

PATHWAY TO SUSTAINABLE FOREST RESOURCES MANAGEMENT IN KWARA STATE, NIGERIA.



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LAND USE AND BIODIVERSITY CONSERVATION IN KWARA STATE: CASE STUDY OF AJASSE-IPO WATERSHEDS

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Introduction

Forestry practices, together with the conservation of biodiversity within and around forest areas, are basically a land use option. Land use refers to the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it (FAO, 1997; FAO/UNEP, 1999). The attendant impact of land use change and activities on ecosystem biodiversity cannot be over-emphasized. For instance, conversion of biodiversity rich land to other purposes through various anthropogenic activities including the process of industrialization and urban development, both of which are simplistically equated with economic growth, have direct impact on the conservation of biodiversity, deprivation for large segments of the local population and destruction of valuable ecosystems.

Tropical forests are one of the most diverse and complex systems in nature providing a multiplicity of goods and services that are indispensable to man. Beside the production of biological resources and provision of social benefits, the forests also offer many environmental and/or ecosystem services. One of such ecosystem services includes the protection of watershed areas. Forests also reduce evapotranspiration and siltation of water body around watersheds. There is generally a strong interdependence between forest vegetation and watershed areas. Forest vegetation makes use of water for growth and in turn help binds and stabilizes soil, thereby reducing the potential for erosion around the catchment areas. Furthermore, water supply, especially to rural dwellers, is affected by whether catchments are vegetated or not (Amusa, 2002).

We need forests to continually provide its many arrays of goods and services into the future, especially in the face of climate change. While the interdependent of forest and watersheds can be managed collectively, conveniently, simultaneously and

efficiently, however, the exploitation of vegetation on watersheds poses great threats to the continued existence of species diversity therein including the innumerable services they provide. It is pertinent therefore, to constantly investigate the impacts of various land use activities going on in and around watersheds in order to create awareness of how individual activities can lead to degradation of watershed and related ecosystem products and services. This paper provides data and information on the status of the Ajassee-Ipo watershed catchments vis-a-vis land use and biodiversity conservation of the area. It also proffers relevant conservation strategies for enhancing its sustainable development.

Ajassee-Ipo Watershed Catchment Area

Ajassee-Ipo Watershed Catchment Area is located in Irepodun Local Government Area of Kwara State (Figure 1). The area lies within Latitude $8^{\circ} 12' 59''$ to $8^{\circ} 21' 45''$ N and Longitude $4^{\circ} 41' 30''$ to $4^{\circ} 56' 25''$ E. It covers an estimated 92.94 sq km within the Guinea Savannah ecological zone. The area is well drained by River Oshin and has a large human population. The 2006 census puts the state's population at 2,371,089; with males being 1,220,581 and female 1,150,508. The population of Irepodun Local Government Area was put at 148,610 (2.5% of State Population) by the same census exercise. The population of the entire Ajassee-Ipo Watershed Catchment site based on the communities identified during this study is placed at 16,850, with annual growth rate of 3.5%. Table 1 shows the communities which stretch along the River Oshin area. These are: Ajassee-Ipo, Sanmora, Iludun-Oro, Oro, Okeya-po, Illala, Esie, Buari, Eggi, Igbonla, and Oke-Ola-Oro. The settlements are entirely rural with an average household size of 6, a little above national size of 5. They contribute substantially to the impact on the watershed area.

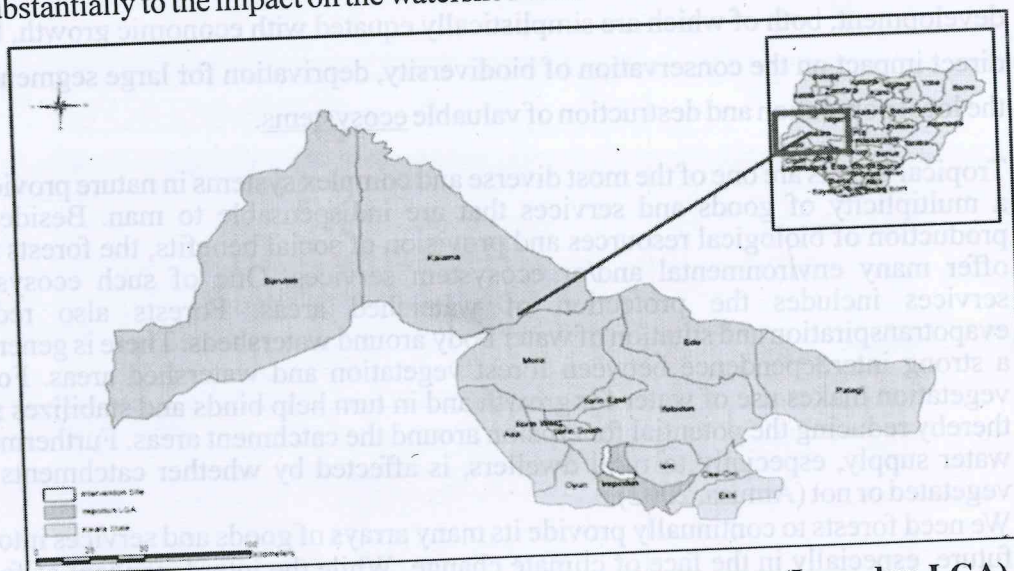


Figure 1: Map of Kwara State showing the study area (Irepodun LGA).

S/N	Community	Estimated Population	Settlement Pattern
1	Ajasse-ipo	40,000	Dispersed
2	Esie	20,000	Dispersed
3	Sanmora	20,000	Dispersed
4	Iludun-oro	20,000	Linear
5	Buari	4,000	Linear
6	Okeya-po	4,000	Linear
7	Igbonla	20,000	Linear
8	Illala	5,000	Linear
9	Eggi	5,000	Linear
10	Okeola-Oro	3,500	Dispersed
11	Oro	7,000	Dispersed

Land use studies

We conducted a land use and land degradation study which focused on land/soil, water, forestry resources, forms of soil/land degradation and the extent, farming systems, cropping pattern, land preparation techniques, farm inputs, etc. Specific information were obtained from the 11 communities within the catchment area on the above-stated issues. Visual observations on the field were complimented with adequate still photographs and the coordinates of important features were captured with hand-held GPS. Farmers (mostly fadama farmers) were interviewed on their farm to confirm what they perceive as the major soil and land resources problems confronting them. The farmers were sometimes asked *on-site* (i.e. on their farm during the field investigations) to suggest solutions to some of the problems they themselves had identified. A draft map showing the catchment area was obtained from previous works, topographical map and satellite imagery. These were combined to produce a base map to serve as a guide for the field work. GPS (Global Positioning System) coordinates were used to delineate the different land use types. The coordinates were superimposed on the draft map layer to get a geo-referenced land use map. GPS coordinates of identified resources within communities were obtained and overlaid on the base map of the study area.

Biodiversity Studies

Biodiversity studies were conducted to provide data on the floristic and fauna composition and structure around the watershed, determine the population density of the key economic plant species within the area, evaluate the level of degradation of the vegetation within the watershed; and suggest measures to conserve or restore the ecosystems within the watershed.

Quadrats were established to study the vegetation, within homogenous plant

communities that were identified within the watershed. These include upland farms, fringing forest, Fadama farm, and woodland savanna. Plant species, composition and structure were obtained using 100m², 25m², and 1m² quadrats. The quadrats were for trees, shrubs and herbs respectively. Within each plot, all plants were identified to species level and their heights measured with a Haga altimeter. The number of strata in the vegetation was noted and the dominant species recorded. Where counting of individuals are not possible as in situations where there are creeping plants, cover was measured using the Braun-Blanquet scale (Sutherland, 1997). The population density of the trees was determined using 100m² quadrats placed within each relatively homogenous vegetation type. Samples of plants not identified on the field were collected and carried to the herbarium for identification.

A total line transects of 15km was surveyed for wild animals in Sanmora forest. The surveys were carried out in the morning (between 600hrs and 1130hrs) and afternoon (between 1230hrs and 1730hrs). Observations on wildlife populations were made by searching for footprints, droppings, burrows and feeding activities of animals. Direct observations were made on animals and birds with the use of binoculars while distance was determined through the use of GPS. All wild animals sighted as well as those whose calls were heard were recorded.

Results

Land use pattern

Across the study site, various land uses are distinguishable, including: crop production (Pate 1), livestock grazing (Plate 2), fisheries, forestry, wildlife sanctuaries, conservation management areas, housing and cottage industry (blocks and burnt-brick production) (Figure 2). Land use in the study site is principally agricultural with about 70% of the entire land area cultivated. Agriculture in the area is dominated by shifting cultivation, crop rotation and mixed farming. Although fallow periods vary from site to site, areas close to the homesteads are intensely farmed. The areal extent of the farmland land is 20km². The length of the fallow period generally increases with distance from the settlement. Crops observed include plantain/banana, maize, okra, and varieties of leaf and fruit vegetables (tomato, garden egg, amaranthus, celosia, cocorus, sugar cane, plantain/banana, and maize).

The low-lying areas adjoining river Oshin is being used for the cultivation of commercial crops. These include vegetables (particularly *Amaranthuscelosia*),

Garden egg, corn, pepper and okra (Figure 3). The upland area adjoining the Fadama farms are sometimes planted with arable crops such as guinea corn, yams, and cassava. Scattered populations of wild oil palm abound within the area. Some of these are being tapped for wine. The notorious weed, spear grass (*Imperata cylindrical*) an indication of soil infertility is common in the upland farms within the study area. Most of the farms are in Sanmora, Iludun- Oro and Ajase. New Fadama farms are starting up in Ilala. Common weeds include plants such as *Ageratum conyzoides*, *Pennisetum* sp., and *Scoparia dulcis*.

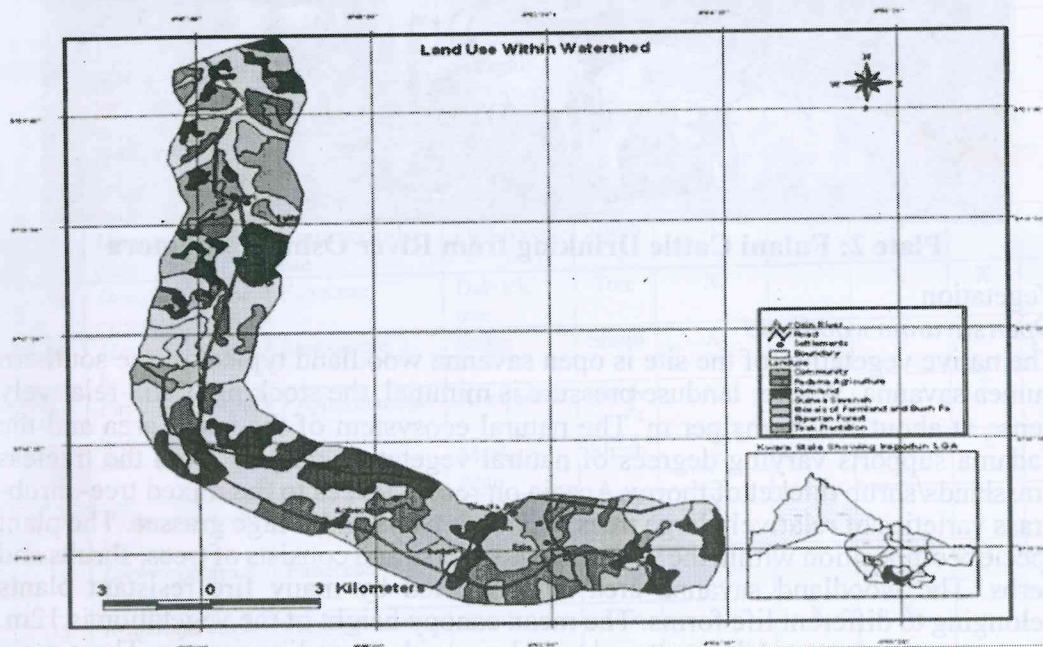


Figure 2: Land Use Map of the Study Area



Plate 1: A Typical Mixed Cropping on Fadama land at Sanmora
(Mixture of Corn and Okra)



Plate 2: Fulani Cattle Drinking from River Oshinat Sanmora

Vegetation

Open savanna woodland

The native vegetation of the site is open savanna woodland typical of the southern guinea savanna. Where landuse pressure is minimal, the stocking is still relatively dense at about 2-3 stems per m². The natural ecosystem of the study area and the Fadama supports varying degrees of natural vegetation ranging from the treeless grasslands/shrub thicket of thorny *Acacia* on recent levees to the mixed tree-shrub-grass varieties of relatively large trees, woody browse and forage grasses. The plant species composition within the watershed is diverse and consists of trees, shrubs and herbs. The woodland savanna area is dominated by many fire resistant plants belonging to different life forms. The mean canopy height of the vegetation is 12m. The canopy is open and the scattered trees have wide spreading crowns. Three main strata are discernible. These are the tree, shrub and herbaceous layers. The commonest trees include: *Parkia biglobosa*, *Prosopis africana*, *Vitellaria paradoxa*, *Daniellia oliveri*, *Combretum glaucescens* and *Vitex doniana*. They have thick barks which may be fissured as in *Vitellaria paradoxa* or flaky as in *Daniellia oliveri*. Shrubs include species such as *Detarium microcarpum*, *Piliostigma reticulatum* and *Gardenia ternifolia* (Table 2).

The herbaceous layer is dominated by grasses such as *Pennisetum purpureum*, *Andropogon* spp and *Hyparrhenia* spp (Table 3). Most of the savanna woodland is typically burnt late in the rainy season or middle of the dry season by hunters, cattle rearers or farmers. The whole landscape is totally devastated by the fire during the dry season. The surviving trees commonly appear twisted. The annual bush fire also enters into various plantations of *Gmelina arborea* (Plate 3). Many of the plants are fire resistant and regenerate after the fire event. The chance of survival however depends on the intensity of fire, stage of growth of the plant and local environmental conditions.

Table 2: Composition, Habit and Distribution of Woody Plants within AjaseIpo Watershed

S/N	Scientific Name	Family Name	Common Name	Habit	Plant occurrence at different site				
					Sanmor a	Ajase	Iludun	Esie	Ilal a
1	<i>Daniellia oliveri</i>	Fabaceae	Copaiba balsam	Tree	X		X	X	X
2	<i>Prosopis africana</i>	Fabaceae	Iron wood	Tree		X	X	X	X
3	<i>Andropogon tectorum</i>	Poaceae	Giant bluestem	Herb	X	X	X	X	X
4	<i>Albizia zygia</i>	Fabaceae	Albizia	Tree	X				
5	<i>Khayasenegalensis</i>	Meliaceae	Senegal mahogany	Tree	X	X	X	X	X
6	<i>Chromolaena odorata</i>	Asteraceae	Siam weed	Shrub	X	X	X	X	X
7	<i>Terminalia glauca</i>	Combretaceae	Idi odan*	Tree	X	X	X	X	X
8	<i>Hymenocardia cida</i>	Hymenocardaceae	Fuel wood	Shrub	X	X	X	X	X
9	<i>Detarium microcarpum</i>	Fabaceae	Dahock tree	Tree	X		X	X	X
10	<i>Malancatanifolia</i>	Sapotaceae	Sedge	Shrub	X	X	X		X
11	<i>Phyllanthus muelerianus</i>	Euphorbiaceae	Arunjeran*	shrub	X	X		X	X
12	<i>Entada africana</i>	Fabaceae	Mackay bean	Shrub	X	X	X	X	X
13	<i>Pilosigma thomningii</i>	Fabaceae	...	Shrub	X	X		X	X
14	<i>Dichrostachys cinerea</i>	Fabaceae	Marabou thorn	Shrub	X	X		X	X
15	<i>Bridelia ferruginea</i>	Euphorbiaceae	Benth	Tree	X	X	X		X
16	<i>Parkia clappertoniana</i>	Fabaceae	African locust bean tree	Tree	X	X	X	X	X
17	<i>Maranthos polyandra</i>	Chrysobalanaceae		Shrub	X		X	X	
18	<i>Anogeissus leiocarpus</i>	Combretaceae	African birch	Tree					X
19	<i>Sarcocephalus latifolius</i>	Combretaceae	African peach	Shrub	X	X	X	X	X
20	<i>Lophira lanceolata</i>	Loganiaceae	Red ironwood	Tree	X		X	X	X
21	<i>Azela africana</i>	Fabaceae	African oak	Tree	X	X	X	X	X
22	<i>Vitellaria paradoxa</i>	Sapotaceae	Shea butter	tree	X	X	X	X	X
23	<i>Vitex doniana</i>	Verbenaceae	Black plum	tree	X	X	X	X	X

Table 3: Composition, Habit and Distribution of Grasses within AjaseIpo Watershed

S/ N	Scientific Name	Family Name	Common Name	Hab it	Plant occurrence at intervention site				
					Sanmo ra	Aja se	Ilud un	Esi e	Ilal a
1	<i>Imperatacylindrica</i>	Poaceae	Spear grass	Her b			X	X	
2	<i>Ageratum conyzoides</i>	Asteraceae	Goat weed	Her b	X	X	X	X	X
3	<i>Scopariadulcis</i>	Scrophulariac eae	sweetbro om	Her b	X	X	X	X	X



Plate 3: A Plantation of *Gmelina Arborea* Scarred By Bush Fire at Ilala
(Note the blackened stems and leaf litter)

Fringing Vegetation

Fringing forests exist along the Oshin river course and create well defined habitat zones with much drier surrounding areas. These make up a minor proportion of the overall area; are generally more productive in terms of biomass (both plant and animal) than the remainder of the forest area; and are a critical source of diversity. They vary considerably in size and vegetative complex because of the conditions that can occur among water sources and physical characteristics of a site e.g. gradient, aspect, topography, soils, and stream bottom, water quality, and plant communities.

Fringing forest buffers play an important role in flood control, as they provide a natural basin where floodwaters may spread out horizontally (Lowrance *et al.*, 1985).

Along the river bank itself, vegetation helps to stabilize the bank by protecting soils and reducing river bank scouring. Restoring forests along smaller stream means more storm flow is captured and retained higher in the watershed.

The fringing vegetation along river Oshin has a variable width. The dominant species found include *Pterocarpussantalinoide*s, *Berlinagrandifoliola*, *Raphiasp*, *Dialiumguineense*, *Entadaafricana*, *Colaspp*, *Combretumsp*, *Alchorneacordifolia*, *Ceibapentandra*, *Elaeisqueineensis* as well as grasses such as *Pennisetumpurpureum*, and *Phragmitescommunis*(Table 4). Within the fringing forest is a multi-layered canopy of large trees, an understory of vines, shrubs and small trees, and herbaceous vegetation on the forest floor. Snags and downed logs and limbs provide other important elements to the forest. The dense vegetation and the presence of surface water provide a protective environment and helps moderate temperature extremes within the riparian area.

Table 4: Composition and Habit of Fringing Vegetation along Oshin Stream

S/ N	Scientific Name	Family Name	Common Name	Habit	Plant occurrence at Intervention site				
					Sanm ora	Aja se	Ilud un	Esi e	Ilala
1	<i>Anthocleista procera</i>	Loganiaceae	Cabbage tree	Tree	X	X	X		X
2	<i>Colocasia esculenta</i>	Araceae	Taro/Swamp cocoyam	Herb				X	
3	<i>Uapacatogoensis</i>	Euphorbiaceae	Canariastrum	Tree	X	X			X
4	<i>Elaeisqueineensis</i>	Arecaceae	Oil palm	Tree	X	X	X	X	X
5	<i>Ficus sp</i>	Moraceae	Fig	Tree	X				X
6	<i>Berlinagrandiflora</i>				X				X
7	<i>Musa sapientum</i>	Musaceae	Banana	Herb	X	X			
8	<i>Phragmites australis</i>	Poaceae	reed	Herb			X		X
9	<i>Raphiasudanica</i>	Arecaceae	Raffia palm	Tree			X		
10	<i>Sterculia segitera</i>	Sterculiaceae		Tree	X				X
11	<i>Pennisetumpurpureum</i>	Poaceae	Elephant grass	Herb	X	X	X		X
12	<i>Dialiumguineensis</i>	Fabaceae	Black tamarind	Tree	X				
13	<i>Alchorneacordifolia</i>	Euphorbiaceae	Christmas bush	Shrub	X	X	X	X	X
14	<i>Combretum tomentosum</i>	Combretaceae	Ogan*	Liana	X	X	X	X	
15	<i>Pterocarpussantalinoide</i> s	Fabaceae		Tree	X	X	X	X	X
16	<i>Gmelina arborea</i>	Verbenaceae	Gmelina/white teak	Tree	X	X	X	X	X
17	<i>Ceibapentandra</i>	Bombacaceae	Silk cotton tree	Tree					X
18	<i>Entada africana</i>	Fabaceae	Mackay bean	Shrub	X	X	X	X	X
19	<i>Bambusa vulgaris</i>	Poaceae	Bamboo	Giant herb			X	X	

Riparian Vegetation

Riparian corridors are elongated edges that attract vegetation species that represent surrounding communities. The increased availability of water, often in combination with deeper soils, promotes a rich and structurally diverse plant community, which provides habitat for a diversity of animals. They are important natural biofilters, protecting aquatic environments from excessive sedimentation, polluted surface runoff and erosion and supply shelter and food for many aquatic animals and shade that is an important part of river temperature regulation.

The riparian vegetation is also critical to maintaining high levels of organic carbon in the soil, necessary to fueling denitrification and other biochemical processes. Within this area, the vegetation slows the speed at which storm waters move through the floodplain, reducing the water's erosive potential, and capturing materials carried by the floodwaters (Gregory *et al.* 1991). In landscapes altered by man, wooded riparian zones provide movement corridors between the remaining blocks of fragmented woodland habitat. Stable riparian vegetation reduces stream bank erosion, provides shade, and contributes organic matter to the stream, thereby improving water quality and fish habitat. It also provides the woody structural components required by many wildlife species for roosting.

The loss of riparian vegetation from the floodplain areas results in an increase in the volume and velocity of floodwaters as they move downstream, since the reduced vegetation and woody debris creates less resistance to water flow. The riparian strips cover between 10 -15 metres on either side of the rivers. However in some places, Fadama farming activities have impacted seriously on the vegetation, thus threatening the pereniality of the rivers. In such places, gradual siltation of the rivers has set in. The ground flora is dominated by tall grasses of species such as *Andropogon gayanus*, *A. tintorum*, *Panicum maximum*, *Imperata cylindrica* and other herbs such as *Agerantum conyzoides* and *Boerhavia diffusa*.

The species composition of the riparian strips along the major rivers and perennial streams give an indication of the history of the native vegetation which was at a time tropical rainforest. At such places species composition include: *Anthocleista djalonensis*, *Milicia excelsa*, *Khaya senegalensis*, *Nauclea diderichii* and, *Dialium guineense* *Nauclea latifolia*, *Pterocarpus spp*, *Piliostigma reticulata*, *Adasonia digitata*.

Wild animals

The surveyed forest area (Sanmora forest) is inhabited by many species of wild animals including birds, mammals and reptiles. Sixty species of birds from thirty families, eight species of mammals belonging to six families and three species of reptiles belonging to three families were recorded (Tables 5 and 7). However,

Samora forest is an highly disturbed environment. There is uncontrolled hunting, logging and grazing activities in the area. Considerable farming activities were also observed. A mining site and some smoking kilns (for conversion of wood to charcoal) were discovered. The above are factors that are inimical to conservation of biodiversity. Therefore, there is need to put the forest under good management plan to prevent loss of biodiversity with consideration for the livelihood of the host community in Samora. The forest holds great potentials for development in to a wildlife sanctuary (conservation area) if necessary protective and funding measures are put in place. The forest provides cover to abundant populations of birds, green monkeys, hare, warthog and grasscutter. The forest has enough bird populations to attract the interest of bird lovers/watchers.

Table 5: Animal Species Inhabiting Samora Forest (Mammals and Reptiles)

S/N	Family	Scientific Names	Common Names
	Mammals		
1	Bovidae	<i>Cephalophus spp.</i>	Duiker
2	"	<i>Sylvicapragrimmia</i>	Red flanked duiker
3	"	<i>Tragelaphus scriptus</i>	Bush buck
4	Cercopithecidae	<i>Cercopithecus tantalus</i>	Green (Tantalus) monkey
5	Leporidae	<i>Lepus crawshayi</i>	Hare
6	Sciuridae	<i>Xerus erythropus</i>	Ground squirrel
7	Suidae	<i>Phacochoerus aethiopicus</i>	Warthog
8	Thryonomidae	<i>Thryonomys swinderianus</i>	Grass cutter (Cane rat)
	Reptiles		
1	Elapidae	<i>Naja nigricollis</i>	Spitting cobra
2	Pythonidae	<i>Python sebae</i>	Python
3	Varanidae	<i>Varanus niloticus</i>	Monitor lizard

Table 6: Animal Species Inhabiting Sanmora Forest (Birds)

S/N	Family	Scientific Names	Common Names
1	Coraciidae	<i>Coracias cynogaster</i>	Blue-bellied Roller
2	"	<i>Cyanomitralis verticalis</i>	Green Headed Sunbird
3	"	<i>Eurystomus glaucurus</i>	Broad-billed Roller
4	"	<i>Coracias abyssinica</i>	Abyssinian Roller
5	Columbidae	<i>Streptopelia semitorquata</i>	Red-eyed Dove
6	"	<i>S. vinacea</i>	Vinaceous Dove
7	"	<i>S. decipens</i>	African Mourning Dove
8	"	<i>S. senegalensis</i>	Laughing Dove
9	Phasianidae	<i>Francolinus bicalcaratus</i>	Double-spurred Francolin (Bush fowl)
10	Bucerotidae	<i>Tockus nasutus</i>	African Grey Hornbill
11	Pycnonotidae	<i>Pycnonotus barbatus</i>	Common Bulbul
12	"	<i>Chlorocichla flavicollis</i>	Yellow Throated Leaflove

13	"	<i>Laniarius aethiopicus</i>	Tropical Boubou
14	Musophagidae	<i>Crinifer piscator</i>	Western Plantain Eater
15	"	<i>Musophaga violacea</i>	Violet Turaco
16	Nectariniidae	<i>Chalcomitra senegalensis</i>	Scarlet Chested Sunbird
17	"	<i>Cinnyris venusta</i>	Variable Sunbird
18	"	<i>C. coccinigaster</i>	Splendid Sunbird
19	"	<i>C. chloropygius</i>	Olive-bellied Sunbird
20	Cuculidae	<i>Centropus senegalensis</i>	Senegal coucal
21	"	<i>Corvus albus</i>	Pied Crow
22	Corvidae	<i>Ptilostomus afer</i>	PiacPiac
23	Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret
24	"	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron
25	Timaliidae	<i>Turdoides plebejus</i>	Brown Babbler
26	"	<i>T. reinwardtii</i>	Black-cap Babbler
27	Accipitridae	<i>Kaupifalco monogrammicus</i>	Lizard Buzzard
28	"	<i>Circus ranivorus</i>	African Marsh Harrier
29	"	<i>Falco tinnuculus</i>	Grey Kestrel
30	Oriolidae	<i>Oriolus auratus</i>	African Golden Oriole
31	Capitonidae	<i>Pogoniulus chrysoconus</i>	Yellow Fronted Tinker-bird
32	"	<i>Lybius vieilloti</i>	Vieillot's Bird
33	Sylviidae	<i>Cisticola natalensis</i>	Croaking Cisticola
34	"	<i>Melocichla mentalis</i>	African Moustached Grass Warbler
35	"	<i>Camaroptera brachyura</i>	Grey-backed Camaroptera
36	"	<i>Eremomela pusilla</i>	Senegal Eremomela
37	"	<i>Prinia subflava</i>	Tawny-flanked Prinia
38	"	<i>Sylvietta brachyura</i>	Northern Crombec
39	Muscicapidae	<i>Tersiphone viridis</i>	African Paradise Flycatcher
40	"	<i>Batis senegalensis</i>	Senegal Batis
41	"	<i>Ficedula hypoleuca</i>	Pied Flycatcher
42	Turdidae	<i>Turdus pelios</i>	African Thrush
43	"	<i>Cossypha albicapilla</i>	White-Crowned Robin-chat
44	Platysteiridae	<i>Platysteira cyanea</i>	Common Wattle Eye
45	Phoeniculidae	<i>Phoeniculus purpureus</i>	Green Wood Hoopoe
46	Psittacidae	<i>Poicephalus senegalus</i>	Senegal parrot
47	Alcedinidae	<i>Halcyon leucocephala</i>	Grey Headed Kingfisher
48	"	<i>Ceyx picta</i>	African Pygmy Kingfisher
49	Motacillidae	<i>Macronyx croceus</i>	Yellow Throated Longclaw
50	Scopidae	<i>Scopus umbretta</i>	Hammerkop
51	Numididae	<i>Numididae leagris</i>	Helmeted Guinea fowl
52	Passeridae	<i>Passer griseus</i>	Northern Grey Headed Sparrow
53	Estrildidae	<i>Spermestes cucullata</i>	Bronze mannikin
54	Paridae	<i>Anthoscopus parvulus</i>	Yellow Penduline Tit
55	Viduidae	<i>Vidua chalybeata</i>	Village Indigobird
56	Fringillidae	<i>Lagonosticus senegalensis</i>	Red-billed Firefinch
57	"	<i>Serinus mozambicus</i>	Yellow Fronted Canary
58	Campephagidae	<i>Campephaga phoenicea</i>	Red Shouldered Cuckoo shrike
59	Malaconotidae	<i>Lanius barbarus</i>	Yellow Crowned Gonolek
60	Laniidae	<i>Corvinella corvine</i>	Yellow Billed Shrike

Impact of Land Use on Ajasse-Ipo Watershed Area

Human and Livestock activities are the major threat in the watershed. Fertilizers and/or pesticides used in farms are washed from surfaces by rain yielding polluted runoff or non-point source pollution which impact surface water quality. This can lead to the demise of aquatic insects important in the food web of an aquatic ecosystem, and can affect the health and diversity of marine organisms downstream. Studies have shown that the average electrical conductivity in river Oshin is 57ms/m while the total dissolved solids (TDS) are about 60mg/l. The pH is less than 6.5 and the rivers are low in nutrients, with an average nitrogen content of 0.20 mg/l and total phosphorus 0.1 mg/l. The data indicate water of high quality, suitable for irrigation farming according to FEPA limits for irrigation water (Fadama ESA, 2006). Poor management and uncontrolled livestock grazing have caused severe abuse and habitat degradation in the riparian areas. Caving and erosion of stream banks is a concern because grazing and trampling, as well as high-water flow has resulted in destabilization of the river bank and accelerated bank collapse.

The exposed landscape is also easily eroded during the rainy season with resultant sedimentation of Oshin stream. Sedimentation is considered a major factor in the decline of fisheries in the United States (Karr and Schlosser, 1978). Sedimentation affects aquatic life by decreasing light penetration, reducing dissolved oxygen levels, and by introducing toxins into the stream. This in turn reduces the food base, impairs fish feeding due to reduced hunting success and reduces reproductive success (by covering spawning grounds and eggs, preventing the emergence of newly hatched fry, limiting the availability of oxygen to incubating eggs, and reducing water flow and removal of wastes. Very high levels of sedimentation can cause direct mortality to fish by clogging their gills and by preventing normal water circulation and aeration of the blood. Sediment deposits also affect the survival of insect larvae through the reduction of food, loss of habitat, and by smothering and sand abrasion (Chutter, 1969).

Although, fuel wood currently constitutes the major source of domestic energy, its exploitation is inefficient, while the growing dependence on fuel wood places extreme pressure on the diminishing woodlands, reducing their recovery capacity. Excessive deforestation and denuding land has resulted. Moreover, the use of the Fadama for crop production is accompanied by uncontrolled clearing of natural vegetation and extreme reduction in biodiversity, while causing increased erosion and flooding downstream. The natural vegetation in the area used to be similar to the rain forest, but over exploitation for fuel, wood, charcoal production, bush burning and overgrazing have led to land degradation. The area is gradually becoming a derived savannah.

The various forms of land degradation in the study area are further outlined as follows:

- Complete Deforestation/Vegetation removal in Fadama farmland areas: trees and shrubs within the Fadama farming areas are completely removed and burnt as part of land clearing and land preparation activities.
- Unsustainable Tapping of Oil Palms: The un-sustainable exploitation of natural resource involves felling of oil palm for wine tapping (Plate 4). The practice worsens the deforestation earlier occasioned by complete deforestation technique of land clearing for agricultural purposes in the area. The practice is wide spread within the study area.
- Sand Mining Activities: These are of particular importance along the bank of River Oshin and in some other upland areas of the watershed. Sand mining along the river bank causes some of the trees in the riparian forest to fall across the river course, which often brings about break in the flow of the water body and significant changes in the river course. The sand evacuation route passes through Fadama farmland thus causing compaction and subsequently enhances soil erosion.
- Establishment of Burrow Pits: Sand mining activities in the upland parts of the study area invariably leaves behind burrow pits. Such pits fragment an otherwise contiguous farmland. However, some of the pits are reported to provide water for cattle to drink at some period of the year.
- Slash and Burn Land Clearing Method: Since no stovers/crop residues are incorporated into the soil, and no green manure or any other form of manure is applied to the soil, the inherent fertility of the soil is rapidly depleted. Furthermore, the bulk density of the soil increases significantly while reducing the water/moisture retention ability. Therefore, the productivity of the soil declines rapidly and thus the land is abandoned or left to fallow (Plate 5).
- Excessive/Uncontrolled Application of Irrigation water: This causes soil erosion in some parts and siltation in other area(Sanmora) of the Fadama farmland. It also encourages leaching and loss of plant nutrients; hence optimal crop utilization of inorganic fertilizer is significantly hindered.

Soil compaction and Puddling: These are brought about through cattle grazing within the study area particularly within the Fadama farmland areas. Besides grazing, cattle are periodically on daily basis driven to the river course to source

for water to drink. Soils along their daily track are compacted and if just irrigated, become puddle and their aeration regime is significantly altered.



Figure 4: An Oil Palm being tapped for Wine after being Cut down at Iludun Oro



Figure 5: Spear Grass commonly found in some of the Upland Farms
(an indication of soil infertility)

Recommended Conservation Strategies

Following from the above findings and analysis, the following approaches are suggested as the possible, practicable, cost effective and sustainable measures for Ajasse-Ipo watersheds:

- Controlling deforestation during farmland preparation and for fuel wood.

Enlightenment campaign to educate the inhabitants on the need to preserve the trees and shrubs within the watershed which may serve as wind break, make the microclimate milder and ensure biodiversity conservation. There is need to also promote the use of a more environment friendly and cost effective alternative domestic fuel - coal and kerosene. The campaign should be at community, local and state level, using a combination of means of communication strategy such as schools, churches, mosques, market place, radio and television jingles amongst several others.

- Educate the rural dwellers about the dangers of mining sand along the river bank and other parts of the study area. Specific area of the watershed can then be surveyed and mapped for the purpose of sand mining and appropriate mitigation measures that would ensure a sustainable environment would be put in place.
- Recruitment of Agricultural Extension Officers and Rural Development Agents to teach the Fadama and other farmers within the area on a more sustainable means of agricultural land clearing wherein only selective tree and shrub removal would be practiced. Furthermore, the extension and development agents will teach the farmers the science and art of trash/stover (plant and crop residue) incorporation into the soil prior to ploughing, ridging and/or bunding. That way, farmers within the watershed would be gradually discouraged from the practice of slash and burn system of land clearing.

Conclusion

Various land use activities are discernible within and around Ajasse-Ipo watershed area in Kwara State, with agriculture being the most prominent. This signifies the central role of the watershed in the livelihoods of inhabitants within the catchment area. However, there are attendant negative impacts arising from a large human population and the various land use practices in the area. These impacts have been particularly prominent on the water bodies and the natural vegetation, now reduced to farmlands in many areas. Thus, given that the natural ecosystem (Guinea savanna) within which the Ajasse-Ipo watershed subsists is a very fragile one, it is important to focus attention on the sustainable utilization of water, soil and land resources within the watershed. If implemented, the various measures proposed in this study would be of benefit.

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