

Ecological Threats of an Ecotourism Destination: The Case of Owu Waterfall, Kwara State, Nigeria

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Abstract

Every Ecotourism destination consists of its own physical and climatic condition with its potentials of natural resources like wildlife, hills, mountains and vegetation to be nurtured and preserved for tourism, educational and research purposes amongst other uses. Maintenance of the physical environment of tourism activity is crucial for site sustainability. To examine the real state of affairs at one of Nigeria's ecotourism destinations, field surveys were implemented within an area approximately 2160 hectares of land which forms the main-bow of Owu Waterfall. Woody plant composition, faunal species and anthropogenic threats were assessed. A total of 34 woody plant species in 20 families were encountered. There were differences in the woody species composition of the Waterfall site. Six species of wild animals: *Cercopithecus mona*, *C. tanzanus*, *Papio anubis*, *Galagoides* Spp *Xerus* Sp and *Epixerus* Sp were directly sighted. Four major threat activities were reported as logging, farming, annual burning and grazing. This study made recommendations that all sustainable measures be explored to maintain the site. More so, development of the site should be a multidisciplinary approach given that it has the capacity to be developed as a world-class tourism destination.

Keywords: Maintenance, surveys, sustainability, world-class and destination

Introduction

Every Ecotourism destination consists of its own physical and climatic condition with a variety of ecological formation and zone (Fennell, 2001; Kiper, 2013). An ecotourism destination has the potentials of natural resources like wildlife, hills and mountains, vegetation (fascinating flora and fauna) (Mathieson & Wall, 2002; Newsome, et. al., 2002). Maintenance of the physical environment of tourism activity is crucial for site sustainability (Adesalu & Nwankwo 2010; Afolayan, et. al, 2004). According to Fadipe (2014), ecological and natural sensitive sites offer great appeals to potential visitors and people are often attracted to such natural sites particularly those they cannot comprehend from ordinary parlance. Sites of this nature possess abundant flora and fauna and their species are of immense value to humanity. Some of these sites are carved out and renamed national parks, protected areas, sanctuaries, forest reserves and wetland among others (Almeyda-Ibáñez, & George, 2017; Zandivuta, 2020). For the uniqueness of products, such sites may sometimes be named after its unique feature or its abundant resource such as; waterfalls, smoking hill, Crocodile village, Snake Island, Monkey forest etc. (Okekedunu, Ogunjemite, Adeyemo & Olaniyi, 2014).

While tourism is the act of practice of travelling temporarily out of one's place of abode to destinations outside the home and workplace to do activities and use facilities at destination visited to meet ones need of leisure and recreation (Geoffrey & Alister, 2006; Mathieson & Wall, 2002), ecotourism involves visiting natural site not grossly altered by human activity or intervention (Newsome, Moore & Dowling 2002; Reynolds & Braithwaite, 2001). Ecotourism destination particularly the physical environment is vulnerable to human pressures caused by the rapidly increasing population and intensive economic activities (Fabricius, Carter & Stanford, 2007; Williams & Ponsford, 2009). Ecotourism feature includes a variety of plants and animals within the human environment (Conservation International, 2001). These resources are often overexploited by men in their search of livelihood and comfort. This is evident in the activities of poachers, hikers and others who destroy the flora and fauna resources in the environment. The ecological destination has ecological values which are those natural resources that exist in the environment and are relatively undisturbed by man (Ezealor, 2002; Fadipe, 2014). An ecological destination is characterized by biodiversity within various ecosystems. Biodiversity comprises of those living things include all habitats, ecosystem and species of the human race, beaches, rivers, oceans, mountains, caves, insects, forest, grassland and wetland among others (Kolawole, 2019).

The importance of vegetation cannot be undermined in an ecotourism destination, because it is one of the primary factors that determine the eligibility of such sites (Schaller, 2010; Stankov, Stojanović, Dragičević & Arsenovic, 2011). Vegetation provides the basis by which other components of the environment thrive and develop. The main drivers of deforestation in the country are agriculture, logging and grazing (Alokan, 1995; Isichei, 2010). Studies in the Southwestern Region of Nigeria have cited rapid population growth, urbanization, and use of fuelwood as major drivers of deforestation in the country (Fasola 2007; Ladipo.2013; Okali, 2010; Ojo, 2004). Woody species composition in vegetation cover provides an immediate corridor for the understanding of the complex plant interaction in an ecosystem (Olaniyi & Ogunjemite, 2015; Olaniyi, Ogunjemite & Isiaka, 2016). Woody plant species exhibit a variety of growth forms. Other forest components such as lianas and epiphytes also present some complex arrangement (Akinsoji, 2003). All these factors, wish must be maintained put together guarantee the sustainability of an ecotourism destination. Nature-based tourism, takes into account this natural ecological attraction, their conservation and development. A destination can be a particular resort or town, a region within a country, the whole of a country or even larger area of the globe. All destinations share certain characteristics and some distinctiveness (UNWTO, 2015; Williams, & Ponsford, 2009). Tourist destinations'

success in attracting tourists will depend on the quality of three essential benefits that they offer, these are; attractions, amenities (or facilities) and accessibility (or ease with which they can travel to the destination). According to Holloway & Humphreys, (2009), destinations are of two kinds; either natural or constructed (man-made). All destinations can suffer overuse.

These days, one of the perfect destinations that can be useful for relaxation is a waterfall. Nigeria is rich in amazing and unique waterfalls such as ‘*Olumirin*’ Waterfall in Osun State; ‘*Arinta*’ in Ekiti State; ‘*FarinRuwa*’ Waterfall in Plateau State; ‘*Agbokim*’ Waterfall in Cross-River State and many others. However, Owu Waterfall is unique based on its height and geographical features (escarpments, pass, canyon and hills) around it. Waterfalls are excellent spots for social entertainments such as parties, picnics, video and photo sessions as well as academic investigations. Not much is known of Owu Waterfall both to local and international tourists. Oyebode (2017) identified tourist infrastructure and attraction of the site, the focus of this research is to assess the harmful effects of human activities on the flora potentials which serve as cover to Owu Waterfalls as an Ecotourism destination in Kwara State in Nigeria. Its main aim is to safeguard the environment of the waterfall, to make it beneficial to local people by generating revenue and educating and serving the pleasure of visiting tourists. Consequently, the researchers conducted an assessment of woody plant species composition and the dependent fauna species as well as anthropogenic threats on Owu Waterfall site in order to make an informed decision about sustainable management of the site.

Literature review

The World Tourism Organization (WTO, 2010), defines tourism as that which comprises activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes. Tourism is as old as man and from historical time, people have travelled for many different reasons. Tourism is by no means a new phenomenon. Fadipe (2007) noted that in time past, people travel across paths, fields, landscapes and forests in search of survival and basic necessities of life (water, food, shelter). Fadipe (2007) attempts a definition of tourism based on conceptual and technical frameworks. The author sees tourism as a leisure activity which tags a tourist a pure consumer of time, money and energy through participation in leisure activity. From the technical framework, Fadipe (2007) described tourism as that activity that tourist engage in with a purpose of the visit to a destination, duration of stay at the place visited, and the nature of transportation in the destination. Tourism itself is an idea, it is a field made up of various physical, programme and action parts (Gun & Van, 2002). Consequently, tourism activity should have a purpose, the duration of time, the distance, movement of tourist and destination to be visited. Tourism has been described as a combination of leisure or recreational activities and services provided within an environment for visitors’ enjoyment.

Ecological tourism / ecotourism

The term Ecotourism, although, subject to some controversy is believed to be originally coined in 1987 by Hector Cellabos Lascrain, an environmentalist from Mexico and because of its appeal it has gained wide usage. He defined ecotourism as travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring and enjoying the scenery and its wild plants and animals as well as any existing cultural manifestations. As time goes by, the society becomes more ecologically mindful, thus, nature-based travel grew and the term ecotourism was widely accepted. more ecologically minded, responses to nature-based travel opportunities grew and the term ecotourism was evolved and widely accepted (Diamanlis 1999; Honey, 1999; Weaver, 2005). Ziffer (1989) is one of the earliest authorities to introduce the idea of benefits and perceived cost to the definition of ecotourism while Fennel

(2005) brings in the concepts of sustainability. Ecotourism implies some scientific, esthetic or philosophical approach. According to World Travel and Tourism Council (2019), tourism must be environmentally compatible with activities of the tourists especially in situations where the environment is the attraction and main motive for tourists visit to a destination.

Ecotourism is practiced throughout the world. However, Ecotourism destinations are restricted to some few specific protected natural areas within specific geographical regions. Ecotourism has grown in influence and importance with man's understanding of his environment and more importantly the role he plays in its improvement or demise (UNWTO, 2015). Ecotourism is a nature-based travel that involves education on the interpretation of the natural environment as it is managed to be ecologically sustainable (Mchunu & Hlengwa, 2018). In this definition, we recognize that natural environment also includes cultural components. Thus, ecologically sustainability involves an appropriate return to the local community for long-term conservation of the resources (Adejumo et al., 2014; Hughes, & Warin, 2005). Likewise, Fennell (2003) and Ziffer (1989) put forward that ecotourism serves as a tool for conservation.

History of ecotourism development in Nigeria

The development of Ecotourism in Nigeria can be traced back to 1889, when the colonial government took steps to establish the first forest reserve in the colony of Lagos (Collier, 1934; Shorthouse, 1935). Since then, the number of protected areas in Nigeria has increased greatly and expanded to include forest reserves, wildlife sanctuaries, game reserves, strict nature reserves, communal forest and national parks. The establishment of these protected areas at any point in time came as a response to an adverse trend, especially within the last 80 years, when environmental degradation set in. By the mid-1980s, it had become an established fact that Nigeria had approximately lost 90% of her original tropical rainforest cover to logging (FAO, 1999; FAO, 2001; FORMECU, 1999; Ojo, 2004), bush burning (Afolayan, et al., 2004; Onadeko, 2004), slash and burn agriculture (Ladipo, 2013).

The foremost protected area specifically earmarked and developed for ecotourism purposes in Nigeria is the Yankari Game Reserve which was later upgraded to National Park status in 1991. Formerly known as Yankari Forest Reserve, it was converted to a game reserve in 1956. By 1962, Yankari Game Reserve had opened to public visitation and enjoyment. In 1963, this was followed by Borgu Forest Reserve, which was later converted to Game Reserve in 1976, and latter to the status of a National Park; Kanji Lake National Park, the first in Nigeria in 1979. In total, there are about 731 protected areas in Nigeria - the Game Reserves, Strict Nature Reserves, Game Sanctuaries, Biosphere Reserves, and National Parks etc. From the Mangrove Forests through the Rainforest, Guinea, Sudan and Scrubs or Shrubs Savannas, there are 32 Game Reserves and Game Sanctuaries plus the 8 newly created national parks, totaling about 3,533,788 hectares (ha) in the country land area. Ever since, ecological and natural sensitive sites had always been identified and added to the list of ecotourism destinations in Nigeria. Ecotourism is to provide tourists with new knowledge about a certain natural area and the culture that is found within, along a little bit of adventure. It is to help improve the local economy and conservation efforts as well as to help gain new appreciation for nature and people and, to allow more in-depth tours and educational opportunities.

The concept of ecological destination and natural sensitive sites

For any particular site or location to be designated as an ecotourism destination, the natural landscape must be relatively without interruption for people to study, enjoy and admire (Olaniyi, 2017). The scenery and its wild animals and plants must be in their natural

state. Nature-based tourism, takes into account the natural ecological attraction, their conservation and development (Ogunjemite et al., 2016; Schaller, 2010; Stankov et al. 2011). Sustainable nature-based tourism is aimed at safeguarding main aim is to safeguard the environment, making it beneficial to local people by generating revenue and educating and serving the pleasure of the tourists. Particularly as a number of communities in developing countries still engage in traditional methods of farming, consequently facing land use constraints (Buba, 2013; Egbe & Vange, 2008). The rising prices of petroleum products, especially cooking gas and kerosene, have encouraged both rural and urban households to rely on fuel wood and charcoal as their main sources of energy (Jayeola et al. 2009), leading to further impact on ecotourism sites in Nigeria.

Ecological threats

The environments as an ecotourism destination must be healthy. Threats to ecotourism destinations are anthropogenic activities which include; invasive species, logging, grazing, pollution, wildfire and a warming climate which expose tourists' populations to risk. These situations must be addressed to develop a healthy tourism destination. In doing so, it is not just helping our environment to flourish, we are helping individuals to live healthier lives too (Spooner 2020). In light of this, there is the need to seek ways to solve problems of current anthropogenic threats and prevent new ones from emerging. Climate change which is majorly caused by harmful greenhouse gas emissions (Kangalawe, Mwakalila, & Masolwa, 2011; Obot, 2013) is worsening with many of the environmental problems we currently face. Climate change poses a long-term threat that demands collective efforts to prevent its causes and cope with its impacts (Ijeomah & Aiyelaja 2009; Osemeobo, 2016). There is the need to mitigate ecological threats to bring about healthy environment for enjoyment of visitors at tourism destinations (Kolawole, 2019). Deforestation and burning of fossil fuels contributes greatly to greenhouse gas emissions. Therefore efficient energy equipment/appliances are suggested in ecotourism destinations (Akinsoji & Obot, 2013). Also significant to mention is that harmful invasive species are also found to disturb the balance of our delicate ecosystems (Isichei & Akin-Fajiye, 2013). Particularly along river courses and at the coastal environment, this is second only to habitat loss in the degradation of the environment. Ecotourism stakeholders should also endeavour to recognize and avert disease transfer between domestic animals and wild one as well as humans in the vicinities of tourism activities (Adejuyigbe & Ogunjemite, 2013). Increase awareness of zoonotic organisms around potential tourism destinations should not be taken lightly. The development of strategies for assessing and reducing ecological risks posed by new technologies should also be priority (Olawejaju, Adeyemo & Ogunjemite, 2020).

The floristic resources in ecological destinations

In any nature-based tourism, the inventory of resource is vital to their development and successful entrepreneurship goal of their economic venture. Floristic composition of a community or ecosystem have been widely used as proxies for biodiversity and conservation planning (Moffatt, et al., 2005, Macia, 2008) especially when related to economic goals (Ogunjemite, 2015; Olaniyi, et al., 2016). A basic requirement for such planning is the assessment of the resources. According to Ferrier (2002); Moffatt, et al. (2005), sampling within quadrants (plots of standard size) are often used in the assessment of an area in which floristic composition can be estimated, counted and species listed (a quadrant delimits). The natural forest of the environment of waterfall site plays essential roles in the maintenance of its ecological integrity (Olaniyi, et al., 2016). Such sites are regarded as reservoir for the indigenous/native species of the destination. According to Ogunjemite (2015), the natural

forest of the environment of waterfall site is usually recognized and set aside as valuable component of the destination and are useful for research purposes, monitoring of immediate ecological processes and aesthetic reasons

Nigerian waterfalls and their locations

The waterfalls in Nigeria include but are not limited to the followings; The Obudu Waterfall, The Kwa Waterfall and The Agbokim Waterfall in Southeastern Nigeria. The Assop Waterfall and FarinRuwa Waterfall are situated in Plateau State in the Northern-Central part of Nigeria. The Awhum Waterfall is situated on Udi Hills in Enugu State in the Eastern part of Nigeria. Olumirin and Arinta Waterfalls are situated in the South-Western part of Nigeria along the Efon Ridge of Osun and Ekiti States. Owu Waterfall had evaded public attention for too long and its uniqueness shielded away in the remote area of Kwara State, Nigeria, where it is located. Its attendant geographical features had not been studied and it remained concealed until recently when relevant institutions and knowledge base in the disciplined area of ecotourism is becoming domesticated in the nation, and the quest for development of alternative income generating ventures are on the increase particularly from tourism sectors.

The study area

Owu Waterfalls is located at Owa Kajola in the Southeastern axis of Ifelodun Local Government Area of Kwara State (Figure 1). It is located on Latitude 08.3 and longitude 05.14E. Kwara State enjoys tropical climate with two seasons: rainy which falls between the months of November and September and dry season between October and April. The region is typically within the Guinea Savanna as described by Alokun (1995); White (1983). The total annual rainfall varies from about 1000mm to 1280mm falling within an average about 170 to 190 rainy days per annum. Temperature ranges from about 20°C and 33°C. The wildlife species of the environment are the common ungulates (Bushbuck *Tragelaphus scriptus*, Maxwell's Duiker *Cephalophus maxwelli*, Redflanked duiker *C. rufilatus*) and small carnivores (Civet cat *Viverra civetta*, Genet cat *Genetta genetta* and Mongoose *Hesperstes* sp) of the savanna environment (Onadoko, Meduna & Shotuyo, 1998). The primate species of drier sub-tropical environment such as *Cecopithecus mona*, *C. tantalus*, *Erythrocebus patas*, *Papio anubis* and *Galagoes Galagoides* spp) are also present (Ogunjemite, Adekanbi, Awoku & Olaniyi, 2019). Owu Waterfall, though situated in Ifelodun Local Government Area of Kwara State with the Headquarter at Saare, it is better accessed through Isin Local Government Area via Oke-Onigbin Owa-Onire route or from Irepodun Local Government Area via Omuaran to Oru-Ago to Owa Kajola. Owu Waterfall is at the extreme southern boundary of Ifelodun Local Government Area.

The study area is on altitude of about 590m above sea level at extreme Northeastern part of the Kukuru Hills which extend from the neighboring Ekiti State from the south (Ogunjemite, 2006). Owu Waterfall is one of the most spectacular natural waterfalls in Nigeria. The waterfall is surrounded with a beautiful natural ambience and hills which makes sightseeing a memorable experience. It is characterized with fall of very cold water, rocky paths and walkways with evergreen surrounding. The water curtain is about 120m above stream level and cascades height down an escarpment with rocky-out crops to form a pool of cold water at its base. The surrounding is composed of stretch of mountain extending to Ekiti and Kogi States, which makes for an attractive environment to visitors and offers them opportunity to engage in the sighting of wild animals such as birds, monkeys and reptiles (Oyebode, 2017). The natural flora and fauna have turned the falls into a nature seekers delight.

Methods of data collection

Field surveys were implemented within about 1.8km from the base of the waterfall along Owa Kajola route and across about 1.2km from the Southward facing cliffy side toward the Owa Onire route i.e. an area approximately 2160 hectares of land. The northern border of the gorge created by this waterfall on a high cliffy side towering higher than the fall itself and running down to about four km frontier along the course of the river. The southern border of the gorge forms steep slopes which cleave into two at about 0.4km distance from the waterfall to accommodate a pass that serve as route from Owa Onire. In this wise three escarpments were produced round the waterfall as the river course moves downward in the eastern direction to produce a canyon. Our surveys took place in the main bow of the Waterfall and across the two southern escarpments being the only portion accessible. Taking the established track as transect, three transect were laid according to Olaniyi et. al., (2016). Transect A 200m, within the main bow of the Waterfall, Transect B 250m, along Owa Onire route and Transect C 300m, which is along Owa Kajola route.

Assessment of woody plants

Along each of the three transect establish for field observation of the site, two plots of 20 x 20m were assessed randomly at opposite sides of these transects in line with Ogunjemite, Odewumi, & Kazeem (2013). All woody species above 1.5 m were recorded and identified to species level based on the Keay (1989) and CIRAD (2004). The woody Plants were classified into species and distributed into families. **Shannon Diversity Index** was used to analyze the diversity among the transects

Shannon-Weiner Diversity Index

$$H' = \sum_{i=1}^s (p_i) (1/p_i)$$

Where H' = Diversity index

S = total no of species in the site

Pi = the proportion of individuals that each species contributes to the total in the sample on a scale of (0-1)

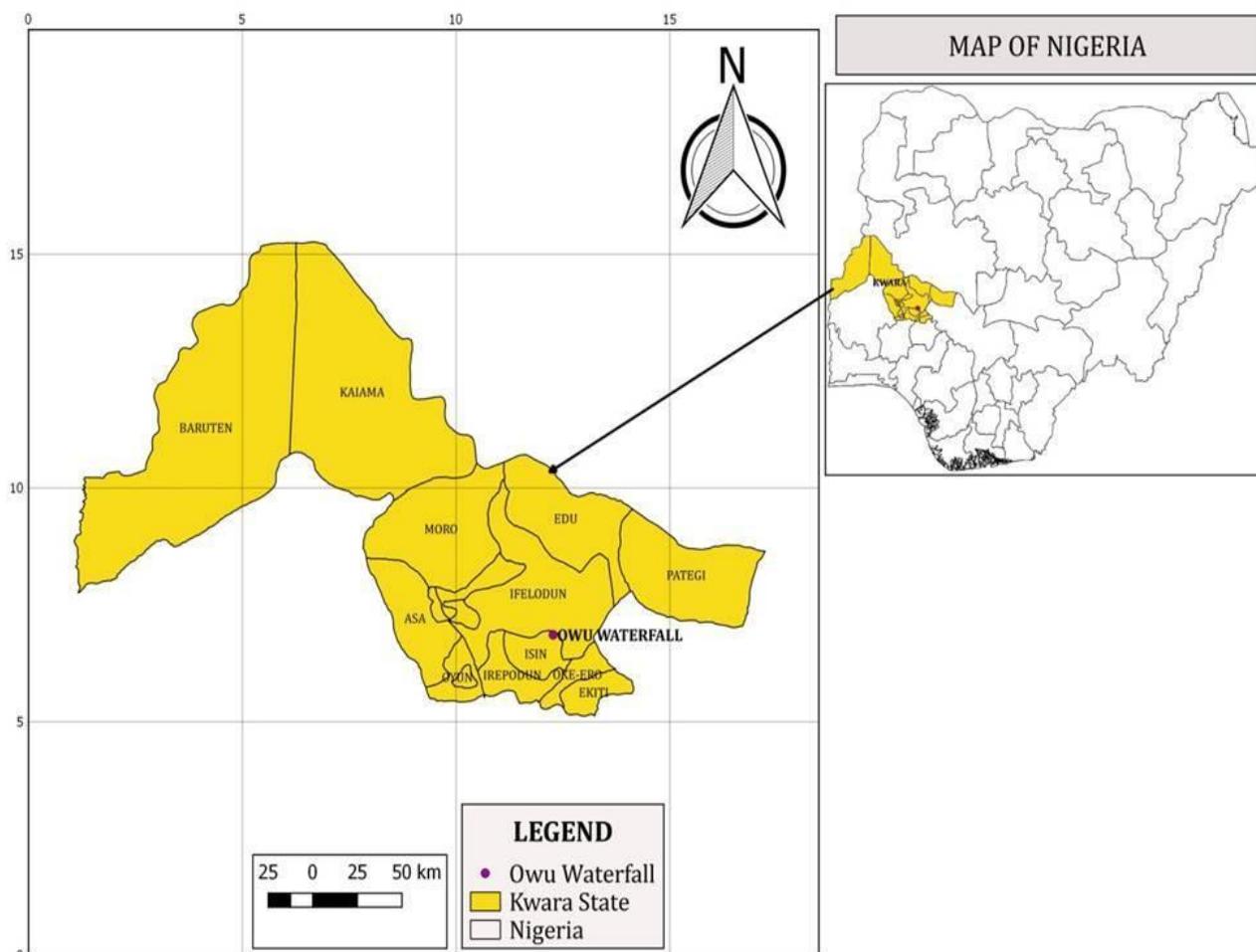
1p pi = Natural Logarithm of pi

Note: The power to which the base e (e = 2.718281828.....) must be raised to obtain a number is called the **natural logarithm** (ln) of the number.

Fauna counts were done on the line transects as described by Akinsorotan & Ogunjemite (2011). Analytical tools used include frequency count and percentage. Threats were also assessed along the three-line transects as opined by Ogunjemite et al (2019). Censuses along the transects were conducted twice daily, once in the morning and once in the afternoon on 13th and 14th September 2019. Encounter rates of threats per kilometer walked were calculated as:

\sum Observations / Distance travelled.

Figure 1: Map showing the location of Owu Waterfall in Kwara State Nigeria



Results and discussion

The result of the assessment of floristic composition of Owu Waterfall site is presented in Table 1. A total of 34 woody plant species in 20 families was encountered.

Table 1: Species composition of woody plants of Owu Waterfall

	Biological name	Family	Occurrence of tree stands/sampled plots		
			A	B	C
1	<i>Accasia sp</i> Steud. ex A. Rich	Mimosoideae		2	3
2	<i>Afzelia sp</i> Smith ex Pers.	Caesalpinioideae		4	2
3	<i>Albizia feruginea</i> Benth.	Mimosoideae	1		
4	<i>Albizia zagia</i> (DC) J. F. Macbr.	Mimosoideae	2	2	2
5	<i>Alchornea cordifolia</i> Schumach & Thonn.	Euphorbiaceae	3		
6	<i>Anacardium occidentale</i> L.	Anacardiaceae			2
7	<i>Anogesius leocarpus</i> (DC) Guill. & Perr.	Combretaceae		3	7
8	<i>Anthocleastia djalolemsis</i> A. Chev.	Loganiaceae	2		
9	<i>Antiaris toxicaria</i> Lesch.	Moraceae	1		
10	<i>Bombax bonoposense</i> P. Beauv.	Bombaceaceae	5		
11	<i>Brachystegia eurycoma</i> Benth.	Caesalpinioideae	2		
12	<i>Bridelia feruginea</i> Benth.	Euphorbiaceae	3		
13	<i>Burkea species</i> Hook. F.	Caesalpinioideae		8	1
14	<i>Ceiba pentandra</i> (L.) Gaertn	Bombaceaceae	2		
15	<i>Clestopholis patens</i> (Benth.) Engl. & Diels	Annonaceae	4		
16	<i>Cola gigantean</i> A. Chev.	Sterculiaceae	1		

17	<i>Eleais guineensis</i> Jacq.	Palmae	4		
18	<i>Ficus exasprata</i> Vahl.	Morceaeae	2		
19	<i>Ficus</i> sp Vahl.	Morceaeae	1		
20	<i>Funtumia elastic</i> Benth.	Apocynaceae	1		
21	<i>Khaya senegalesis</i> A. Juss.	Meliaceae		2	
22	<i>Lecaniodiscus cupanioidea</i> Planch	Sapindaceae	1		
23	<i>Lophira lanceolata</i> Van Tiegh. ex Keay	Ochnaceae		2	
24	<i>Mangifera indica</i> L.	Anacardiaceae		1	1
25	<i>Mitagyna</i> sp Willd.	Rubiaceae	1		
26	<i>Newboldea leaves</i> P. Beauv.	Bignoniaceae		1	
27	<i>Parkia biglobossa</i> Jacq.	Mimosoideae		1	2
28	<i>Phoenix reclinata</i> Jacq.	Palmae			2
29	<i>Piptadeniastrum africanum</i> Brenam.	Mimosoideae	1		
30	<i>Pterocarpus</i> spp Poir	Fabaceae	1		
31	<i>Raphia hookeri</i> P. Beauv.	Palmae	3		
32	<i>Spondia monbin</i> L.	Anacardiaceae	1		
33	<i>Trema orientalis</i> (L.) Blume	Ulmaceae			2
34	<i>Vitex doniana</i> Sweet	Verbenaceae		2	
	Numbers of families per sampled		14	9	6
	Numbers of stands sampled Plots		42	28	24
	Observable threats		Lo ggi ng	Log ging Bur ning Gra zing	Logging Burning Grazing Farming

Source: Fieldwork (2019)

In the immediate surroundings of the waterfall (Plot A), 21 woody plant species in 14 families were observed and the floristic composition of the location is essentially like that of the most rainforest. Most of the species encountered in this part of the waterfall site are rainforest species of evergreen tropical forest (White, 1983). These include *Clestopholis patens*, *Cola gigantea*, *Piptadeniastrum africanum* and *Funtumia elastica*. This is as a result of the dew produced from the water falling at great height of about 120m above the vegetation thus sustaining these species. *Clestopholis patens* and *Piptadeniastrum africanum* in particular are characteristic of rainforest vegetation that receives precipitation throughout the year with just few months of dryness (Ojo, 2004; Osemeobo, 2016). Such are the types of trees recorded in Okomu Forest (Ezealor, 2002; Akinsorotan, et al., 2011) and Ologbo Forest Concession by Ogunjemite (2015), both sites are in Edo State, Nigeria, Southern Nigeria, one of the locations reputed to be the most forested region of the country. Also present at the site are *Bombax bonoposense* and *Ceiba pentandra* which are reputed to be among the largest species in size and dominance in the Gulf of Guinea Forest (ODSG, 2008). The only explanation for the presence of such species in an ‘island of forest’ in a Nigerian savanna environment, is the continuous flow of the fall water and the dew produced that keep the trees growing at the site. The maintenance of critical sites like this is a natural way to control the advancement of savanna on the Nigerian forest ecosystem.

On Plot B along the transect leading to Owa-Onire Road, eleven woody species in nine families were encountered. The floristic composition is closed woody vegetation that is dominated by typical woodland savanna species of the Guinea Savanna formation (Jayeola et al., 2009; Buba, 2013). *Burkea species* is the dominant species on this plot and accounting for 28% of the woody species recorded. Plot C on the transect along Owa Kajola Road recorded ten woody species in only six families and the formation is composed of open woodland species. Here, much of the threats logging, burning, grazing and farming were observed. With *Anogesius leocarpus* as the dominant species on Plot C and it accounts for 29.2% of the species recorded in this section of the waterfall. The major explanation that could be offered on the

variability of species across the site is attributed to the geographic features. While Plot B is located along Owa Kajola Route, it faces the Northeastern direction and therefore, on the leeward side of the hill across the South West trade wind that brings rainfall. It thus supports fragmented woody vegetation even though it is far away from the coast. The effect of this trade wind (Agboola & Holder, 1987) is still felt within the region. This is the general situation on the Kukuruku Hills as reported by Ogunjemite (2006) bearing in mind that this location is the extreme Northeastern part of the Hills. This arrangement is typical of Nigeria’s woodland environment which make up about 80% of total vegetation cover of the country (National Atlas, 1987; White, 1983). Within this ecological formation are located the major and prominent protected areas of the country, some of which are Old Oyo National Park, Kainji Lake National Park, Kamuku National Park and Yankari Game Reserve and Olaniyi, *et al.* (2016). *Burkea species* is the dominant species on the sloppy area leading from Owa-Onire axis accounting for 28% of the woody species recorded there. *Anogesius leocarpus* is the dominant species on the Owa-Kajola axis of the waterfall and it accounts for 29.2 of the species recorded in this section of the waterfall. Although the site paraded species of both rainforest and savanna zone and should therefore translate to rich site, nevertheless because of constant disturbances associate with the destinations (Turton, 2005) and the anthropogenic threat accompany it, the diversity of the accessible portion remain poor.

Nevertheless, the site is rich in the leguminous plant species (*Accasia sp*, *Afzelia sp*, *Albizia feruginea*, *Albizia zagia* *Brachystegia eurycoma*, *Burkea species*, *Parkia biglobossa* and *Piptadeniastrum africanum*) which are very important to the diet of herbivores and frugivores. This is one of the reasons apart from the cool condition that favored grazing and why cattle herders are constantly available at the site even in the heart of rainy season when the survey was carried out. The Shannon-Weiner diversity index, (Table 2) of the site shows that there were differences in the woody species composition of the waterfall site with the immediate environment of the fall having the highest value of 2.50, followed by the Owa-Onire axis 1.9, and the Owa Kajola road at 1.52. The index of dominance was lowest in the immediate vicinity of the waterfalls with trees such as *Ceiba pentandra* and *Bombass bonoposense* present in the rainforest formation. Six species of wild animals were directly sighted at Owu Waterfall site (Table 3). These are *Cercopithecus mona*, *C tantalus*, *Papio anubis*, *Galagoides Spp.*, *Xerus Sp.*, *Epixerus Sp.* All but one of which are arboreal animals. Four major threat activities were reported as logging, farming, annual burning and grazing (it is constantly done). Hunting could be inferred but not serious activities on the site as a result of people constantly been around either as visitors or grazers. Hunting is generally a seasonal activity around this area.

Table 2: The diversity and dominance indices of the tree species observed along the different vegetation types on the transects

Indices	Transect 3 Waterfall area forest	Transect 2 Woodland (Owa-Onire Road)	Transect 1 Grazing area (Owa-Kajola Road)
Shannon- Wenner	2.50	1.90	1.52
Dominance	0.10	0.82	0.34

Source: Fieldwork (2019)

Generally, the diversity of plants on such a rare site is not usually on the woody components but mostly on the lower vascular plants. The epiphytes along the cliffy side of the waterfall are bound to be completely different from the remaining parts of the site vegetation. This deserves thorough attention of specialist taxonomist. For a site that receives 24hrs daily dew throughout

the year and for so long as this feature had been in existence, surely there are bound to be some peculiar species associated with the site other than what had been observed as laypersons. The microclimatic condition of the environment surely envisioned this suggestion. Landscapes/site of spectacular importance like this had often been known for endemism. Example include Oke Idanre for the endemic amphibian species, Peret’s toad, *Amietophrynus pereti* (Nneji, Salako, Oladipo, Ayoola, Onadeko, Adedeji, Omotosho, Alda, Ugwumba, & Adeola, 2019; Onadeko, Rodel, Liedtke & Barej 2014) and Erin Oke (Olumirin) waterfall for its peculiar prawn *Caridina africana* (Ajulo, Ogunjemite & Adeeko, 2017). It is important that the site is given the due attention and protection needed before it is lost completely to anthropogenic disturbances such as grazing, logging and farming which were commonly observed at the site.

Table 3: Faunal species composition of Owu Waterfall

	Common name	Scientific Name	No of times sighted	Remark
1	Mona Monkey	<i>Cercopithecus mona</i>	2	Group usually 5 – 8 in numbers
2	Tantalus/Green Monkey	<i>Cercopithecus tantalus</i>	4	Group usually 6 – 10 in numbers
3	Baboon	<i>Papio Anubis</i>	1	Ditto
4	Palm Squirrel	<i>Xerus sp</i>	3	
5	Tree Squirrel			
6	Ground squirrel		3	Usually singly

Source: Fieldwork (2019)

The environment of Owu Waterfall no doubt appeared threatened with lots of anthropogenic factors just as it is observed in many ecotourism destinations (Brown, Turner, Hameed, & Bateman, 1997; ; Kiper, 2013; Pickering & Buckley, 2003; Smith & Newsome, 2002; Turton, 2005). The species composition of the woody trees of the site is low with only twenty-one species observed in the richest part the waterfall. Other areas of the site appear monodominant. This scenario is a clear attestation of a degraded environment usually observed in savanna encroachment zones across Sub-saharan Region of West Africa (Olaniyi et al., 2016; Sinsin & Kampmann., 2010). Faunal species of the site has also been depleted seriously as only very few species were observed directly. The few observed were highly wary of the human as they disappear with great speed into their forest cover at the sighting of human. These are serious signs of threats to animals. Other major challenges to the development of the site as a blossom tourist destination include the absence of infrastructures such as good roads, electricity, health center, communication facilities. Hence the location gradually been taken up by herders and it is serving grazing purpose rather than being seen as a good tourism destination.

Owu waterfall site has the capacity to be developed to a canyon. Even though it may not be able to compare with the Grand Canyon of the Colorado River in the United State of America, it has tourist value when compared to that of Swadini Resort along the Blyde River in Limpopo Province of South Africa. Spectacular sites as these are rarely reported as a tourist destination in Nigeria. Apart from some locations in the Mambila Region of Nigeria, Jos plateau, Obudu Hills Resort, Oke Idanre Hills, Udi Hills, such features are rare in Nigeria as the relief of the country is generally described as lowland environment (National Atlas, 1978). Some of the special features that Owu Waterfall has over the Mambilla Region which is important to tourism development are accessibility and security. With little efforts these facilities will be developed to international standard.

The basis of this work was to establish the potentials of Owu Waterfall as a veritable tourist destination by determining the ecological threats of the destination. Thus a promotion of the Nigerian national tourism master plan which focuses on use of domestic ecotourism as a tool to drive her proposed dominance of the Gulf of Guinea economy (ODSG, 2008). This lofty idea will remain unfulfilled until the country’s infrastructural development particularly

road network is reasonably fixed as observed by Bakare (2020). One of the main reasons Owu Waterfall had remained hidden for long is the poor road network around the destination, consequently inhibiting the accessibility of this site. This study had been able to project the site scientifically and executed all it sets out to do in this regard. It is pertinent that this site could be developed in multidisciplinary areas/approaches. It will combine Natural Sciences (Botany and Zoology), Physical Sciences (Geography and Geology), Environmental Sciences (Regional and Urban Planning), Natural Resource Management, (Forestry, Wildlife and Tourism) and host of other disciplines including Engineering and Production Agriculture. Owu Waterfall will, therefore, serve as a field laboratory to many of the institutions of higher learning within Kwara State and neighboring states. An investment involving public/private initiative of this kind is bound to boost the economy of the host community and the Nation at large.

Conclusion

In conclusion, the destination has a large focus on Ecotourism, there are species of plants and animals in their natural habitat/state, the geographical features are also spectacular. The ecological challenges and threats should be given considerations to minimize and possibly forestall observed threats and possible threats that may be. Therefore, all sustainable measures especially enforcement of the law by the government and serious punishments that would deter perpetrators of these man-made threats should be accorded to whosoever destroy the natural conditions of the destination. Owu waterfall site has the capacity to be developed as a world-class tourism destination. The combination of the rare geographical features of the site with its biological diversity hold promises for this development. Moreover, the level of security enjoyed at this section of the country is an added advantage for branding the destination for ecotourism.

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