

1. Evaluation of Range Condition and Trend of Ikwe Game Reserve Igbor, Gwer-East Local Government Area of Benue State, Nigeria.

ABSTRACT

Public concern over biological resources assessment has grown over the decade because of habitat fragmentation. The study was designed to evaluate the range condition and trend of Ikwe game reserve in Gwer-East local government area of Benue State, Nigeria. Assessment of herbaceous cover and composition, woody plant/shrubs density and plant vigor were carried out in randomly selected sample plots. Litter cover was determined by step point transect method, while erosion and its extent were assessed by presence and degree of gullies. Data collected was analyzed using descriptive statistics and analysis of variance (ANOVA). Results obtained showed that the herbaceous cover composed of perennials (39%) and annuals (61%). Mean litter cover and mean tree/shrub density were 37% and 252 trees and shrubs per hectare. The relative density of general herbaceous species shows that *Ludwigia decurrens* was the highest (8.22%) and the lowest *Tephrosia bracteolata* with (1.27%). Grass species shows that *pennicetum pendicellatum* had the highest with 17.58% (320 species) while *Maricus alternifolis* has the lowest of 1.21% (22 species). Water is available in the reserve for 7 months in a year. The range condition was evaluated to be in fair condition (total score of 41.5%) when compared to a key for rating condition and on a downward trend because of the rapid succession of less desirable plants (annuals and weeds), stunted plants and presence of slight erosion. Range management and improvement practices such as

23 prescribed burning, range seeding and reseeding, control rate of grazing and other sustainable
24 management practices should be put in place to restore the reserve.

25 **Keywords :-Range sites, botanical composition, herbaceous plant, tree density, game**
26 **reserve.**

27 **2. INTRODUCTION**

28 All nature reserves are adjudged based on the range condition (number and types of trees
29 species and animals co-existing) in an area [1]. Public concern over biological resources
30 assessment has grown over the decades. The concern stems from our increasing dependence
31 on renewable natural resources and rate of extinction of plants and animals species [2] habitat
32 destruction and poaching [3]. Many factors that affect the biodiversity of any area of land or
33 water are human induced [4 and 5].

34 A large proportion of Nigerian grass-land may be considered in the accepted definition of
35 range as land producing nature forage for animal consumption or land that are naturally or
36 artificially revegetated. The vegetation varies a great deal in the savanna zones, consisting of
37 rather open savanna woodland, shrubs and dominant grassland. The science of ecology is one
38 of fundamental building blocks upon which the applied field of range condition, trend and
39 management has been fashioned, therefore, the range condition and trend constitutes the
40 important component of any reserve, and most often reflect the suitability of choice of habitat
41 for fauna species. Generally, rangeland ecosystems are dynamic and complex to evaluate and
42 understand because they are constantly changing as a result of nature's driving forces
43 including climate condition [6].

44 Range condition is the state of health and vigor of a rangeland in relation to its full productive
45 potential [7]. It determines the improvement or inclining in relation to traditional composition
46 of a rangeland over a time. Therefore, it is the basis for adjusting and stocking figures and
47 revision of the management plans [8]. Thus, range protection and its proper management
48 increase total palatable vegetation cover [9]. Range condition is one of the basic tools used in
49 range evaluations to enable adequate judgment of stocking rate of both flora and fauna
50 resources, and management practices [10 and 11]. Range composition of botanical species is
51 the proportion of various plant species in relation to the total plant species in a given area. It
52 measures the degree of deterioration and improvement of a range land [12].

53 Range trend indicates the changes in status of resources at a site and is usually expressed as
 54 improving, declining or stable [13]. It originally pertained to any goal defined by
 55 management such as vegetation cover by adjusting stocking rates [14]. Its assessment
 56 depends upon evaluation of general health of individual plants, the vegetation cover and the
 57 soil structure [7]. According to Kefa and Oche [15], major attributes such as vegetation cover,
 58 frequency, abundance, herbage yield, species composition, herbaceous layer as well as water
 59 availability are to be monitored to determine the condition of that range. These influence the
 60 presence of animals in rangelands and undoubtedly affect distribution and promotion of their
 61 survival.

62 The general association of range trend with date describing any vegetation attribute in a
 63 monitoring program is still theoretically valid, but today the term carries a more specific
 64 interpretation relating to the comparison of consecutive assessment of range condition in a
 65 monitoring program [16]. The major attributes that need to be monitored and inventoried to
 66 determine the condition of rangelands are vegetation cover, frequency, abundance or density
 67 and yield of herbage species composition [8], herbaceous layer (cover, density and
 68 frequency) and water availability [13]. Water availability influences the presence of animals
 69 in rangelands and undoubtedly affects distribution and promotion of their survival and
 70 production. Animals tend to move away from areas with available forage to areas where the
 71 forage is overgrazed but there is water. This paper reviews the range condition of Ikwe game
 72 reserve the aim of ascertaining the possibility of range improvement or deterioration.

73 **3. MATERIALS AND METHODS**

74 **2.1 Study Area**

75 The research was carried out at Ikwe Game Reserve, Igbo, Gwer Local Government Area of
 76 Benue State, Nigeria which is located in the southern Guinea savanna belt on the hill area of
 77 Igbo and lies on latitude 7°27' and 7°30'N and longitude 8°37'E [2 and 17]. It has an area of
 78 approximately 25km² and it is about 40km² south of Makurdi along Makurdi –Aliade road.
 79 Three microhabitats of the reserve are; the woodland savannah, grassland savannah and
 80 cultivated land [2]. The reserve was created in 1980 by the Benue State Government with the
 81 aim of promoting ecotourism and biodiversity conservation. The duration of rainfall of the
 82 area ranges from 1140mm-1520mm and evapotranspiration is between 0.40-0.70.
 83 Temperature is about 30⁰c and the relative humidity is between 60% and 80%. The
 84 topography is highly undulated ranging from 45m to 800m above sea-level. The soil is

85 relatively fertile, shallow, well drained and sandy loam [18]. Dominant vegetation in the area
86 is compose of grasses and woody plants and shrubs.

87 **2.2 Data Collection**

88 The methods used for evaluating range condition and trend were those outlined by Kershaw,
89 [19]; Akosim *et al.*, [12]; Khobe *et al.*, [11]; Mbaya *et al.*, [13] and Khobe, [8]. A
90 reconnaissance survey was conducted for the purpose of identifying and delineating major
91 range sites of the area. Three range sites (A, B and C) were delineated based on the
92 microhabitat and laid down division of the reserve.

93 A survey of vegetation was conducted; **these** cover the grasses, forbs as well as trees and
94 shrubs. Parameters measured were liter cover, plant vigor, erosion, number of trees/shrubs
95 per hectare, relative density of plants species, perennials and annuals species. In each of the
96 three range sites, a base line of 1000m was established. A 18 x 20m plot was marked out in
97 each range sites. Each plot contained 180 sub plots of 1x1m each. Each plot represents about
98 5% or more of each range sites.

99 Herbaceous layer estimate was made using 1m² quadrat frame. At each five (5) steps count
100 (5.40m) at a distance range of 100m along the transect, the mapper located a sampling point
101 by placing the quadrat in such a way that the stop point laid at the center of the quadrat.
102 Estimate of green or dry herbaceous materials were considered. Litter cover was assessed by
103 walking along a line transect of 100m long and recording at every two (2) steps (1.45), the
104 presence or absence of litter. Only detached leaves and straws, weather green or dry, were
105 considered as litter. Data were collected along two (2) transect in each range site.

106 Assessment of erosion was done using the method modified by Akosim *et al.*, [12]. There is
107 no erosion (none) if there is no sign of gullies and exposures of sub-soil, erosion is slight, if
108 there are signs of shallow fresh gullies and exposure of the sub-soil and severe if there are
109 many deep gullies and large scale exposure of sub-soil in the are 

110 Plant vigor was measured using the method by Kershaw [19]. This involved evaluation using
111 the color of leaf and general plant appearanc 

112 Density of trees/shrubs was assessed by the total number of trees and shrubs present in one
113 hectare.

114 Relative density of herbaceous species was determined as:

115
$$\text{Relative density} = \frac{\text{number of individuals of a species}}{\text{total number of all species}} \times 100$$

116 Water availability was assessed through information obtained from the support zone
117 community 

118 2.2 Data Analysis

119 Data was analyzed using the descriptive statistics tables, frequency, and Analysis of Variance
120 (ANOVA).

121 4. RESULTS

122 The number of dominant herbaceous species in the game reserve estimated at random using a
123 1m² quadrat in the range site was as shown in Table 1. The result shows that 25 herbaceous
124 species were dominant in the game reserve with 18 species belonging to 13 families
125 occurring in all the range sites at varying diversities. Equally site A had the highest
126 occurrence of herbaceous species (179), site B with 174 and site C with the least number of
127 species (158) respectively.

128 Table 2 shows the result of the analysis of variance (ANOVA) which indicates that, there is
129 no significant difference in the distribution of dominant herbaceous species for range sites [P
130 > 0.05]. Furthermore, when the result was subjected to follow-up test, it was found that the
131 mean number of the dominant herbaceous species per range site was not significantly
132 different from one another (Table 3).

133 The result of relative densities of general herbaceous species and grass species presented in
134 (Table 4 and 5) revealed that, *Laggera aurita* had the highest percentage of 8.22%; while
135 *Tephrosia bracteolata* had the least (1.37%) while grass species, *Pennecetum pendicellatum*
136 has the highest density (17.3 ) while *Maricus alternifolius* had the least (1.21).

137 Results of plant vigor in Table 6 showed that the plants were stunted in all the sites; the
138 incidence of erosion was slight in the entire reserve. The mean percentage litter cover and
139 tress/shrubs/ha was 37.00% and 252, respectively.

140 Water was available in the reserve for over a period of 7 months. However, the total range
 141 condition rating point was 41.50% (Table 7) and the range condition of the game reserve was
 142 classified to be fair as indicated in (Table 8).

143 **Table 1: Dominant Herbaceous Species in the Range Sites Estimated at Random using**
 144 **1m² Quadrat.**

S/no	Species	Family	Ranges Sites		
			A	B	C
1.	<i>Ludwigia decurrens</i>	Onagraceae	13	07	14
2.	<i>Ageratum coyzooides</i>	Asteraceae	15	14	11
3.	<i>Laggera aurita</i>	Asteraceae	16	15	11
4.	<i>Evolvulus alsinoides</i>	Convolvaceae	07	06	06
5.	<i>Nelsonia caneseens</i>	Rubiaceae	12	13	11
6.	<i>Waltheria indica</i>	Sterculiaceae	10	10	04
7.	<i>Tephrosia linearis</i>	Papilionoideae	06	07	03
8.	<i>Mitracarpus villosus</i>	Rubiaceae	09	07	04
9.	<i>Euphorbia heterophylla</i>	Euphorbiaceae	10	04	12
10.	<i>Polycarpaea corymbosa</i>	Carryophyllaceae	07	00	08
11.	<i>Tridax procumbens</i>	Asteraceae	10	03	07
12.	<i>Aspilia africana</i>	Asteraceae	03	00	07
13.	<i>Celosia leptostachya</i>	Amaranthaceae	08	06	04
14.	<i>Gomphrena celosiodes</i>	Amaranthaceae	07	07	03
15.	<i>Oldelandia herbacea</i>	Rubiaceae	06	10	08
16.	<i>Heterotis rotundifolia</i>	Melastaceae	08	07	04
17.	<i>Ecipia alba</i>	Asteraceae	05	06	02
18.	<i>Spermacoce verticillata</i>	Rubiaceae	07	10	00
19.	<i>Aspilia bussei</i>	Asteraceae	05	08	09
20.	<i>Stchytarpheta jamaicensis</i>	Verbenaceae	04	08	03
21.	<i>Boerhavia diffusa</i>	Nyctagmaceae	00	09	00
22.	<i>Hibiscus asper</i>	Malvaceae	00	09	04
23.	<i>Sida acuta</i>	Maliaceae	04	00	13
24.	<i>Ludwigia hyssopifolia</i>	Onagraceae	07	08	03
25.	<i>Tephrosia bracteolata</i>	Papilionoideae	00	00	07

Total	179	174	158
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Source: Field Survey, 2016

Table 2: Analysis of Variance of the Distribution of Dominant Herbaceous species in the Range Sites.

Source of Variance	DF	SS	MS	F.cal	F.tab
Treatment	2	27.13	13.57	1.65	3.15
Error	63	518.49	8.23		(ns)
Total	65	548.62			

Ns= not significant at 0. 05

Table 3: Follow-up Test of mean Number of Dominant Herbaceous Species in the Range Sites.

Range Sites	Mean
B	8.29a
A	8.14a
C	6.89a

Mean number of dominant grass species in the range sites subjected to follow-up test using LSD at 0.05. The arrangement of values is in descending order.

Table 4: Relative Densities of Herbaceous Species in the Reserve.

S/No.	Species	No. of Species	Relative Density
1	<i>Ludwigia decurrens</i>	42	8.22
2	<i>Ageratum conyzoides</i>	40	7.83
3	<i>Nelsonia canescens</i>	36	7.05
4	<i>Ludwigia decurrens</i>	34	6.65

5	<i>Euphorbia heterophylla</i>	26	5.09
6	<i>Waltheria indica</i>	24	4.69
7	<i>Oldenlandia herbacea</i>	24	4.69
8	<i>Aspillia bussei</i>	22	4.31
9	<i>Mittracarpus villosus</i>	20	4.91
10	<i>Tridax procumbens</i>	20	4.91
11	<i>Evolvulus alsinoides</i>	19	3.72
12	<i>Heterotis rotundifolia</i>	19	3.72
13	<i>Ludwigia hyssopifolia</i>	18	3.52
14	<i>Celosia leptostachya</i>	18	3.52
15	<i>Gomphrena celosiodes</i>	17	3.33
16	<i>Spermacoce verticillata</i>	17	3.33
17	<i>Sida acuta</i>	17	3.33
18	<i>Tephrosia linearis</i>	16	3.13
19	<i>Polycarpaea corymbosa</i>	15	2.94
20	<i>Stchytarpheta jamaicensis</i>	15	2.94
21	<i>Hibiscus asper</i>	13	2.54
22	<i>Eclipla alba</i>	13	2.54
23	<i>Aspillia africana</i>	10	1.96
24	<i>Boerhavia diffusa</i>	09	1.76
25	<i>Tephrosia bracteolata</i>	07	1.37
	Total	511	100

155 **Source:** Field Survey, 2016

156 **Table 5: Relative Densities of Grass Species in the area.**

S/No.	Species	No. of Species	Relative Density
1	<i>Pennisetum pedicellatum</i>	320	17.58
2	<i>Loudetia annua</i>	170	9.34
3	<i>Andropogon tectorum</i>	96	5.27
4	<i>Seteria longista</i>	85	4.67
5	<i>Hyparrhenia rufa</i>	76	4.18

6	<i>Eragrostis ciliaris</i>	70	3.85
7	<i>Echinochloa colona</i>	67	3.63
8	<i>Eragrostis tremula</i>	65	3.57
9	<i>Panicum maximum</i>	64	3.52
10	<i>Urelytrium maricatum</i>	63	3.46
11	<i>Digitaria horizontalis</i>	62	3.41
12	<i>Andropogon gayanus</i>	61	3.35
13	<i>Pennisetum purpureum</i>	60	3.30
14	<i>Panicum subalbidum</i>	58	3.19
15	<i>Leersia hexandra</i>	56	2.91
16	<i>Imperata cylindrica</i>	52	2.86
17	<i>Oryza barthii</i>	50	2.75
18	<i>Killingia erecta</i>	45	2.47
19	<i>Sacciolepis africana</i>	42	2.31
20	<i>Axonopus compressus</i>	40	2.20
21	<i>Sporobulus pyramidalis</i>	37	2.03
22	<i>Perotis indica</i>	36	1.98
23	<i>Rottboellia cochinchinensis</i>	34	1.87
24	<i>Brachiaria falcifera</i>	33	1.81
25	<i>Elytrophorus spicatus</i>	30	1.65
26	<i>Ischaemun rugosum</i>	26	1.43
27	<i>Maricus alternifolius</i>	22	1.21
	Total	1820	100

157 **Source:** Field Survey, 2016

158 **Table 6: Assessment of Litter Cover, Plant Vigor, Erosion and Density of Trees/Shrubs**
 159 **per hectare in the Range Sites.**

Range Sites				
Parameters	A	B	C	Mean
Plant Vigor	Stunted	Stunted	Stunted	
Erosion	Slight	Slight	Slight	

No. of Trees and Shrubs/ha	201	245	308	252
Litter Cover	35	31	45	37.0

Source: Field Survey, 2016

Table 7: Range Condition Score Card

Factors	Quantity (%)	Scale Score	of Actual Score (%)
Percentage herbaceous cover	75 – 100 50 – 74 25 – 49 6 – 24 0 – 5	25-40	25
Botanical Composition			
Perennial Species	0-5 6-25		

Annual Species	26-50	5-8	2.0
	51-75		
	76-100		
	0-5		
Plant Vigor	6-25		
	26-50	0-5	5.0
	51-75		
	76-100		
Soil Condition (Litter)	Healthy	2-1	1.0
	Stunted		
	Weak		
	20% litter		
Erosion: None	20-50% litter	2-1	0.5
	100% litter		
	0-8% slope		
	8-16% slope	2-1	1.0
Water Availability	16% slope		
	All year round		
	9-11 months		
	6-8 months	1-5	4.0
Trees and Shrubs/ha	Less than 6 months		
	0-250/ha		
	251-500		
	501-1000	1-5	3.0
	1001-2000		
	2000/ha	\	
Total			41.5

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174 **Table 8: Key for Rating Condition**

S/no.	Range Condition Class	Total Score (%)
1	Excellent	80 – 100
2	Good	60 – 79
3	Fair	40 – 59
4	Poor	20 – 39
5	Very Poor	0 – 19

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5. DISCUSSION

Analysis of the range and its rating indicates that the game reserve was in a fair condition (41.50%). This could be attributed to habitat fragmentation through human encroachment. This may have been influenced by the degradation of the vegetation composition of the game reserve in line with the report of Khobe [8], that, a range in a fair condition may be deteriorating depending on the proportion of less desirable and undesirable, logging and burning pressure by resident and nomadic pastoralists.

The classification of the vegetation used in this study shows that, annuals are more desirable groups of forage which are classified as increasers or less desirable forest plant. This is in line with the findings of Mbaya *et al.*, [13]. Result of the herbaceous composition analysis showed that, annual (61%) e.g *Pennisetum pedicellatum*, *Loudetia annua*, *Andropogon tectorum* and *Seteria longista* dominated the range sites. However, there was no significant different in herbaceous species occurrence across the sites. The stunted plants and presence of slight erosion are in conformity with the report of Khobe [8]; as indications of deteriorating site. The reserve is on a downward trend because of the rapid succession of less desirable plants (annuals and weeds), stunted plants, and presence of slight erosion, illegal grazing and unplanned burning. This is similar to the findings of Khobe [8] in Jibiro Grazing Reserve Adamawa State. Khobe, [8] observed that indiscriminate and unplanned use of burning and grazing management have been the principal causes of deterioration in range condition

6. CONCLUSION

The result of this study showed presented the overall condition of the range to be fair. However, results of the analysis of soil factors such as litter cover and erosion; and plant factor, such as vigour tend to suggest the range to be tilting towards a poor condition. This

implies that the direction of the trend of the range depends on how the range is utilised subsequently and on other activities such as burning, logging and farming.

There is need to exercise caution in the utilization of the land of Ikwe Game Reserve to ensure the improvement of the area. This strongly points to the need for range manipulation and the use of improvement practices. Thus, reseeding the site with desirable plant species is required, and Government should imbibe community participatory approach to enhance the success of managing the Game Reserve for upward improvement.

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