African Primates 8:39-50 (2013)

Population Survey of Nigerian-Cameroon Chimpanzees (*Pan troglodytes ellioti*) in Southwestern Nigerian Priority Sites: Idanre Forest Cluster and Ise Forest Reserve

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Abstract: The Regional Action Plan for the Conservation of the Nigerian-Cameroon Chimpanzee (*Pan troglodytes ellioti*) identified four areas in southwestern Nigeria as priority sites for chimpanzee conservation. Our survey was conducted in two of these sites: the Idanre Forest Cluster and Ise Forest Reserve. The overall aim of the survey was to determine the population status and spatial distribution of chimpanzees and understand the dimensions of anthropogenic influences to provide a basis for effective conservation and periodic monitoring. Chimpanzee observations and related evidence of their presence were encountered 0.03 times per kilometer walked in Ise and 0.12/km in the Idanre Forest Cluster. Although data from the survey were insufficient to make conclusions about the species' population numbers or density, results from field observations and reliable local reports are used to hypothesize that chimpanzee population in the survey areas fall within the range of 0 – 115 individuals (≤ 20 in Ise and ≥ 55 in the Idanre Forest Cluster) distributed within an area of about 400km^2 of forests, 18% of the cumulative size of forest reserves surveyed. Survey results also show that populations in these sites are at high risk of extinction due to targeted killings and accelerated habitat loss corresponding to a 34.5% loss of natural forest since the year 2000, which makes habitat loss the most significant threat facing chimpanzee survival in these forest reserves. Although the chimpanzee populations remaining in the survey areas are relatively small and the degree of threats they face is enormous, these are regionally significant populations and deserve assertive conservation efforts.

Key words: chimpanzee, population, forest reserves, habitat, deforestation, hunting, Nigeria

INTRODUCTION

All chimpanzees are endangered (Oates *et al.* 2008a, 2008b), and the Nigerian-Cameroon chimpanzee (*Pan troglodytes ellioti*) is considered the most endangered of all currently known chimpanzee subspecies (Morgan *et al.* 2011), as well as being the most range-restricted. The subspecies survives only in forested habitats in southern Nigeria to western Cameroon, north of the Sanaga River. It is also the most recently recognized subspecies of the common chimpanzee and it has been estimated that there may be as few as 3,500 individuals living in the wild (Morgan *et al.* 2011).

The conservation planning workshop for West African Chimpanzees held in Ivory Coast in 2002 identified the forests of southwestern Nigeria of highest priority for surveys to assess their little-known chimpanzee populations (Kormos *et al.* 2003). Chimpanzee populations in these forests (and the Niger Delta) are perhaps the least known biologically and demographically. This recommendation led to a wide ranging chimpanzee survey conducted in 2006 covering 17 forest sites or reserves in 5 states in southwestern Nigeria (Greengrass 2006, 2009). The 2006 survey found that chimpanzees were either extinct or at the verge of extinction in 5 of the forest sites (Ala, Akure, Oba Hills, Ogbesse and Oni Forest Reserves). Seven sites definitely contain chimpanzees (Idanre, Ifon, Omo, Oluwa, Okomu, Ologbo and Ise Forest Reserves) and, though their abundance could not be ascertained due to the rapid nature of the survey, the populations were perceived as being generally small and isolated (Figure

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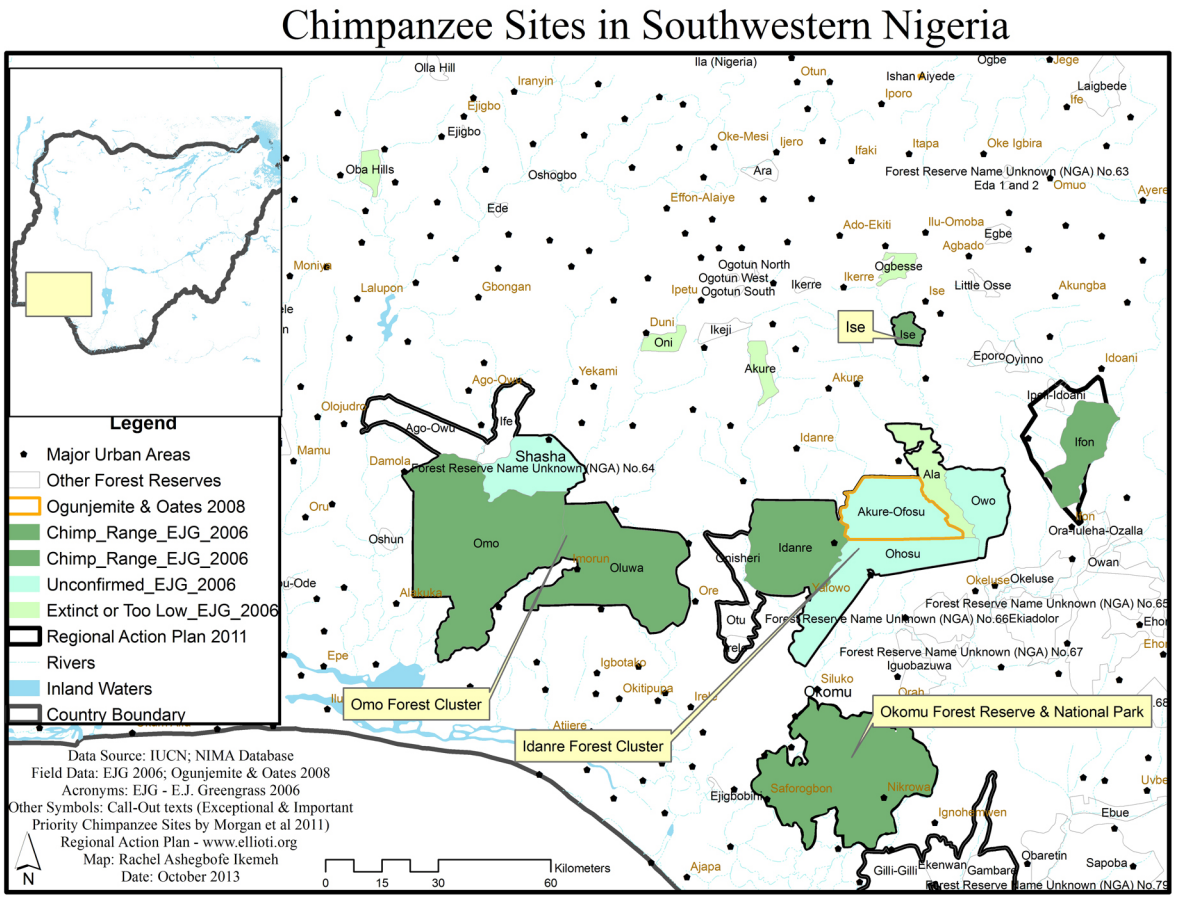


Figure 1. Southwestern Chimpanzee Sites. Forest sites (reserves) where chimpanzees have been previously reported in 2006, 2008, and 2011 and their associated status.

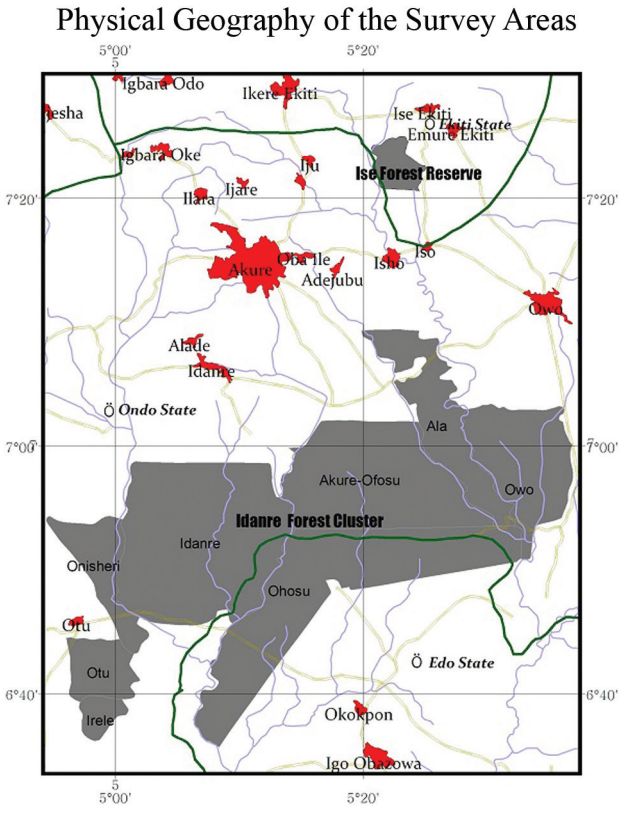
1). However, chimpanzee presence was not confirmed in five forest reserves: Owo, Shasha, Ishan-Aiyede, Ohosu and Akure-Ofosu (Greengrass 2009). Ogunjemite and Oates (2008) further surveyed Ishan-Aiyede, Akure-Ofosu and Ifon Forest Reserves in intervals from December 2006 through January 2008. The survey found that chimpanzees are probably extinct in Ishan-Aiyede and noted the population in Ifon Forest Reserve is not viable for long-term conservation. Akure-Ofosu Forest Reserve was identified as having a significant population of chimpanzees with potential for conservation, and their report recommended further study for formulating practical conservation strategy (Ogunjemite & Oates 2008). Similarly, in 2008 the Nigerian Conservation Foundation (NCF) embarked on a biodiversity survey in the Omo Forest Cluster (Oates *et al.* 2008c) where chimpanzees were confirmed to persist in Omo (Ikemeh 2009a) and Oluwa Forest Reserves (Ogunjemite 2010; Ogunjemite & Olaniyi in press).

During a series of workshops held in Cameroon and Nigeria in 2009 and 2010, researchers, government officials and international experts deliberated the plight of *P. t. ellioti* in a first ever attempt to formulate strategic actions to conserve the Nigerian-Cameroon chimpanzee since it was first identified as a distinct subspecies in 1997 (Gonder *et al.* 1997). Priority sites were identified and actions were determined that highlighted the Okomu National Park/Forest Reserve, the Omo Forest Cluster, and the Idanre Forest Cluster as Exceptional Priority Sites, and the Ise Forest Reserve was recognized as an Important Priority Site in southwestern Nigeria. As a result, this survey was initiated based on the recommendations of the resultant Nigerian-Cameroon Chimpanzee Regional Action Plan Document (Morgan *et al.* 2011).

STUDY AREAS

Our surveys were carried out at two sites: (1) the Idanre Forest Cluster*, which comprises Idanre, Akure-Ofosu, Ala and Owo Forest Reserves in Ondo State, and Ohosu Forest Reserve in Edo State; and (2) the Ise Forest Reserve in Ekiti State. The other sites identified as "Exceptional Priority Sites" (the Omo Forest Cluster and Okomu National Park and Forest Reserve) are already

* "Forest Cluster" refers to a number of administratively separate forest reserves with shared boundaries.



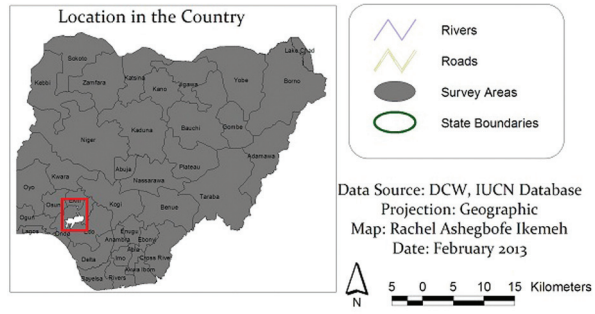


Figure 2. Geographic Location of the Survey Areas. Map showing the locations of the survey sites within the country with accompanied information on the roads, rivers and major urban areas around the sites. The Idanre forest cluster is made up of five forest reserves namely Idanre, Akure-Ofosu, Ala, Owo, Onisheri, Otu, Irele forest reserves in Ondo State including Ohosu forest reserve in Edo State.

receiving some form of conservation attention and, although these efforts are not focused on chimpanzee conservation, they afford some protection to chimpanzee habitat.

The survey areas cover a cumulative Geographical Information Systems (GIS) estimated land area of 2205.8km^2. The Idanre Forest Cluster covers 2159.2km^2, and the Ise Forest Reserve is 46.6km^2. The Idanre Forest Cluster is located within coordinates 07°15'N at the northern edge, 04°89'E at the western edge, 06°58'N at the southern edge, and 05°62'E at its eastern edge. The Ise Forest Reserve is the northerly site, which can be accessed from Ise-Ekiti town located at 05°42'E 07°47'N, which is about 6km straight line distance to the northern edge of the reserve at 05°39'E 07°43'N (Figure 2).

The natural vegetation of the survey region is mixed deciduous forest (Isichei 1995, Mengistu & Salami 2007). The sites are located within the Nigerian lowland forest ecoregion that extends from the eastern margin of the Dahomey Gap in Benin to the Niger River in the west (Werre 2001) and are situated within the Congolian subdivision of the Guinea–Congolian belt (Oates *et al.* 2008b). Where intact natural forest vegetation still persists, some relatively dominant plant species include *Cola* spp., *Mansonia altissima*, *Nesogordonia papaverifera*, *Pterygota* spp., *Sterculia* spp., *Triplochitonscleroxylon*, *Antiaris africana*, *Ficus* spp., *Milicia excelsa*, *Brachystegia* spp., *Cylicodiscus gabunensis*, and P*iptadeniastrum africanum* (Werre 2001). However, the natural vegetation has been greatly modified by excessive logging and deforestation. The forests are now severely fragmented with pockets of monocultures of exotic tree plantations including farmlands of cocoa, plantain, and other food crops. Throughout the survey region, the forests are mostly low-lying at altitudes ranging between 10–400 meters above sea level; average altitude for the Idanre Forest cluster is 177m while the altitude average is 349m in Ise Forest Reserve. Mean annual temperature is between 25°C – 26°C, with a minimum temperature of 19°C and a maximum temperature of 33°C. Annual precipitation is between 1200mm–1800mm. Specifically, Ise forest reserve receives 1380mm of rain annually while the Idanre cluster receives 1654mm of rain annually (DIVA-GIS World Climate Database 1950-2000). The region experiences 3 months of dry season from December to February with intermittent rain showers in March, whereas the rest of the year is the rainy season with peak periods from May to October.

METHODS

Field surveys were conducted from the 1 November 2012 – 25 January 2013 covering a distance of 332.9km in a combination of systematic reconnaissance and direct search methodologies within and around the 2205.8km^2 area covered by both Ise Forest Reserve (46.6km^2) and Idanre Forest Cluster (2159.2km^2). Of the cumulative distance covered by the survey within and around the survey areas, 120.6km distance was covered in Ise forest reserve and 212.3km in the Idanre forest cluster; primarily, survey methods were developed based on suggestions in Kühl *et al.* (2008). In the first instance, the survey area(s) was divided into two strata, remnant forested areas and non-forest areas based on spectral response from public domain satellite images. Within the delineated forest patches, automated sampling lines were

designed using the computer program DISTANCE™ version 6.0 (Thomas *et al.* 2006). These sampling lines were used to guide the direction of our survey routes using a compass bearing on an approximate straight line direction along paths of least resistance. However, this approach was only partially achieved in parts of Ise Forest Reserve and was not implemented in Idanre Forest Cluster because of the activities of armed gangs (some with automatic weapons) operating marijuana (*Cannabis sativa*) plantations within the forest reserves in the region. This information became known only after commencement of the field surveys. Attempting to follow a straight line led us into contact with these gangs, and after one particularly dangerous encounter we decided the risk to life was too great to continue this method. Afterwards, we took only the routes well-known to our local guides. Throughout the area, we either made daily night camps as we traveled or used hunter camps. In order to maximize survey efforts, we did not visit areas where only very patchy forests exist (as depicted from satellite imagery) or areas where reliable information gathered from local people and forest guards suggested that chimpanzees no longer occur. For example, satellite imagery indicated there is some forest left in Otu and Irele Forest Reserves, but reports by government forest guards working in the area suggested that what may appear to be forests are actually exotic tree plantations and that chimpanzees have not been observed or reported in these areas in the last ten years. This provided credible information that prevented surveys in those areas.

All available evidence of chimpanzee presence (e.g., direct sighting, vocalization, feces, nests, foot or handprints, and feeding signs) was recorded including associated data on other wildlife species and habitat status (i.e., whether habitat is unspoiled, regenerating or has been cleared, otherwise degraded or converted). A systematic method of observing and recording data during sampling followed recommendations in White and Edwards (2000). Face-to-face interviews with resource users, researchers and government officials were also conducted including investigations (also through interviews) into wildlife trade in the major bushmeat market destinations in the region. Secondarily, efforts were made to gather information from published and unpublished literature related to the species in the survey area or region to determine previously observed locations related to chimpanzee presence (or absence) and distribution. A Geographical Information Systems (GIS) database was developed for the project with integrated information on elevation, climate, human population, land use/cover and the areas' boundaries. Data were collected on human activities in five major categories: poaching/hunting (including snares, hunters seen, gun shots, used cartridges and animal kills); logging (workers seen, chainsaws heard, timber stock piles, felled logs and timber trucks); farming (land clearing, bush burning, standing crops, harvest, farmers seen); collection of Non-Timber Forest Products (NTFPs) such as fishing, firewood gathering, including collection of *Carpolobia* spp. (stem supplied mostly to cattle herdsmen), *Thaumatococus danielli* (leaves used mostly to wrap food), *Irvingia gabonensis* (also known as bushmango, the seed of which is an important soup ingredient); and settlements (such as houses/huts, old camps, camps in use, villages). Public-domain USGS satellite data from 2000–2013 were used to understand habitat status and assess the changes in land cover over the 13 year period and to measure the rate of change in the Idanre Forest Cluster.

RESULTS AND DISCUSSION

Chimpanzees and related evidence of their presence (e.g., nests, foot or knuckle prints, feeding sign and vocalizations) were observed a total of 22 times during the survey. Only one direct observation of two individuals was made in Akure-Ofosu forest reserve. Foot or knuckle prints were seen twice, 10 nest sites were observed; loud vocalizations (screams and grunts) were heard on one occasion and feeding signs were seen three times. Other evidence includes carcasses and body parts. Only three observations were made in Ise forest reserve, while 17 observations were made in the Idanre Forest Cluster. In general, the encounter rate of chimpanzee evidence was 0.03 per kilometer walked in Ise and 0.12/km in the Idanre Forest Cluster (Table 1). Several factors may have contributed to this low encounter rate which may have limited overall survey data. For example, high hunting pressure may have inhibited animals from vocalizing, large-scale felling of trees would have prevented some nest observations and the resultant effect of avoiding armed gangs and deviating from vast areas of dense fallow bush had significant impact on the straight-line sampling method used to assess the target species. Thus, the sampling methods employed may not have been well-suited for quantitatively assessing chimpanzee numbers in this area.

Nonetheless, the cumulative data from field observations confirmed the presence of chimpanzees within the areas surveyed and was useful in identifying group size (see Table 1) but too low to provide any useful information on abundance or density and as such is insufficient to make accurate suggestions about the population size of chimpanzee in these sites. However, an attempt is made to hypothesize about approximate chimpanzee numbers using these field data, reliable local reports (observations made ≤ 1 year prior to the report) and habitat conditions. Survey observations in Ise Forest Reserve indicated the presence of 3 – 6 individuals while accompanying information gathered from local people

Table 1. Summary of Chimpanzee Observations.

Area	Type of Obs.	Estimated age of sign	No. of items	Associated Notes	Survey Type	Date/Time of Obs.	Habitat
Ise	Nests (Cluster)	Very Old (Over 8 weeks)	3	appeared to have been more nests in this cluster because area was only recently cleared	reccet	02-NOV-12 7:36:34	Secondary forests but highly degraded form
Ise	Footprint	Recent (2 days)	1	local hunter saw 2 individuals (male & female)	recce	04-NOV-12 8:39:41	Area of dense vegetation of lianes, stranglers and thorn bushes
Ise	Body parts	Very Old (Over 1 year)		A traditional native doctor/hunter shows off his remains from chimpanzee killed over a year ago	Inter-view	10-NOV-12 17:45:08	
Ise	Feeding Sign	Old	-	Frayed tips from leafstalk of a young palm tree.	recce	14-JAN-13 15:27:52	Gallery forests along the Ogbesse river. Seasonally inundated areas surround-ed by farmlands
Akure-Ofosu	Body parts	Recent (About 2 weeks)	-	A hunter encountered shows off his chimpanzee bones (from upper arm) which he distributed to his associates and traditional doctors. A kill he claimed he made (confirmed by others) only 2 weeks before.	Inter-view	15-NOV-12 11:12:17	
Akure-Ofosu	Nests (Cluster)	Fresh	4	There might have been more individuals in the group than the nests observed because some vegetation on the rocky areas were suppressed but could have been done by a buffalo whose feces was observed some distance away	recce	20-NOV-12 14:20:59	Relatively undisturbed forests with rocky outcrops
Akure -Ofosu	Nests (Cluster)	Fresh	7	The vegetation used for the nests was still green	recce	21-NOV-12 9:46:58	Relatively undisturbed forests with rocky outcrops
Akure -Ofosu	Nests (Single)	Fresh	1	Only one nest was observed close to a rocky cliff.	recce	24-NOV-12 9:26:46	Secondary forests surrounding hills/ rocky outcrops
Akure -Ofosu	Nests (Cluster)	Fresh	4	Nests were located on different trees	recce	27-NOV-12 11:11:49	Secondary forests surrounding hills/ rocky outcrops

Table 1. Summary of Chimpanzee Observations (continued).

Area	Type of Obs.	Estimated age of sign	No. of items	Associated Notes	Survey Type	Date/Time of Obs.	Habitat
Akure -Ofosu	Feeding Sign	Fresh (Early morning)	-	Fresh signs apparently made just before arrival at the spot. Chimpanzee knuckle prints were also visible at the site. The amount of feeding remains suggests it may have been a reasonably large group of up to 10 individuals.	recce	27-NOV-12 11:19:33	Forest patches along a water source.
Akure-Ofosu	Nests (Cluster)	Recent	2	Nests were observed on ropes and stranglers.	recce	27-NOV-12 11:37:05	Relatively undisturbed forests with rocky outcrops
Akure-Ofosu	Nests (Cluster)	Fresh	2	New nests believed may have been constructed the previous night.	recce	27-NOV-12 9:27:05	Relatively undisturbed forests with rocky outcrops
Akure-Ofosu	Trail/ Footpath	Fresh (few hours before sighting)	1-2	We believe that this individual (couldn't have been more than two individuals) might have heard us approaching because the footpath was very fresh and trail appeared to have been flattened during walk. Footprint of an adult was visible.	recce	28-NOV-12 11:49:40	Secondary regrowth with thorn bushes
Akure-Ofosu	Direct Sighting	Real time	2	We were startled by two individuals (or perhaps they had been startled by us). Sighting was for a few seconds before scurrying off.	recce	19-JAN-13 7:58:55	Relatively undisturbed forests with rocky outcrops
Idanre	Carcass	Recent (Still decompos-ing)	1	Skull, hands and feet in possession of hunter.	Inter-view	30-NOV-12 15:08:43	Idanre area
Idanre	Feeding Sign	Old	-	Hunter guide had observed chimpanzee eating at the spot a week ago and the feeding remains bits of fibrous vegetation eaten and discarded were still visible.	recce	24-JAN-13 10:57:53	New clearing for farmland. Some rocky outcrops can be found in this area
Idanre	Nests (Single)	Very Old	1	Vegetation already almost completely disintegrated	recce	24-JAN-13 11:37:04	Area of rocky outcrops and open understorey
Idanre	Nests (Cluster)	Very Old	2	Nests observed were located on large cotton tree (Ceiba pentandra).	recce	24-JAN-13 13:40:00	Recently burned forest presently over-taken by the Chromolaena odorata weed.
Idanre	Vocaliza-tion	Real time	3 - 4	Loud grunts were heard accompanied by a sharp scream supposedly from an infant.	recce	24-JAN-13 6:53:35	Inselberg surrounded by over-logged forests and new farm clearings
Idanre	Nests (Single)	Fresh	1	It seemed likely that there were more nests besides this single nest observed because we observed a nest-like structure on felled trees around this area.	recce	25-JAN-13 9:38:29	Highly disturbed forest patch mixed with old farmlands

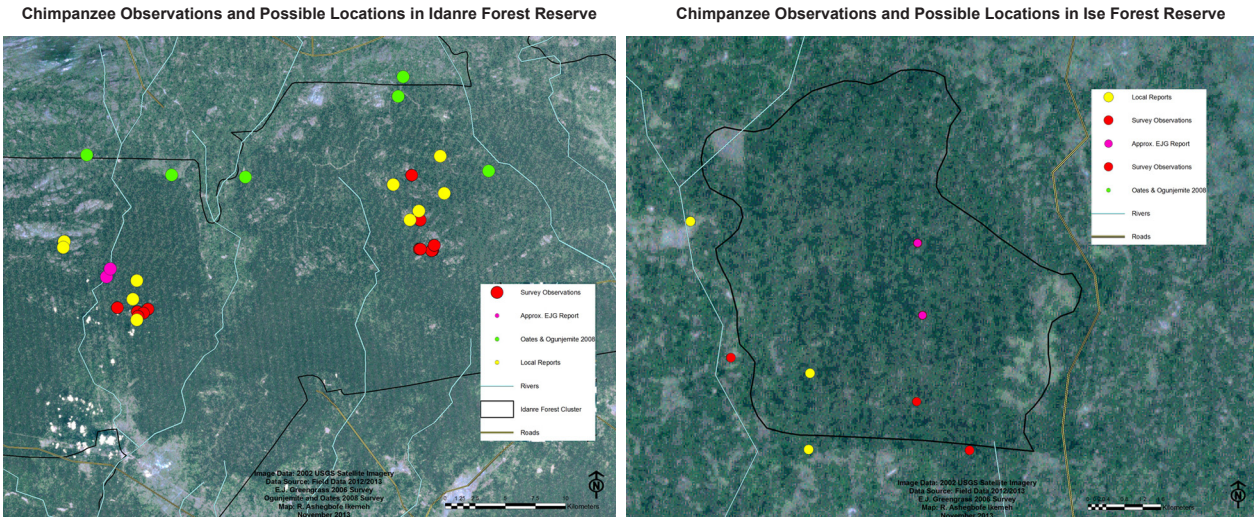


Figure 3. Chimpanzee observations in the survey areas, Idanre (above) and Ise (right) Forest Reserves. Maps show chimpanzee observations from this survey, reliable local reports and previous systematic surveys conducted on the species.

suggest there may be up to 15 individuals there. In Akure-Ofosu a total of 20 fresh or recent nests were seen in six clusters; the largest cluster, 7 nests, sets a minimum boundary on the number of individuals present. Because some clusters were within 3km of each other and seen on different days, there may have been overlap in party membership so the total number of individuals is likely to be less than 20 (see Plumptre & Reynolds 1997, Kühl *et al.* 2008). Observations in Akure-Ofosu also included one direct sighting of two adult individuals (male and female), the trail of no more than two individuals, and feeding signs from a reasonably large group. Taken together, these observations suggest there may be 16 – 38 chimpanzees especially if reliable local hunters' reports are taken under consideration as well. One hunter who killed an adult male two weeks prior to the survey (evidence provided), claimed he counted 13 individuals in the group that day, and another account of 9 weaned individuals was reported separately. Field data collected in Idanre Forest Reserve indicated there may be a group of about 5 individuals from which vocalizations were heard, 4 individuals from nest observations, while additional information from accounts of recent encounters by some locals suggest that chimpanzees surviving in the Idanre Forest Reserve are between 8 – 13 individuals. Within this Forest Cluster, Owo Forest Reserve was completely avoided because of reports of the presence notorious marijuana armed gangs in the reserve (although, some parts of Ala and Akure-Ofosu have also been occupied by these illegal marijuana growers). There were credible reports of chimpanzee presence in Onisheri Forest Reserve along its boundary with Idanre, although direct field assessment was not made in this forest patch. In Ohosu Forest Reserve, our survey assumed that with the high-level of human activities observed, chimpanzees are unlikely to inhabit this area. Although, some local hunters believe that chimpanzees occur in this reserve, it may be the same populations from Akure-Ofosu.

Generally, these observations and reports suggest a population size within the range of 7 – 115 individuals (≤ 20 in Ise F.R. and ≥ 51 in the Idanre forest cluster) that may be present in the survey areas. Thus, even at the high end of the gross estimates of 115, populations are small and can be considered highly vulnerable to extinction owing to the level of anthropogenic threats discussed in succeeding sections. Figure 3 shows the locations of chimpanzee observations during this survey, reported locations indicated by recent observations (less than 1 year of sighting) made by local people, GPS locations reported in Ogunjemite and Oates 2008, and observations reported in Greengrass 2006 (as indicated by the same local guides utilized by Greengrass during her survey). Only a few previous surveys can make reliable suggestions on population numbers from which to estimate the species' population trends or make comparisons about population numbers over time. However, Ogunjemite *et al.* (2006) reported 13 nest clusters in Akure-Ofosu Forest Reserve and 22 nest clusters in Ise Forest Reserve, Ogunjemite and Oates (2008) reported observing 7 nest clusters made up of 33 individual nests in Akure-Ofosu Forest Reserve, while Ogunjemite (2011) estimated a density of 0.22 km^{-2} in Akure-Ofosu Forest Reserve and 0.31 – 0.40 chimpanzees km^{-2} in Ise Forest Reserve with about 12 -17 chimpanzees estimated to occur in Ise (Ogunjemite 2004). Overall, there were no substantial differences in the frequency of chimpanzee observations over time.

Occurrence, Range and Distribution of Chimpanzees

The current distribution of chimpanzees in the Akure-

Ofosu forest reserve is very patchy. The remnant habitat where they occur is severely fragmented and is faced with an onslaught of human encroachment. It appears that chimpanzees are restricted to the remnant tract of forest patch at the center of the reserve – an area characterized by vast expanse of inselbergs (rocky outcrop vegetation). It is difficult to tell at this stage how the chimpanzees in Idanre forest reserve are distributed, but based on our observations and local reports, chimpanzees occur mostly within the gallery forest patches along the three major rivers that traverse and border the Idanre forest reserve. In Ise forest reserve, we were able to observe chimpanzees only at the southern edge of the reserve, and only one observation was made inside the reserve itself while another observation was made outside the boundaries of the reserve along the gallery forests of River Ogbesse. Field observations and most local reports consistently associate current chimpanzee occurrence with forested patches within the survey areas. However, despite habitat analysis on satellite imageries indicating that an area of 669km^2 (31%) of forests remain in the Idanre Forest Cluster much of which is within Akure-Ofosu and Idanre Forest Reserves, study results (both from field data and local accounts) suggest that chimpanzees are present in an estimated area of only about 487km^2 within the Idanre forest landscape and an area of 32km^2 in Ise Forest Reserve, which is about 68% of the total land area covered by the reserve.

Anthropogenic Influence

Encounter rates of human activities suggest that logging in both sites is a major part of income generating activities for people in the region. Logging was the most predominant activity in Ise Forest Reserve and Idanre Forest Cluster, making up about 40% of an estimated 181 (57 in Ise and 124 in Idanre) total human activities recorded during the survey. However, hunting, farming, and settlements are relatively more intense in the Idanre Forest Cluster than in Ise as they were observed 0.21, 0.20, and 0.11 per kilometer walked, respectively, compared to the 0.07, 0.10, and 0.04 per kilometer recorded in the Ise Forest Reserve. Survey results indicate that a combination of excessive logging activities and land cultivation preceded by clearing must have had a profound impact on chimpanzee abundance and distribution inside the forest reserves. Land cultivation also contributes significantly to overall forest loss in the survey areas. Two forms of farming were observed during the survey: the cultivation of cash/food crops and the cultivation of marijuana. The Idanre Forest Reserve is almost completely taken over by illegal farm encroachment, and areas that were previously relatively intact during a 2009 survey (Ikemeh 2009b) have become farmland with permanent settlements. The level of new clearing observed during this survey suggests that the remaining forest patches within the Idanre forest reserve would have all become farmland by the end of 2013 if no decisive action had been taken to stop it. Fortunately, the Ondo State Government reacted quickly to the report of this survey, submitted to the State Governor in April 2013, and in the week following the report presentation the government arrested hundreds of illegal encroachers in the reserve. Similarly, marijuana farms are spreading throughout the survey areas. The Cannabis sativa leaves supply a growing local illicit drug market and this has become an important income-generating activity for many locals. By its very nature, the Cannabis plant requires fertile areas of rich habitats and its vegetative growth phase requires more than 12 – 13 hours of light per day. As a result, the forest canopy is removed completely, speeding up deforestation and biodiversity loss. It is unclear at this stage (and difficult to estimate) how many hectares of forest cover have been lost to marijuana plantations in the survey areas, but survey findings indicate that vast areas of forest land within the reserves have been affected by the cultivation of this plant. GIS analysis (Figure 4) indicates that 744,488ha of forest (34.5% of the total land area) was converted from 2000 to 2013. This further suggests that an average of 7.7% (57, 268ha) of forest is cleared each year within the Idanre Forest Cluster, and land cover classification analysis for the 13 year period indicates that 85.1% of forest conversion is driven by farming activities. In Ise forest reserve, our observations were not consistent with the reflection (indications of forests/non-forests) from the satellite imagery. We found that much of what appeared to be forest were actually large areas of fallow land with no large trees but with dense understory characterized by thorn bushes.

Other human disturbances such as hunting also have an impact on chimpanzee populations as their body parts (particularly hands, feet, and head) provide relatively huge profits when sold to traditional native doctors who produce charms believed to enhance physical strength and protection (Figure 5). Although many local people claim they would not eat chimpanzee meat because of its resemblance to humans, a few individuals admit they would eat the meat if available. Overall, the interviews conducted suggest that an average of 5 chimpanzees have been hunted annually since 2005. Ninety-four percent of these involved killing for sale to traditional native doctors and 6% during the 9-year period were to capture an infant for sale as a pet. There were no claims that chimpanzees have been hunted for meat and the chairman of the Hunters' Association insists that there is a law within the Association that prohibits the hunting of chimpanzees in Ondo State because the ape is revered in traditional Yoruba culture. He admits, however, that even though some hunters regularly break this law, the meat must not be seen in the open market where other bushmeat is sold. Hunting of wildlife is generally very

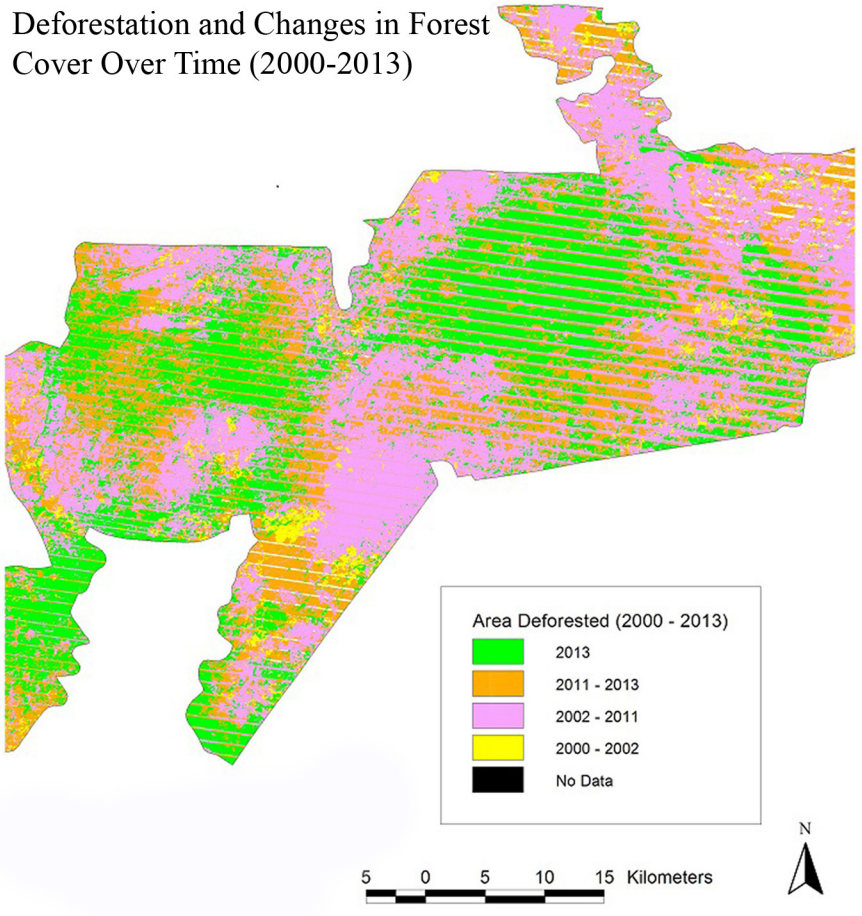


Figure 4. Deforestation Rate in the Idanre Forest Cluster. Rate of loss of natural forest/tree cover in the Idanre forest cluster over a period of 13 years. Current areas covered by forests and other tree cover types such as exotic tree plantations is about 34.5% of the total land area. Data source: USGS Imagery 2000-2013. Groundtruthing: R. Ashegbofe Ikemeh, December 2012/January 2013. Map: R. Ashegbofe Ikemeh, April 2013.

high in these forests, according to one of the Hunters' Association executives; there are about 400 registered members of the Association in Ondo State. Even in a case where some animals are legally protected in the State, such as the case for forest elephants (*Loxodonta africana cyclotis*), evidence of poaching continues. For example, in 2012 alone, there were three independent reports of elephant killings within the Idanre –Akure Ofosu forest landscape and we found that only one of these cases was prosecuted by officers of the Ministry of Natural Resources.

CONCLUSION AND RECOMMENDATIONS

Very small and severely fragmented natural forest remains in the survey area but a great deal of biodiversity is already lost. This current situation can be attributed to several causes (based on observed human activities), but there are underlying factors that must be identified and addressed before these threats can be ameliorated. One of the major resultant effects of the high level of human activities in the survey areas, especially logging

Figure 5. Fresh chimpanzee parts with traditional native doctor/hunter. Our survey found that chimpanzees are mostly hunted for their body parts supplied for use by traditional native doctors. This photo is taken in Idanre during the survey. Photo © Rachel Ashegbofe Ikemeh 2013.

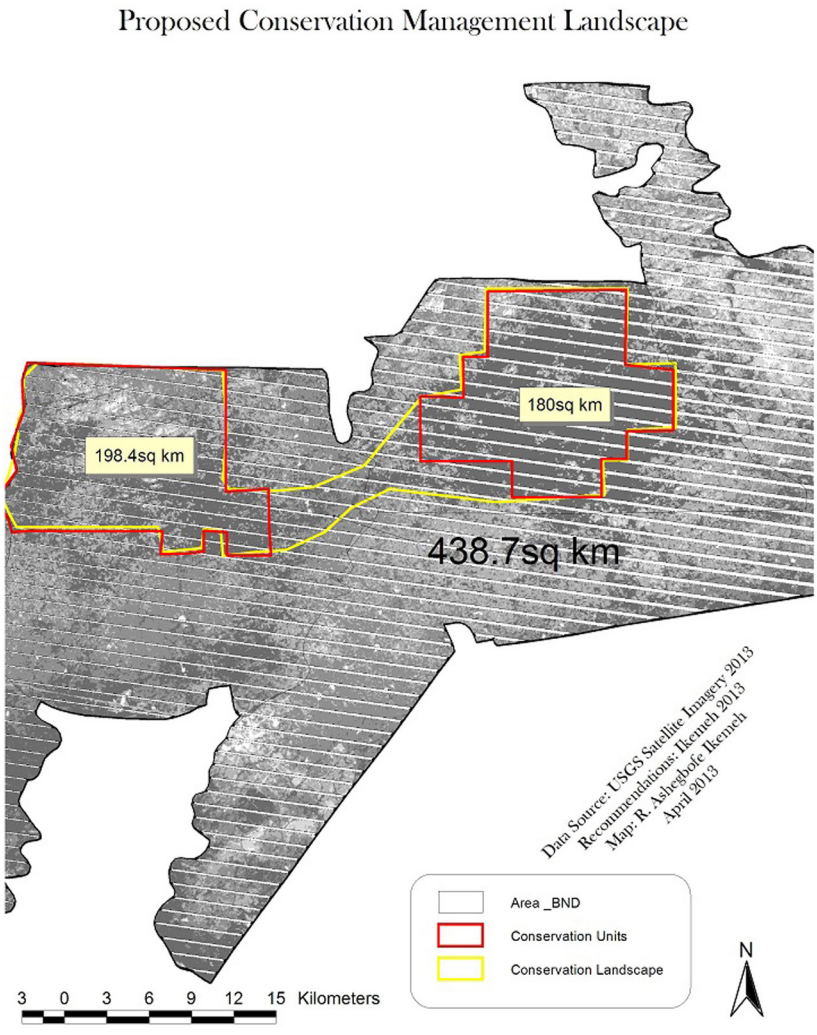


Figure 6. Recommended Areas in Idanre Forest Cluster for Chimpanzee Management and Monitoring.

and farming, is habitat loss and degradation. Hunting is equally devastating to wildlife populations in general; forest elephants are being poached in record numbers. It is therefore recommended that clearly defined management objectives targeted at the establishment of conservation areas should form the basis for any further efforts. It is imperative that these objectives are defined based on available information gathered so far, in this regard, emphasis should be placed on species conservation or the conservation of a range of species within this threatened landscape. Correspondingly, connecting chimpanzee and other wildlife populations via a series of protected habitat corridors is also very important, e.g., Ikemeh (2009b, 2009c) found that elephants were using areas east of Idanre Forest Reserve to travel to the Akure-Ofosu Forest Reserve. Chimpanzees and other large mammal species require relatively large forest tracts to forage and thrive; otherwise wildlife will continue to come into conflict with humans. For example, of the three reported killings of elephants in 2012, one was an occasion of elephants raiding crops. The farmer had reportedly targeted the elephant as he claimed the animal always trampled his crops (cultivated illegally in a forest reserve).

Chimpanzee populations, like other wildlife species in the Idanre Forest Cluster and Ise Forest Reserve, are heavily threatened and are on the verge of extinction. If no further action is taken in the near future, populations will not have a chance of recovery. Yet, the taxonomic status of chimpanzees in southwestern Nigeria still remain unresolved (Gonder *et al.* 2006), and this survey was unable to find faecal remains needed for genetic sampling. There are indications suggesting there are differences between chimpanzee populations in western

and eastern Nigeria (Gonder *et al.* 1997, Gonder 2000), and if this difference is confirmed it will further increase the importance of the western Nigerian chimpanzees. The loss of this population will represent the loss of biological and cultural heritage of this great ape. With existing survey data, a conservation management landscape of about 438.7km^2 in the Idanre Forest Cluster (180km^2 in Akure-Ofosu Forest Reserve, 198.4km2 in Idanre Forest Reserve, and 60.3km^2 as Community Conservation Area, or CCA) is recommended to ensure a habitat corridor that may connect isolated populations (Figure 6). A 30km^2 chimpanzee reserve is recommended in Ise Forest Reserve, but in both sites government needs to address insecurities and habitat devastation resulting from marijuana cultivation before any conservation-related activities can be successful.

ACKNOWLEDGEMENTS

The survey was funded by Rufford Small Grants for Nature and the project is further supported by the African Wildlife Foundation (AWF) and the Ondo State Government Ministry of Natural Resources' Department of Wildlife Conservation, Parks and Ecotourism. The author is grateful to these organizations and institutions. Thanks also to the Ministries of Environment Departments of Forestry in Ekiti and Edo States for research permits and to the Federal Department of Forestry for support. Thanks to Prof. John Oates and Drs. Elizabeth J. Greengrass, Bethan Morgan, Femi Ogunjemite, Katy Gonder and Jef Dupain for providing advice, overall guidance, and support to the project from inception through to its implementation. The author also wishes to thank all those who participated in the surveys including the local assistants and community leaders who provided some form of assistance in the field. Thanks to the three anonymous reviewers who made tremendous contributions to the final outcome of the manuscript.

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Received: 3 September 2013
Revised: 28 October 2013