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Indices of human disturbances on Protected Areas: a case study of Idanre Forest and Omo Biosphere reserves, Southwest Nigeria.

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Abstract

Government Protected Areas (GPAs) are a legal sanctuary for wildlife, but competition between wildlife and man for the resources within these forests have been of great concern to conservationists worldwide. This study was undertaken to find out the extent of human disturbances in the Idanre Forest reserve (IFR) and Omo Biosphere reserve (OBR) using the line transect method. A total of eighteen (18) transects comprising of 9 transects each and totaling 103.4 km was traversed in both Idanre Forest Reserve (52.8 km) and Omo Biosphere Reserve (50.6 km) between January 2014 and November 2015. Data were collected on human activity-encounters in five major categories: Poaching/hunting; Logging; Farming; Collection of Non-Timber Forest Products and Human settlements and analyzed into frequency counts and percentages. The result of encounter-rate observations shows that Farming was predominant in IFR with standing crop, harvested land, farmers seen, bush burning and land clearing at 20.75, 18.32, 14.02, 12.02 and 10.84 observations per kilometer respectively. However, poaching/hunting was predominant in the Omo Biosphere reserve with the animal kill, hunters seen/gunshot heard, spent cartridges, traps/snares, and ash deposits/spent batteries seen at 1.11, 0.66,0.23, 0.14 and 0.07 observations per kilometer respectively. These human activities which account for habitat loss and degradation were more prevalent in IFR than in OBR. Therefore, it is necessary to step up conservation and protection measures in the reserves to reduce the impact of human activities which is detrimental to the well-being of wildlife resources of the reserves.

Keywords: Protected area, transect, encounter-rate, poaching, cartridges,

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Introduction

Human disturbance in the form of habitat loss represents a significant threat to biodiversity and many ecological processes (Ogunjemite, 2006). It causes widespread disruption to the ecosystem and it is very important to understand how, at what rate, and to what extent such disruption affects the integrity of the ecosystem and their ability to provide key services to humanity. Habitat loss, degradation, and fragmentation are collectively termed used to describe the main threat to primates (Chapman and Peres 2001). However, sub-Saharan Africa with a projected 26–30% of the world's primate species (Estrada 2012), lost 74.8 million ha of forests at a rate of 0.5% (3,740,950 ha) per year between 1990 and 2010 (FAO 2011). Habitat disturbance can be caused by agricultural expansion, logging,

infrastructural development (Ogunjemite, 2006, Orimaye 2017), mineral exploitation and extraction of non-timber forest products (NTFP), and is driven by the demands of a growing human population (Laurence *et al.,* 2006; Ogunjemite, *et al.,* 2006; Oates *et al* 2008b, Orimaye 2016). For instance, data from the United Nations Population Fund revealed that human population in primate range countries of sub-Saharan Africa increased from eight to 132 people/km^2 between 1950 and 2010 (UNFPA 2011), and studies have demonstrated that the geographical range of most threatened primate species overlaps with areas of high human density (Harcourt and Parks 2003).

Idanre Forest Reserve (IFR) and Omo Biosphere Reserve (OBR) are Protected Areas in Southwest Nigeria with diversity in vegetation which makes them very important refuge for several threatened species especially the forest elephant (*Loxodonta africana cyclotis*). Ajayi, (2011) and Orimaye (2016) reported that endangered wildlife species of local and global concern found within these PAs include Chimpanzee (*Pan troglodytes*), and red-capped mangabey (*Cercocebus torquatus*) while African gray parrot (*Psittacus erithacus*), Black Casqued Hornbill (*Ceratogymna atrata*), Great Blue Turacos (*Corythaeola cristata*) and Crested Guineafowl (*Guttera pucherani*) are some examples of endangered bird species (Okosodo, et al 2016). Studies have revealed that these forest reserves are under enormous pressure from widespread illegal logging, (Oates, 1995, Ogunjemite, 2006) rapid extension of cultivated lands (Ogunjemite, 2006, Orimaye et al 2018) and a growing human population infiltration (Ogunjemite, 2006 Orimaye, 2016). However, current information on the extent of human disturbance threatening Idanre Forest Reserve and Omo Biosphere reserve is lacking and such evidence, when provided, would serve as a valuable tool to government and stakeholders for the management of these fragile forest ecosystems in Southwest Nigeria. This study is done to provide the necessary information on the extent of human disturbances in the Idanre Forest reserve and the Omo Biosphere reserve, Southwest Nigeria.

Study Area

This study was done in two separate forest reserves in Southwestern Nigeria namely, Idanre Forest Reserve (IFR) and Omo Biosphere Reserve (OBR). Idanre Forest Reserve, in Idanre Local Government Area of Ondo State, is located about 20 km southeast of Akure with a population of 129,024 ((NPC, 2006). IFR is an IUCN (International Union for Conservation of Nature) designated nature reserve which covers 527.1 km^2 (Ikeme, 2013) and lies between 6°51'27.72" N, 5°6'19.84" E, 527.1km^2". The Forest Reserve is characterized by a dry season between November and February with a mean annual rainfall of 1, 654 mm. DIVA-GIS World Climate database (1950-2000), 5 minutes' resolution showed that the mean annual temperature ranged between 25 °C – 26 °C while the minimum and maximum temperature is 19 °C and 33 °C respectively. Annual precipitation is between 1200 mm – 1800 mm. Wettest periods are usually in July and September characterized by double maximal rainfall (Greegrass and Ogunjemite, 2008).

Omo Biosphere Reserve, on the other hand, is part of Omo Forest Reserve which was legally constituted as a forest reserve by Order No 10 of 1925 and amended in 1952 (Ola-Adams, *et al.,* 1999) and is situated between latitudes 6^0 35' to 7^0 05' N and longitudes 4^0 19' to 4^0 40' E in the Southwest Nigeria (Ojo, 2004). OBR shares a common boundary in its northern part with two other forest reserves – Ago Owu and Shasha in Osun State and with Oluwa Forest Reserve in Ondo State (Karimu, 1999) with a total landmass of 1, 305 km^2 (Ojo, 2004). Its mean annual rainfall ranges between 1600 to 2000 mm with two annual peaks in June/September, and November/February being the driest months (Isichei, 1995)

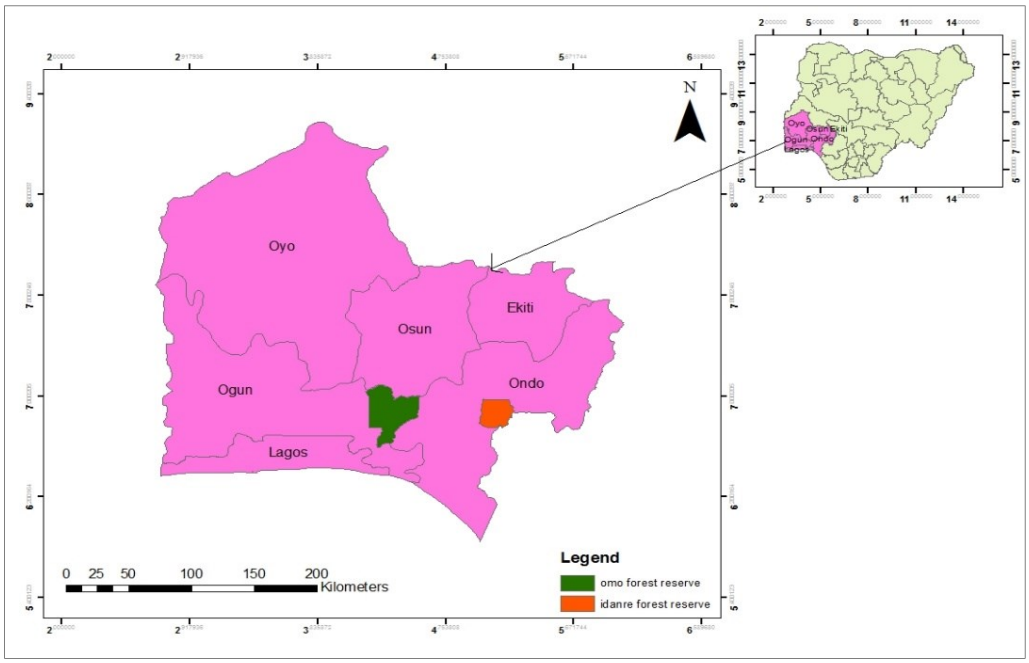

Fig. 3: Southwestern Nigeria showing Omo Biosphere Reserve and Idanre Forest Reserve. Source: Field survey

Vegetation, Topography, and Hydrology

The Southwestern eco-zone is a mixture of the following ecosystems namely: The Guinea forest, Savannah mosaic, Guinea-Congo lowland rain forest, and the central African mangroves. However, the natural vegetation is mixed deciduous forest, (Isichei 1995, Mengistu & Salami, 2007). Idanre Forest Reserve is situated within the Nigerian lowland forest eco-region extending from the eastern margin of the Dahomey Gap in Benin to the Niger River in the west (Werre, 2001) and is situated within the Congolian subdivision of the Guinea-Congolian belt (Oates *et al.,* 2008b). The predominant habitat type is the Guinea-Congo lowland rain forest (Oates *et al.,* 2008) with relatively dominant plant species to include *Cola spp., Mansonia altissima, Nesogordonia papaverifera, Pterygota spp., Sterculia spp., Triplochiton scleroxylon, Antiaris africana, Ficus spp., Milicia excelsa, Brachystegia spp., Cylicodiscus gabunensis, Gossweilerodendron balsamiferum, Piptadeniastrum africanum* where natural forest vegetation still exists (Werre, 2001). Several large rivers flowing within and around the reserve include river Ofosu and river Lejua which is also called River Idanre. These large perennial rivers can measure up to 500 m in width and many are over 10 km in length. However, none of these major rivers flow directly to the sea but discharge into narrow lagoons, which run along the entire coast from the Niger Delta to Benin (Werre, 2001).

Omo Biosphere Reserve is home to tropical humid forests, including dry evergreen mixed deciduous forests in the north and wet evergreen forests in the south. However, plantations (*Gmelina arborea*, *Pinus caribaea*, *Cola sp.* and *Theobroma cacao* species), residential areas, and agricultural land containing agro-ecosystems with cash crops and arable crops are also present. The main plant species in the Omo are *Diospyros spp.*, *Dracaena manni*, *Khaya ivorensis*, and *Cordia millenii*. Around 80 percent of the area is well-drained into the watershed of Omo River and metamorphic rocks of the Pre-Cambrian Basement Complex are found underneath the area. The terrain is undulating and the maximum elevation of 150 m above sea level. The Lagos-Ore-Benin Highway passes through the southern tip of the Reserve. The mean annual rainfall ranges from about 1600 to 2000 mm with two annual peaks in June/September, with November/February being the driest months.

Methodology

A total of eighteen (18) transects comprising of 9 transects in IFR and OBR were traversed between January 2012 and November 2014 covering a total

distance of 626.4 km at both reserves with a total of 322.8 km transects ranging between 2.2 km and 4.0 km in length having a mean length of 3 km was covered in IFR while 303.6 km transect, ranging between 1.9 km and 3.7 km with a mean length of 2.8 km was achieved in OBR using existing trails. Data were collected on human activity encounters in five major categories in both IFR and OBR which include: **Poaching/hunting** (traps, snares, hunters seen, gunshots, used cartridges, used carbide ash deposits, and animal kills); **Logging** (workers' seen, chainsaws heard, timber stockpiles, felled logs, and timber trucks); **Farming** (land clearing, bush burning, standing crops, harvest, farmers seen); **Collection of Non-Timber Forest Products (**NTFPs) (Fruits collection, firewood gathering, Rattan collection, and Herbs/Leaves/Barks collection); and, **Settlements** (Villages, Hamlets, huts, old camps, camps in use, Tarpaulin).

Data analysis

Data collected on the human activity encounters in both forest Reserve were processed into frequency counts and percentages and were described using the histogram.

Results

Poaching/hunting activities

Figure 2 shows the results of poaching indices recorded at both the IFR and OBR during the study period. The result shows that poaching activities were very high at IFR with traps and snares counts ranking highest (190), followed by spent cartridges (125) and ash deposit (from hunters' local lamp)/used batteries (40) while animals kill count (14) was the least. Some of the kills include African forest elephant (*Loxodonta africana),* Mona Monkey *(Cercopithecus mona),* Potto, and Pangolin. OBR witnessed a very low poaching activity. The results revealed that used cartridges were more (6), closely followed by traps and snare (4) while hunters' seen/gunshot heard (1) was the least.

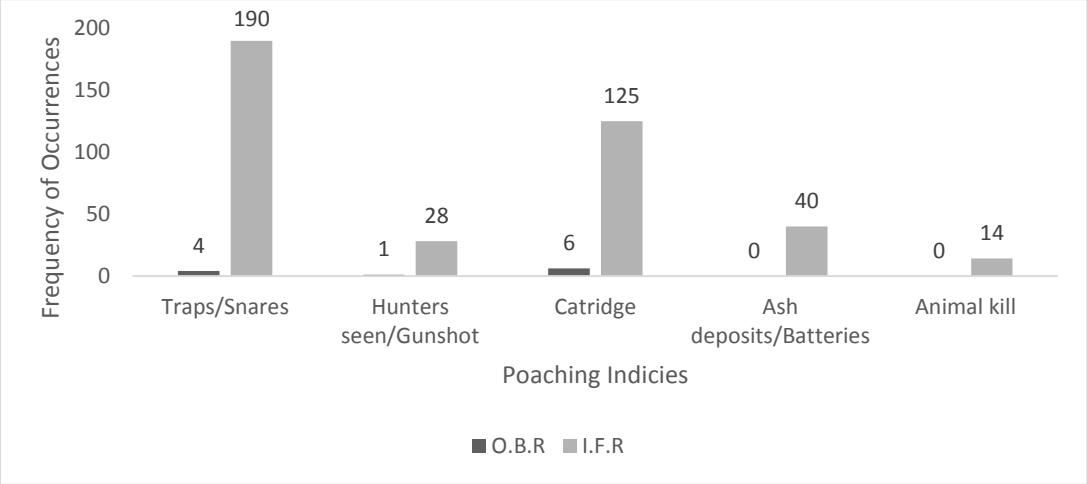

Figure 2: Poaching indices observed in OBR and IFR, Southwestern Nigeria

Logging activities

Active logging indices were recorded under the following: Number of loggers seen within the reserves, Frequency of Sound of chainsaws heard, Frequency of timber stockpiles seen, Frequency of felled logs, and Frequency of timber trucks encountered. Figure 3 revealed that the frequency of fell logs (280) encountered and chain-saws heard (105) were very high in IFR Furthermore, the frequencies of loggers' seen (33), timber truck encountered (26) and timber stockpiles (24) encountered were widespread in Idanre Forest Reserve during the study period. However, the frequency counts of chainsaws heard (12) and fell logs (6) encountered were low in OBR and there was no record of loggers' seen, timber stockpiles saw, and timber trucks encountered during the period in the study area.

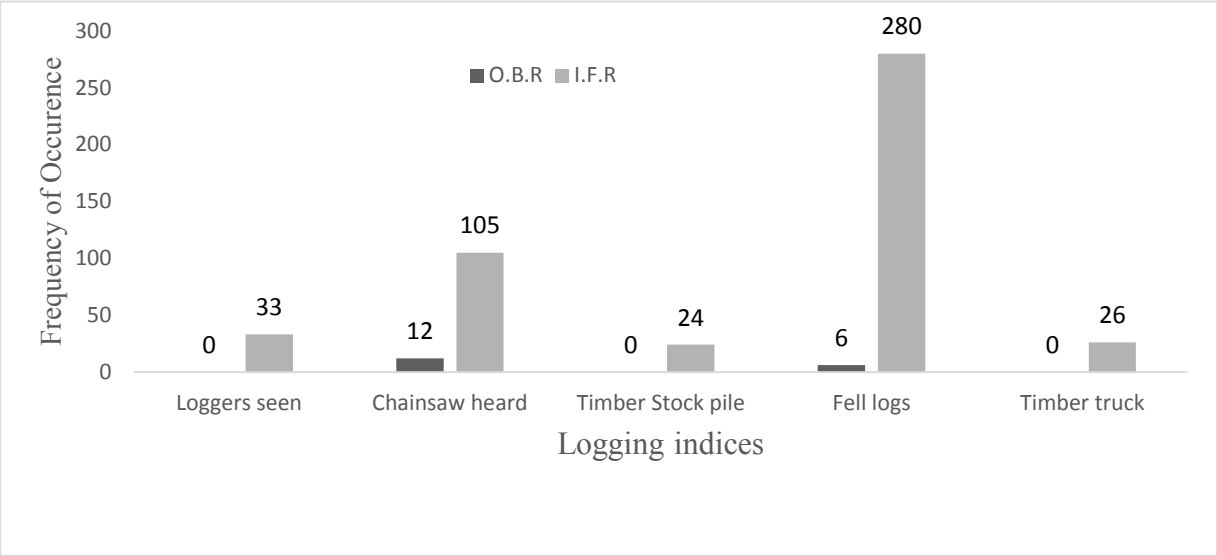

Fig 3: Active logging indices observed in IFR, and OBR, Southwestern Nigeria

Farming activities in the study areas:

The active farming index was recorded under the following indices in the study areas namely: Number of Farmers seen during the period of study, Frequency of Land clearing activities during the period of study, Bush burning, Standing crops, and Harvested land. Figure 4 revealed that the frequency count of harvested land and standing crop encountered between 2012 and 2014 were extremely high with each count greater than one thousand and also, farmers seen (510), bush burning (460) and land clearing (380) encountered was very high at Idanre Forest Reserve. The most common form of land use in IFR include land clearing/slash and burn activities while most common crops encountered include Cocoa (*Theobroma cacao*), Plantain *(Musa spp.*), Cassava *(Manihot utilissima),* Yam *(Discorea spp.).* Moreover, the frequency of Farmers seen (3) and the frequency of land clearing (2) encountered in OBR was very low. However, no observation was made for bush burning, standing crops, and harvested land in OBR during the period of study.

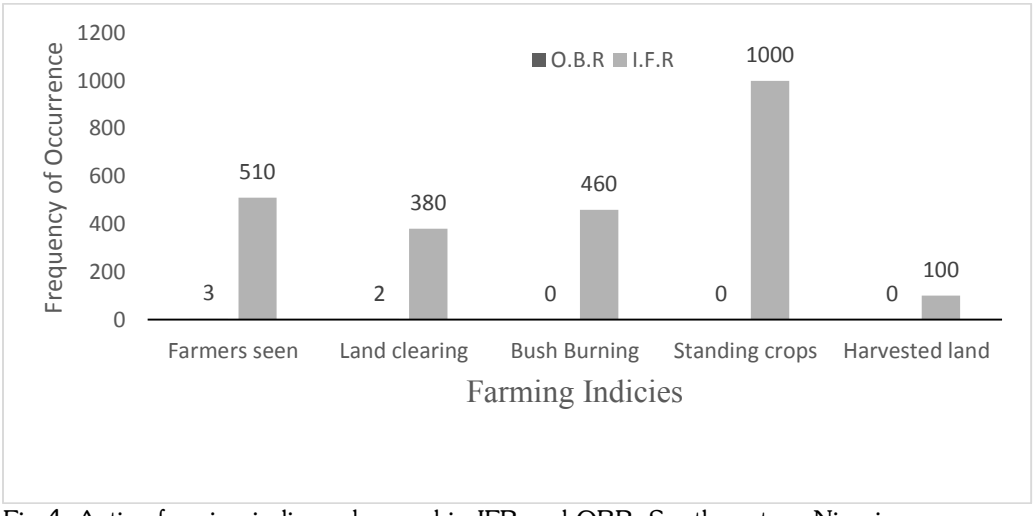

Fig 4: Active farming indices observed in IFR and OBR, Southwestern Nigeria

Collection of Non-Timber Forest Products (NTFPs) in the study areas:

Active Non-Timber Forest Products' (N. T. F. P) collection index was recorded using indices like Fruits collection, Firewood gathering, Rattan collection, and Herbs/Leaves/Barks collection.

Figure 5 revealed that the frequency counts of Fruits collection (854), Firewood gathering (765), Rattan collection (240) (Herbs/Leaves/Barks collection (649) encountered were extremely high in IFR while the frequency of Fruits collection (4), Firewood gathering (30), Rattan collection (4) and Herbs/Leaves/Barks collection (10) encountered were low in OBR

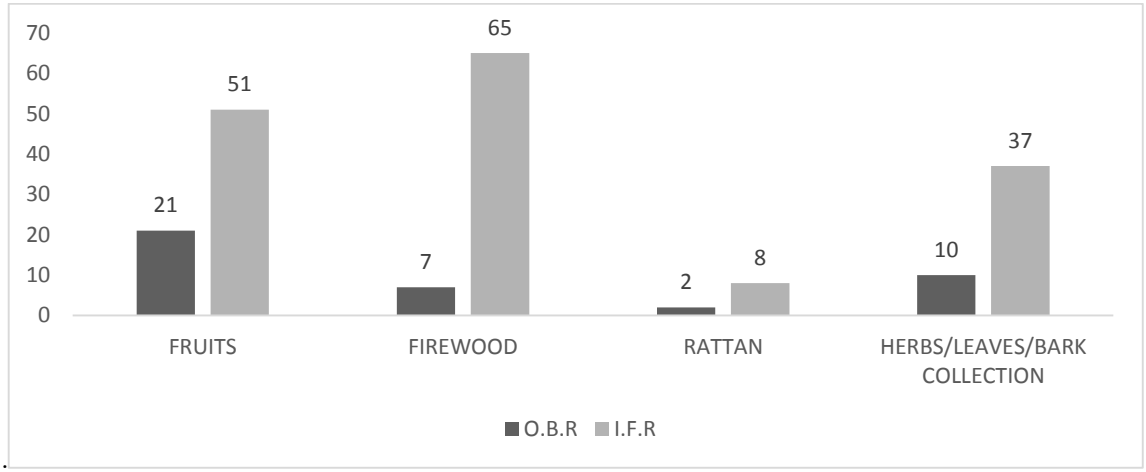

Figure 5: Active Non-Timber Forest Products' (NTFP) collection indices at in IFR and OBR

Settlements within the Reserves.

Human settlements within the protected area are measured through the frequency count of the following structures within these protected areas. These structures include Villages, Hamlets, Huts, Old camps, Camps in use, Tarpaulin. Figure 6 also shows that the frequency counts of Huts (223) and Tarpaulin structures (126) were many in IFR. This is followed by the frequency count of Old camp (92), Camp in use (87), while Villages and Hamlets have 12 and 15 counts each as at the period of the study.

Some of the human settlements around Idanre Forest Reserve include Jimgbe, Aba Alake, Ogunmojuba, Owomofewa, Ologede,Opa, Ipinle-rere, Obajare, Omi-efun, Olowokofaruwo, , Gbogi camp and Ofosu. However, in Omo Biosphere Reserve, the settlements around the biosphere reserve were few with one major village (J4) and 10 hamlets which are, Abeku, Abeku Temidire, Tami, Sojukoro, Oloji, Osoko, Tibetu-Ibiade, Idi-Egun, and Eseke.

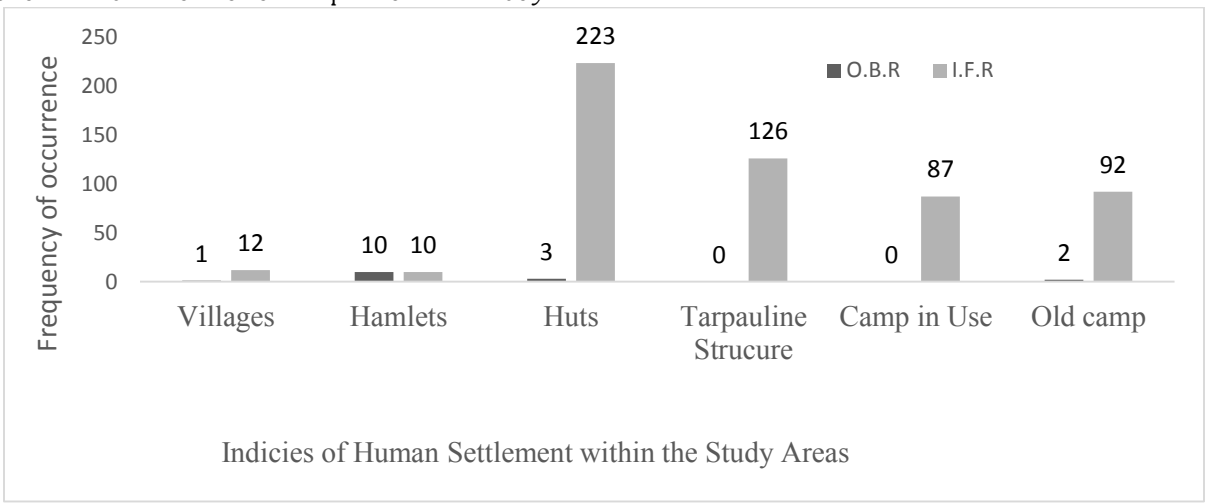

Fig 4.10: Indices of Human Settlement within IFR and OBR, Southwestern Nigeria.

Discussion

The poor or non-protective measure and habitat fragmentation due to clearing tropical forests for agriculture, illegal felling of timber and fuelwood within the protected area are the reason for the decline in the resources within these protected area (Agbelusi, 2003, Oates et al 2008). The Protected Areas (Pas) were established for protecting; conserving biodiversity and natural resources, and are formally recognized by states and/or national governments. This study showed that poaching was the major method used in harvesting wildlife resources within IFR. The choice of this method may be due to poor enforcement of law prohibiting poaching in PAs. This result agreed with many results obtain in Nigeria (Agbelusi, 2003, Ogunjemite et al 200 and Orimaye et al 201), Ethiopia (Wale et al., 2017 and EWCA, 2018) and Kenya (Kiringe and Okello, 2007).

The consequence of the findings is that while most PAs are prone to poaching, dealing with this menace and other anthropogenic activities in both IFR and OBR would protect these fragile ecosystems and biodiversity populations in the areas.

The illegal activities of loggers that were widespread in both reserves imply that wildlife conservation in these PAs and in the southwest Nigeria in general is currently at jeopardy. Tessema et al (2019) observed that wildlife conservation in Ethiopia is currently at huge risk during his study on the threats and their relative severity and driving forces in the African Elephant range wildlife protected areas of Ethiopia. Conservation emergencies in Nigeria has become an overwhelming challenge which has already been documented in reports of several studies (Afolayan 1980, Anadu, 1987, Meduna *et al.,* 2009) and national development plan (NBSAP, 2015). However, the ever-increasing demand for land as a result of increasing human population in rural areas (Ogunjemite, xxx, Orimaye xxx) has put more pressure on biodiversity and Pas. Although, different PAs follow different types of conservation management objectives which differ giving the diverse policy frameworks enforced by the country, for example, policy that focuses on the conservation of wildlife, sustainable rational use of specific natural resources or both) and on cultural and historical importance. This study has shown that the effectiveness of protection varies across these PAs, from very effective which was almost achieved in OBR, to practically non-effective as observed in IFR (Ervin, 2003). The susceptibility of these PAs is amplified by different anthropogenic pressures due to human settlements around these PAs. IFR has more than 50 settlement in and around it while OBR has about 15 settlements. The accelerated human population growth in these enclaves exacerbated the incidence of poaching and other illegal activities leading to a decline in biodiversity populations these PAs (Oates 1999, Ogunjemite, 2009).

Conclusion and Recommendations.

It is a fact that when PAs are surrounded by agricultural activities and human settlements, they become more prone to all forms of human-induced damages leading to biodiversity loss, and degraded habitat. Both IFR and OBR are threatened with ever-increasing anthropogenic activities orchestrated by increased human population and lack of the enforcement of laws that establish these PAs.

The control of frequency and impact of threats to PAs will only be successful if the local communities are socially and economically empowered through their involvement and when the resource management policies are structured to embrace their needs and aspirations. It is therefore important that community participation in biodiversity conservation and management as well as providing them with economic benefits in resource conservation will give them sense of belonging towards their natural endowment and jettison their interest in poaching and bush meat trade and the overall wellbeing of the biodiversity resources of the PAs

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