens might help the predator population to increase in Yankari, it is more likely that as in other African and world Reserves (Petrides, 1957) predator numbers are controlled by dominance relationships among the carnivores themselves.

All the predators observed during the study, seemed to be healthy and free of infections thus suggesting that the low population was due neither to disease nor insufficient food.

Migration

Except for local seasonal movements within the Reserve the animals of Yankari seemed rather sedentary. During the rains, animals were found all over the Reserve except on the submerged floodplain. In the dry months, however, animals tended to be concentrated on the floodplain and near the river. This brought about heavy grazing and browsing pressure especially on Mimosa pigra and Jardinea Congoensis.

In years gone by, the animals in Yankari may have migrated for longer distances. If so, however, their migration routes have been cut by the establishment and growth of villages across them.

Buffer Zones

Because the Reserve is surrounded by villages the GPU found it necessary to insulate the Reserve from them by establishing buffer zones. Around the villages of Rimi, Dogon Ruwa and Mainamaji, the buffer zones extend for about 1 to 2 kilometers beyond the boundary of the Reserve towards the settlements. Near Gaji, Duguri and

Birkin Dutse, the buffer zone extends 0.5 to 1 kilometer from the reserve boundary.

Generally, however, animals were not seen within the area 3 to 5 km from the Reserve boundaries. Presumably, they were disturbed by farmers and hunters near the boundaries even though they were in the Reserve. Parts of the buffer zones adjacent to the settlements are now farmed, too bringing the farmers closer to the Reserve.

Effects of Pesticides

At the time of the study, Yankari had a high incidence of tse-tse fly, and this resulted in visitors occassionally but sparingly using pesticides while there. At times some researchers used a negligible amount of pesticides to keep off flies and insects while they worked. Efforts were being made, however, to control the tse-tse fly population biologically by the Institute of Trypanosomaisis Research. Also the GPU sprayed all vehicles entering or leaving Wikki camp for the purpose of reducing the tse-tse flies there.

General use of pesticides have never been encouraged at Yankari and they have not constituted a problem yet in the Reserve. The effects of the minimal pesticide use have not been studied.

Effects of Tourists on Wildlife

Most of the animals in the Reserve are used to people and are not shy. They would run, however, when people came close. The baboons, especially, were used to tourists and the workers in the camp. They did regularly visit the restaurant and often were fed by visitors. This induced familiarities with humans has led the 2 to 3 baboon families that have their territories around Wikki camp to attack domestic livestock, children and workers in the camp on several occassions. Sanitary workers in the camp especially were targets of attack in the mornings when they collected household garbage. Apart from this, there have been few problems between the tourists and the animals. Yet it is evident that the "taming" of wild animals by tourists may make it necessary that overly-familiar individual animals to be destroyed in order to prevent injuries or more serious consequences.

Conclusions and Summary

The best time to observe the animals in the Reserve would be in the late afternoons during the dry season when most of them are near water sources either feeding or drinking. Low animal counts should be expected then in both the Afzelia woodlands and the Combretaceous savanna shrubland at this time of year.

The red-flanked duiker, bushbuck, waterbuck, hippopotamus and elephants tended to become more evident in the Riparian vegetation type. All other animal species were found all over the Reserve indicating no particular attachment to any special habitats. From personal assessment based on earlier visits to Yankari, related accounts from both the GPU staff and the villagers, and the feeding pressure evident on the vegetation, the animal population in the Reserve has maintained an upward trend.

There were no sudden increases nor decreases in numbers among the different animal species during the study period, thus ruling out an cases of immigration into the Reserve.

Judging from Coulthad's earlier accounts and personal observation of the author, the predator population is also on the increase. Though not many predators were seen during the day, their activities at night were noted from calls and abundant footprints, especially of lions.

Both pesticides and visitors have not had any great effects yet on Yankari animals or vegetation.

A study should be made to ascertain which animal species once occurred in Yankari, but have now become extinct there. If any species are identified as being locally extinct while their habitats are neither degraded nor occupied by other species, attempts at restocking

should be considered.

Creating of artificial dens to augument the existing ones might be tested to determine if they help to increase the predator population in the Reserve.

Given the rather small sample area used in this study, and considering the limited time available and the time of year study was carried out, no very strong inferences can be drawn on the densities per square kilometer obtained for each animal species for each vegetation type. Repeated counts on the same areas, over a period of years, however, together with further vegetation analysis could provide more concrete information on the population trend of the animal species.

CHAPTER III

ATTITUDE OF THE LOCAL PEOPLE TOWARDS THE GAME RESERVE; PRIVATE RIGHTS AND PRIVILEGES AND THEIR EFFECTS ON NATURE PRESERVATION.

Yankari is surrounded by villages some of which were located inside the boundaries of the Reserve in earlier days. Occupants of these villages often had some rights to lands now within the Reserve. Some residents were professional hunters, while others had farmed areas around the rivers. Their eviction and the inconveniences they still suffer from being unable to live, farm and hunt there has antagonised them toward the GPU.

Since the reserved areas for forests and game in Nigeria typically were established with no consideration for the well-being, opinions and convenience of the people that owned the land, it was thought that a survey should be designed to determine the attitudes and reaction of the people to the Reserve.

Study objectives were:

1. to identify areas of friction between the villages and the GPU and to ascertain how to solve them,

2. to determine how the Reserve can best help the villagers, and thus restore their confidence in the GPU, and
3. to secure cooperation from the villages regarding information on poaching and minor vandalism apparent in the Reserve.

Methods

Twenty-nine(29) questions (Questionnaire 1) were designed to determine villager reaction and to estimate the Reserve's chances of future success. The questionnaire dealt with the personal characteristics of the villagers sampled, their attitude towards the Reserve, and their relationships with the GPU. Each question was provided with 2 to 5 alternative answers from which choices could be made, but which would restrict the interviewees from rambling and offering irrelevant answers.

In order to randomise the sample, it was planned that on arriving at a village, the occupants of every third house on the right and every second home on the left hand side of the main village street would be identified. Efforts would then be made to interview all adults older than 20 years. Unfortunately the Moslem religion forbids entry of strangers into the homes of married people. Due to this restriction, procedures were modified so that the entire available village population was interviewed at

the same time.

Of 22 possible villages, the nine chosen for study were Birkin Dutse, Dogon Ruwa, Duguri, Gaji, Gale, Kuka, Mainamaji, Rimi and Yashi. These were selected because they were close to the Reserve boundaries, were suspected to be involved in poaching, or showed sympathy toward poachers. They were accessible to the investigator and contained over 40 adult men each.

On arriving at a village an audience was requested with the Serkin (village chief) through one of his counsellors. After the purpose of the visit was explained, he would send out messengers to different parts of the village summoning those at home to his court. Because of Moslem restrictions, it also was impossible to interview women. Responses to questions therefore were only from males. They were divided by age groups to avoid the traditional reluctance of young persons to speak up before their elders. The age categories were:

Group 1 - 20 to 30 years

Group 2 - 31 to 50 years

Group 3 - 51 years and over

Only in Gaji village, where they were more than 35 elders, did the size of any age group exceed 20.

Working with three Hausa-speaking members of the GPU, each age group in succession was asked a question. All

possible answers were read to them and their responses tallied. The data are summarized in Questionnaire 1 with the responses for each village tallied in Appendix III.

Results and Discussions

Of the 563 persons interviewed, 463 (82 percent) indicated that they liked the Reserve, 50 (9 percent) said they did not like the idea of its existence and the remaining 50 persons expressed indifference to it. In Rimi village, where all the interviewees claimed to be professional hunters, everyone expressed indifference to it. In Gaji, all claimed to be farmers yet there was a 50 percent opposition to the Reserve. This could be interpreted to mean that the group opposed to the Reserve really wanted to hunt there. In all other villages sampled there was a 100 percent response in favor of the Reserve.

As to what they would have preferred in its place 378 of the 563 interviewees (67 percent) opted for agricultural establishments. 150 (27 percent) preferred industrialisation. Although 80 percent had said that they liked the Reserve, only 150 (27 percent) wanted the Game Reserve kept as it was. One must doubt therefore, the general approval of the Reserve which was first stated.

304 out of 563 persons interviewed had worked in some ways for the GPU. The villages that had benefitted finacially from the Reserve included Sira/Yashi, Dogon Ruwa, Kuka, Gale and Mainamaji. About 80 percent of the GPU labor force came from these areas.

Contracts for the construction of roads, drifts, culverts and some residential house in Yankari were often awarded to workers of these communities. As based on conversations with Yankari's assistant game warden Stephen Haruna, most of the other villages had gained nothing from the Reserve. The inability of these places to benefit from the Reserve was attributed to their hostile attitudes to the Reserve and to their more remote locations.

During the study, the deprived villages did not hesitate to express contempt for the Reserve and its management. The GPU for its part, regarded these villages as hostile, uncooperative and had taken no measures to curtail possible friction. Reducing such conflicting differences could facilitate control of poaching and such vandalism as setting fires in the Reserve.

202 persons (36 percent) in the sample population claimed to have lost portions of their farms to the Game Reserve. This claim was common in the villages of Sira/ Yashi, Birkin Dutse, Gaji, Gale and Kuka. The villagers of Gaji especially felt bitter about their losses and were

hostile to the GPU. 101 persons (18 percent) claimed to have lost livestock and grazing lands to the Reserve while only 62 interviewees (11 percent) said that they had lost farm products. 152 persons (27 percent), surprisingly, did not lose anything to the Reserve.

All who claimed losses said that no compensation was offered. If outstanding records substantiated their claims, it would be well even now to pay compensation. This would contribute in great measure to arresting dissatisfaction.

Rather than work for the GPU or other organizations, 450 interviewees (80 percent) said that they would prefer to intensify their farming activities and to sell their farm products to Reserve visitors. 113 persons (20 percent) indicated that they would prefer to work for the GPU.

Farming was preferred because most of those interviewed were illiterate people with large families to support. Crop production would earn them much more than their GPU wages.

534 persons (95 percent) of the number interviewed owned more than five hectares of land, and some even had more than 100 hectares. The limiting factor to food production in this area evidently is soil fertility rather than land shortage. Many of the people could weave or carve and their finished products sold as

souveniers to tourists also could earn them appreciable sums.

Asked whether they had trapped or hunted in the Reserve, 439 persons (78 percent) admitted having done so. 540 interviewees (96 percent) agreed that if they had to hunt, it would be solely for meat to eat. It seemed evident that if the Reserve could increase its wildlife herds and produce cropable meat, it would have a saleable commodity and also help to control poaching. Population build-up of reserve wildlife, however, must come first.

Only 191 persons (34 percent) of those interviewed indicated that they would report a game violation to the GPU. 247 interviewees (44 percent) let him go regardless and 50 persons (9 percent) would even show the poacher the best way to escape. In other words, 371 (66 percent) of the interviewees would not cooperate with the GPU to report poachers even when they knew of them.

The reasons advanced by most villagers for their reluctance to act were that they probably would not be armed while the poacher in all cases would be. They stood a good chance of being killed if they showed even the slightest tendency to intrude in the poacher's affairs. They also felt that reporting a poacher would disrupt the solidarity of the villages whether or not the reported poacher was from their village or another

one.

Situations such as these are often very difficult to reverse. The most obvious ways to neutralise the conspiracy between the villages is for the GPU to intensify its patrolling of the Reserve and to hire paid informants among the villagers. The villagers of Duguri even claimed that they would like to report poachers to the GPU. This response does not conform, however, with their local reputation and to their resistance to the Reserve and the GPU. (Because of this discrepancy, one must question whether their other responses were truthful).

264 (47 percent) of the persons interviewed wanted monetary compensation for reporting a poacher, 90 (16 percent) would prefer to share the meat with a poacher and have nothing to do with the GPU and 11 persons (2 percent) wanted permission to collect firewood, thatch, or fish and to graze their livestock inside the Reserve as their price for cooperation. 202 persons (36 percent) said they would report the poachers to the GPU without demanding compensation, but would only demand it if they had spent money to collect the information.

If the boundaries of the Reserve were to be extended, probably force would be required to move the people. 447 (79 percent) would refuse to move and would be ready to fight if need be. Another 112 (20 percent)

would demand and require that they receive compensation before they would leave. Only 11 (2 percent) of those interviewed would move peaceably. It seems most improbable that Reserve boundaries could be extended except by decree and this would be very disadvantageous to the Reserve and the GPU.

Asked whether the animal population was increasing in Yankari, all the villagers answered in the affirmative indicating that there had been remarkable population growth in the last decade. In Kuka, the villagers complained about constant disturbances by hyenas and baboons. In Rimi, they talked about threats to their livestock by leopards. Other animal species believed to have increased considerably included the western hartebeest, waterbuck, roan antelope, warthog and lion.

The chances of any animal returning safely to the Reserve from the adjoining farmland seemed quite remote. 501 persons (89 percent) said they would trap, kill or cripple any individual that strayed onto their property. Only 28 persons (5 percent) would report the crop destruction on their farms and hope to claim compensation. 11 persons (2 percent) would scare the animal away and 22 interviewees (4 percent) said they would invite hunter friends to kill the animal.

These tough decisions were motivated by a shortage of meat in a society that used to enjoy an abundant supply before the creation of the Reserve. They felt that they had little chances of being paid compensation by the GPU, if they reported animal intrusion and damages to them.

On whether the people were ready to give up their current engagements and work for the GPU if required mandatorily, 450 (80 percent) of the people said they would only work for the GPU if there were nothing else to do. 112 (20 percent) would under no condition accept employment from the GPU. Resentment against the GPU was especially severe in Rimi and Gaji villages, where nobody would work for the organisation even if forced to do so.

Asked if employed by the GPU whether they would be available for emergency duties, 450 persons (80 percent) said they would respond. In both Rimi and Gaji, where they claimed they would refuse employment offers from the GPU, no one would respond to emergency demands.

101 people (18 percent) admitted being moderately well treated, while 352 interviewees (62 percent) held the GPU treated them very well. But 110 persons (20 percent) from the villages of Duguri and Rimi, said the GPU treated them very poorly.

The villages of Duguri, Gaji and Rimi were completely dissatisfied with the GPU. The level of understanding between these groups needs badly to be improved. For their mutual benefit especially that of the GPU, these villages known to be sympathetic towards poachers should be better treated.

On how the GPU could improve on its relationships and the villages, 336 interviewees (60 percent) wanted the GPU to help them obtain farming aids, improved seeds and fertiliser from the Ministry of Agriculture and Natural Resources. 143 persons (24 percent) suggested more and better-paying jobs for the people while 79 persons (14 percent) mainly from Gaji, wanted permission to exercise some privileges such as fishing, thatch and firewood collection and hunting in the Game Reserve.

422 interviewees (75 percent) would welcome the establishment of new Game Reserves and national parks, provided they were not located in their areas. 141 persons (25 percent), comprising interviewees from Duguri, Gaji, and Rimi Villages, did not see the need for creating more reserves and parks in the country. They suggested reducing the areas of the existing ones, and redistributing the freed portions of land to farmers.

Asked why the need to reduce the areas, they responded that the land within the Reserve was more fertile

and would yield more food. This attitude might be modified by teaching improved soil management techniques to the farmers.

All of the interviewees would permit tourists to visit their areas. They suggested that they had numerous activities with which to entertain the tourists when and if they came. They felt that the GPU should arrange to have the villagers bring their entertainment to the visitors camp and thereby afford them the chance to derive additional income.

Local/Private Rights And Privileges In Yankari Game Reserve And Their Effects On Nature Preservation.

Only GPU employees can exercise privileges in the Reserve. These involved the collection of thatch, firewood and the use of an area close to Wikki camp as a burial ground, especially for children.

Firewood collection was intensive in Yankari and has initiated some soil erosion, but mainly only near Wikki camp. Thatch collection is normally carried out in the late dry season. Because the grasses are dead, thatch collection has no effect on available forage and only reduces the amount of shade available to the animals in the hot dry season. On the other hand, it aids in the reduction of fires in the Reserve.

QUESTIONNAIRE 1

Questionnaire for the Determination of the Reaction of 563 People Living Around the Game Reserve and the Future Chances of Success of the Yankari Game Reserve, Nigeria (with questions 9 - 29 Percentages of Response April to May, 1977

1. Name - not used

2. Sex (a) M (b) F = 563

3. Occupation?
   (a) Farmer (510)
   (b) Hunter (50)
   (c) Civil Servant (3)

4. Number of Children?
   (a) less than 5 (310)
   (b) more than 5 (253)

5. Approximate size of land owned?
   (a) 1 - 5 Hectares (30)
   (b) 5 Hectares and more (533)

6. Level of education?
   (a) Literate (5)
   (b) Illiterate (558)

7. State of origin - Bauchi

8. Number of years of occupancy in present area of domicile.
   (a) 1 - 5 years (0)
   (b) 5 - 25 years (40)
   (c) 25 - 50 years (300)
   (d) 50 and above (223)

9. How do you feel about the existence of this Game Reserve here.
   (a) I like it. (82%) of 563
   (b) I do not like it. (9%) of 563
   (c) I could not care less. (9%) of 563

10. What would you have preferred in its place?
    (a) An agricultural establishment (67%)
    (b) An industry (6%)
    (c) Open up the area to the villagers to farm (0%)
    (d) None of the above (27%)

11. Have you derived any benefits from the Game Reserve?
    (a) Monetary gain (54%)
    (b) Material gain (0%)
    (c) None (46%)

12. Have you lost anything because of the Game Reserve being where it is?
(a) Livestock (18%)
(b) Portions of land (36%)
(c) Farm products (11%)
(d) None of the above (27%)
(e) All of the above (9%)

13. What opportunities do you think will be open to you when tourist industries are fully established?
(a) None (0%)
(b) Make more money by selling your agricultural products (80%)
(c) Opportunity for employment by the GPU (20%)

14. Do you have any side occupation or hobby like carving, weaving, that you can practice for more money when the product is sold?
(a) No (22%)
(b) Yes (78%)

15. Have you trapped animals or hunted in the Game Reserve?
(a) Yes (78%)
(b) No (22%)

16. What did you trap for if you had to trap
(a) Meat for food (96%)
(b) Meat to sell for money (1%)
(c) For the skin (0%)
(d) To prevent crop damage (2%)
(e) For items needed by a native doctor for the preparation of medicine or juju? (0%)

17. If you saw any violators or poachers in the Game Reserve, which of these would you do?
(a) Report him to the GPU (34%)
(b) Let him go (43%)
(c) Show him the best way to escape (9%)
(d) Pretend as if you did not see him (14%)

18. What type of compensation would you expect if you had reported him?
(a) Monetary compensation (47%)
(b) Some privileges (to exercise some rights) in the game reserve (2%)
(c) Part of the booty confiscated from the poacher (0%)
(d) To benefit the reserve (36%)
(e) Share meat with poacher (11%)

19. Assuming that the boundaries of the Game Reserve are extended, which of these would you do if you were to be relocated?
(a) Move peacefully (2%)
(b) Demand compensation before moving (20%)
(c) Refuse to move (78%)
(d) Demand control over certain things in the old place, and insist on exercising the rights you had prior to this (0%)

20. Do you think that the population of the animals in this Game Reserve has declined or increased in the past ten years? (100%)
    (a) Which species have declined?
    (b) Which have increased?

21. If they have declined, what are the causes you think are responsible?
    (a) Poaching
    (b) Degradation of habitat by the people
    (c) Indifference on the part of the GPU towards the welfare of the animals
    (d) Migration
    (e) Disease

    Not Used

22. If any of the animals strayed into your farm from the Game Reserve which of the following would you do?
    (a) Report to the GPU and claim compensation (5%)
    (b) Just scare them away (2%)
    (c) Kill, trap, or cripple the animals (89%)
    (d) Call a hunter friend to kill them. (4%)

23. Are you ready to give up what ever you are doing now and work for the GPU?
    (a) Yes (80%)
    (b) No (20%)
    (c) Have not thought about it. (0%)

24. If you are employed to work by the GPU, would you be available to spend some time away from your family in other parts of the Game Reserve on routine patrol duties and during emergency?
    (a) Yes (82%)
    (b) No (18%)
    (c) Can spend not more than two days away from home (0%)

25. How do you think that the GPU is treating the people in the surrounding villages?
    (a) Very well (66%)
    (b) Moderately well (15%)
    (c) Poorly (20%)

26. What changes in their attitude do you suggest? (Not Used)

27. In what ways could the GPU treat the people better?
    (a) Farming aid (62%)
    (b) Permission to exercise previous rights (14%)
    (c) Employ people in the game reserve (24%)

28. Do you think that additional Game Reserve and national parks should be established?.....Why or why not?
    (a) Yes (75%)
    (b) No (25%)

29. Are you happy to have tourists visit your area?
(a) Yes (100%)
(b) No (0%)
(c) I really do not care about tourists. (0%)

Status of Other Man-Made Structures and Buildings in the Reserve and Their Effects on Nature Preservation.

The continuing danger facing the Yankari ecosystem is destruction of vegetation to prepare sites for buildings and access roads. Recently, about 20 hectares of vegetation were destroyed to create space for the visitors' chalets annexes and a conference hall.

The GPU cannot control this expansion since it is only responsible for animal welfare and game viewing trips. The Yankari Game Reserve is managed and operated by a consortium including the Ministries of Social Welfare, Commerce and Cooperatives, Health, Works and Education. Each ministry pursues its own objectives. The Ministry of Works, for example, decides where to locate a building and in most cases with no consideration for the ecology of the Reserve.

Currently the Wikki camp covers between 2 and 3 square kilometers, and further expansions are envisaged. The elementary school which in 1972 operated in a single building, now has three plus a soccer field. With continuing increase in enrollment, more buildings will be needed soon. The Moslems have three places of worship inside the camp and a new Central Mosque has been added recently. The Christians also have a church in the camp. The Ministry of Health operates a large dispensary and a maternity ward also in Wikki camp. Okafor, (1972,

unpublished) discussed problems of human interference and expansion in Yankari, and the situation in Wikki camp continues to develop towards the predictions.

Vegetation on the loose, porous and sandy soil bordering the immediate hilly catchment area of the Wikki warm spring was destroyed to make way for a conference centre. No drainage system was constructed to accomodate the rainfall run-off. Following these and earlier abuses of vegetation in the immediate vicinity, the depth of the warm spring is being adversely affected by silting.

Buildings, roads and other man-made structures markedly are hampering nature preservation in Yankari Game Reserve. Unless limited, the objectives of the Reserve will be defeated.

Summary, Conclusions and Recommendations

To provide for an improved and better understanding between the villagers and the GPU, and for the future success and progress of the Game Reserve, the following should be considered for implementation by the GPU:

1. Distribute employment opportunities equally among the villages surrounding the Reserve. Construction contracts should be equitably awarded to capable contractors.

2. In order to reduce tensions and to promote goodwill, the Ministry of Agriculture and Natural Resources should provide a tractor pool in Yankari, which would be used in road maintenance within the Reserve and also at a nominal charge in cultivating farm lands for the villagers.
3. Roads should be improved on feeder routes between the villages and Wikki camp. This would:
   (a) help the farmers move their products to market,
   (b) help the GPU with border patrols, and
   (c) benefit maintenance on GPU vehicles.
4. Any plans to extend the boundaries of the Reserve should be implemented only after careful review. Disturbances and civil disobedience could result to the detriment of the Reserve.
5. Conservation education classes should be started. Especially, those should involve motor vehicle visits to the Reserve and the use of visual aids. It should be aimed at educating the local people on the need for conservation and the benefits that can be derived from an established and well-managed

game reserve. This program should be extended more widely as it develops.

6. Whenever possible, poacher kills should be recovered, processed and sold to villagers at some distance from the Reserve. If sold locally, poaching could be encouraged.
7. If the natural ecosystem is to be maintained at Yankari, further visitor development within the Reserve should be stopped immediately. A site, preferably near the Reserve border (perhaps at Mainamaji base camp) should be acquired to substitute for the housing, eating and recreational facilities.
8. The warm spring should be open only for daytime swimmers. The GPU should start a bus shuttle system between the new camp and Wikki. This would reduce traffic inside the Reserve and help limit road kills which are beginning to become apparent.

Apart from the ecological advantages to be derived by moving Wikki camp from its present location other advantages include extending such facilities as dispensary and maternity services, good drinking water, electricity supply and good schools to be available to some nearby villages. Making these amenities accessible to the

villages will indicate to them the better quality of life possible through cooperation to get Yankari fully established. Also locating the GPU offices nearer some of the villages would promote a better understanding between the villagers and the Reserve staff.

CHAPTER IV

WILDLIFE VIEWING VERSUS VISITS TO WIKKI WARM SPRING, AND LOCAL/NATIONAL BENEFITS AND DISADVANTAGES OF TOURISM

A study was carried out during the Christmas/New Year/ Easter, peak tourist seasons in Yankari to determine the major reasons for people coming to the Reserve. A total of 1000 visitors between 15 and 61 years of age (Table 7) was randomly chosen by interviewing every fifth visitor met in Wikki camp.

Visitors were asked whether they mainly came to see the animals, swim in the warm spring; both to see the animals and swim, or to relax and get away from the city.

Results showed that about 85 percent came mainly to see the animals. Game viewing was found to be a major attraction especially for visitors between the ages of 15 and 60. Those over 60 were more interested to relax, to get away from the city and to swim in the warm spring.

Exactly two-thirds of the sample were visitors from Britain, Canada, Denmark, France, Germany, India, Sweden and the United States. This confirmed the 1968 observation of the Nigeria Tourist Association that the main flow of

true domestic tourism is generated by the foreign residents within Nigeria.

Of the 200 Nigerians in the visitor sample, 195 came principally to see the wildlife and secondarily to swim in the warm spring. Their ages ranged between 25 to 50 years.

Local/National Benefits and Disadvantages of Tourism

Though Nigeria cannot be considered today as a world tourist center, it is none the less rich in tourist attractions. Among these is the Yankari Game Reserve which between October and December of 1976 catered to some 8000 visitors (Yankari Visitor's book, 1976).

In addition to the Wikki warm spring and the wildlife, the Reserve has several unique features that can be expected to widen its appeal to tourists. Among these are the Sir Gwain Gell falls (though now dried up and used not long ago as a den by lions), the Abandoned Site of the historic village Sherman and the 132 disused Dukki wells. The wells are similar to those made today by the Fulanis along the southern edge of the Sahara. There are also excellent scenic routes with hills that can be used for game viewing.

In 1966, 16,878 visitors came to Nigeria (Nigeria Tourist Association, 1968), but less than one percent of

TABLE 7: REASONS GIVEN BY TOURISTS FOR VISITING YANKARI GAME RESERVE, NIGERIA, DECEMBER 1976, JANUARY AND MAY, 1977

		Percentages Selecting Alternatives			
Age Category	Number	A (Animals)	B (Swimming)	C (Both)	D (Relaxing)
15-30 years	240	100	10	65	0
31-45 years	525	90	15	85	12
46-60 years	210	60	30	75	10
Above 60 years	25	8	60	10	70
Total	1000				

them made any attempts to see the country's wildlife, (Holsworth, 1970). The situation now, however, is different as more people from home and abroad are becoming aware of both Yankari and also the Kainji National Park (the former Borgu Game Reserve).

Though the publicity given to Yankari is not adequate (as was confirmed by visitors who claimed only to have known about Yankari from earlier visitors), it still attracts a modest number of tourists. At the present time, Yankari does not have enough and adequate infrastructure for handling all the tourists who came there. Holsworth (1970), indicated that, among all the Game Reserves in Nigeria only Yankari, somehow, was equipped to handle tourists.

The development of new towns and tourist class hotel close to some Reserves has changed the tourism picture in Nigeria. But there is still a great need for:

1. an enlarged advertising program, particularly at the points of entry into the country and in the hotels catering to overseas visitors,
2. adequate internal transportation system to move tourists about, since most do not have a means of mobility once in the country, and
3. adequate hotels, camping and recreation facilities at tourist location.

Countries that have advanced in managing their wildlife resources for tourism and have developed the basic and necessary infrastructure attract both local and foreign visitors and earn large revenues from tourism. In Kenya, 225,000 tourists who primarily came to view African wildlife produced an industry worth 24.4 million Naira ($45.5 million) in 1966, (Denny, 1967). In both Kenya and Tanzaria, tourism based on game viewing was the largest foreign exchange earner except for all agricultural products combined. Mitchell (1968), reported that Kenya earned revenue equal to 29 million Naira ($52.2 million) annually, while Hall (1972) reported a 60 million Naira ($108 million) income annually for Kenya from wildlife-related tourism. In the four years 1968-72, there was more than a 200 percent increase in earnings from tourism in the East African Country. He indicated also a high potential for further growth there.

About 200,000 people are employed in Kenya by the different tourist-motivated industries such as airlines, hotels and souvenire shops (Ajayi, 1972). Tanzanian Development Plan (1970) reported that more than 40,000 people visited their national parks, that they had 10 to 15 percent annual growth in tourism, and that about 6 million Naira ($10.8 million) were spent in the national parks-related services during 1968.

When Yankari Game Reserve is fully established it is expected to have earning powers similar to most of the East African National Parks. If well managed, the expectation is that Yankari can attract between 25,000 and 35,000 visitors annually. These might well include investors who might desire to establish industries in Nigeria if they discover potential markets for their products.

Nigeria's greatest problems since the civil war ended in 1970 have been unemployment and food shortages, especially of meat. A well-planned and managed Yankari could help to alleviate these problems (Okafor, 1973). If properly administered, it could attract tourist-related industries that offer employment to many. These could include weaving, carving and knitting industries which would offer employment and income to the local people.

Although the benefits to be derived from tourism are considerable, there are disadvantages. The most serious would be the possible introduction of exotic diseases, and the initiation and proliferation of alien, normally-unacceptable cultural characteristics. These problems are not apparent yet in Yankari, except for minor acts of vandalism and littering.

The benefits accruing from tourism outweigh its disadvantages both locally and nationally. If Yankari

can be properly managed, the area close to it and the country as a whole stand to gain from the tourism it can attract.

CHAPTER V

EVALUATION OF THE PROGRESS AND LIMITATIONS IN YANKARI GAME RESERVE

Protection of wildlife immediately followed the creation of the Game Reserve in 1955. Since then the few animals that were left seem to have responded favorably. One is now able to be sure of seeing certain animals in specific habitats at specific hours. The objectives of the GPU still to be accomplished in Yankari are:

1. to protect, conserve and build up the animal population for the benefit of present and future generations,
2. to develop the area economic and recreational tourism,
3. to disseminate information concerning the reserve and conservation objectives to the public,
4. to preserve a portion of the natural heritage in the Reserve,
5. to manage some population possibly for meat production if surplus numbers develop.

Physical Developments

Jeep track construction was the first physical development in the Reserve. Based on information supplied by selected hunters, these tracks were constructed to pass through game concentration areas for the few animals that were still left.

Visitors' Camp

The camp was initially to be located at Gar Mainamaji. Due to hostility of the villagers, however, the idea was abandoned and Fali village was chosen. When Mr. Coulthad, the first manager of the Reserve died, the visitors' camp at Fali was abandoned due to logistic reasons.

In July of 1969, Althji Jibrin Jia was invited to head the Reserve. He had earlier helped to establish some game patrol posts in the villages of Dogon Ruwa, Duguri and Rimi, and also in the construction of the Ahmadu Bello Way which passes through Mainamaji to the Wikki camp. The construction of the game patrol posts and the Ahmadu Bello Way were sound decisions that have contributed immensely to the success of the Reserve.

When Wikki was designated the visitors' camp, structures necessary for housing and catering to the visitors were established. This building in the heart of the Reserve has now become a source of great concern to the people

with modern ideas concerning the composition of game reserves and national parks. Alhaji Jibrin Jia, now the head of the GPU indicated that expansions in Yankari had gone beyond the expected amount and should be limited or completely stopped. Despite this opinion, further expansions have been approved and the GPU does not seem to be in a position to stop them.

Planlessness has been the order in establishing buildings inside the Reserve. Visitors' bungalows that were erected some years back, now present, both environmental and hygienic problems. Their nearness to one another also does not encourage privacy for the occupants. They constitute both an eyesore and high fire risks. Their demolition should be considered.

The extreme human interference in the Reserve also hase resulted in noise pollution. Furthermore, animals such as baboons now move and invade the camp looking for food. These animals are erroneously considered to be "tame" and harmless by many visitors. This increases the chances for accidents and disease transmission. The refuse disposal method and the bucket toilet system found in most of the old bungalows also leave a lot to be desired and must be improved on.

Poaching

The GPU does not consider poaching in Yankari a serious management problem. Their anti-poaching staff unfortunately even treat the matter with levity. The GPU believes that poaching is mainly carried on for subsistence by the local people. This assumption may not, however, be correct. More poaching probably goes on in Yankari than is reported or documented. The assumption of a low poaching rate may be responsible for the improper attention to anti-poaching efforts in Yankari.

Regardless of the officially-expressed opinions on this issue, poaching in Yankari is not only assuming wider and graver dimensions but also is taking a sharp rise. While undertaking research in the Reserve, a number of snares were recovered from the bush and some contained carcasses. It seems likely that reported cases of poaching in Yankari may represent 50 percent or less of the number of actual instances. Very few arrests are made. Poachers probably get away with their booty and leave before they can be detected.

The anti-poaching unit in Yankari can best be described as primitive and mostly ineffective. Apart from its not being well organized it lacks both equipment and trained personnel. The GPU had taken steps to curtail poaching by establishing 23 game patrol posts around the

Reserve. But it failed to provide the unit with the necessary equipment, manpower and adequate training effective to combat poaching. The unit has only one Land Rover to patrol a Reserve of 2274 square kilometers. Even, that one vehicle must be shared with the administrative staff during the last two weeks of each month in order to pay workers in out-stations.

Despite these inadequacies, poaching in Yankari is not yet out of control. Inevitably, however, it will constitute a serious problem. The prevention of a major problem in the near future demands attention at once.

Conservation Education

The majority of the local inhabitants around Yankari have little or no education and they may find it difficult to comprehend what conservation is all about. The GPU does not currently operate any program in conservation education. Mr. Abdul Lassan, the deputy chief of forests, says that the effects of conservation education are indirectly applied to poachers when they are cautioned and released or jailed. But his method gets only to an insignificant portion of the population and without much success.

The GPU proposes to start a conservation education unit and youth club program soon through which the teachings of conservation will be spread to the local people. If

this is indeed accomplished, the classes should lay strong emphasis on the socio-economic benefits that can accrue to the people rather than only preach the esthetic values of conservation.

Training Program

Staff training is not a major program in the GPU because:

1. most GPU staff members do not possess even the basic education to enable them to proceed toward higher or special training,
2. staff members with basic training in wildlife management could not be spared for further training,
3. most junior and intermediate staffs who are trained, then resign to seek better-paying jobs , and
4. the Ministry of Agriculture and Natural Resources does not allocate funds for training purposes to the GPU

Research

Most of the research that has been carried out in Yankari has been by private individuals with no ties to the GPU nor the Game Reserve. Even where their findings were available to the GPU, the results were either not implemented due to lack of funds and personnel or were

unacceptable to the management. Mr. Abdul Lassan indicated that within the unit, research does not have any priority because of insufficient funds, materials and qualified personnel. He advised that research findings have played no part in the management of the Reserve and neither have they contributed to its progress and success this far.

Control

The GPU headquarters is located at Bauchi, some 112 kilometers away from the Reserve. All important decisions concerning the Reserve are made there. The Yankari assistant warden, Stephen Haruna, is responsible for daily operations in the Reserve, but he is responsible to the chief game preservation officer for any decision. He cannot take immediate, important and necessary decisions without consulting with the Bauchi Office, and their main link with him is a worn-out and mostly inoperable radio transmitter. For efficient running of the Reserve and administrative convenience, a better communication system should be provided. The assistant warden should also be delegated the power to take decisions on matters of immediate needs.

In view of the fact that the GPU has not used most of the modern wildlife management techniques considered

important and also has not implemented any research findings apart from offering protection to the animals, the Yankari Game Reserve has done exceptionally well in taking care of itself. The protection and other efforts put in by the GPU staff for the progress of the Reserve must be given credit. Without the efforts of the GPU, the Reserve probably could not have come this far.

Conclusions, Summary and Recommendations

Being one of the newer and better known Reserves in West Africa, Yankari can be managed to attain standards equivalent to those in both East and South African Reserves. The Yankari has not been involved in any irreversible managemental errors. The IUCN standards should be reviewed and the Yankari should plan to be designated and managed as a national park.

A few matters that require immediate attention, for the continued success and progress of Yankari, include the following:

1. the formation of a central managing body to be designated "The Board of Management of Yankari," to make decisions on operational and managemental matters affecting Yankari. This board should be granted its own official seal and the permission to seek both material and technical assistance

from international bodies, organisations and governments.

2. All other ministerial units operating in Yankari should be dissolved and their duties assumed by the board.
3. The composition of the board should be the responsibility of the Federal Commissioner for Agriculture who should work closely with the chief wildlife officers in deciding who should serve on the board.
4. The federal government should embark on further staff developments in wildlife management and make money available to the GPU for the training and appointment of intermediate and junior staff.
5. The promulgation of a wildlife preservation law, which would establish modern and effective operating conditions for all the Game Reserves and National Parks in the country is desirable.
6. The establishment immediately, as a matter of priority a division of conservation education within the Federal Department of Forestry and the GPU. This division is to be responsible for publicising Yankari and other Reserves not only to Nigerians but also to the people of the other nations.

7. The organization of research in all aspects of reserve management. Results and research findings should be implemented for the benefit of the Reserve.
8. The eventual establishment of a veterinary unit as a part of the research effort in the Reserve, to provide care in the event of visitor accidents especially in case of an epidemic within the animal population.
9. The adequate funding of the GPU to enable the purchase of necessary equipment including adequate vehicles, communication accessories and animal-immobilising guns and chemicals, necessary for the successful management of the Reserve.
10. The discontinuance of Wikki camp and its movement to a new location, perhaps close to Gar-Mainamaji.

Given improved management, Yankari Game Reserve can become a leading Reserve and tourist attraction. It can become a "living Museum" and tourist attraction of both world and national value.

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LITERATURE CITED

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APPENDIX IA

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment AFZELIA WOODLAND District YANKARI Cluster No. 1

Date 1/16/77 By C.KAGEL, E.T. No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. Hits*	Av.%of Total Plant Density	Intermediate	Av.No. Hits*	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
Bur-11	6	8.82	Bu-28-15-9	17.33	25.48			
Af2-5-5-3	4.3	6.23	C-11	11	16.19			
Dte-1-2	1.5	2.20	D-11-2-5	6	8.82			
Tg-5	5	7.35	Cm-1-	1	1.47			
And-14-32	2.3	33.82	Sc-1	1	1.47			
Cmg-4-2	3	4.41	Sc-11-2	6.5	9.55			
Ta-4	4	5.93	Cm-1-	1	1.47			
Cmo-2	2	2.94						
Total		71.02	Total			Total		

*List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	Average
Bare soil	8	16	7	
Erosion Pavement	—	—	—	
Rock	—	—	—	
Litter	27	27	11	
Moss	—	—	—	
Browse Density	62	57	32	
Index Total	180	180	180	
Forage Density Index	65	57	32	
Shrub Cover Index	12	54	13	
Overstory	3	6	4	
Understory	62	57	28	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
AFZ	3.03	5.64	5.24	4.64
BUR	1.51	1.5	1.54	1.52

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	10
Composition	15
Vigor	5
Total	30

SOIL STABILITY

Erosion Hazard	15
Current Erosion	12
Total	27

Condition Class EXCELLENT

Current Trend Up__ Down__ Static__

Condition Class EXCELLENT

Current Trend Up__ Down__ Static__

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX IB

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment AFZELIA WOODLAND District YANKARI Cluster No. 2

Date 1/16/77 By OKAFOR. E.C.J No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. Hits *	Av.%of Total Plant Density	Intermediate	Av.No. Hits *	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
Af2-3-	3	5.50	Syt-1	1	1.83			
Hyp-51-38	4.5	51 6.5	Ccc-1	1	1.83			
Cro-4-3	3.5	6.42						
Bur-2	2	3.66						
Afz-2-3	2.5	4.58						
Cmg-1	1	1.83						
Ip-1	1	1.83						
Total			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	Transect No. 2	Average
Bare Soil	16	25	
Erosion Pavement	—	—	
Rock	—	—	
Litter	21	29	
Moss	—	—	
Plant Density	63	46	
Index Total	100	100	
Forage Density Index	63	4.6	
Ground Cover Index	84	76	
Overstory	8	5	
Understory	55	41	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
AFZ	6.20	6.00	5.66	=5.7
BUR	1.5	1.46	1.5	=1.4

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION		SOIL STABILITY	
Forage Density Index	9	Erosion Hazard	13
Composition	15	Current Erosion	12
Vigor	7	Total	25
Total	31		
Condition Class	EXCELLENT	Condition Class	GOOD
Current Trend Up__ Down__ Static__		Current Trend Up__ Down__ Static__	

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX IC

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment AFZ-LIA (west half) District Yampa Cluster No. 3

Date 1/19/77 By Okafor, Ec J. No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. Hits *	Av.% of Total Plant Density	Intermediate	Av.No. Hits *	Av.% of Total Plant Density	Undesirable	Av.No. Hits	Av.% of Total Plant Density
Fb-2-1	1.5	2.63	SC-1-1	1	1.75			
Bur-1-1-2	1.33	2.33	D-11-	11	19.29			
Cmg-3-2	2.5	4.38	Mb-1	1	1.75			
Hyp-41-5235	43.66	76.54	Ar-1	1	1.75			
Cmn-1-1	1	1.75						
JS-1	1	1.75						
Afz-2	2	3.50						
Grs-4	4	7.0						
Total			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	Average
Bare soil	26	12	18	
Erosion Pavement	—	—	—	
Rock	—	—	—	
Litter	24	23	25	
Moss	—	—	—	
Plant Density	50	65	56	
Basal Total	100	100	100	
Forage Density Index	50	65	56	
Ground Cover Index	74	88	81	
Overstory	6	2	4	
Understory	74	63	68	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	Average
AFZ	5.5	5.0	=5.25
BUR	1.25	1.0	= 1.13

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	5
Composition	15
Vigor	7
Total	20

Condition Class EXCELLENT

Current Trend Up__ Down__ Static__

SOIL STABILITY

Erosion Hazard	11
Current Erosion	14
Total	25

Condition Class GOOD

Current Trend Up__ Down__ Static__

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 2a

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment COMBRETACEOUS SAVANNA WOODLAND District YANKARI G.R Cluster No. 1

Date 1/20/77 By OKAFOR. E.C.J. No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. * Hits	Av.%of Total Plant Density	Intermediate	Av.No. * Hits	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
Cmn-2+1-8	14.33	22.62	Hmb-2-1	1.5	2.47			
Amb-24-5	17	28.02	Xa-4	4	6.59			
Cte-2-7-2	3.66	6.03	D-2-4	3	4.49			
Bur-2	2	3.29	Ag-1-3	2	3.29			
Fp-1	1	1.64	Cam-2-1	1.5	2.47			
TL-3	3	4.94	Dig-2-1	2.1	47.84			
Smg-2	2	3.29						
Stp-1	1	1.64	Wi-1	1	1.64			
Cyb-8	8	13.18	Cav-19	19	31.32			
			Sr-5-1	3	4.94			
			Total			Total		

* Show only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	Average
Bare soil	9.0	15.0	21.0	
Erosion Pavement	—	—	—	
Rock	—	—	—	
Litter	24	30	24	
Moss	—	—	—	
Plant Density	62	65	55	
Index Total	100	100	100	
Forage Density Index	62	65	55	
Ground Cover Index	91	85	79	
Overstory	16	11	13	
Understory	46	54	42	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
Cro	4.02	3.98	3.0	=3.67
Bur	1.50	1.50	1.50	± 1.57

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	10
Composition	9
Vigor	8.5
Total	27.5

SOIL STABILITY

Erosion Hazard	15
Current Erosion	15
Total	30

Condition Class Good

Current Trend Up__ Down__ Static__

Condition Class EXCELLENT

Current Trend Up__ Down__ Static__

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 2B

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment COMBRETACEOUS SAVANNA WOODLAND District YANKARI G.R Cluster No. 2

Date 1/20/77 By OKAFOR E.C.J No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. Hits*	Av.%of Total Plant Density	Intermediate	Av.No. Hits*	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
And-21-12-5	12.66	[illegible]	Ady-2-	2	[illegible]			
Cmn-17-16-8	13.66	[illegible]	Mk-1	1	[illegible]			
TA-4-2	[illegible]	[illegible]	D-7-1	[illegible]	[illegible]			
Fb-1-4	[illegible]	[illegible]	Vs-5-7-	6	[illegible]			
BM-1-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
Ti-10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
Total		[illegible]	Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER 2

	Transect No. 1	2	3	Average
Bare soil	11	7	13	11
Erosion Pavement	—	—	—	—
[illegible]	—	—	—	—
Litter	27	31	19	25.66
Moss	—	—	—	—
Plant Density	62	60	68	63.33
Ground Total	100	100	100	100
Forage Density Index	62	60	68	63.33
Ground Cover Index	89	91	87	89
Overstory	7	13	3	—
Understory	55	45	65	—

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
Cro	3.76	3.60	4.24	3.87
Cmn	6.10	6.54	5.65	6.10

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION		SOIL STABILITY	
Forage Density Index	9	Erosion Hazard	13
Composition	13	Current Erosion	15
Vigor	10	Total	28
Total	32		

Condition Class EXCELLENT — Condition Class EXCELLENT

Current Trend Up__ Down__ Static__ — Current Trend Up__ Down__ Static__

. Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 2C

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment COMBRETACEOUS SAVANNA WOODLAND District YANKARI G.R Cluster No. 3

Date 1/21/77 By OKAFOR E.C.J No. of Transects 1, 2.

COMPOSITION

Desirable	Av.No. Hits	Av.%of Total Plant Density	Intermediate	Av.No. Hits	Av.%of Total Plant Density	Undesirable	Av No. Hits	Av.%of Total Plant Density
Cmn-22-14	18	39.56	CYB-10-6	8	17.58			
CrA-1	1	2.19	C-1-5	3	6.59			
FB-7	7	15.38	D-1	1	2.19			
Lau-4	4	8.79	H-3	3	6.59			
			H-1	1	2.19			
			AL-1-3	2	4.39			
			Acn-1	1	2.19			
			AG-1-	1	2.19			
			SE-2	2	4.39			
			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	Transect No. 2	Average
Bare soil	25	19	22
Erosion Pavement	—	—	—
[illegible]	—	—	—
Litter	34	31	32.5
Moss	—	—	—
Plant Density	41	50	45.5
Intercept Total	100	100	100
Forage Density Index	41	50	45.5
Ground Cover Index	75	81	75
Overstory	15	11	—
Understory	23	31	—

VIGOR MEASUREMENTS

Species	Transect No. 1	Transect No. 2	Average
Bur	1.06	1.20	= 1.13
Cro	4.00	4.01	= 4.00

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	6
Composition	10
Vigor	9
Total	35
Condition Class	Good
Current Trend Up Down Static	

SOIL STABILITY

Erosion Hazard	11
Current Erosion	13
Total	24
Condition Class	Good.
Current Trend Up Down Static	

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 3A

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Ecological Site: COMMIPHORA-ACACIA SAVANNA SHRUBLAND District: YANKARI G R Cluster No.: 1

Date: 1/22/77 By: OKAFOR E.C.J No. of Transects: 1, 2

COMPOSITION

Dominant*	Av. No. Hits	Av. % of Total Plant Density	Intermediate	Av. No. Hits	Av. % of Total Plant Density	Undesirable	Av. No. Hits	Av. % of Total Plant Density
Cmn - 10 - 7	8.5	19.5%	Wi - 2	2	4.6			
Hyp - 2 - 15	8.5	19.5	Sc - 3 - 1	2	4.6			
Cte - 17 - 5	11	25.3	D - 5 -	5	11.5			
Cre - 5	5	11.5	Al - 2 - 3	2.5	5.7			
Ti - 1 -	1	2.3	Lo - 1	1	2.3			
			Lou - 3	3	6.9			
			Bur - 1	1	2.3			
			Bl - 3	3	6.9			
Total		78.1	Total		44.8	Total		

* Use only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	Average
Bare soil	17	26	21.5
Erosion Pavement	—	—	—
Rock	—	—	—
Litter	41	29	35.0
Moss	—	—	—
Plant Density	42	45	43.5
Percent Total	100	100	100
Average Density Index	42	45	43.5
Canopy Cover Index	83	74	78.5
Overstory	47	14	—
Understory	36	31	—

VIGOR MEASUREMENTS

Species	Transect No. 1	2	Average
Cmn	6.10	6.02	= 6.06
Al	1.06	1.02	= 1.04

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	6
Composition	7
Vigor	10
Total	23

Condition Class: FAIR

Current Trend Up__ Down__ Static__

SOIL STABILITY

Erosion Hazard	13
Current Erosion	14
Total	27

Condition Class: EXCELLENT

Current Trend Up__ Down__ Static__

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 3B

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment CRETACEOUS SAVANNA SHRUBLAND District YANKARI G.R Cluster No. 2

Date 1/22/77 By OKAFOR E.C.J No. of Transects 1, 2

COMPOSITION

Desirable *	Av.No. Hits	Av.%of Total Plant. Density	Intermediate	Av.No. Hits	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
Cmn-18-19	18.5	38.1	D-2-1	1.5	3.1			
Hyp-10-10	10.0	20.6	Ai-2-3	2.5	5.2			
Cts-15-7	12.5	25.8	Sc-1	1	2.1			
			Ci-1	1	2.1			
			Wi-3	3	6.2			
Total		84.5	Total		18.7	Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	Transect No. 2	Average
Bare soil	26	20	23
Erosion Pavement	—	—	—
Rock	—	—	—
Litter	31	26	28.5
Moss	—	—	—
Plant Density	43	54	48.5
Index Total	100	100	100
Forage Density Index	43	54	48.5
Ground Cover Index	75	80	77
Overstory	—	13	—
Understory	35	41	—

VIGOR MEASUREMENTS

Species	Transect No. 1	Transect No. 2	Average
Cmn	4.55	5.81	5.18
Ai	1.06	1.07	1.06

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	7
Composition	8
Vigor	10
Total	25
Condition Class	Good
Current Trend Up	Down Static

SOIL STABILITY

Erosion Hazard	12
Current Erosion	14
Total	26
Condition Class	Good
Current Trend Up	Down Static

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 3C

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment COMMIPHORA DECIDUOUS SAVANNA SHRUBLAND District YANKARI G.R Cluster No. 3

Date 1/22/77 By OKAFOR . E.C.J. No. of Transects 1, 2, 3, 4.

COMPOSITION

Desirable	Av.No. * Hits	Av.%of Total Plant. Density	Intermediate	Av.No. * Hits	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
Cmu-5-16-35-15	17.75	31	D-5-2-7	5.33	9.3			
Hyp-45-22-5	2.50	43.7	Cc-5-1-2	2.66	4.6			
Cre-1-2-35	10.66	18.62	La-1-1-1	1.0	1.7			
			Gib-3	3	5.2			
			Amd-6	6	10.5			
			Dig-6	6	10.5			
			Vi-4	4	7.0			
TOTAL		93%	Total		48.8	Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	4	Average
Bare soil	22	17	25	10	= 18.5
Erosion Pavement	—	—	—	—	—
Rock	—	—	—	—	—
Litter	14	40	27	16	= 24.3
Moss	—	—	—	—	—
Plant Density	64	43	48	74	57.3
Index Total	100	100	100	100	100
Forage Density Index	64	43	48	74	57.25
Ground Cover Index	78	83	75	90	81.5
Overstory	4	11	24	8	—
Understory	60	32	24	66	—

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	4	Average
Cmu	6.0	6.0	5.5	7.73	= 6.3
AL	1.06	1.05	1.05	1.05	= 1.05

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION		SOIL STABILITY	
Forage Density Index	10	Erosion Hazard	13
Composition	12	Current Erosion	14
Vigor	10	Total	27
Total	32		
Condition Class	EXCELLENT	Condition Class	EXCELLENT.
Current Trend Up__ Down__ Static__		Current Trend Up__ Down__ Static__	

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 6A

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment HIGH FOREST District YANKARI Cluster No. 1

Date 1/27/77 By Okafor .E.C.J No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. * Hits	Av.%of Total Plant. Density	Intermediate	Av.No. * Hits	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
Dic-18-	18	37.5	Ptc-1	1	2.08	Cd-2	2	4.16
NZ=23-15	19	39.58	Dig-4	4	8.33	Ci-1	1	2.08
KS-1	1	2.08	Cat-2-24-10	12	25.00	Lg-4	4	8.33
Ber-1	1	2.08	[illegible]			Bro-1	1	2.08
Vd-1	1	2.08	Psy-1-2	1.5	3.12			
Eg-1-1-3	5	10.41	Pc-14	14	29.16			
			No-1	1	2.08			
			Ci-6	6	12.5			
			Cm-1	1	2.08			
			Bu-1	1	2.08			
Total			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	Average
Bare soil	—	—	—	
Erosion Pavement	—	—	—	
Rock	—	—	—	
Litter	70	39	47	
Moss	—	—	—	
Plant Density	30	61	53	
Index Total	100	100	100	
Forage Density Index	30	61	53	
Ground Cover Index	100	100	100	
Overstory	17	10	16	
Understory	13	51	37	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
NP	2.04	2.04	2.0	=2.02
CoF	7.04	5.06	4.20	=5.43

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	4
Composition	15
Vigor	5
Total	24
Condition Class	FAIR
Current Trend Up__ Down__ Static__	

SOIL STABILITY

Erosion Hazard	5
Current Erosion	15
Total	20
Condition Class	FAIR
Current Trend Up__ Down__ Static__	

Form for summarizing transect cluster date and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 6B

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment HIGH FOREST District _____ Cluster No. _____

Date _____ By _____ No. of Transects _____

COMPOSITION

Desirable	Av.No. * Hits	Av.%of Total Plant. Density	Intermediate	Av.No. * Hits	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
			UL-10	10	20.53			
			Ash-1	1	2.05			
			Cx-1	1	2.05			
			Lo-2	2	4.16			
Total			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No.	Average
Bare soil		
Erosion Pavement		
Rock		
Litter		
Moss		
Plant Density		
Index Total		
Forage Density Index		
Ground Cover Index		
Overstory		
Understory		

VIGOR MEASUREMENTS

Species	Transect : No.	Average

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index _____
Composition _____
Vigor _____
Total _____

Condition Class _____
Current Trend Up__ Down__ Static__

SOIL STABILITY

Erosion Hazard _____
Current Erosion _____
Total _____

Condition Class _____
Current Trend Up__ Down__ Static__

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 4

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment DETAILUM WOODLAND District YAMHILL Cluster No. 1

Date 1/24/77 By Schafer. E.C.J. No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. Hits *	Av.%of Total Plant Density	Intermediate	Av.No. Hits *	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
DVE-5-3-1	3	4.10	SL-1	1	1.36			
Fb-7-3	5	6.94	Lu-2-1	1.5	2.05			
Cmg-10-13-13	12	16.43	SL-2-	2	2.73			
Dte-45-47-6E	51	69.86	D-2					
Total			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	Average
Bare soil	7	9	5	
Erosion Pavement	—	—	—	
Rock	—	—	—	
Litter	26	12	22	
Moss	—	—	—	
Plant Density	67	79	73	
Index Total	100	100	100	
Forage Density Index	67	79	73	
Ground Cover Index	93	91	95	
Overstory	8	4	12	
Understory	54	75	61	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
CmG	5.04	4.35	5.17	4.85
Dte	2.76	2.51	2.48	2.58

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION

Forage Density Index	10
Composition	15
Vigor	5
Total	30

Condition Class EXCELLENT

Current Trend Up__ Down__ Static__

SOIL STABILITY

Erosion Hazard	15
Current Erosion	13
Total	28

Condition Class EXCELLENT

Current Trend Up__ Down__ Static__

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 5

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment PHELPS WOODLAND District YANKARI Cluster No. 1

Date 1/26/77 By OKAFOR. E.C.J No. of Transects 1, 2, 3, 4

COMPOSITION

Desirable	Av.No. Hits *	Av.%of Total Plant Density	Intermediate	Av.No. Hits *	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
CZ-3-10-8-9	7.5	24	HG-3-3-4-8	4.5	14.4			
			HZ-1-4-5	5.0	16.0			
			CJ-2-2-1-1	1.5	4.8			
			ACH-1-2-2-5	2.5	8			
			CO-2-12-7	7.0	22.4			
			CL-1-	1	3.2			
			KG-1	1	3.2			
			KCH-5-	5	16.0			
			SG-1-1	2	6.4			
Total			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	4	Average
Bare soil	10	9	13	—	10.66
Erosion Pavement	—	10	—	43	26.5
Rock	14	—	—	—	14.0
Litter	56	51	48	21	44
Moss	—	—	—	—	—
Plant Density	20	30	39	36	31.25
Index Total	100	100	100	100	100
Forage Density Index	20	30	39	36	31.25
Ground Cover Index	76	91	87	57	
Overstory	4	5	6	5	
Understory	16	25	33	31	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	4	Average
PTE	1.52	1.54	1.54	1.52	1.54
CZ	5.05	5.09	5.30	5.49	5.4

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION		SOIL STABILITY	
Forage Density Index	4	Erosion Hazard	6
Composition	5	Current Erosion	7
Vigor	3	Total	13
Total	12		
Condition Class	FAIR	Condition Class	POOR
Current Trend Up Down Static		Current Trend Up Down Static	

Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 7

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment FADAMAN BARKONO District YANKARI Cluster No. 1

Date 1/25/77 By OKAFOR E.C.J No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. Hits *	Av.%of Total Plant Density	Intermediate	Av.No. Hits *	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
JAC-75-77-70	75	51.52	III-1-2-6	3	3.26			
Fb-13-10-11	11.33	12.31						
Hyp-2-3-3	2.66	2.89						
Total			Total			Total		

* Not only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	Average
Bare Soil	—	—	—	
Erosion Pavement	—	—	—	
Rock	—	—	—	
Litter	6	8	10	
Moss	—	—	—	
Plant Density	94	92	90	
Index Total	100	100	100	
Forage Density Index	94	92	90	
Ground Cover Index	100	100	100	
Overstory	—	—	—	
Understory	94	92	90	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
Ryp	34.4	34.4	34.8	34.5
Fb	3.22	3.2	3.2	3.2

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION		SOIL STABILITY	
Forage Density Index	10	Erosion Hazard	15
Composition	15	Current Erosion	15
Vigor	10	Total	30
Total	35		

Condition Class EXCELLENT — Condition Class EXCELLENT

Current Trend Up__ Down__ Static__ — Current Trend Up__ Down__ Static__

Form for summarizing transect cluster date and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX 8

TRANSECT CLUSTER SUMMARY AND CURRENT RANGE CONDITION AND TREND RATING

Allotment ~~FADAMAN~~ MAKA District YANKARI Cluster No. 1

Date 1/25/77 By OKAFOR E.C.T No. of Transects 1, 2, 3

COMPOSITION

Desirable	Av.No. Hits *	Av.%of Total Plant Density	Intermediate	Av.No. Hits *	Av.%of Total Plant Density	Undesirable	Av.No. Hits	Av.%of Total Plant Density
MP-69-74-78: 73 44		77.26	Cal-2.7-3	4	4.19			
Byp-24-18-15	5.5	5.91						
Total			Total			Total		

* List only key indicator species - group others.

SUMMARY OF ALL TRANSECTS IN CLUSTER

	Transect No. 1	2	3	Average
Bare soil	1/3	1/5	3/5	
Erosion Pavement	—	—	—	
Rock	—	—	—	
Litter	1	—	—	
Moss	—	—	—	
Plant Density	96	95	95	
Index Total	100	100	100	
Forage Density Index	96	95	95	
Ground Cover Index	96	95	95	
Overstory	—	—	—	
Understory	96	95	95	

VIGOR MEASUREMENTS

Species	Transect No. 1	2	3	Average
MP	0.25	0.25	0.25	0.25
RYP	35.70	35.60	35.70	=356

CLASSIFICATION OF CONDITION AND TREND RATING OF CLUSTER

VEGETATION		SOIL STABILITY	
Forage Density Index	10	Erosion Hazard	15
Composition	13	Current Erosion	15
Vigor	9	Total	30
Total	32		

Condition Class EXCELLENT — Condition Class EXCELLENT

Current Trend Up__ Down__ Static__ — Current Trend Up__ Down__ Static__

: Form for summarizing transect cluster data and for classifying Condition and Trend ratings obtained in Step Two.

APPENDIX II

RECORD OF PERMANENT LINE TRANSECT

Allotment AFZELIA WOODLAND Date 1/18/77 By OKAFOR. E.C.J Cluster No. 1

1	2	3	4	5	6	7	8	9	10
							Dte		
Brgr	Brgr	Brgr	Br	Br	Br	Brgr		L	Br
11	12	13	14	15	16	17	18	19	20
Br	Br	Br	Br	L	L	C	Br	L	C
21	22	23	24	25	26	27	28	29	30
L	L	Wl	D	L	Brgr	L	L	C	C
31	32	33	34	35	36	37	38	39	40
D	L	L	D	D	L	L	L	L	Br
41	42	43	44	45	46	47	48	49	50
			Afz	Bur					
L	L	C			L	L	C	L	Br
51	52	53	54	55	56	57	58	59	60
L	Afz	L	Afz	Brgr	L	L	C	C	Br
61	62	63	64	65	66	67	68	69	70
Afz	Br	Br	L	C	GA	Br	C	L	Br
71	72	73	74	75	76	77	78	79	80
D	Afz	L	Brgr	Brgr	SL	Br	Br	AC	Cm
81	82	83	84	85	86	87	88	89	90
C	Hm	Br	Br	Br	Br	D	Br	D	Br
91	92	93	94	95	96	97	98	99	100
Br	D	D	Br	Br	D	D	Br	Br	Cm

Transect No. 1

BARE SOIL	8
EROSION PAVEMENT	—
ROCK	—
LITTER	27
MOSS	—
PLANT DENSITY INDEX	65
TOTAL	100
FORAGE DENSITY INDEX	45
GROUND COVER INDEX	92
OVERSTORY	3
UNDERSTORY	62

SPECIES (List by name, symbol and number of hits)

Bracheria - Br = 28
Cophia spp - C = 11
Disertis cordifolia - D = 11
Burkea africana - Bur = 1
Afzelia africana - Afz = 5
Gardenia africana - GA = 1
Securidaca longipedunculata - SL = 1
Detarium microcarpum - Dtr = 1

KEY INDICATOR SPECIES NOT RECORDED

Crossopteris febrifuga - Cr
Anogeissus leiocarpus - Al
Terminalia glaucescens - Tg

VIGOR MEASUREMENTS

	AFz	Dtr	Bur.
1	3.0	3.0	1.5
2	3.0	2.9	1.5
3	3.2	2.8	1.6
4	3.1	3.1	1.6
5	3.2	3.1	1.6
6	3.2	3.2	1.4
7	3.1	3.0	1.4
8	3.0	3.0	1.5
9	3.0	2.8	1.5
10	3.0	3.0	1.5
Total	30.8	29.8	15.1
Avg. Max.	3.08	2.98	1.51

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment AFZELIA woodland Date 1/16/77 By OKAFOR. E.C.J Cluster No. 1

Transect No. 2

1	2	3	4	5	6	7	8	9	10
						TG			
L	L	Br	Br	Br	Br		Br	L	Br
11	12	13	14	15	16	17	18	19	20
			TG						
Brgr	Brgr	L	Br	L	Brgr	L	Br	Br	Br
21	22	23	24	25	26	27	28	29	30
L	Brgr	Brgr	Brgr	Brgr	Brgr	Brgr	Br	Br	Br
31	32	33	34	35	36	37	38	39	40
									Afz
L	L	L	St	L	L	L	L	Afz	Afz
41	42	43	44	45	46	47	48	49	50
L	Cmg	Br	St	St	And	And	Afz	Afz	L
51	52	53	54	55	56	57	58	59	60
L	L	And	And	St	St	And	And	L	Cmg
61	62	63	64	65	66	67	68	69	70
	TG								
And		And	Brgr	L	Occ	St	Brgr	L	L
71	72	73	74	75	76	77	78	79	80
L	L	L	Brgr	Brgr	Brgr	L	L	Cmg	And
81	82	83	84	85	86	87	88	89	90
TG									TG
And	And	And	D	D	St	Brgr	Brgr	Brgr	
91	92	93	94	95	96	97	98	99	100
Brgr	And	And	And	Br	St	St	St	St	Cmg

BARE SOIL	16
EROSION PAVEMENT	—
ROCK	—
LITTER	27
MOSS	—
PLANT DENSITY INDEX	57
TOTAL	100
FORAGE DENSITY INDEX	57
GROUND COVER INDEX	84
OVERSTORY	6
UNDERSTORY	51

SPECIES
(List by name, symbol and number of hits)

Brachiaria sp - Br = 15
Terminalia glutinosum - TG = 5
Strichnos spp - St = 11
Occimum sp - Occ = 1
Disortis - D = 2
Afzelia africana - Afz = 5
Andropogon gayanus - And = 11
Combretum glutinosum - Cmg = 4

KEY INDICATOR SPECIES NOT RECORDED

Burkea africana - Bur
Crossopteris febrifuga - Cr
Terminalia indica - Ti

VIGOR MEASUREMENTS

	Bur.	TG.	Afz.
1	1.5	9.5	5.5
2	1.5	9.0	6.0
3	1.5	8.8	5.6
4	1.5	8.5	5.8
5	1.5	8.6	5.4
6	1.5	8.5	5.6
7	1.5	8.6	5.5
8	1.5	8.5	5.5
9	1.5	8.5	5.5
10	1.5	8.8	5.6
Total	15.0	86.3	56.4
Avg. Max.	1.5	8.63	5.64

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment AFZELIA WOODLAND Date 1/16/77 By OKAFOR.E.C.J Cluster No. 1

1	2	3	4	5	6	7	8	9	10
Det									
	And	And	And	Brgr	And	And	And	And	And
11	12	13	14	15	16	17	18	19	20
Afz									
	And	D	D	Bur	D	And	D	St	And
21	22	23	24	25	26	27	28	29	30
And	Bur	Bur	And	L	And	And	And	Brgr	And
31	32	33	34	35	36	37	38	39	40
And	Cmg	L	Brgr	L	L	Brgr	Brgr	D	And
41	42	43	44	45	46	47	48	49	50
L	L	Bur	Bur	Bur	Bur	L	Det	And	L
51	52	53	54	55	56	57	58	59	60
L	L	Brgr	Cmg	And	Bur	Bur	Afz	Br	Br
61	62	63	64	65	66	67	68	69	70
Br	Hyp	Hyp	Hyp	Hyp	TA	TA	Afz	And	And
71	72	73	74	75	76	77	78	79	80
			TA						
And	L	And		And	Cmn	Brgr	TA	D	St
81	82	83	84	85	86	87	88	89	90
Br									TG
Br	Br	Br	Hyp	And	Hyp	Br	Hyp	And	
91	92	93	94	95	96	97	98	99	100
And	Hyp	Br	Cmn	Hyp	And	And	Br	Bur	Bur

Transect No. 3

BARE SOIL	7
EROSION PAVEMENT	—
ROCK	—
LITTER	11
MOSS	—
PLANT DENSITY INDEX	82
TOTAL	100
FORAGE DENSITY INDEX	92
GROUND COVER INDEX	93
OVERSTORY	4
UNDERSTORY	78

SPECIES (List by name, symbol and number of hits)

Andropogon gayanus – And = 32
Terminalia avicennioides – TA = 4
Detarium microcarpum – Det = 1
Afzelia africana – Afz = 3
Diserts — D = 5
Burkea africana – Bur = 11
Brachiaria spp – Br = 9
Combretum glutinosum – Cmg = 2
Combretum nigricans – Cmn = 3
Strichnos – St = 2.

KEY INDICATOR SPECIES NOT RECORDED

Cressopteryx febrifuga – G
Terminalia glaucescens – TG

VIGOR MEASUREMENTS

	AFZ	TG	Bgr
1	5.5	7.6	1.6
2	5.6	7.6	1.6
3	5.5	7.6	1.5
4	5.5	7.5	1.5
5	5.6	7.6	1.5
6	5.5	7.6	1.5
7	5.5	7.5	1.5
8	5.5	7.5	1.6
9	5.5	7.5	1.6
10	5.5	7.6	1.5
Total	55.2	75.6	15.4
Avg. Max.	5.52	7.56	1.54

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK: Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment AFZELIA WOODLAND Date 1/16/77 By Okafor E.C.J. Cluster No. 2

Transect No. 1

1	2	3	4	5	6	7	8	9	10
Afz									
	Hyp	Hyp	L	Hyp	Hyp	Hyp	Hyp	Hyp	Hyp
11	12	13	14	15	16	17	18	19	20
							Cro		
L	Hyp	Hyp	Hyp	Brgr	Hyp	Hyp		Hyp	Hyp
21	22	23	24	25	26	27	28	29	30
Hyp	Hyp	L	Hyp	St	Brgr	Brgr	Hyp	L	L
31	32	33	34	35	36	37	38	39	40
Brgr	Brgr	Brgr	Hyp	Brgr	Brgr	Hyp	L	Hyp	Hyp
41	42	43	44	45	46	47	48	49	50
			Cro	Cro	Cro				
Hyp	Hyp	Hyp				Hyp	Hyp	Hyp	Hyp
51	52	53	54	55	56	57	58	59	60
Brgr	Brgr	Hyp	Occ	Hyp	Hyp	L	L	Hyp	L
61	62	63	64	65	66	67	68	69	70
Hyp	Bur	L	L	Hyp	L	L	L	L	L
71	72	73	74	75	76	77	78	79	80
L	Lau	Lau	Brgr	L	L	Hyp	Brgr	Brgr	Hyp
81	82	83	84	85	86	87	88	89	90
								Bur	
Hyp	Hyp	Brgr	Brgr	Brgr	Hyp	Hyp	Hyp		Hyp
91	92	93	94	95	96	97	98	99	100
			Afz				Afz		
Hyp	Hyp	Hyp		L	L	Hyp		Hyp	Hyp

BARE SOIL	16
EROSION PAVEMENT	—
ROCK	—
LITTER	21
MOSS	—
PLANT DENSITY INDEX	63
TOTAL	100
FORAGE DENSITY INDEX	63
GROUND COVER INDEX	84
OVERSTORY	8
UNDERSTORY	55

SPECIES
(List by name, symbol and number of hits)

Afzelia africana-Afz=3
Hyparrhenia involucrata-Hyp
Crossopteryx febrifuga-Cro.
Borkea africana-Bur=2
Strichnos spp-St=1
Ocimum spp-Occ=1
Laudatia spp-Lau=2

KEY INDICATOR SPECIES NOT RECORDED

Terminalia avicennioides
Combretum nigricans=Con

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	T.A	Afz	Bur.
1	8.0	6.0	1.5
2	8.0	6.0	1.5
3	8.0	5.4	1.5
4	9.2	6.9	1.5
5	9.1	6.1	1.5
6	9.2	6.1	1.5
7	9.0	6.0	1.5
8	9.0	6.0	1.5
9	8.0	6.0	1.5
10	8.0	6.0	1.5
Total	80.5	62.0	15.0
Avg. Max.	8.05	6.20	1.5

RECORD OF PERMANENT LINE TRANSECT

Allotment AFZELIA woodland Date 1/16/77 By Okafor E.C.J. Cluster No. 2

Transect No. 2

1	2	3	4	5	6	7	8	9	10
Crp									
	Hyp	Brgr	Hyp	Lau	Lau	Lau	Hyp	Hyp	Brgr
11	12	13	14	15	16	17	18	19	20
								Cng	
Hyp	Hyp	Hyp	Brgr	Hyp	L	L	L		Hyp
21	22	23	24	25	26	27	28	29	30
			Tg						
L	L	Hyp		Hyp	Hyp	L	L	L	Brgr
31	32	33	34	35	36	37	38	39	40
						Crp			
Brgr	Hyp	Hyp	Brgr	L	L		Hyp	L	Hyp
41	42	43	44	45	46	47	48	49	50
Hyp	Hyp	Hyp	L	Brgr	Brgr	Brgr	Hyp	Hyp	Hyp
51	52	53	54	55	56	57	58	59	60
							Cro		
L	Hyp	L	Hyp	Hyp	Hyp	L		L	L
61	62	63	64	65	66	67	68	69	70
L	Hyp	L	Brgr	L	L	L	Hyp	L	Hyp
71	72	73	74	75	76	77	78	79	80
Brgr	L	Brgr	Brgr	Brgr	Brgr	Hyp	Brgr	Brgr	Hyp	L
81	82	83	84	85	86	87	88	89	90
Hyp	Hyp	Brgr	Brgr	Brgr	Brgr	Brgr	L	L	Hyp
91	92	93	94	95	96	97	98	99	100
Brgr	Brgr	Brgr	Hyp	Hyp	Brgr	L	Hyp	Hyp	L

BARE SOIL	25
EROSION PAVEMENT	—
ROCK	—
LITTER	2.9
MOSS	— —
PLANT DENSITY INDEX TOTAL	100
FORAGE DENSITY INDEX	46
GROUND COVER INDEX	76
OVERSTORY	5
UNDERSTORY	41

SPECIES (List by name, symbol and number of hits)

Crossopteryx febrifuga. Cro = 5
Hyperrhenia involucrata—Hyp = 35
Kaudatia spp—Kau = 3
Combretum glutinosum—Cng = 1
Terminalia glaucescens. Tg = 1

KEY INDICATOR SPECIES NOT RECORDED

Burkea africana — Bur
Butyrospermum paradoxum = Brg

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	AFZ.	Cro.	Bur
1	6.0	2.5	1.5
2	6.2	2.4	1.5
3	6.0	2.4	1.4
4	6.2	2.5	1.4
5	6.1	2.5	1.4
6	6.0	2.5	1.5
7	6.1	2.5	1.5
8	6.2	2.5	1.4
9	6.2	2.5	1.5
10	6.0	2.5	1.5
Total	60.8	24.8	14.6
Avg. Max.	6.08	2.48	1.46

RECORD OF PERMANENT LINE TRANSECT

Allotment Afzelia (Woodland) Date 1/16/77 By OKAFOR. E.C.J Cluster No. 2

Transect No. 3

1	2	3	4	5	6	7	8	9	10
Afz									
	Cmg	Hyp	L	L	L	L	L	Hab	L
11	12	13	14	15	16	17	18	19	20
Brgr	Brgr	L	Hyp	L	Brgr	Brgr	Hyp	L	L
21	22	23	24	25	26	27	28	29	30
									AL
Hyp	Hyp	L	Hyp	Hyp	L	Hyp	Hyp	Hyp	
31	32	33	34	35	36	37	38	39	40
Cro						Cro			
	L	L	Brgr	Hyp	Hyp		Hyp	L	Brgr
41	42	43	44	45	46	47	48	49	50
Hyp	Brgr	Hyp	Hyp	Hyp	Hyp	Hyp	L	Brgr	L
51	52	53	54	55	56	57	58	59	60
St									
	L	L	Hyp	Hyp	L	Brgr	Brgr	Hyp	Hyp
61	62	63	64	65	66	67	68	69	70
						Bur	Afz	Bur	
Hyp	Hyp	Hyp	L	L	Brgr				Cro
71	72	73	74	75	76	77	78	79	80
		Cro							
Hyp	Hyp		L	L	L	L	Hyp	Hyp	Hyp
81	82	83	84	85	86	87	88	89	90
L	L	L	L	L	Hyp	Cmg	Brgr	L	Hyp
91	92	93	94	95	96	97	98	99	100
									Bur
Hyp	L	Hyp	Hyp	Hyp	Brgr	L	Hyp	L	

BARE SOIL	11
EROSION PAVEMENT	—
ROCK	—
LITTER	38
MOSS	—
PLANT DENSITY INDEX	56
TOTAL	100
FORAGE DENSITY INDEX	56
GROUND COVER INDEX	89
OVERSTORY	10
UNDERSTORY	46

SPECIES (List by name, symbol and number of hits)

Afzelia africana - Afz = 1
Combretum glutinosum - Cmg = 1
Habiscus (spp) - Hab = 1
Hyparrhenia involucrata - Hyp = 31
Crossopteryx febrifuga - Cro = 1
Anogeissus leiocarpus - Alo = 1
Strichnos spp - St = 1
Burkea africana - Bur = 7
Fimbristylis spp - Fb = 1

KEY INDICATOR SPECIES NOT RECORDED

Terminalia glaucescens

VIGOR MEASUREMENTS

	Bur	Afz	Cro
1	1.5	5.0	2.5
2	1.5	5.1	2.5
3	1.5	5.0	2.4
4	1.5	5.0	2.4
5	1.5	5.2	2.5
6	1.5	5.1	2.6
7	1.5	5.0	2.5
8	1.5	5.0	2.4
9	1.5	5.0	2.4
10	1.5	5.2	2.5
Total	15.0	50.6	24.5
Avg. Max.	1.5	5.06	2.45

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment AFZELIA WOODLAND Date 1/19/77 By OKAFOR E.C.J Cluster No. 3

1	2	3	4	5	6	7	8	9	10
Bur									
	Hyp	Hyp	Hyp	Brgr	L	Hyp	L	Brgr	Hyp
11	12	13	14	15	16	17	18	19	20
						Cng			
Hyp	Hyp	Hyp	L	Hyp	L		L	Brgr	L
21	22	23	24	25	26	27	28	29	30
	Cng								
Hyp		L	Hyp	Hyp	Hyp	Brgr	L	L	Hyp
31	32	33	34	35	36	37	38	39	40
Brgr	Hyp	Brgr	Hyp	Brgr	L	Hyp	Brgr	Hyp	Brgr
41	42	43	44	45	46	47	48	49	50
Hyp	Hyp	Brgr	Hyp	Brgr	L	Hyp	L	L	Hyp
51	52	53	54	55	56	57	58	59	60
				Tg	St				
Hyp	L	Hyp	Hyp			Hyp	Brgr	L	Hyp
61	62	63	64	65	66	67	68	69	70
Brgr	Brgr	Brgr	fb	Brgr	fb	fb	L	Brgr	Hyp
71	72	73	74	75	76	77	78	79	80
L	Hyp	Hyp	Brgr	Brgr	Brgr	Hyp	Hyp	L	Hyp
81	82	83	84	85	86	87	88	89	90
						Cng			
Hyp	L	Brgr	Brgr	L	Hyp	Hyp		Hyp	L
91	92	93	94	95	96	97	98	99	100
Hyp	Brgr	Hyp	Hyp	L	Brgr	L	L	Brgr	Brgr

Transect No. 1

BARE SOIL	26
EROSION PAVEMENT	—
ROCK	—
LITTER	24
MOSS	—
PLANT DENSITY INDEX	50
TOTAL	100
FORAGE DENSITY INDEX	50
GROUND COVER INDEX	74
OVERSTORY	6
UNDERSTORY	44

SPECIES (List by name, symbol and number of hits)

Fimbristylis spp - Fb = 2

Burkea africana - Bur = 1

Combretum glutinosum - Cng = 3

Hyparrhenia involucrata - Hyp = 4

Combretum nigricans - Cnn = 1

Strichnos - St = 1

Terminalia glaucescens - Tg = 1

KEY INDICATOR SPECIES NOT RECORDED

Afzelia africana - Afz

Detarium microcarpum

Gardenia africana - GA

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Afz	Bur	Cng.
1	5.5	1.4	5.0
2	5.5	1.4	5.0
3	5.6	1.4	5.0
4	5.5	1.5	5.0
5	5.5	1.5	5.0
6	5.5	1.4	5.0
7	5.5	1.5	5.0
8	5.5	1.4	5.0
9	5.5	1.5	5.0
10	5.5	1.5	5.0
Total	55.0	12.5	50.0
Avg. Max.	5.5	1.25	5.0

RECORD OF PERMANENT LINE TRANSECT

Allotment Af22.1A Woodland Date 1/19/77 By Okafor E.C.J Cluster No. 3

Transect No. 2

1	2	3	4	5	6	7	8	9	10
L	L	L	Hyp	Brgr	Hyp	Hyp	Hyp	Hyp	L
11	12	13	14	15	16	17	18	19	20
L	D	Hyp	L	Brgr	Hyp	L	Brgr	Brgr	L
21	22	23	24	25	26	27	28	29	30
Hyp	L	Hyp	D	Hyp	Hyp	Hyp	L	Hyp	Hyp
31	32	33	34	35	36	37	38	39	40
Cnn									
	Hyp	Hyp	Hyp	Hyp	Hyp	Hyp	L	L	Hyp
41	42	43	44	45	46	47	48	49	50
D	Hyp	L	D	Hyp	Hyp	Hyp	D	D	Hyp
51	52	53	54	55	56	57	58	59	60
L	L	D	Hyp	Hyp	Brgr	Brgr	Brgr	Hyp	L
61	62	63	64	65	66	67	68	69	70
	Bur								
L		Hyp	Brgr	Brgr	L	Hyp	Hyp	L	Hyp
71	72	73	74	75	76	77	78	79	80
D	L	Hyp	Hyp	Hyp	Hyp	Hyp	Hyp	Hyp	Hyp
81	82	83	84	85	86	87	88	89	90
Brgr	D	D	Hyp	L	L	Hyp	Hyp	Hyp	Hyp
91	92	93	94	95	96	97	98	99	100
D	Hyp	Hyp	Brgr	Hyp	Brgr	L	Hyp	Hyp	Hyp

BARE SOIL	12
EROSION PAVEMENT	—
ROCK	—
LITTER	23
MOSS	—
PLANT DENSITY INDEX	65
TOTAL	100
FORAGE DENSITY INDEX	65
GROUND COVER INDEX	88
OVERSTORY	2
UNDERSTORY	63

SPECIES (List by name, symbol and number of hits)

Hyparrhenia involucrata – Hyp – 5

Disotis spp – D – 11

Burkea africana – Bur – 1

Combretum nigricans – Cnn – 1

Strichnos spp – St – 1

KEY INDICATOR SPECIES NOT RECORDED

Afzelia africana – Afz

Anogeissus leiocarpus – AL

Crossopteryx febrifuga – Cro

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:

Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Afz.	Cro.	Bur.
1	3.0	3.5	1.0
2	3.0	3.6	1.0
3	3.0	3.6	1.0
4	3.0	3.4	1.0
5	2.0	3.5	1.0
6	3.0	3.4	1.0
7	3.0	3.5	1.0
8	3.0	3.5	1.0
9	3.0	3.5	1.0
10	3.0	3.5	1.0
Total	30.0	35.0	10.0
Avg. Max.	3.0	3.5	1.0

RECORD OF PERMANENT LINE TRANSECT

Allotment Combretaceous Sav. woodland Date 1/20/77 By OKAFOR. E.C.I Cluster No. 1

Transect No. 1

	1	2	3	4	5	6	7	8	9	10
					Cmn					Cmn
	L	And	L	L		And	And	L	L	
	11	12	13	14	15	16	17	18	19	20
					Cmn	Cmn				Cmn
	And	L	L	L	And		L	Brgr	L	
	21	22	23	24	25	26	27	28	29	30
	XA			XA			XA	Cmn		
		XA	And		L	And			And	Cmn
	31	32	33	34	35	36	37	38	39	40
									Cmn	
	And	L	L	Hab	And	L	L	Cmn		And
	41	42	43	44	45	46	47	48	49	50
	Cmn									
	Hab	Cmn	And	Cte	And	Cmn	And	And	Cmn	
	51	52	53	54	55	56	57	58	59	60
			Cmn		Cmn					
	L	And		Brgr		And	L	L	Cmn	Cmn
	61	62	63	64	65	66	67	68	69	70
						Cmn				
	And	L	And	Cmn	And		D	And	D	L
	71	72	73	74	75	76	77	78	79	80
	L	Cte	Cmn	Cmn	Cmn	And	And	And	And	And
	81	82	83	84	85	86	87	88	89	90
				Cmn						
	And	L	L		Brgr	L	And	L	Brgr	Brgr
	91	92	93	94	95	96	97	98	99	100
										Cmn
	Brgr	Brgr	L	Brgr	Brgr	And	L	L	L	

BARE SOIL	9
EROSION PAVEMENT	—
ROCK	—
LITTER	29
MOSS	—
PLANT DENSITY INDEX	62
TOTAL	100
FORAGE DENSITY INDEX	62
GROUND COVER INDEX	91
OVERSTORY	16
UNDERSTORY	46

SPECIES (List by name, symbol and number of hits)

Andropogon gayanus = And = 21

Combretum nigricans = Cmn = 24

Ximenia Americana = XA = 4

Hibiscus spp = Hab = 2

Cteinium sp = Cte = 2

Disortis = D = 2

KEY INDICATOR SPECIES NOT RECORDED

Crossopteris febrifuga

Burkea africana

Balanite egyptica

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Cro	Be	Bur.
1	3.5	3.5	1.5
2	4.2	4.0	1.5
3	4.2	4.0	1.5
4	4.0	4.0	1.5
5	4.0	3.5	1.5
6	4.0	4.5	1.5
7	4.0	4.5	1.5
8	4.1	4.0	1.5
9	3.8	4.0	1.5
10	4.1	3.5	1.5
Total	40.2	39.5	15.0
Avg. Max.	4.02	3.95	1.50

RECORD OF PERMANENT LINE TRANSECT

COMBRETACEOUS

Allotment SAV. NOV→4 Date 1/20/77 By OKAFOR E.C.J. Cluster No. 1

Transect No. 2

	1	2	3	4	5	6	7	8	9	10
	AL							St	St	
		Brgr	Hab	Com	Cmn	Cyb	L	St		L
	11	12	13	14	15	16	17	18	19	20
	Cmn	Cyb								St
			Cmg	Cmg	Cyb	L	L	L	St	
	21	22	23	24	25	26	27	28	29	30
	Cyb	And	Brgr	L	Brgr	Cyb	Cmn	Brgr	L	L
	31	32	33	34	35	36	37	38	39	40
	And	And	Cte	Wi	Cte	D	Brgr	D	D	And
	41	42	43	44	45	46	47	48	49	50
		Cmn								
	L		And	L	Brgr	L	Cyb	Cyb	Cyb	D
	51	52	53	54	55	56	57	58	59	60
	L	Brgr	Cte	Cte	Cte	L	Brgr	Cte	Lau	Lau
	61	62	63	64	65	66	67	68	69	70
						Cmn				
	Cmg	L	Brgr	L	Lau		Lau	Brgr	Lau	Lau
	71	72	73	74	75	76	77	78	79	80
								Cmn		
	Lau	Lau	Lau	Lau	Brgr	Brgr	Cmn		Lau	Lau
	81	82	83	84	85	86	87	88	89	90
	Lau	Brgr	Cmn	L	L	Lau	Cte	Brgr	Lau	Cmn
	91	92	93	94	95	96	97	98	99	100
			Cmn	Cmn						
	L	Lau			Lau	Cmn	Brgr	Lau	L	Lau

BARE SOIL	15
EROSION PAVEMENT	—
ROCK	—
LITTER	20
MOSS	—
PLANT DENSITY INDEX	65
TOTAL	100
FORAGE DENSITY INDEX	65
GROUND COVER INDEX	85
OVERSTORY	11
UNDERSTORY	54

SPECIES
(List by name, symbol and number of hits)

Anogiessus leiocarpus=AL = 1
Strychnos = St = 5
Combretum nigricans: Cmn = 11
Comelina sp: Com = 1
Andropogon gayanus: And = 5
Ctenium = Cte = 7
Cymbopogon sp = Cyb = 8
Laudatia = Lau = 19
Hebiscus spp = Hab = 1
Combretum glutinosum: Cmg = 2
Wissteria indica = Wi = 1
Diosotis = D = 4

KEY INDICATOR SPECIES NOT RECORDED

Burkea africana · Ba
Crossopteris febrifuga = Cfe
Terminalia laxiflora = Tl.

VIGOR MEASUREMENTS

	Cyb	Tl	Byr
1	4.0	5.0	1.5
2	4.0	5.5	1.5
3	3.5	5.5	1.5
4	3.5	5.5	1.5
5	3.5	5.0	1.5
6	4.1	5.5	1.5
7	4.1	5.0	1.5
8	4.2	5.0	1.5
9	4.0	5.5	1.5
10	4.0	5.5	1.5
Total	39.8	53.0	15.0
Avg. Max.	3.98	5.30	1.50

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment COMBRETACEOUS SAV-WOODLD Date 1/20/77 By OKAPOR E.C.J Cluster No. 1

Transect No. 3

1	2	3	4	5	6	7	8	9	10
		Cmn							
Brgr	L		Fb	And	Dig	Dig	Dig	Cte	Cte
11	12	13	14	15	16	17	18	19	20
		AL							
Dig	Dig		Dig	L	Brgr	Dig	Brgr	Brgr	Dig
21	22	23	24	25	26	27	28	29	30
Bur									TL
	L	L	L	L	L	L	Dig	Dig	
31	32	33	34	35	36	37	38	39	40
							AL		
Dig	Dig	Brgr	Brgr	Dig	Cmn	Dig		L	L
41	42	43	44	45	46	47	48	49	50
				St			AL		
Brgr	Brgr	Brgr	Brgr		Dig	Dig		L	L
51	52	53	54	55	56	57	58	59	60
			CrP				Cmn		
Brgr	Dig	L		Dig	Dig	Brgr		Bur	Cmn
61	62	63	64	65	66	67	68	69	70
									TL
L	L	L	Cmn	L	L	TL	Brgr	Dig	
71	72	73	74	75	76	77	78	79	80
				Cmn					
Dig	L	L	Brgr		Brgr	Brgr	Brgr	Brgr	Brgr
81	82	83	84	85	86	87	88	89	90
L	Dig	Cmn	Dig	Dig	L	L	Dig	Com	Com
91	92	93	94	95	96	97	98	99	100
			Grp	Cmn					
Dig	Dig	Dig			Cmn	Dig	Brgr	L	Brgr

BARE SOIL	21
EROSION PAVEMENT	—
ROCK	—
LITTER	24
MOSS	—
PLANT DENSITY INDEX	55
TOTAL	100
FORAGE DENSITY INDEX	55
GROUND COVER INDEX	79
OVERSTORY	13
UNDERSTORY	42

SPECIES
(List by name, symbol and number of hits)

Digitaria spp Dig = 29
Crossopteryx febrifuga = Cp = 1
Cteneium = Cte = 2
Fimbristylis spp = Fb = 1
Anogeissus leiocarpus = AL = 3
Combretum nigricans = Cmn = 8
Commelina spp = Com = 2
Burkea africana = Bur = 2
Terminalia laxiflora = TL = 3
Strychnos = St = 1

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	Crp	TL	Bur
1	3.5	8.5	1.5
2	3.5	5.5	1.5
3	3.5	7.0	1.5
4	4.0	9.0	1.5
5	4.0	9.0	1.5
6	3.5	9.0	1.5
7	3.5	8.5	1.5
8	3.6	8.5	1.5
9	3.6	9.0	1.5
10	3.5	8.5	1.5
Total	36.2	87.5	15.0
Avg. Max.	3.62	8.75	1.50

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment Combretaceous Sav. Woodld Date 1/20/77 By OKAFOR E.C.J Cluster No. 2

Transect No. 1

	1	2	3	4	5	6	7	8	9	10
						TA				
	Asy	Asy	L	Brgr	L		L	Brgr	L	L
	11	12	13	14	15	16	17	18	19	20
	L	And	Cmn	Cmn	Cyb	Cmn	L	TA	L	And
	21	22	23	24	25	26	27	28	29	30
	XA	And	And	And	And	And	Cm	fb	Brgr	Brgr
	31	32	33	34	35	36	37	38	39	40
	L	Cmn	L	L	Wi	Brgr	L	L	D	D
	41	42	43	44	45	46	47	48	49	50
	L	L	Brgr	L	And	Cmn	And	XA	XA	L
	51	52	53	54	55	56	57	58	59	60
	L	L	D	Cmn	And	D	L	L	D	L
	61	62	63	64	65	66	67	68	69	70
				TA			Cmn			Cmn
	L	L	And		XA	XA		And	And	
	71	72	73	74	75	76	77	78	79	80
	And	And	L	L	Brgr	Brgr	And	And	Cmn	Cmn
	81	82	83	84	85	86	87	88	89	90
	Brgr	D	D	Cmn	L	Brgr	And	Brgr	And	Cmn
	91	92	93	94	95	96	97	98	99	100
	Cmn			Cmn						Cmn
		Cmn	And		And	And	Brgr	L	L	

BARE SOIL	11
EROSION PAVEMENT	—
ROCK	—
LITTER	27
MOSS	—
PLANT DENSITY INDEX	62
TOTAL	100
FORAGE DENSITY INDEX	63
GROUND COVER INDEX	89
OVERSTORY	7
UNDERSTORY	55

SPECIES (List by name, symbol and number of hits)

Asysthecia = Asy = 2
Andropogon gayanus = And = 21
Terminalia avicenoides = TA = 4
Waltheria indica = Wi = 1
Combretum nigricans = Cmn = 17
Disortis spp = D = 7
Ximenia americana = XA = 5
fimbristylis = fb = 1
Cymbopogon = Cyb = 1

KEY INDICATOR SPECIES NOT RECORDED

Anogeissus leiocarpus = Al
Burkea africana = Bur
Crossopteris febrifuga = Cf

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	T.A	Cr.p	Cmn
1	8.5	3.5	6.0
2	8.6	4.0	6.0
3	8.6	4.0	6.1
4	8.8	3.5	5.9
5	8.8	3.5	6.0
6	8.5	3.5	6.0
7	8.5	3.5	6.0
8	8.5	4.0	6.0
9	8.5	4.0	6.0
10	8.6	3.5	6.0
Total	85.9	37.6	60.0
Avg. Max.	8.59	3.76	6.0

RECORD OF PERMANENT LINE TRANSECT

Combretaceous
Allotment SAV·woodl Date 1/20/77 By OKAFOR·E·C·J Cluster No. 2

Transect No. 2

	1	2	3	4	5	6	7	8	9	10
	Bur									
		Cmn	XA	And	L	XA	XA	L	Cmn	Cyb
	11	12	13	14	15	16	17	18	19	20
				Cmn		Cmn				
	L	Cyb	Cmn		Cyb		L	L	Brgr	Brgr
	21	22	23	24	25	26	27	28	29	30
									AL	AL
	L	L	TA	Brgr	L	L	L	XA		
	31	32	33	34	35	36	37	38	39	40
								AL	AL	
	St	L	L	Cmn	L	St	St			L
	41	42	43	44	45	46	47	48	49	50
				Ti	Ti	Cmn			TL	TL
	Ti	Ti	Ti				L	L		
	51	52	53	54	55	56	57	58	59	60
	L	L	Ti	Ti	Cmn	Ti	Brgr	Brgr	St	Ti
	61	62	63	64	65	66	67	68	69	70
					Ti			Cmn		
	Cmn	L	L	TA	L	L	And		Cyb	Cyb
	71	72	73	74	75	76	77	78	79	80
					Cmn					
	L	L	Brgr	L		Cmn	XA	XA	L	And
	81	82	83	84	85	86	87	88	89	90
	Fb	Fb	Brgr	Brgr	Fb	Brgr	Fb	XA	Cmn	Cmn
	91	92	93	94	95	96	97	98	99	100
	L	L	L	L	Cmn	Cmn	And	And	L	L

BARE SOIL	9
EROSION PAVEMENT	—
ROCK	—
LITTER	31
MOSS	—
PLANT DENSITY INDEX	60
TOTAL	100
FORAGE DENSITY INDEX	60
GROUND COVER INDEX	91
OVERSTORY	15
UNDERSTORY	45

SPECIES
(List by name, symbol and number of hits)

Burkea africana: Bur = 1
Combretum nigricans: Cmn = 16
Terminalia indica: Ti = 10
Xamania americana: XA = 7
Terminalia avicinoides: TA = 2
Strychnos: St = 4
Anogeissus leiocarpus: AL = 4
Terminalia laxiflora: TL = 2
Fimbristylis: Fb = 4
Gymbopogon sp.: Cyb = 5
Andropogon ascinoides: And = 5

KEY INDICATOR SPECIES NOT RECORDED

Khaya Senegalensis = Ks.

VIGOR MEASUREMENTS

	Cro	TA	Cmn
1	3.5	7.0	6.5
2	4.0	6.5	6.6
3	3.6	6.6	6.6
4	3.4	6.8	6.6
5	3.0	7.2	6.5
6	4.5	6.8	6.5
7	3.0	7.0	6.5
8	4.0	7.4	6.5
9	3.5	7.2	6.5
10	3.5	7.0	6.6
Total	36.0	69.8	65.4
Avg. Max.	3.60	6.98	6.54

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

COMBRETACEOUS

Allotment SAV. WOODLD Date 1/20/77 By OKAFOR E.C.J Cluster No. 2

1	2	3	4	5	6	7	8	9	10
Bur									
	L	Cte	Brgr	Cte	Cte	L	Brgr	Cmn	And
11	12	13	14	15	16	17	18	19	20
Cte	Cte	Cte	Cte	And	Brgr	Brgr	Cte	Cte	Cte
21	22	23	24	25	26	27	28	29	30
L	L	Cte	Cte	L	L	Cte	Cte	Cte	Cte
31	32	33	34	35	36	37	38	39	40
									Cmn
Cte	L	L	Brgr	Brgr	Cte	Cte	Cte	And	
41	42	43	44	45	46	47	48	49	50
L	And	And	And	And	And	And	Cte	Cmn	Cte
51	52	53	54	55	56	57	58	59	60
	Bur								
Cte		Cte	D	Cte	L	L	Brgr	Brgr	Cte
61	62	63	64	65	66	67	68	69	70
Cte	L	L	Brgr	Cte	Cte	Cmn	Cmn	Cte	Cte
71	72	73	74	75	76	77	78	79	80
Cte	And	And	L	L	Bur	And	Cte	Dig	Dig
81	82	83	84	85	86	87	88	89	90
Brgr	Brgr	Cte	Cte	L	Cte	L	Cte	Cte	Cte
91	92	93	94	95	96	97	98	99	100
And	Cte	Cmn	L	L	Brgr	Cte	Cmn	Cmn	Brgr

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 3

BARE SOIL	13
EROSION PAVEMENT	—
ROCK	—
LITTER	19
MOSS	—
PLANT DENSITY INDEX	68
TOTAL	100
FORAGE DENSITY INDEX	68
GROUND COVER INDEX	87
OVERSTORY	3
UNDERSTORY	65

SPECIES
(List by name, symbol and number of hits)

Burkea africana = Bur = 2

Cteniun spp = Cte = 41

Combretum nigricans = 8

Andropogon gayanus = And = 12

Digiteria = Dig = 2

Disortis = D = 1

KEY INDICATOR SPECIES NOT RECORDED

Afzelia africana = Afz.

Anogiessus leicocarpus = AL

Crossopteris febrifuga = Cf

VIGOR MEASUREMENTS

	Afz.	Crp.	Cmn
1	4·0	4·3	5·6
2	4·5	4·3	5·8
3	4·6	4·5	5·0
4	4·6	4·0	5·0
5	4·0	4·2	5·0
6	4·5	4·2	5·6
7	4·0	4·5	5·6
8	4·0	4·0	5·8
9	4·6	4·2	5·6
10	4·6	4·2	5·8
Total	43·4	42·4	56·8
Avg. Max.	4·34	4·24	5·68

RECORD OF PERMANENT LINE TRANSECT

Combretaceous
Allotment SAV. WOODLD Date 1/21/77 By OKAFOR E.C.J Cluster No. 3

1	2	3	4	5	6	7	8	9	10
					Cmn			Cmn	
Cmn	Brgr	Brgr	Ci	Cyb		Cmn	L		Dig
11	12	13	14	15	16	17	18	19	20
						Cmn	Cmn		
L	Cyb	L	Cmn	Cyb	L			Cyb	L
21	22	23	24	25	26	27	28	29	30
		Cmn				Cmn			
L	Cyb		Cmn	L	Cyb		L	Cyb	L
31	32	33	34	35	36	37	38	39	40
				Cmn					
L	Cyb	Brgr	L		Cmn	L	D	L	Brgr
41	42	43	44	45	46	47	48	49	50
	Cmn	Cmn						Cmn	
Cyb			Cmn	L	L	L	Brgr		L
51	52	53	54	55	56	57	58	59	60
		Cmn							
L	Brgr		Wi	Wi	L	L	Dig	L	L
61	62	63	64	65	66	67	68	69	70
Cmn					Cmn				
	L	L	L	Cyb		L	L	Wi	Brgr
71	72	73	74	75	76	77	78	79	80
				Cmn					
L	L	Brgr	L		L	Brgr	Brgr	Brgr	Brgr
81	82	83	84	85	86	87	88	89	90
Brgr	Brgr	Brgr	Brgr	Brgr	Brgr	Brgr	L	Brgr	L
91	92	93	94	95	96	97	98	99	100
			AL	Cmn		Cmn			Cmn
L	Brgr	Brgr			Brgr		Brgr	Brgr	

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 1

BARE SOIL	25
EROSION PAVEMENT	—
ROCK	—
LITTER	34
MOSS	—
PLANT DENSITY INDEX	41
TOTAL	100
FORAGE DENSITY INDEX	41
GROUND COVER INDEX	75
OVERSTORY	18
UNDERSTORY	23

SPECIES
(List by name, symbol and number of hits)

Combretum nigricans = Cmn = 22
Cymbopogon = Cyb = 10
Cider spp = Ci = 1
Disortis = D = 1
Waltenia indica = Wi = 3
Anogeissus leiocarpus = AL = 1
Digitenia = Dig = 2

KEY INDICATOR SPECIES NOT RECORDED

Terminalia laxiflora = TL
Crossopteryx febrifuga = Cf
Burkea africana = Bur.

VIGOR MEASUREMENTS

	TL	Crf	Bur
1	7.5	4.0	1.0
2	8.0	3.9	1.1
3	7.5	3.9	1.1
4	7.0	3.9	1.0
5	8.0	4.1	1.2
6	8.0	4.0	1.0
7	7.5	4.1	1.0
8	7.5	4.0	1.0
9	7.5	4.0	1.2
10	8.0	4.1	1.0
Total	76.5	40.0	10.6
Avg. Max.	7.65	4.00	1.06

RECORD OF PERMANENT LINE TRANSECT

Allotment Combretaceous SAV. WOODLD Date 1/21/77 By OKAFOR E.C.J Cluster No. 3

Transect No. 2

1	Cmn								Cmn
2		L	L	G	L	AL	Cmn	L	L	
3										
4							Cmn	Grp		
5	Brgr	L	L	St	L	Cyb			Cyb	AL
6										
7	Cyb	Brgr	L	UL	Cmn	Cyb	L	Lau	Lau	Lau
8							Cmn			
9	Lau	Ci	Brgr	L	L	Brgr		L	Fb	Fb
10					Acm					
11	Fb	Brgr	L	fb		St	fb	L	L	Cyb
12	Brgr	Brgr	L	Cmn	Cmn	L	Hyp	Brgr	Brgr	Ci
13						Cmn				
14	fb	fb	L	Brgr	Brgr		L	Brgr	L	L
15		AL	As							
16	L			L	Cmn	Cmn	Cyb	L	Ci	L
17	Brgr	Ci	L	Cmn	Cmn	Brgr	Cmn	L	L	Brgr
18					Ti					Ti
19	Brgr	Brgr	Brgr	Ti		Ti	L	L	Brgr	

BARE SOIL	19
EROSION PAVEMENT	—
ROCK	—
LITTER	31
MOSS	—
PLANT DENSITY INDEX	50
TOTAL	100
FORAGE DENSITY INDEX	50
GROUND COVER INDEX	81
OVERSTORY	11
UNDERSTORY	39

SPECIES (List by name, symbol and number of hits)

Combretum nigricans = Cmn = 14
Cider spp = Ci = 5
Urena Lobata = UL = 1
Anogeissus Leiocarpus = AL = 3
Cymbopogon = Cyb = 6
Crossopteryx + abn fungi = Grp = 1
Lauotia spp = Lau = 4
fimbristylis = fb = 7
Acacia mimosoides = Acm = 1
Anona Senegalensis = AS = 1
Strychnos = St = 2
Terminnalia indica = Ti = 4

KEY INDICATOR SPECIES NOT RECORDED

Khaya Senegaleucis = KS
Terminalia Laxiflora = TL

VIGOR MEASUREMENTS

	Grp	TL	B.ur
1	4·0	8·0	1·0
2	5·9	5·7	1·5
3	3·9	3·4	1·1
4	4·0	5·2	1·0
5	4·2	8·2	1·0
6	4·0	3·4	1·6
7	4·0	8·4	1·5
8	3·9	5·0	1·0
9	4·1	5·0	1·0
10	4·1	5·4	1·6
Total	40·1	52·2	12·9
Avg. Max.	4·01	8·22	1·29

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

- Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment CRETACEOUS SAV-SHRUB Date 1/22/77 By OKABA E.J. Cluster No. 1

1	2	3	4	5	6	7	8	9	10
LA									
	L	L	L	L	AL	AL	Lau	Brgr	L
11	12	13	14	15	16	17	18	19	20
L	L	L	AL	L	Lau	Lau	Brgr	Brgr	L
21	22	23	24	25	26	27	28	29	30
Cte	L	Cmn	Cmn	L	Cte	L	Cte	L	L
31	32	33	34	35	36	37	38	39	40
Cte	Cte	Cte	Cte	Cte	L	Cte	Cte	L	L
41	42	43	44	45	46	47	48	49	50
D	D	Cte	D	L	L	Cte	Cte	Cmn	Cte
51	52	53	54	55	56	57	58	59	60
	Cmn								
L		Brgr	Brgr	Cmn	Cte	Cte	Brgr	Brgr	Brgr
61	62	63	64	65	66	67	68	69	70
Brgr	Brgr	Brgr	Brgr	L	Hyp	Brgr	L	L	Brgr
71	72	73	74	75	76	77	78	79	80
			Cmn	Cmn					
L	D	Brgr			L	L	Cte	L	L
81	82	83	84	85	86	87	88	89	90
	Cmn					Cmn			
L		L	L	L	L		L	Brgr	L
91	92	93	94	95	96	97	98	99	100
							Cmn		
St	L	Hyp	L	L	L	D		Brgr	L

Transect No. 1

BARE SOIL	17
EROSION PAVEMENT	—
ROCK	—
LITTER	41
MOSS	—
PLANT DENSITY INDEX	42
TOTAL	100
FORAGE DENSITY INDEX	42
GROUND COVER INDEX	83
OVERSTORY	7
UNDERSTORY	35

SPECIES
(List by name, symbol and number of hits)

Lannea spp — LA = 1
Aneurolepidium dasystachys = AL = 3
Cenchrus ciliaris = Cmn = 11
Hyparrhenia involucrata = Hyp = 2
Cteniuum spp = Cte = 17
Digitaria spp = D = 5
Landolphia spp = L = 3
Strychnos spp = St = 1

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	Cmn	AL	Cte.
1	6.0	1.0	24.0
2	6.0	1.0	22.0
3	5.9	1.1	22.0
4	6.1	1.1	24.0
5	6.1	1.0	24.0
6	6.0	1.2	24.0
7	6.0	1.1	22.0
8	5.9	1.1	22.0
9	6.1	1.0	22.0
10	6.1	1.0	22.0
Total	60.2	10.6	230.0
Avg. Max.	6.02	1.06	23.00

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment Combretaceous Savanna Date 1/22/77 By Okafor. E.C.J Cluster No. 1

1	2	3	4	5	6	7	8	9	10
Cro	Cro			Cro	Cro			Cro	
		L	L			L	L		Brgr
11	12	13	14	15	16	17	18	19	20
					Cmn				
L	L	Brgr	L	L		AL	L	L	AL
21	22	23	24	25	26	27	28	29	30
				Cmn					
Brgr	Brgr	St	Brgr		L	Brgr	Hyp	Brgr	Brgr
31	32	33	34	35	36	37	38	39	40
						Cmn			
Hyp	D	L	L	Brgr	St		Brgr	Hyp	L
41	42	43	44	45	46	47	48	49	50
							Cmn	Bur	
Cmn	L	Bo	Brgr	Brgr	L	L			L
51	52	53	54	55	56	57	58	59	60
								St	
L	L	Hyp	Brgr	Brgr	Brgr	Wi	Brgr		Hyp
61	62	63	64	65	66	67	68	69	70
Hyp	Hyp	Hyp	Brgr	Cte	Cte	Cte	Cte	Cte	Brgr
71	72	73	74	75	76	77	78	79	80
Brgr	Wi	Hyp	L	Brgr	Brgr	Hyp	Brgr	Hyp	L
81	82	83	84	85	86	87	88	89	90
L	Cmn	Bo	L	Hyp	Brgr	Hyp	Hyp	Hyp	L
91	92	93	94	95	96	97	98	99	100
Cmn		Ti							
	Bo		L	L	L	Brgr	Brgr	L	Brgr

Transect No. 2

BARE SOIL	26
EROSION PAVEMENT	—
ROCK	—
LITTER	29
MOSS	—
PLANT DENSITY INDEX	45
TOTAL	100
FORAGE DENSITY INDEX	45
GROUND COVER INDEX	74
OVERSTORY	14
UNDERSTORY	31

SPECIES (List by name, symbol and number of hits)

Crossopteryx febrifuga-Cro = 4
Terminalia indica-Ti = 1
Hyparrhenia involucrata-Hyp = 11
Waltheria indica — Wi = 2
Anogeissus leiocarpus-AL = 2
Combretum nigricans-Cmn = 7
Brassia scabrifolia-Bo = 3
Burkea africana-Bur = 1
Cteinium spp — Cte = 5
Strychnos — St = 3

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	Bur	Cmn	AL
1	1.1	6.1	1.0
2	1.0	6.0	1.0
3	1.0	6.0	1.0
4	1.1	6.2	1.0
5	1.1	6.3	1.1
6	1.0	5.9	1.1
7	1.1	6.0	1.0
8	1.0	6.0	1.0
9	1.0	6.0	1.0
10	1.0	6.0	1.0
Total	10.4	61.0	10.2
Avg. Max.	1.04	6.10	1.02

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment CLIMAX TACCOUS SAV-SHRUB Date 11/22/77 By OKAFOR-E.C.J Cluster No. 2

Transect No. 1

1	2	3	4	5	6	7	8	9	10
			Cmn				AL		AL
Brgr	Brgr	Brgr		L	Brgr	L		L	
11	12	13	14	15	16	17	18	19	20
					Cmn				
L	L	L	L	Cmn		AL	L	L	L
21	22	23	24	25	26	27	28	29	30
Cte	Cte	Cte	L	L	Brgr	Ni	Cte	Cte	Cte
31	32	33	34	35	36	37	38	39	40
								Cmn	
Hyp	Hyp	Ni	Ni	Hyp	L	L	L		L
41	42	43	44	45	46	47	48	49	50
	Cmn								
L		L	Hyp	Hyp	L	Cmn	Cmn	Hyp	Brgr
51	52	53	54	55	56	57	58	59	60
Cmn	L	Brgr	Brgr	Brgr	Hyp	Hyp	Brgr	Brgr	Brgr
61	62	63	64	65	66	67	68	69	70
									Cmn
Brgr	Brgr	Brgr	Brgr	Brgr	L	Cmn	Cmn	Cmn	
71	72	73	74	75	76	77	78	79	80
					Cmn				
Cmn	Cmn	Ni	Brgr	Brgr		L	L	D	Hyp
81	82	83	84	85	86	87	88	89	90
Cmn	Cmn	Cmn	L	L	Brgr	L	L	Hyp	Brgr
91	92	93	94	95	96	97	98	99	100
L	Brgr	Brgr	Cmn	L	Brgr	Brgr	Brgr	L	L

BARE SOIL	26
EROSION PAVEMENT	—
ROCK	—
LITTER	31
MOSS	—
PLANT DENSITY INDEX	43
TOTAL	100
FORAGE DENSITY INDEX	43
GROUND COVER INDEX	74
OVERSTORY	5
UNDERSTORY	35

SPECIES
(List by name, symbol and number of hits)

Combretum nigricans = Cmn. = 19
Waltevia indica = Wi = 3
Cteniun = Cte = 7
Disertis = D = 1
Hyparrhenia involucrata = Hyp = 10
Andropogon Ischaemum = AL = 3

KEY INDICATOR SPECIES NOT RECORDED

Gardenia spp (Ga)
Jasmin a. sp. (Ja)

VIGOR MEASUREMENTS

	Cmn.	AL.	Ga
1	5.5	1.1	2.0
2	5.5	1.2	2.0
3	6.0	1.1	2.1
4	6.0	1.1	2.1
5	6.0	1.0	2.0
6	5.8	1.0	2.0
7	5.9	1.0	2.0
8	5.9	1.0	2.0
9	6.0	1.1	2.1
10	5.2	1.1	2.0
Total	58.1	10.7	20.3
Avg. Max.	5.81	1.07	2.03

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Bare = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Combretaceous
Allotment SAN SHRUB Date 1/22/77 By OKAfor E.C.J. Cluster No. 2

Transect No. 2

1	2	3	4	5	6	7	8	9	10
Cmn						Cmn		Cmn	
	Brgr	L	L	L	L		L		L
11	12	13	14	15	16	17	18	19	20
Cmn	Cmn						Cmn		Cmn
		Cmn	L	L	Cmn	D		Cte	
21	22	23	24	25	26	27	28	29	30
Cte	Brgr	Brgr	Cte	Cmn	Cte	L	Brgr	L	L
31	32	33	34	35	36	37	38	39	40
L	Brgr	Cte	L	Brgr	Brgr	Ci	L	L	Cte
41	42	43	44	45	46	47	48	49	50
							Cmn		Cmn
Cte	Cte	Cte	Cte	Cte	Cte	Brgr		Cte	
51	52	53	54	55	56	57	58	59	60
	Cmn								
L		L	L	L	L	Bo	L	Hyp	L
61	62	63	64	65	66	67	68	69	70
Cmn	AL								
		Cmn	Cmn	AL	L	L	Cmn	Brgr	Brgr
71	72	73	74	75	76	77	78	79	80
Brgr	Brgr	Brgr	Hyp	Brgr	Cte	Hyp	L	Hyp	D
81	82	83	84	85	86	87	88	89	90
							Cmn		
Cte	Brgr	Brgr	D	Hyp	Hyp	Cmn		Hyp	Hyp
91	92	93	94	95	96	97	98	99	100
Brgr	Hyp	Cte	Hyp	Brgr	Cte	Cte	L	Brgr	Brgr

BARE SOIL	20
EROSION PAVEMENT	—
ROCK	—
LITTER	26
MOSS	—
PLANT DENSITY INDEX	54
TOTAL	100
FORAGE DENSITY INDEX	54
GROUND COVER INDEX	50
OVERSTORY	13
UNDERSTORY	41

SPECIES (List by name, symbol and number of hits)

Combretum nigricans = Cmn = 10
Cteniun spp. Cte = 18
Hyparrhenia involucrata = Hyp = 10
Disortis spp = D = 2
Anogiessus leiocarpus = AL = 2
Boscia salicifolia = Bo = 1
Cider spp = Ci = 1

KEY INDICATOR SPECIES NOT RECORDED

Crassopteris febrifuga = (Cr.
Lannia spp.

VIGOR MEASUREMENTS

	Cmn.	Cro.	AL.
1	5.0	4.0	1.1
2	4.5	3.6	1.1
3	4.5	3.6	1.2
4	4.5	4.0	1.1
5	4.5	4.0	1.0
6	4.5	4.0	1.0
7	4.5	4.0	1.0
8	4.5	3.6	1.1
9	4.5	3.6	1.0
10	4.5	3.6	1.0
Total	45.5	38.0	10.6
Avg. Max.	4.55	3.80	1.06

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment CHRYSOTHAMNUS SAV-SHRUB Date 1/22/77 By OKAFOR-E-C-J Cluster No. 3

1	2	3	4	5	6	7	8	9	10
LA						Cmn		Cmn	
	Hyp	Brgr	Hyp	Hyp	Hyp		Hyp		Hyp
11	12	13	14	15	16	17	18	19	20
Hyp	L	Hyp	Hyp	Hyp	H-p	Hyp	Brgr	Brgr	Brgr
21	22	23	24	25	26	27	28	29	30
L	L	Hyp	Hyp	Hyp	St	D	Hyp	Hyp	D
31	32	33	34	35	36	37	38	39	40
L	Brgr	Brgr	Brgr	D	Hyp	Hyp	Hyp	St	Brgr
41	42	43	44	45	46	47	48	49	50
Brgr	Brgr	Hyp	Hyp	Brgr	Brgr	Brgr	Brgr	Brgr	Brgr
51	52	53	54	55	56	57	58	59	60
Brgr	Brgr	L	L	Brgr	L	Brgr	Brgr	Hyp	Hyp
61	62	63	64	65	66	67	68	69	70
Brgr	Hyp	Hyp	Hyp	L	D	D	Hyp	L	St
71	72	73	74	75	76	77	78	79	80
			Cmn						
L	L	St	Hyp	L	L	Hyp	Hyp	Hyp	Hyp
81	82	83	84	85	86	87	88	89	90
Hyp	Hyp	Hyp	Hyp	Hyp	Hyp	Cmn	Cmn	Hyp	Cte
91	92	93	94	95	96	97	98	99	100
Hyp	Hyp	Hyp	L	Hyp	Hyp	Hyp	Hyp	St	Hyp

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; ~~Dash~~ Brgr = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 1

BARE SOIL	22
EROSION PAVEMENT	—
ROCK	—
LITTER	14
MOSS	—
PLANT DENSITY INDEX	64
TOTAL	100
FORAGE DENSITY INDEX	64
GROUND COVER INDEX	78
OVERSTORY	4
UNDERSTORY	60

SPECIES
(List by name, symbol and number of hits)

LA - Lanni a-SP=LA = 1
Hyparrhenia involucrata=Hyp=41
Combretum micricans=Cmn=5
Strychnos sp=St = 5
Discetis sp = D = 5

KEY INDICATOR SPECIES NOT RECORDED
Detarium microcarpum
Terminalia indica

VIGOR MEASUREMENTS

	Det	Cmn	AL
1	3.0	6.0	1.1
2	3.5	6.0	1.0
3	3.0	6.0	1.1
4	3.5	6.0	1.0
5	3.5	6.0	1.1
6	3.5	6.0	1.1
7	3.5	6.0	1.0
8	3.5	6.0	1.0
9	3.5	6.0	1.1
10	3.0	6.0	1.1
Total	34.0	60.0	10.6
Avg. Max.	3.40	6.00	1.06

RECORD OF PERMANENT LINE TRANSECT

Allotment Cumbres Taceous Sav-Grass Date 1/22/77 By OKAFOR-ECJ Cluster No. 3

Transect No. 2

1	2	3	4	5	6	7	8	9	10
							Cmn	Cmn	
Cyb	Cyb	Brgr	Cyb	Hyp	Brgr	Cte			L
11	12	13	14	15	16	17	18	19	20
		Cmn							
L	Brgr		L	Cmn	L	L	L	Brgr	L
21	22	23	24	25	26	27	28	29	30
Cmn					Cmn	Cmn		Cmn	
	L		L	Hyp	L			L	L
31	32	33	34	35	36	37	38	39	40
L	Cmn	L	Cmn	L	L	Cmn	Hyp	Hyp	Hyp
41	42	43	44	45	46	47	48	49	50
Hyp	Hyp	Hyp	Brgr	L	L	Brgr	Brgr	L	Hyp
51	52	53	54	55	56	57	58	59	60
Hyp	L	L	Brgr	L	L	L	Brgr	Brgr	Brgr
61	62	63	64	65	66	67	68	69	70
	Cmn								
Brgr		L	Cmn	Cmn	L	L	Brgr	Brgr	L
71	72	73	74	75	76	77	78	79	80
			Cmn	Lm					
Brgr	L	L			Hyp	Brgr	L	L	Hyp
81	82	83	84	85	86	87	88	89	90
									Cmn
L	L	L	Hyp	L	Hyp	Hyp	L	Hyp	
91	92	93	94	95	96	97	98	99	100
Brgr	L	L	L	Hyp	Hyp	Hyp	Hyp	Hyp	Hyp

BARE SOIL	17
EROSION PAVEMENT	--
ROCK	--
LITTER	40
MOSS	--
PLANT DENSITY INDEX	43
TOTAL	180
FORAGE DENSITY INDEX	43
GROUND COVER INDEX	53
OVERSTORY	11
UNDERSTORY	32

SPECIES (List by name, symbol and number of hits)

Cymbopogon sp Cyb = 3

Cumbretum nigricans Cmn = 16

Hyparrhenia involucrata Hyp = 4

Ctenium sp = Cte = 1

Lannia sp = LA = 1

KEY INDICATOR SPECIES NOT RECORDED

A. Leiocarpus (AL)

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:

Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Cmn	AL	Lm
1	6.0	1.1	4.5
2	6.0	1.0	5.0
3	6.1	1.1	5.0
4	6.2	1.1	4.5
5	5.9	1.0	4.5
6	5.8	1.0	4.5
7	6.0	1.0	4.5
8	6.0	1.0	5.0
9	6.0	1.1	5.0
10	6.0	1.1	4.5
Total	60.0	10.5	57.6
Avg. Max.	6.00	1.05	5.16

RECORD OF PERMANENT LINE TRANSECT

Allotment COMBRETACEOUS SAV. SHRUB Date 1/22/77 By CRAFOR E.C.J. Cluster No. 3

1	2	3	4	5	6	7	8	9	10
LA									Cmn
	Cmn	Brgr	L	L	L	Brgr	L	Cmn	
11	12	13	14	15	16	17	18	19	20
								Cmn	Cmn
L	Brgr	L	L	Brgr	Brgr	Brgr	L		
21	22	23	24	25	26	27	28	29	30
Cmn				Cmn	Cmn	Cmn			Cmn
	L	And	L				L	L	
31	32	33	34	35	36	37	38	39	40
	Cmn	Cmn	Cmn	Cmn					St
And					Brgr	Brgr	L	D	
41	42	43	44	45	46	47	48	49	50
And	Brgr	And	L	Brgr	Brgr	Brgr	Brgr	Brgr	Brgr
51	52	53	54	55	56	57	58	59	60
					Cmn	Cmn	Cmn		Cmn
Brgr	And	L	L	Cmn				And	
61	62	63	64	65	66	67	68	69	70
								Cmn	Cmn
L	Brgr	Brgr	Brgr	Brgr	Brgr	Brgr	L		
71	72	73	74	75	76	77	78	79	80
L	L	Cmn	Cmn	L	Brgr	Cmn	Cmn	L	Brgr
81	82	83	84	85	86	87	88	89	90
			Cmn						
D	L	Brgr	Cte	Cte	Cmn	Cmn	Cmn	Cmn	Cmn
91	92	93	94	95	96	97	98	99	100
							Cmn	Cmn	Cmn
Cte	Cmn	L	L	L	L	Cmn			

Transect No. 3

BARE SOIL	25
EROSION PAVEMENT	—
ROCK	—
LITTER	27
MOSS	—
PLANT DENSITY INDEX	48
TOTAL	100
FORAGE DENSITY INDEX	48
GROUND COVER INDEX	75
OVERSTORY	24
UNDERSTORY	24

SPECIES
(List by name, symbol and number of hits)

LAMIACEAE - LA = 1

Combretum apiculatum = Cmn = 35

Andropogon gayanus = And = 6

Cteniumsp Cte. = 3

Diospyros sp. D = 2

Strychnos sp. St = 1

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	Cmn. Crown	Stem	# Al.
1	5.0	15.0	1:1
2	5.5	18.0	1:1
3	5.5	17.0	1:0
4	6.0	17.0	1:0
5	5.5	18.0	1:0
6	5.0	16.0	1:1
7	6.0	16.0	1:1
8	5.5	19.0	1:0
9	6.0	15.0	1:1
10	5.5	18.0	1:0
Total	55.5	169.0	10:5
Avg. Max.	5.55	16.90	1:05

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment Cambrian Trails Date 1/22/77 By [illegible] Cluster No. 3

Transect No. 1

1	2	3	4	5	6	7	8	9	10
Cmn									
	St	D	L	L	L	Cte	L	Brgr	Cmn
11	12	13	14	15	16	17	18	19	20
Cte	D	Brgr	Hyp	Cte	Cte	Dig	Dig	L	Cmn
21	22	23	24	25	26	27	28	29	30
L	L	Brgr	Brgr	D	Cte	D	D	D	Cte
31	32	33	34	35	36	37	38	39	40
				Cmn					
Dig	L	Cte	D		Brgr	Hyp	Cmn	D	Wi
41	42	43	44	45	46	47	48	49	50
Dig	D	Wi	Cte	Cte	L	Wi	Brgr	Wi	D
51	52	53	54	55	56	57	58	59	60
Brgr	Cte	Cte	Cte	Cte	Dig	Cte	Hyp	Cte	Brgr
61	62	63	64	65	66	67	68	69	70
Brgr	L	Cte	Cmn	Dig	Cmn	Cte	Cte	Cte	Cte
71	72	73	74	75	76	77	78	79	80
							Cmn	Cmn	Cmn
Cte	L	Cte	Cte	L	Cte	Cte			
81	82	83	84	85	86	87	88	89	90
	Cmn		Cmn						
Cmn		L		Cte	Cte	L	Brgr	Cte	Cmn
91	92	93	94	95	96	97	98	99	100
									Cmn
Ni	Dig	Hyp	L	L	St	Dig	Hyp	Cte	Brgr

BARE SOIL	10
EROSION PAVEMENT	—
ROCK	—
LITTER	16
MOSS	—
PLANT DENSITY INDEX	74
TOTAL	100
FORAGE DENSITY INDEX	74.
GROUND COVER INDEX	90
OVERSTORY	8
UNDERSTORY	82.

SPECIES (List by name, symbol and number of hits)

Disceria sp. D = 9

Cteniium = Cte = 29

Strichnos sp. St = 2

Digiteria = Dig = 6

Cambretum nigricans - Cmn = 15

Hyparrhenia involucrata - Hyp = 5

Wolfteria indica - Wi = 4

KEY INDICATOR SPECIES NOT RECORDED

A. leiocarpus

Burkea africana - Brg

Lanea sp.

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK: Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Cmn	Brg	AL
1	7"	2"	1.0
2	6"	1.9	1.1
3	7.5	2	1.1
4	7.5	2.3	1.1
5	5.0	2.0	1.1
6	7.6	2.0	1.0
7	5.0	2.0	1.0
8	6.4	1.9	1.1
9	7.5	2.1	1.0
10	7.9	1.5	1.0
Total	77.3	20.0	10.5
Avg. Max.	7.73	2.00	1.05

RECORD OF PERMANENT LINE TRANSECT

Allotment Detarium Woodland Date 1/24/79 By OKAFOR. E.C.J Cluster No. 1

Transect No. 1

	1	2	3	4	5	6	7	8	9	10
	Ln									
		And	L	And	And	L	And	And	And	Brgr
	11	12	13	14	15	16	17	18	19	20
	Brgr	L	L	D	Cmg	Cmg	L	L	Cmg	Cmg
	21	22	23	24	25	26	27	28	29	30
	L	And	And	And	And	And	L	And	D	Brgr
	31	32	33	34	35	36	37	38	39	40
	Brgr	And	And	And	And	And	And	And	And	And
	41	42	43	44	45	46	47	48	49	50
	Dte	Hab	And	And	And	And	And	D	And	And
	51	52	53	54	55	56	57	58	59	60
	And	And	And	And	And	And	And	Cmg	And	Brgr
	61	62	63	64	65	66	67	68	69	70
	Brgr	Brgr	Brgr	L	And	And	And	Cmg	Cmg	Cmg
	71	72	73	74	75	76	77	78	79	80
	And	And	Cmg	And	L	And	And	And	And	And
	81	82	83	84	85	86	87	88	89	90
	Hab	L	L	And	And	And	And	And	And	And
	91	92	93	94	95	96	97	98	99	100
	Cmg									Cmg
		Cmg	And	And	And	Brgr	And	And	And	Cmg

BARE SOIL	9
EROSION PAVEMENT	—
ROCK	—
LITTER	12
MOSS	—
PLANT DENSITY INDEX	79
TOTAL	100
FORAGE DENSITY INDEX	79
GROUND COVER INDEX	91
OVERSTORY	4
UNDERSTORY	75

SPECIES (List by name, symbol and number of hits)

Lannia spp — Ln = 1

Andropogon ascinoides - And = 61

Hibiscus spp — Hab = 2

Detarium microcarpum - Dte = 1

Combretum glutinosum - Cmg = 13

Nicotis spp — D = 2

KEY INDICATOR SPECIES NOT RECORDED

Burkea africana - Ba

Anogeissus leiocarpus - AL

VIGOR MEASUREMENTS

	Cmg	Dte	Ba.
1	5.0	2.5	2.0
2	5.1	2.6	1.6
3	5.2	3.0	1.8
4	5.1	2.8	1.8
5	5.0	2.9	1.6
6	5.0	2.5	1.8
7	5.0	2.6	1.8
8	5.0	2.9	1.6
9	5.0	3.0	2.0
10	5.0	3.0	2.0
Total	50.4	27.6	18.0
Avg. Max.	5.04	2.76	1.80

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment DETARIUM WOODLAND Date 1/24/77 By OKAFOR.E.C.J Cluster No. 1

Transect No. 2

1	2	3	4	5	6	7	8	9	10
Dtr	Dtr	Dtr							
			And	And	And	L	L	And	And
11	12	13	14	15	16	17	18	19	20
fb	L	L	fb	And	And	And	And	And	L
21	22	23	24	25	26	27	28	29	30
And	And	And	L	L	L	And	And	L	L
31	32	33	34	35	36	37	38	39	40
L	L	Cmg	And	And	Cmg	Cmg	And	And	And
41	42	43	44	45	46	47	48	49	50
				Dtr					
L	L	Cmg	And		L	And	And	And	Brgr
51	52	53	54	55	56	57	58	59	60
L	fb	fb	And	L	Cmg	Brgr	Brgr	fb	And
61	62	63	64	65	66	67	68	69	70
And	And	Brgr	fb	L	Brgr	L	L	And	Brgr
71	72	73	74	75	76	77	78	79	80
			Dtr						
L	And	And		L	L	And	Brgr	L	And
81	82	83	84	85	86	87	88	89	90
			Cmg						
fb	And	And		And	And	And	And	Cmg	And
91	92	93	94	95	96	97	98	99	100
Cmg									Cmg
	L	And	And	And	And	And	Cmg	L	

BARE SOIL	7
EROSION PAVEMENT	—
ROCK	—
LITTER	26
MOSS	—
PLANT DENSITY INDEX	67
TOTAL	100
FORAGE DENSITY INDEX	67
GROUND COVER INDEX	93
OVERSTORY	8
UNDERSTORY	59

SPECIES (List by name, symbol and number of hits)

Detarium microcarpum - Dtr = 5

Andropogon ascinoides - And = 45

Cenchrus glutinosum - Cmg = 10

Fimbristylis (spp) - fb = 7

KEY INDICATOR SPECIES NOT RECORDED

Leguminosae longifoliolate - L

Anogeissus leiocarpus - Al

Burkea africana - Ba

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Bare = Soil.

DOT CHECK:

Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Cmg	Dtr	Al
1	5·0	2·5	1·2
2	5·2	2·5	1·3
3	5·2	2·4	1·2
4	5·4	2·6	1·2
5	5·2	2·6	1·3
6	5·0	2·3	1·4
7	5·3	2·4	1·3
8	5·2	2·5	1·3
9	5·2	2·5	1·4
10	5·0	2·5	1·2
Total	51.7	24.9	12.8
Avg. Max.	5·17	2·48	1·28

RECORD OF PERMANENT LINE TRANSECT

Allotment Detarium woodland Date 1/24/77 By OKAFOR · E·C·J Cluster No. 1

1	2	3	4	5	6	7	8	9	10
St.						Dte.			
	L	Fb	And.	And.	And.		And.	And.	And.
11	12	13	14	15	16	17	18	19	20
					Dte.				
And.	And.	And.	And.	And.		Cmg.	Brgr.	L	L
21	22	23	24	25	26	27	28	29	30
					Cmg.				St.
Brgr.	L	L	And.	And.		And.	And.	And.	
31	32	33	34	35	36	37	38	39	40
		SL							
L	And.		Brgr.	And.	And.	And.	And.	Cmg.	And.
41	42	43	44	45	46	47	48	49	50
									Cmg.
And.	And.	And.	And.	And.	L	L	And.	And.	
51	52	53	54	55	56	57	58	59	60
							Cmg.		
L	L	And.	And.	L	Fb.	Brgr.		And.	And.
61	62	63	64	65	66	67	68	69	70
		Cmg.				Cmg.			
And.	And.		And.	And.	And.		Cmg.	And.	And.
71	72	73	74	75	76	77	78	79	80
And.	And.	L	And.	And.	L	Cmg.	And.	Cmg.	Dte.
81	82	83	84	85	86	87	88	89	90
				Cmg.					
Dte.	L	And.	And.		L	Brgr.	And.	Fb.	L
91	92	93	94	95	96	97	98	99	100
			Cmg.						La.
L	L	And.		L	L	L	Brgr.	L	

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Bare = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 3

BARE SOIL	5
EROSION PAVEMENT	—
ROCK	—
LITTER	32
MOSS	—
PLANT DENSITY INDEX	73
TOTAL	100
FORAGE DENSITY INDEX	73
GROUND COVER INDEX	95
OVERSTORY	12
UNDERSTORY	

SPECIES
(List by name, symbol and number of hits)

Detarium microcarpum - Dte = 3
Andropogon asiaticus - And = 47
Fimbristylis ~~spp Fb~~ - dichotoma Fb = 3
Combretum glutinosum - Cmg = 18
Securidaca longipedunculata SL - 1
Lannea sp La - 2
Strichnos spp = St · 2.

KEY INDICATOR SPECIES NOT RECORDED

Prosopis africana · PA.

VIGOR MEASUREMENTS

	Cmg	Dte	PA
1	4.0	2.5	0.5
2	4.5	2.4	0.5
3	4.0	2.4	0.5
4	4.5	2.5	0.6
5	4.5	2.5	0.6
6	4.5	2.6	0.5
7	4.0	2.6	0.6
8	4.5	2.6	0.5
9	4.5	2.5	0.7
10	4.5	2.5	0.5
Total	43.5	25.1	6.1
Avg. Max.	4.35	2.51	0.61

RECORD OF PERMANENT LINE TRANSECT

Allotment Fadaman Maka Date 1/25/77 By OKAFOR.ECJ Cluster No. 1

1	2	3	4	5	6	7	8	9	10
mp	mp	Ryp	mp	Ryp	mp	mp	Ryp	Ryp	mp
11	12	13	14	15	16	17	18	19	20
mp	mp	mp	Brgr	Ryp	mp	mp	L	Ryp	mp
21	22	23	24	25	26	27	28	29	30
mp	mp	Ryp	Ryp	Ryp	Brgr	mp	mp	mp	mp
31	32	33	34	35	36	37	38	39	40
mp	mp	Ryp	Cal	Cal	Rye	mp	mp	Ryp	mp
41	42	43	44	45	46	47	48	49	50
mp	mp	mp	mp	mp	mp	mp	mp	Ryp	Ryp
51	52	53	54	55	56	57	58	59	60
mp	mp	mp	mp	mp	mp	mp	mp	mp	Ryp
61	62	63	64	65	66	67	68	69	70
Ryp	mp	mp	mp	mp	mp	Ryp	Ryp	Ryp	Ryp
71	72	73	74	75	76	77	78	79	80
Ryp	mp	mp	mp	mp	mp	mp	Brgr	Brgr	mp
81	82	83	84	85	86	87	88	89	90
Ryp	mp	mp	mp	mp	mp	mp	Ryp	Ryp	mp
91	92	93	94	95	96	97	98	99	100
mp	mp	mp	mp	mp	mp	Ryp	mp	mp	mp

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 1

BARE SOIL	3
EROSION PAVEMENT	-
ROCK	-
LITTER	1
MOSS	-
PLANT DENSITY INDEX	96
TOTAL	100
FORAGE DENSITY INDEX	96
GROUND COVER INDEX	96
OVERSTORY	-
UNDERSTORY	96

SPECIES
(List by name, symbol and number of hits)

Mimosa pigra - mp = 69
Rhynchosbra Corymbosa - Ryp = 24
Calapogonium spp - Cal = 2

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	mp	Ryp.
1	0.25	36.0
2	0.25	36.0
3	0.25	36.0
4	0.25	36.0
5	0.25	36.0
6	0.25	36.0
7	0.25	35.0
8	0.25	35.0
9	0.25	35.0
10	0.25	36.0
Total	2.50	357.0
Avg. Max.	0.25	35.70

RECORD OF PERMANENT LINE TRANSECT

Allotment Fadaman Malka Date 1/25/77 By Okafor E.C.J Cluster No. 1

1	2	3	4	5	6	7	8	9	10
mp	mp	mp	mp	mp	mp	mp	Ryp	mp	mp
11	12	13	14	15	16	17	18	19	20
Ryp	Ryp	Ryp	mp	mp	mp	Brgr	mp	Cal	mp
21	22	23	24	25	26	27	28	29	30
Cal	Cal	Ryp	Ryp	Ryp	mp	mp	Ryp	mp	mp
31	32	33	34	35	36	37	38	39	40
mp	mp	mp	mp	mp	mp	Ryp	mp	mp	mp
41	42	43	44	45	46	47	48	49	50
mp	Brgr	Brgr	mp	mp	Ryp	Ryp	Ryp	Brgr	mp
51	52	53	54	55	56	57	58	59	60
mp	mp	mp	mp	mp	mp	Ryp	mp	mp	mp
61	62	63	64	65	66	67	68	69	70
Ryp	mp	Brgr	Ryp	Ryp	mp	mp	mp	mp	mp
71	72	73	74	75	76	77	78	79	80
mp	mp	mp	mp	mp	mp	Ryp	mp	mp	mp
81	82	83	84	85	86	87	88	89	90
mp	mp	mp	mp	mp	mp	mp	mp	mp	mp
91	92	93	94	95	96	97	98	99	100
Ryp	mp	mp	mp	mp	mp	mp	mp	mp	mp

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 2

BARE SOIL	5
EROSION PAVEMENT	—
ROCK	—
LITTER	—
MOSS	—
PLANT DENSITY INDEX	95
TOTAL	100
FORAGE DENSITY INDEX	95
GROUND COVER INDEX	95
OVERSTORY	—
UNDERSTORY	95

SPECIES
(List by name, symbol and number of hits)

Mimosa pigra – mp = 74
Rhynchosstora corymbosa – Ryp – 18
Calopogon spp – Cal = 3

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	mp	Ryp
1	0.25	36.0
2	0.25	35.0
3	0.25	35.0
4	0.25	36.0
5	0.25	36.0
6	0.25	36.0
7	0.25	36.0
8	0.25	35.0
9	0.25	36.0
10	0.25	36.0
Total	2.50	357.0
Avg. Max.	0.25	35.70

RECORD OF PERMANENT LINE TRANSECT

Allotment Fadamen Maka Date 1/25/77 By OKAFOR E.C.J Cluster No. 1

1	2	3	4	5	6	7	8	9	10
mp	mp	mp	mp	mp	mp	Ryp	Brgr	mp	mp
11	12	13	14	15	16	17	18	19	20
mp	mp	mp	mp	mp	mp	mp	mp	mp	mp
21	22	23	24	25	26	27	28	29	30
Brgr	Brgr	Cal	mp	mp	mp	mp	mp	Cal	Cal
31	32	33	34	35	36	37	38	39	40
mp	mp	mp	mp	Cal	Brgr	Ryp	Ryp	Ryp	mp
41	42	43	44	45	46	47	48	49	50
Ryp	mp	mp	mp	mp	mp	Cal	mp	mp	mp
51	52	53	54	55	56	57	58	59	60
mp	mp	mp	mp	mp	mp	mp	mp	mp	mp
61	62	63	64	65	66	67	68	69	70
mp	Ryp	Ryp	Ryp	Ryp	mp	mp	mp	mp	mp
71	72	73	74	75	76	77	78	79	80
mp	mp	Cal	mp	Cal	Brgr	mp	mp	mp	mp
81	82	83	84	85	86	87	88	89	90
mp	mp	mp	mp	mp	mp	mp	mp	mp	mp
91	92	93	94	95	96	97	98	99	100
mp	mp	mp	Ryp	mp	mp	mp	mp	mp	mp

Transect No. 3

BARE SOIL	5
EROSION PAVEMENT	—
ROCK	—
LITTER	—
MOSS	—
PLANT DENSITY INDEX	95
TOTAL	100
FORAGE DENSITY INDEX	95
GROUND COVER INDEX	95
OVERSTORY	—
UNDERSTORY	95

SPECIES (List by name, symbol and number of hits)

Mimosa bigra - Mp = 78

Rhynchosia sp. Ryp = 15

Calopogon spp - Cal = 7

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	Mp	Ryp
1	0.25	35.0
2	0.25	35.0
3	0.25	36.0
4	0.25	36.0
5	0.25	36.0
6	0.25	36.0
7	0.25	35.0
8	0.25	35.0
9	0.25	36.0
10	0.20	36.0
Total	2.50	356.0
Avg. Max.	0.25	35.60

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:

Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment [illegible] Date 1/25/77 By CLARK · E·C·J Cluster No. 1

1	2	3	4	5	6	7	8	9	10
Fb	Jac	Fb	Fb	Fb	Jac	Fb	Jac	Fb	Fb
11	12	13	14	15	16	17	18	19	20
Jac	Fb	Fb	Jac	Jac	Jac	Jac	Jac	Jac	Fb
21	22	23	24	25	26	27	28	29	30
Fb	Jac	UL	Fb	Jac	Jac	Jac	Jac	Jac	Fb
31	32	33	34	35	36	37	38	39	40
Jac	Jac	Jac	Jac	Jac	L	L	L	Jac	Jac
41	42	43	44	45	46	47	48	49	50
Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac
51	52	53	54	55	56	57	58	59	60
Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac
61	62	63	64	65	66	67	68	69	70
Jac	L	L	Jac	Jac	L	Jac	Jac	Jac	Jac
71	72	73	74	75	76	77	78	79	80
Jac	Jac	Jac	Jac	Jac	Jac	Jac	Hyp	Hyp	Jac
81	82	83	84	85	86	87	88	89	90
Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac
91	92	93	94	95	96	97	98	99	100
Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac	Jac

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 1

BARE SOIL	—
EROSION PAVEMENT	—
ROCK	—
LITTER	6
MOSS	—
PLANT DENSITY INDEX	94
TOTAL	100
FORAGE DENSITY INDEX	94
GROUND COVER INDEX	100
OVERSTORY	—
UNDERSTORY	94

SPECIES
(List by name, symbol and number of hits)

Jardinea Congdonis-Jac-78
Fimbristylis dichotoma-Fb-1
Urena lobata-UL-1
Hyparrhennia involucrata-Hyp

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	Jac	Fb
1	36.0	3.0
2	34.0	3.2
3	34-0	3.2
4	36.0	3.0
5	32.0	3.4
6	32.0	3.4
7	34.0	3.4
8	34.0	3.2
9	36.0	3.2
10	36.0	3.2
Total	344.0	32.2
Avg. Max.	34.4	3.22

RECORD OF PERMANENT LINE TRANSECT

Allotment Fashman Barkono Date 1/25/77 By Okafor. E.C.J Cluster No. 1

Transect No. 2

1	2	3	4	5	6	7	8	9	10
JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC
11	12	13	14	15	16	17	18	19	20
JAC	Fb	Fb	Fb	JAC	JAC	JAC	JAC	JAC	JAC
21	22	23	24	25	26	27	28	29	30
L	L	Fb	Fb	Fb	Fb	JAC	Hyp	Hyp	Hyp
31	32	33	34	35	36	37	38	39	40
JAC	JAC	JAC	L	L	L	JAC	JAC	JAC	Fb
41	42	43	44	45	46	47	48	49	50
Fb	Fb	JAC	UL	JAC	JAC	JAC	UL	JAC	JAC
51	52	53	54	55	56	57	58	59	60
JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC
61	62	63	64	65	66	67	68	69	70
JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC
71	72	73	74	75	76	77	78	79	80
JAC	JAC	JAC	L	L	L	JAC	JAC	JAC	JAC
81	82	83	84	85	86	87	88	89	90
JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	UL
91	92	93	94	95	96	97	98	99	100
JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC

BARE SOIL	—
EROSION PAVEMENT	—
ROCK	—
LITTER	8
MOSS	—
PLANT DENSITY INDEX	92
TOTAL	100
FORAGE DENSITY INDEX	92
GROUND COVER INDEX	100
OVERSTORY	—
UNDERSTORY	92.

SPECIES
(List by name, symbol and number of hits)

Jardinea Congoensis - JAC-7
Fimbrictylis dichotoma - Fb-1
Urena lobata - UL - 1
Hyparrhennia invulucrata - Hyp.

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	JAC	Fb
1	35.0	3.1
2	35.0	3.4
3	34.0	3.2
4	33.0	3.0
5	33.0	3.0
6	35.0	3.4
7	32.0	3.4
8	32.0	3.2
9	36.0	3.2
10	36.0	3.2
Total	341.0	32.2
Avg. Max.	34.10	3.22

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:

Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment Fadman Barrow Date 1/25/77 By Okafor, Ecj Cluster No. 1

Transect No. 3

	1	2	3	4	5	6	7	8	9	10
	Hyp	Hyp	Fb	Fb	L	L	Hyp	JAC	JAC	JAC
11	12	13	14	15	16	17	18	19	20	
	JAC	JAC	JAC	JAC	JAC	JAC	JAC	L	L	Fb
21	22	23	24	25	26	27	28	29	30	
	Fb	Fb	JAC	JAC	JAC	UL	UL	JAC	JAC	UL
31	32	33	34	35	36	37	38	39	40	
	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC
41	42	43	44	45	46	47	48	49	50	
	JAC	UL	UL	L	L	L	JAC	JAC	Fb	Fb
51	52	53	54	55	56	57	58	59	60	
	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC
61	62	63	64	65	66	67	68	69	70	
	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC
71	72	73	74	75	76	77	78	79	80	
	Fb	L	L	JAC	JAC	JAC	JAC	JAC	JAC	JAC
81	82	83	84	85	86	87	88	89	90	
	JAC	JAC	Fb	UL	L	Fb	Fb	JAC	JAC	JAC
91	92	93	94	95	96	97	98	99	100	
	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC	JAC

BARE SOIL	—
EROSION PAVEMENT	—
ROCK	—
LITTER	10
MOSS	—
PLANT DENSITY INDEX	90
TOTAL	100
FORAGE DENSITY INDEX	90
GROUND COVER INDEX	100
OVERSTORY	—
UNDERSTORY	90

SPECIES
(List by name, symbol and number of hits)

Fimbristylis dichotoma - Fb - 11

Hyparrhenia involucrata - Hyp - 3

Urena lobata - UL - 6

Jardinea congensis - JAC - 80

KEY INDICATOR SPECIES NOT RECORDED

VIGOR MEASUREMENTS

	Fb	JAC
1	3.0	35.0
2	3.4	35.0
3	3.4	36.0
4	3.2	36.0
5	3.2	34.0
6	3.0	35.0
7	3.4	34.0
8	3.4	34.0
9	3.2	35.0
10	3.2	34.0
Total	32.4	348.0
Avg. Max.	3.24	34.80

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment HIGH FOREST Date 1/27/77 By OKAFOR E.C.J. Cluster No. 1

1	2	3	4	5	6	7	8	9	10
Pte									
	L	L	L	Dio	L	L	L	L	Dio
11	12	13	14	15	16	17	18	19	20
		Dio	Dio						
Dio	Dio			L	L	L	L	L	L
21	22	23	24	25	26	27	28	29	30
								Dio	Dio
L	L	L	L	Dio	L	L	Dio		
31	32	33	34	35	36	37	38	39	40
				Dry	Dio	Caf			
L	L	L	L				L	L	L
41	42	43	44	45	46	47	48	49	50
L	L	L	L	EG	Dio	L	L	L	L
51	52	53	54	55	56	57	58	59	60
L	L	L	L	L	L	L	L	L	L
61	62	63	64	65	66	67	68	69	70
Dio		Dry		Dry				Dio	
	Dry		L		L	L	Dio		L
71	72	73	74	75	76	77	78	79	80
L	L	L	L	L	L	L	L	L	L
81	82	83	84	85	86	87	88	89	90
NP							Caf	Dio	
	L	L	L	L	L	L			Dio
91	92	93	94	95	96	97	98	99	100
					NP				NP
L	L	Bs	L	L		Dio	L	L	

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

Transect No. 1

BARE SOIL	—
EROSION PAVEMENT	—
ROCK	—
LITTER	70
MOSS	—
PLANT DENSITY INDEX	30
TOTAL	100
FORAGE DENSITY INDEX	30
GROUND COVER INDEX	100
OVERSTORY	17
UNDERSTORY	13

SPECIES
(List by name, symbol and number of hits)

Pteleopsis hebecarpa – Pte = 1
Diospyros mespiliformis – Dio = 19
Drypetes gilgiana – Dry = 4
Coffea spp – Caf = 2
Elaeis guineensis – EG = 1
Psychotria spp – Rp = 1
Nesogordonia papaverifera – NP = 3

KEY INDICATOR SPECIES NOT RECORDED

Acacia spp. Ac.
Rhizophora – Rhz.

VIGOR MEASUREMENTS

	N.P.	Dio.	Caf.
1	2.0	4.2	7.0
2	2.1	4.1	7.0
3	2.0	4.1	7.2
4	2.2	4.2	7.2
5	2.0	4.0	7.0
6	2.0	4.0	7.0
7	2.0	4.0	7.0
8	2.0	4.0	7.0
9	2.0	4.0	7.0
10	2.0	4.0	7.0
Total	20.4	40.6	70.4
Avg. Max.	2.04 in	4.06 in	7.04

RECORD OF PERMANENT LINE TRANSECT

Allotment HIGH FOREST Date 1/27/77 By OKAFOR E.C.J. Cluster No. 1

Transect No. 2

1	2	3	4	5	6	7	8	9	10
Pe	Ne	Ci	Cof	Com	Pe	Dd	Dd	L	L
11	12	13	14	15	16	17	18	19	20
Cof	L	L	Cof	Ci	Ci	Ci	L	L	L
21	22	23	24	25	26	27	28	29	30
Cof	L	Cof	Cof	Cof	Ci	Cof	L	Cof	L
31	32	33	34	35	36	37	38	39	40
IJ	L	Cof	Cof	Cof	Cof	L	L	L	L
41	42	43	44	45	46	47	48	49	50
L	Ci	Cof	L	Cof	Cof	L	L	L	L
51	52	53	54	55	56	57	58	59	60
Cof	Cof	Cof	L	L	Psy	Cof	L	L	Pe
61	62	63	64	65	66	67	68	69	70
						Lw			
Pe	Pe	Psy	L	Pe	Pe		L	Cof	L
71	72	73	74	75	76	77	78	79	80
									Cof
L	L	Pe	Pe	Pe	Pe	L	L	Pe	
81	82	83	84	85	86	87	88	89	90
				Bu	Psy	Lw		Cof	
L	L	L	L				L		Eg
91	92	93	94	95	96	97	98	99	100
		Lw							Lw
Pe	L		L	L	L	Pe	Br	Cof	

BARE SOIL	—
EROSION PAVEMENT	—
ROCK	—
LITTER	39
MOSS	—
PLANT DENSITY INDEX	61
TOTAL	100
FORAGE DENSITY INDEX	61
GROUND COVER INDEX	100
OVERSTORY	10
UNDERSTORY	51

SPECIES
(List by name, symbol and number of hits)

Pteris (fern) spp. - Pe = 14
Nephrolepis (fern) spp. - Ne = 1
Citaria spp - Ci = 6
Coffea spp - Cof = 24
Comelina (grass) - Com = 1
Oldlandia (herb) - Dd = 2
Ladia jenipiflora = IJ = 1
Psychotria spp - Psy = 2
Lannia ~~spp~~ - Lw = 4
Blighia unigitata - Bu = 1
Elaeis guineensis - Eg = 1
Brideli a ferugina - Br = 1

KEY INDICATOR SPECIES NOT RECORDED

Uapaca togoensis Ut
Agavaceae spp. Ag
Boraciuo palm.
Vitex ~~doniana~~.

VIGOR MEASUREMENTS

	NP	LW	Cof.
1	2.0	4.2	5.2
2	2.0	4.2	5.1
3	2.1	4.1	5.2
4	2.2	4.0	5.1
5	2.1	4.0	5.0
6	2.0	4.1	5.0
7	2.0	4.0	5.0
8	2.0	4.0	5.0
9	2.0	4.0	5.0
10	2.0	4.0	5.0
Total	20.4	40.6	50.6
Avg. Max. (inches)	2.04	4.06	5.06
(meters)			

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment HIGH FOREST Date 1/27/77 By O KAFOR E.C.J Cluster No. 1

Transect No. 3

1	2	3	4	5	6	7	8	9	10
Ks									
	UL	NP	NP	UL	NP	NP	UL	UL	UL
11	12	13	14	15	16	17	18	19	20
								NP	EG
UL	UL	UL	UL	Psy	Cof	Psy	L		
21	22	23	24	25	26	27	28	29	30
L	EG	L	NP	NP	NP	NP	CX	EG	L
31	32	33	34	35	36	37	38	39	40
									Cof
L	L	L	L	Cof	L	L	Bor	L	
41	42	43	44	45	46	47	48	49	50
				Cof		Cof			VD
L	L	L	L		Cof		L	L	
51	52	53	54	55	56	57	58	59	60
						Cof			Cof
L	L	EG	EG	L	L		L	NP	
61	62	63	64	65	66	67	68	69	70
			Cof						
NP	EG	L		L	L	L	L	L	L
71	72	73	74	75	76	77	78	79	80
				NP		NP			Cof
L	L	L	L		L		L	L	
81	82	83	84	85	86	87	88	89	90
				EG	NP				LO
L	L	L	L			L	L	L	
91	92	93	94	95	96	97	98	99	100
L	L	NP	L	EG	Ach	UL	L	L	LO

BARE SOIL	—
EROSION PAVEMENT	—
ROCK	—
LITTER	47
MOSS	—
PLANT DENSITY INDEX	53
TOTAL	100
FORAGE DENSITY INDEX	53
GROUND COVER INDEX	100
OVERSTORY	16
UNDERSTORY	37

SPECIES
(List by name, symbol and number of hits)

Khaya Senegalensis - KS = 1
Urena lobata - UL = 10
Boraccius flab = BorB = 1
Nesogodonia papravifera - NP = 15
Archirantes spp = Ach = 1
Psychotria spp - Psy = 2
Culcasia exculanta - CX = 1
Elaeis Guineensis - EG = 5
Coffea spp - Cof = 10
Landephia owariensis - Lo = 2
Vitex doniana - VD = 1

KEY INDICATOR SPECIES NOT RECORDED

Diospyros mespiliformis - DM

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Cof	NP	VD
1	4.2	2.0	4.0
2	4.2	2.0	4.0
3	4.2	2.0	4.0
4	4.4	2.0	4.0
5	4.0	2.0	4.0
6	4.2	2.0	4.0
7	4.2	2.0	4.0
8	4.2	2.0	4.0
9	4.2	2.0	4.0
10	4.2	2.0	4.0
Total	42.0	20.0	40.0
Avg. Max.	42.0	2.0	4.0

RECORD OF PERMANENT LINE TRANSECT

Allotment Ptelopsis woodland Date 1/26/77 By OKAFOR. E.C.J. Cluster No. 1

Transect No. 1

1	2	3	4	5	6	7	8	9	10
Pte									
	Cy	Cle	L	Cz	Cz	Cz	L	L	L
11	12	13	14	15	16	17	18	19	20
									Pte
UL	L	L	L	L	L	Ce	L	Cy	
21	22	23	24	25	26	27	28	29	30
Ce	L	L	L	L	L	L	L	Cy	L
31	32	33	34	35	36	37	38	39	40
		Pte							
Brgr	L		L	UL	L	L	L	L	L
41	42	43	44	45	46	47	48	49	50
Brgr	Brgr	Acn	brgr	L	L	L	Brgr	L	L
51	52	53	54	55	56	57	58	59	60
L	L	L	Brgr	L	Pte	L	L	L	L
61	62	63	64	65	66	67	68	69	70
			Pte						
L	L	L		L	L	L	L	L	L
71	72	73	74	75	76	77	78	79	80
L	Brgr	Cyb	L	L	R	R	R	R	R
81	82	83	84	85	86	87	88	89	90
R	R	R	R	R	R	R	R	R	L
91	92	93	94	95	96	97	98	99	100
L	L	L	L	L	Brgr	Brgr	Brgr	L	Pte

BARE SOIL	10
EROSION PAVEMENT	—
ROCK	14
LITTER	56
MOSS	—
PLANT DENSITY INDEX	20
TOTAL	100
FORAGE DENSITY INDEX	20
GROUND COVER INDEX	76
OVERSTORY	4
UNDERSTORY	16

SPECIES
(List by name, symbol and number of hits)

Croton zambesicus . cz : 3
Ptelopsis habensis . Pte = 6
Urena lobata = UL . 3
Cyperus spp = Cy = 2
Celosia spp = Ce = 2
Clerodendron spp = Cle = 1
Cymbopogon giganteus = Cyb = 1
Acacia nilotica = Acn = 1

KEY INDICATOR SPECIES NOT RECORDED

Adansonia digitata = Ad
Dysperous mesbiliformis = Dm

VIGOR MEASUREMENTS

	Dm	Cz	Pte
1	5·0	5·0	1·5
2	4·5	5·1	1·6
3	4·5	5·1	1·6
4	4·9	5·2	1·6
5	4·9	5·0	1·5
6	5·2	5·0	1·4
7	5·2	5·1	1·5
8	5·2	5·3	1·6
9	5·0	5·0	1·5
10	5·0	5·0	1·5
Total	50·0	50·8	15·3
Avg. Max.	5·0c	5·0E	1·53

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; EP=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

RECORD OF PERMANENT LINE TRANSECT

Allotment Ptelopsis woodii Date 11/26/77 By OICAFOR EC.J Cluster No. 1

Transect No. 2

1	2	3	4	5	6	7	8	9	10
Pte									
	L	L	L	L	L	L	CY	CY	L
11	12	13	14	15	16	17	18	19	20
Pte									Pte
	L	L	L	L	L	L	L	L	
21	22	23	24	25	26	27	28	29	30
L	CZ	CZ	L	UL	L	UL	CZ	L	L
31	32	33	34	35	36	37	38	39	40
								Pte	
Brgr	Brgr	L	UL	L	L	L	L		L
41	42	43	44	45	46	47	48	49	50
L	L	CZ	Ce	Ce	L	L	L	L	CZ
51	52	53	54	55	56	57	58	59	60
CZ	L	Brgr	Brgr	L	Can	L	L	L	Brgr
61	62	63	64	65	66	67	68	69	70
L	L	L	Brgr	Brgr	L	Aca	Brgr	L	L
71	72	73	74	75	76	77	78	79	80
L	L	Can	Can	Can	Can	CZ	L	L	Brgr
81	82	83	84	85	86	87	88	89	90
EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
91	92	93	94	95	96	97	98	99	100
									Pte
CZ	L	Ac	L	L	CZ	CZ	L	L	

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

BARE SOIL	9
EROSION PAVEMENT	10
ROCK	—
LITTER	51
MOSS	—
PLANT DENSITY INDEX	30
TOTAL	100
FORAGE DENSITY INDEX	30
GROUND COVER INDEX	81
OVERSTORY	5
UNDERSTORY	25

SPECIES
(List by name, symbol and number of hits)

Cythula spp = CY = 2
Croton Zambesicus. CZ = 10
Ptelopsis habensis = Pte = 4
Urena lobata = UL = 3
Canthium spp = Can = 5
Acacia nilotica = Acn = 2

KEY INDICATOR SPECIES NOT RECORDED

Adansonia digitata = Ad.
Sansevieria libnica = SL.

VIGOR MEASUREMENTS

	Pte	CZ	SL
1	1.5	5.0	25.0
2	1.5	5.0	24.0
3	1.6	5.2	24.0
4	1.5	5.2	25.0
5	1.5	5.2	23.0
6	1.6	5.0	22.0
7	1.6	5.0	25.0
8	1.6	5.2	25.0
9	1.5	5.1	25.0
10	1.5	5.0	24.0
Total	15.4	50.9	247.0
Avg. Max.	1.54	5.09	24.70

RECORD OF PERMANENT LINE TRANSECT

Allotment PTEL0BSISWOODLAND Date 1/26/77 By OKAAR·E·C·J Cluster No. 1

Transect No. 3

1	2	3	4	5	6	7	8	9	10
Pte									
	L	L	Ce	Brgr	L	L	Brgr	Brgr	L
11	12	13	14	15	16	17	18	19	20
							Pte		
Ce	SL	L	L	L	Cy	Cy		L	L
21	22	23	24	25	26	27	28	29	30
Cy	L	L	L	Ce	Ce	L	L	L	L
31	32	33	34	35	36	37	38	39	40
L	L	L	L	Ce	Brgr	Ce	Brgr	L	L
41	42	43	44	45	46	47	48	49	50
Ac	Cz	Cz	Cz	UL	Cz	L	UL	Cz	L
51	52	53	54	55	56	57	58	59	60
								Pte	Pte
Brgr	L	Ac	Cz	L	L	L	L		
61	62	63	64	65	66	67	68	69	70
UL	UL	L	Cz	L	L	L	Brgr	Brgr	Brgr
71	72	73	74	75	76	77	78	79	80
Brgr	L	Brgr	Ce	Ce	Brgr	Brgr	Ac	Ce	L
81	82	83	84	85	86	87	88	89	90
							Pte		
L	L	L	L	Brgr	L	L		L	L
91	92	93	94	95	96	97	98	99	100
									Pte
Ce	Cz	L	L	L	L	Ce	Ce	L	

BARE SOIL	13
EROSION PAVEMENT	—
ROCK	—
LITTER	48
MOSS	—
PLANT DENSITY INDEX	39
TOTAL	100
FORAGE DENSITY INDEX	39
GROUND COVER INDEX	87
OVERSTORY	8
UNDERSTORY	33

SPECIES
(List by name, symbol and number of hits)

Pteleopsis habeensis - Pte. 6
Sansevieria liberica - SL = 1
Urena lobata = UL = 4
Celocia spp = Ce = 12
Cyperus spp = Cy = 1
Acacia nilotica — Ac. 2
Croton Zambesicus - Cz = 8

KEY INDICATOR SPECIES NOT RECORDED

Dyschorous nesp. liformis.

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R= Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

VIGOR MEASUREMENTS

	Pte	Cz	Dm
1	1.5	5.0	4.0
2	1.5	4.7	3.8
3	1.6	4.9	3.8
4	1.5	4.8	4.0
5	1.6	5.0	4.0
6	1.6	5.2	4.2
7	1.5	5.2	4.2
8	1.5	5.0	4.0
9	1.5	5.0	4.0
10	1.6	5.0	4.0
Total	15.4	530	400
Avg. Max.	1.54	5.30	4.0

APPENDIX II

RECORD OF PERMANENT LINE TRANSECT

Allotment Ptelepsis woodii Date 11/26/77 By Okafor. E.C.J Cluster No. 1

Transect No. 4

	1	2	3	4	5	6	7	8	9	10
	Pte			Pte						
		L	L		L	L	UL	CZ	L	L
	11	12	13	14	15	16	17	18	19	20
	L	L	L	L	EP	EP	L	UL	Ce	Ce
	21	22	23	24	25	26	27	28	29	30
	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
	31	32	33	34	35	36	37	38	39	40
	EP	EP	EP	EP	EP	EP	EP	EP	EP	EP
	41	42	43	44	45	46	47	48	49	50
	L	L	Ce	CY	CZ	EP	EP	EP	EP	EP
	51	52	53	54	55	56	57	58	59	60
						Pte				
	EP	EP	EP	SL	L		Acn	Acn	CZ	UL
	61	62	63	64	65	66	67	68	69	70
						Pte				
	UL	UL	Acn	Acn	Acn		CZ	L	EP	EP
	71	72	73	74	75	76	77	78	79	80
								Pte		
	EP	EP	EP	CZ	CZ	L	L		EP	EP
	81	82	83	84	85	86	87	88	89	90
	EP	EP	EP	L	Ce	CZ	UL	UL	Ce	CZ
	91	92	93	94	95	96	97	98	99	100
	CZ	Ce	Ce	L	EP	EP	UL	EP	L	L

BARE SOIL	
EROSION PAVEMENT	43
ROCK	—
LITTER	21
MOSS	—
PLANT DENSITY INDEX	36
TOTAL	100
FORAGE DENSITY INDEX	36
GROUND COVER INDEX	57
OVERSTORY	5
UNDERSTORY	31

SPECIES
(List by name, symbol and number of hits)

Ptelopsis habensis. Pte = 5
Urena lobata = UL = 8
Croton Zambesicus = CZ = 9
Acacia nilotica - Acn - 5
Celosia spp - Ce. 7
Cyathula spp - CY = 1
Sansevieria liberica. SL = 1

KEY INDICATOR SPECIES NOT RECORDED

Adansonia digitata - Ad
Canthium spp - Can.

VIGOR MEASUREMENTS

	Pte	Ce	SL
1	1.6	4.9	24.0
2	1.6	4.8	23.0
3	1.5	4.9	24.0
4	1.5	5.2	22.0
5	1.5	5.2	22.0
6	1.5	5.0	22.0
7	1.4	5.0	20.0
8	1.6	5.0	23.0
9	1.6	5.0	24.0
10	1.6	5.0	24.0
Total	15.4	5.40	228.0
Avg. Max.	1.54	5.40	22.80

NOTE: List overstory species at top of each block and circle symbol when dead. L=Litter; R=Rock; P=Pavement; M=Moss; Dash = Soil.

DOT CHECK:
Annuals

Form for recording information obtained in Step One.

APPENDIX III

QUESTIONNAIRE 1: PERCENTAGE RESPONSES OF 563 AREA RESIDENTS TO QUESTIONNAIRE CONCERNING THE STATUS AND SUCCESS OF THE YANKARI GAME RESERVE, NIGERIA, 1977

QUESTIONS		STR. / YASHI	DOGON RUWA	DUGURI	GAJI	BIRKIN DUTSE	KUTA	GALE	MAIWAJAJI	RIMI	TOTAL	
1	a	63	70	60	80	60	70	60	50	50	563	
2	b	0	0	0	0	0	0	0	0	0	0	
3	a	60	70	60	80	60	70	60	50	0	510	
	b	0	0	0	0	0	0	0	0	50	50	
	c	3	0	0	0	0	0	0	0	0	3	
4	a	40	40	40	50	20	30	40	20	30	310	
	b	23	30	20	30	40	40	20	30	30	253	
5	a	30	0	0	0	0	0	0	0	0	30	
	b	33	70	60	80	60	70	60	50	50	533	
6	a	3	0	0	2	0	0	0	0	0	5	
	b	60	70	60	78	60	70	60	50	50	558	
7	Bauchi State	63	70	60	80	60	70	60	50	50	563	
8	a	0	0	0	0	0	0	0	0	0	0	
	b	20	20	0	0	0	0	0	0	0	40	
	c	30	40	30	30	30	40	40	30	30	300	
	d	13	10	30	50	30	30	20	20	20	223	
9	a	63	70	60	40	50	70	60	50	0	463	82%
	b	0	0	0	40	10	0	0	0	0	50	9%
	c	0	0	0	0	0	0	0	0	50	50	9%
10	a	43	0	25	80	0	70	60	50	50	378	67%
	b	0	0	35	0	0	0	0	0	0	35	6%
	c	0	0	0	0	0	0	0	0	0	0	0%
	d	20	70	0	0	60	0	0	0	0	150	27%

11	a	53	70	0	0	0	70	60	50	0	303	54%
	b	0	0	0	0	0	0	0	0	0	0	0%
	c	10	0	60	80	60	0	0	0	50	260	46%
12	a	20	0	0	50	30	0	0	0	0	100	18%
	b	13	0	0	30	30	70	60	0	0	203	36%
	c	0	0	60	0	0	0	0	0	0	60	11%
	d	30	70	0	0	0	0	0	50	0	150	27%
	e	0	0	0	0	0	0	0	0	50	50	9%
13	a	0	0	0	0	0	0	0	0	0	0	0%
	b	63	70	0	80	60	70	60	50	0	453	80%
	c	0	0	60	0	0	0	0	0	50	110	20%
14	a	13	0	0	0	0	0	0	50	0	123	22%
	b	50	70	60	80	60	70	0	0	50	440	78%
	c	0	0	0	0	0	0	0	0	0	0	0%
15	a	30	30	60	80	60	70	60	0	50	440	78%
	b	33	40	0	0	0	0	0	50	0	123	22%
16	a	40	70	60	80	60	70	50	0	50	540	96%
	b	5	0	0	0	0	0	10	0	0	15	1%
	c	0	0	0	0	0	0	0	0	0	0	0%
	d	8	0	0	0	0	0	0	0	0	8	1%
	e	0	0	0	0	0	0	0	50	0	50	9%
	f	10	0	0	0	0	0	0	0	0	10	2%
17	a	50	70	60	0	10	0	0	0	0	190	34%
	b	13	0	0	80	50	20	30	50	0	243	43%
	c	0	0	0	0	0	0	0	0	50	50	9%
	d	0	0	0	0	0	50	30	0	0	80	14%
18	a	33	0	0	0	0	70	60	50	50	263	47%
	b	10	0	0	0	0	0	0	0	0	10	2%
	c	0	0	0	0	0	0	0	0	0	0	0%
	d	20	70	60	0	50	0	0	0	0	200	36%
	e	0	0	0	80	10	0	0	0	0	90	16%
19	a	10	0	0	0	0	0	0	0	0	10	2%
	b	40	0	0	0	0	70	0	0	0	110	20%
	c	13	70	60	80	60	0	60	50	50	443	78%
	d	0	0	0	0	0	0	0	0	0	0	0%

20	a	0	0	0	0	0	0	0	0	0	0	0%
	b	63	70	60	80	60	70	60	50	50	563	100%
21	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	0%
22	a	30	0	0	0	0	0	0	0	0	30	5%
	b	10	0	0	0	0	0	0	0	0	10	2%
	c	0	70	60	80	70	60	60	50	50	500	89%
	d	23	0	0	0	0	0	0	0	0	23	4%
23	a	50	70	60	80	60	70	10	50	0	450	80%
	b	13	0	0	0	0	0	50	0	50	113	20%
	c	0	0	0	0	0	0	0	0	0	0	0%
24	a	60	70	60	80	60	70	10	50	0	460	82%
	b	3	0	0	0	0	0	50	0	50	103	18%
	c	0	0	0	0	0	0	0	0	0	0	0%
25	a	60	70	0	0	60	70	60	50	0	370	66%
	b	3	0	0	80	0	0	0	0	0	83	15%
	c	0	0	60	0	0	0	0	0	50	110	20%
26	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not Not	Used Used
27	a	30	70	40	0	60	50	50	50	0	350	62%
	b	0	0	0	80	0	0	0	0	0	80	14%
	c	33	0	20	0	0	20	10	0	50	133	24%
28	a	63	70	0	50	60	70	60	50	0	423	75%
	b	0	0	60	30	0	0	0	0	50	140	25%
29	a	63	70	60	80	60	70	60	50	50	563	100%
	b	0	0	0	0	0	0	0	0	0	0	0%
	c	0	0	0	0	0	0	0	0	0	0	0%