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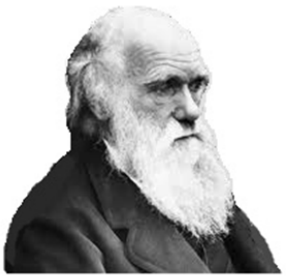

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Birds Species Richness and Diversity in Okomu National Park, Nigeria

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ABSTRACT

This study focused on the bird's species richness and diversity in Okomu National Park, Nigeria. The studies was undertaken to derive information on the species of birds utilizing the Okomu National Park as well as determine the relative abundance and diversity of birds in area. The methodology employed in the study includes the use of direct method of census. Line transects was used. The data collected were analyzed using descriptive statistics (tables). The result gathered revealed that the national park is rich in birds species. A total number of 706 birds' species in 23 families were also inventoried in all the ranges. The highest families Accipitridae, Alcedinidae, Bucerotidae, Muscicapidae, and Ploceidae has 3 represented species each, followed by families Meropidae, Nectariniidae, Picidae and Sturnidae having 2 represented species each. Birds were found in all the selected habitats. The park areas are under constant threat from unsustainable poaching, logging practices, and land conversion to agricultural uses. This logging and land use change have impacted Okomu National Park forests and the forest ability to withstand the effect or to become 'resilient' might be difficult due to the effects of climate change, and deforestation. Therefore there is need to include both the local indigenes and staff who knows the park area boundaries very well to be involved in the protection of the park resources. This will help in discouraging the killings of bird's species by local poachers and others.

***Keywords*:** Birds, Species Richness, Diversity, Okomu National Park

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1. INTRODUCTION

One potential objective in designating a protected area is to conserve elements of biodiversity that are unable to survive elsewhere (Bruner *et al.*, 2001). However, there is growing recognition that the landscape matrix surrounding protected areas also plays an important role in protecting many species (Hannah *et al.,* 2002).

Ecosystems are broadly arranged in a latitudinal pattern, with increasing species richness towards the equator (Barthlott *et al*., 2005). From Ethiopia to the Cape, mountains contain several centers of endemism for birds, mammals, and plants (Fjeldsa and Lovett 1997, de Klerk *et al.,* 2002). One of the most globally important centres of endemism is the coastal mountain range in the eastern part of Madagascar (Hamilton and Taylor 1991). Species richness can be larger in a particular plot or smaller because of the confounding effects of rainfall patterns, soil series, and season of the year.

Species richness is often regarded as the fundamental unit of biodiversity, and is the most frequently applied measure in community ecology (Williams and Martinez, 2000). For instance as animals in general and arthropods in particular contribute most to overall diversity (May, 1988), they play a significant role in the development of ecological theory. However, because arthropods are typically small, express a wide range of mobility, and require enormous sampling intensity to count all species in diverse communities, they have been largely ignored in favour of larger, less mobile organisms such as trees and other plants.

Species richness is simply the number of species for a certain sample of individuals, *it is* is generally used as a surrogate measure of biodiversity, and has in fact become the 'common currency' in much biodiversity science. Species richness can be corrected for total abundance (number of individuals) to produce the diversity index better-known as Simpson's Diversity Index: S.Index1-D (Simpson 1949; Sodhi, *et al.,* 2005). In contrast to species richness, species diversity indices take the relative abundance of each species into account, while species richness is the simplest way to describe community and regional diversity, and this variable - number of species - forms the basis of many ecological models of community structure (Stevens 1989).

Quantifying species richness is important, not only for basic comparisons among sites, but also for addressing the saturation of local communities colonized from regional source pools (Cornell 1999). Quantifying the species richness of bird's communities has gained increasing importance in environmental impact assessment, for example conservation planning and ecology research (Gotelli and Colwell, 2002; Fingesi *et al.,* 2019).

About 1000 vertebrate species occur in just 4 of the 119 eco-regions (covering about 8 per cent of Africa's total area): Northern Acacia-Commiphora bush lands and thickets, Northern Congolian forest-savannah mosaic, Albertine Rift Montana forests and Central Zambezian Miombo woodlands (Burgess *et al* 2005; Brooks *et al.,* 2001), Bird species richness is highest in Eastern Africa around the Albertine Rift montane forests, the Victoria basin forest and savannah mosaic (Burgess, *et al*., 2005). The BirdLife International on the *State of the World's Birds in* 2004 *stated that the p*atterns of bird diversity are driven by fundamental biogeographic factors, with tropical countries (especially in South America) supporting the highest species richness. While a total of 153 bird species is believed to have become extinct since 1500.

The rate of extinctions on continents appears to be increasing, principally as a result of extensive and expanding habitat destruction (Johnson and Stattersfield 1990; Butchart *et al.* 2006). Threatened birds occur in nearly all countries and territories. The rain forests are the most species rich ecological community on earth having sufficient rainfall throughout the year.

Majority of Nigeria's rainforest areas including Okomu National Park (ONP) are being destroyed, birds and others wildlife are facing imminent danger of extinction due to illegal hunting, deforestation, logging and agricultural encroachment (Chapman, *et al*., 1997).

2. MATERIALS AND METHODS

2. 1. The Study Area

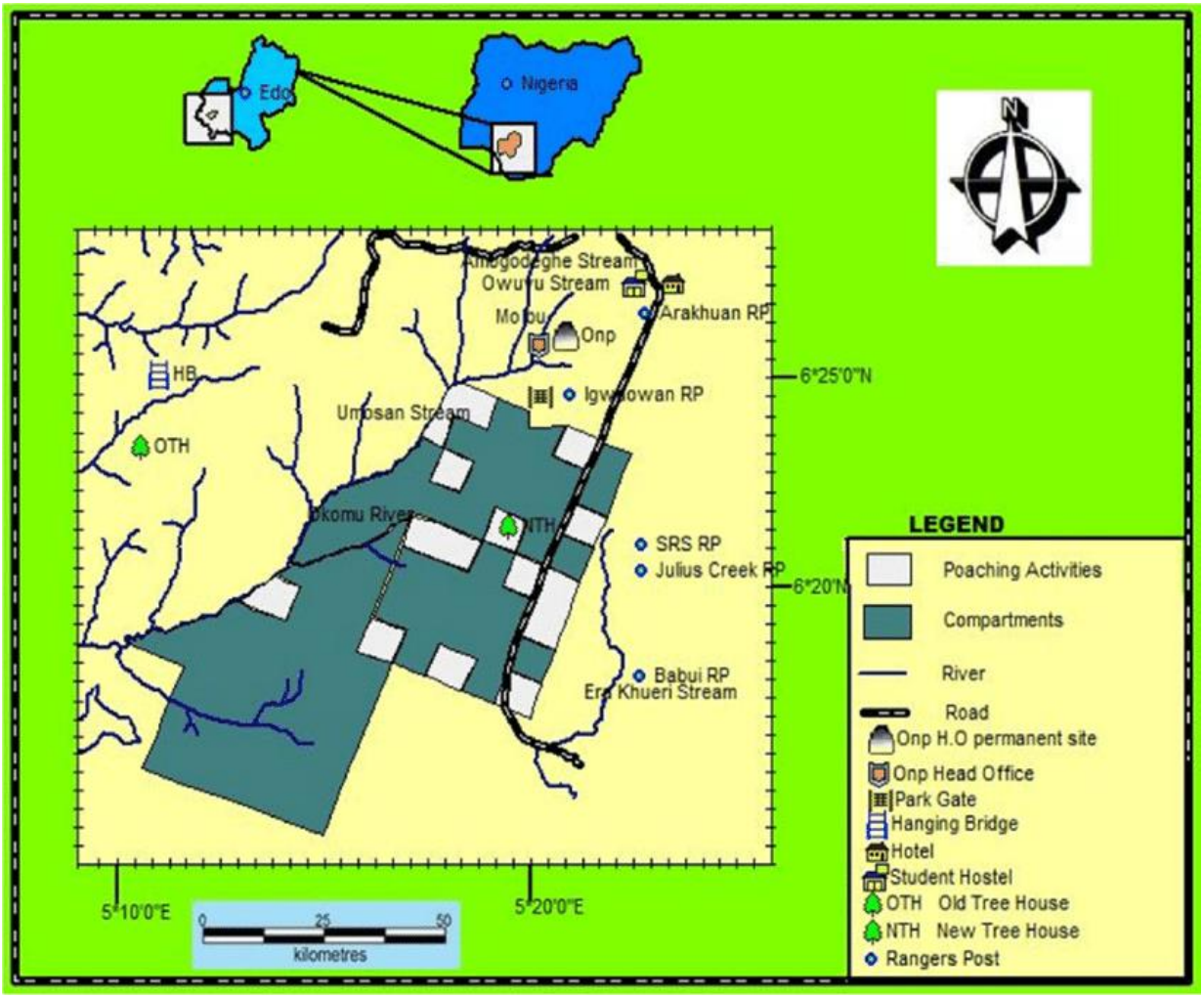

Figure 1. The Map of Okomu National Park
(Source: Okomu National Park, Benin City)

Okomu National Park is located in Ovia south west local government area of Edo state, west of the river Niger in southwest Nigeria. It lies between latitude 6°15′ and 6°25′ N and longitude 5°9′ and 5°23′ E. It is bounded in the west by the Okomu River and in the North, east and south by a series of straight cut lines. The park covers a land area of approximately 19712 hectares (202 km^2) making it the smallest of Nigeria seven National Parks (Ikhuoria 1993).

2. 2. Study Design

Existing tracks as line transects 4km in length was randomly selected in five ranges of the study area. Line transects as recommended by (Plumptre& Reynolds, 1994) were used in five selected ranges of Okomu National Park, namely; Arakhuan – range (1), Iguowan -range (2), Julius creek -(3), Mile 3- range (4) and Camping Hot Port -range (5) Line transects was chosen as sampling units due to the open nature of tracks. The project was carried out for a period of six (6) month, December- June, 2018. Each site was visited five (5) days in the month. Period of visit was between 6:00 am – 9:00 am in the morning and 3:00 pm – 6:00 pm in the evening.

2. 3. Data Collection Techniques

Both direct and indirect methods of census were used. Transects was walked at approximately 0.5 km/h, counting all groups of birds seen. The distance from the transect line to the centre of the group seen was measured and the number of birds seen in the group recorded (Plumptre& Reynolds 1994). The observer walking along transects and, on sighting bird's species waits for a few minutes to allow the distributed birds to settle. Counting was carried out for 10 minutes. Each individual bird was counted once and all birds seen or heard out-side the band but was identified and recorded, Birds, Indices, Feathers, calls was also be recorded.

2. 4. Data Analysis

The data was analyzed using descriptive analysis (Tables). Bird species richness was calculated for each study site using Microsoft Excel. The relative abundance of bird species in each habitat was calculated thus:

$$A = n/N \times 100$$

where:

A = Relative abundance
n = Quantity of each species present
N = Quantity of all species present.

Diversity of bird species was achieved using Simpson's (1949) diversity index. The index is mathematically stated thus:

$$D_s = \sum^{S}_{t-1} (n_1 (n-1)/(N (N-1))$$

where:

D_s = Simpson's diversity index
n_1 = Total number of individuals in each species
N = Total number of individuals in all species
s = Number of species present
$\sum$ = Summation sign.

The data was analyzed using Description statistics (tables).

3. RESULT AND DISCUSSION

The findings from this study show that a total of 706 birds in 23 families were inventoried in all the ranges. The findings from Table 1 indicates that, the present number and kinds of birds species in all the ranges sampled is very low with Range 2 having the highest 22 different bird's species richness, followed by Range5 having 20 bird's species while the least is Range1 having only 16 birds species. The highest families Accipitridae, Alcedinidae, Bucerotidae, Muscicapidae, and Ploceidae has 3 represented species each, followed by families Meropidae, Nectariniidae, Picidae and Sturnidae having 2 represented species each. Birds were found in all the selected habitats.

Table 1. Checklist of birds in Five Selected Ranges of Okomu National Park.

S/No	Family name	Common name	Scientific name	Authority	Rang 1	Rang 2	Rang 3	Rang 4	Rang 5
1	Accipitridae	African Harrier-hawk	*Polyboroides typus*	Smith, 1829	+	+	+	-	+
2	Accipitridae	Palm-nut Vulture	*Gypohierax angolensis*	(Gmelin, 1788)	+	-	+	-	+
3	Accipitridae	Crowned Hawk-eagle	*Stephanoaetus coronatus*	(Linnaeus, 1766)	-	-	-	+	+
4	Alcedinidae	Woodland Kingfisher	*Halcyon senegalensis*	(Linnaeus, 1766)	+	+	+	+	+
5	Alcedinidae	White-bellied Kingfisher	*Alcedo leucogaster*	(Fraser, 1843)	-	+	-	-	-
6	Alcedinidae	African Dwarf-kingfisher	*Ceyx lecontei*	Cassin, 1856	-	+	-	-	-
7	Apodidae	Asian Palm-swift	*Cypsiurus balasiensis*	(Gray, 1829)	+	-	-	-	-
8	Bucerotidae	Piping Hornbill	*Bycanistes fistulator*	(Cassin, 1852)	+	+	+	+	+
9	Bucerotidae	Black-casqued Hornbill	*Ceratogymna atrata*	(Temminck, 1835)	+	+	+	+	+
10	Bucerotidae	Crowned Hornbill	*Tockus alboterminatus*	(Büttikofer, 1889)	-	+	-	-	-
11	Columbidae	Blue-headed Wood-dove	*Turtur brehmeri*	(Hartlaub, 1865)	-	+	+	+	+
12	Hirundinidae	Lesser Striped-swallow	*Hirundo abyssinica*	Guérin-Méneville, 1843	-	+	-	-	-
13	Indicatoridae	Cassin's Honeyguide	*Prodotiscus insignis*	(Cassin, 1856)	+	-	-	-	-
14	Meropidae	White-throated Bee-eater	*Merops albicollis*	Vieillot, 1817	+	+	+	-	+
15	Meropidae	Rosy Bee-eater	*Merops malimbicus*	Shaw, 1806	-	-	-	+	+
16	Muscicapidae	White-browed Forest Flycatcher	*Fraseria cinerascens*	Hartlaub, 1857	-	-	+	-	-

17	Muscicapidae	African Forest Flycatcher	*Fraseria ocreata*	(Strickland, 1844)	-	-	-	+	+
18	Musophagidae	Great Blue Turaco	*Corythaeola cristata*	(Vieillot, 1816)	-	+	+	+	+
19	Nectariniidae	Olive Sunbird	*Nectarinia olivacea*	(Smith, 1840)	-	-	-	+	-
20	Nectariniidae	Green-tailed Sunbird	*Aethopyga nipalensis*	(Hodgson, 1837)	-	+	+	+	+
21	Numididae	Crested Guinea fowl	*Guttera pucherani*	(Hartlaub, 1860)	+	+	+	+	+
22	Oriolidae	Western Black-headed Oriole	*Oriolus brachyrhynchus*	Swainson, 1837	-	+	+	+	+
23	Phasianidae	Forest Francolin	*Francolinus lathami*	Hartlaub, 1854	-	+	+	+	+
24	Picidae	Fire-bellied Woodpecker	*Thripias pyrrhogaster*	(Malherbe, 1845)	+	-	-	-	-
25	Picidae	Speckle-breasted Woodpecker	*Dendropicos poecilolaemus*	(Reichenow, 1893)	+	-	+	-	+
26	Ploceidae	Crested Malimbe	*Malimbus malimbicus*	(Daudin, 1802)	-	+	-	-	-
27	Ploceidae	Vieillot's Black Weaver	*Ploceus nigerrimus*	Vieillot, 1819	+	+	+	+	+
28	Ploceidae	Yellow-mantled Weaver	*Ploceus tricolor*	(Hartlaub, 1854)	-	-	+	-	-
29	Psittacidae	Blue-rumped Parrot	*Psittinus cyanurus*	(Forster, 1795)	-	+	+	+	+
30	Pycnonotidae	Plain Greenbul	*Andropadus curvirostris*	Cassin, 1860	-	+	-	-	-
31	Ramphastidae	Crested Barbet	*Trachyphonus vaillantii*	Ranzani, 1821	+	-	-	-	-
32	Ramphastidae	Speckled Tinkerbird	*Pogoniulus scolopaceus*	(Bonaparte, 1850)	+	-	-	-	-
33	Strigidae	Spotted Eagle-owl	*Bubo africanus*	(Temminck, 1821)	-	-	-	+	+
34	Sturnidae	Purple Glossy-starling	*Lamprotornis purpureus*	(Müller, 1776)	+		-	-	-
35	Sturnidae	Long-tailed Glossy-starling	*Lamprotornis caudatus*	(Müller, 1776)	+	+	-	-	-
36	Sylviidae	Rufous-crowned Eremomela	*Eremomela badiceps*	(Fraser, 1843)	-	+	-	-	-
37	Viduidae	Pin-tailed Whydah	*Vidua macroura*	(Pallas, 1764)	-	+	+	+	+
		Total			16	22	18	17	20

Note; (+) represent present, (-) represent absent.

The Table 2 shows the relative abundance of birds species present in the study area, the result shows that *Guttera pucherani occurs* in all the habitat types and has the highest relative abundance two habitat types, having 25.59 relative abundance in habitat range 1 and 22.73 relative abundance in range 5. Followed by *Halcyon senegalensis, Bycanistes fistulator, Ceratogymna atrata* and *Ploceus nigerrimus* which appeared in the habitat types too, while *Ceyx lecontei* with 0.96 relative abundance is the least occurrence across all the habitat.

These findings show that most birds were not sighted in some habitats probably because they might have been extirpated from the site through continuous poaching, deforestation and other illegal activities, therefore constant monitoring is required for instance, through continuous monitoring the Ontario Eastern Bluebird in North America, formerly considered threatened in the area but as a result of nest box programs and other conservation actions, the bluebird population has made a dramatic comeback, and it is no longer considered to be at risk (Sodhi, *et al.*, 2005).

Table 2. Relative Abundance of Birds in Five Selected Ranges of Okomu National Park

S/No	Family name	Scientific name	Rang 1	Rang 2	Rang 3	Rang 4	Rang 5
1	Accipitridae	*Polyboroides typus*	2.38	1.92	5.59	0.00	1.70
2	Accipitridae	*Gypohierax angolensis*	3.57	0.00	5.59	0.00	5.68
3	Accipitridae	*Stephanoaetus coronatus*	0.00	0.00	0.00	1.74	1.14
4	Alcedinidae	*Halcyon senegalensis*	4.76	7.69	2.8	1.74	2.27
5	Alcedinidae	*Alcedo leucogaster*	0.00	1.92	0.00	0.00	0.00
6	Alcedinidae	*Ceyx lecontei*	0.00	0.96	0.00	0.00	0.00
7	Apodidae	*Cypsiurus balasiensis*	3.57	0.00	0.00	0.00	0.00
8	Bucerotidae	*Bycanistes fistulator*	9.52	3.85	9.79	5.22	6.82
9	Bucerotidae	*Ceratogymna atrata*	4.76	1.92	5.59	5.22	8.52
10	Bucerotidae	*Tockus alboterminatus*	0.00	5.77	0.00	0.00	0.00
11	Columbidae	*Turtur brehmeri*	0.00	3.85	6.99	5.22	4.55
12	Hirundinidae	*Hirundo abyssinica*	0.00	5.77	0.00	0.00	0.00
13	Indicatoridae	*Prodotiscus insignis*	5.95	0.00	0.00	0.00	0.00
14	Meropidae	*Merops albicollis*	2.98	3.85	1.40	0.00	1.14
15	Meropidae	*Merops malimbicus*	0.00	0.00	0.00	5.22	1.70
16	Muscicapidae	*Fraseria cinerascens*	0.00	0.00	3.50	0.00	0.00
17	Muscicapidae	*Fraseria ocreata*	0.00	0.00	0.00	3.48	1.70
18	Musophagidae	*Corythaeola cristata*	0.00	9.62	18.18	10.43	12.50
19	Nectariniidae	*Nectarinia olivacea*	0.00	0.00	0.00	2.61	0.00
20	Nectariniidae	*Aethopyga nipalensis*	0.00	1.92	2.80	3.48	1.70
21	Numididae	*Guttera pucherani*	25.59	13.46	5.59	17.39	22.73
22	Oriolidae	*Oriolus brachyrhynchus*	0.00	1.92	2.80	3.48	1.14

23	Phasianidae	*Francolinus lathami*	0.00	5.77	9.09	12.17	10.23
24	Picidae	*Thripias pyrrhogaster*	2.38	0.00	0.00	0.00	0.00
25	Picidae	*Dendropicos poecilolaemus*	14.28	0.00	3.50	0.00	4.55
26	Ploceidae	*Malimbus malimbicus*	0.00	3.85	0.00	0.00	0.00
27	Ploceidae	*Ploceus nigerrimus*	10.71	7.69	4.20	8.69	1.70
28	Ploceidae	*Ploceus tricolor*	0.00	0.00	4.20	0.00	0.00
29	Psittacidae	*Psittinus cyanurus*	0.00	5.77	4.20	5.22	5.68
30	Pycnonotidae	*Andropadus curvirostris*	0.00	1.92	0.00	0.00	0.00
31	Ramphastidae	*Trachyphonus vaillantii*	1.19	0.00	0.00	0.00	0.00
32	Ramphastidae	*Pogoniulus scolopaceus*	2.38	0.00	0.00	0.00	0.00
33	Strigidae	*Bubo africanus*	0.00	0.00	0.00	1.74	1.14
34	Sturnidae	*Lamprotornis purpureus*	2.38	0.00	0.00	0.00	0.00
35	Sturnidae	*Lamprotornis caudatus*	3.57	0.96	0.00	0.00	0.00
36	Sylviidae	*Eremomela badiceps*	0.00	5.77	0.00	0.00	0.00
37	Viduidae	*Vidua macroura*	0.00	3.85	4.2	6.96	3.41
		Total	**168**	**104**	**143**	**115**	**176**
			99.97	**100**	**100.01**	**100.01**	**100**

The finding in Table 3 shows the diversity of birds' species in the study area %. The finding indicates that Range 2 and Range 3 have the highest (14.24 and 11.45) species diversity respectively, while Range 1 has the lowest (7.22) species diversity. A randomisation test for a significant difference in diversity between ranges indicates that there is no significant difference ($P>0.05$) between the ranges in birds species composition. While the equitability or evenness on the pattern of distribution of the individuals between the species indicates that species evenness was highest at Range (3) having e^H/S 0.8377 and lower at Range 5 with e^H/S 0.6608, though the identities and densities of birds species generally differ markedly between ranges in the study.

Table 3. Diversity indices within habitats in the study area.

Simpson index	**Range 1**	**Range 2**	**Range 3**	**Range 4**	**Range 5**
S. Index 1-D	0.8783	0.9344	0.9197	0.9128	0.8961
Reciprocal index 1/D	7.22	14.24	11.45	10.47	8.62
Evenness_e^H/S	0.7017	0.8133	0.8377	0.8093	0.6608

Relationship in the habitat structure of the five selected ranges of Okomu National Park

The birds composition of our study sites is said to differ from range to range with Arakhuan – range (1), having more- 168 birds species than other sites, while Iguowan –range (2), has the least- 104 birds These differences can be attributed to the following variable variations. They are variation in rainfall, soil composition, elevation, and temperature, differences in logging history, and historical differences in the distribution and abundance of large mammals. For instance, Personal observation in all ranges shows that illegal activities in the area have existed for several decades or more, it is conceivable that they might be at least partly responsible for the differences in bird's composition between sites. The low abundance and diversity of birds in the some area indicates that birds relation to habitat characteristics is very poor, for instance they may not have been safely breeding well except for the *Bycanistes fistulator, Guttera pucherani. Ploceus nigerrimus* present in all the habitat ranges indicating that they are endemic and needs to be properly protected and conserved.

4. CONCLUSION

This study on the inventory of Okomu National Park bird species has help us to know the major target species to focus on for conservation purposes, species such as the *Guttera pucherani* which could be regarded as one off the endemic species and are in high demand by the hunters and bird traders around the area but still exist in Okomu National Park habitat. This study also indicates that the Okomu National Park environment is quite conducive for birds species such as the Accipitridae families to adapt, but logging and other land use changes have impacted the Park forests and the forest ability to withstand the effect might be difficult due to the effects of climate change, and deforestation. Therefore there is need to include both the local indigenes and staff who knows the park area boundaries very well to be involved in the protection of the park resources. This will help in discouraging deforestation and the killings of bird's species by local poachers and others.

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