The Flora and Conservation Status of Ifon Forest Reserve, Ondo State, Nigeria

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Abstract
A vegetation survey of Ifon Forest Reserve, Ondo State, Nigeria was carried out. The Reserve had been converted to forest fragments, derived savanna and abandoned farmlands by human activities. A total of 119 plant species distributed in 49 families were encountered during the survey. The forest was dominated by members of Leguminosae, Sterculiaceae and Moraceae Families. Many of the species were being harvested for timber but there were Non-Timber Forest Products (NTFPs) from *Irvingia gabonensis, Piper guineensis* and *Xylopia aethiopica* that could be exploited for income generation. 35 species belonging to 18 Families were encountered in the derived savanna, some of which were extracted for timber. The presence of tree seedlings indicated that the forest fragments could recover from abuse if proper management practices were put in place. The approach being recommended is the Participatory Forest Management, which entails the involvement of forest-edge communities in the conservation of the forests. This method has been in practice in Tanzania since 1980s and it was reported to be effective. With the Forest restored, the State could develop the ecotourism potentials of the Reserve to increase accruable revenue from the Forest. It would also enable the State participate in the United Nations' Reduced Emissions from Deforestation and Forest Degradation (REDD) and carbon trading programmes.

Keywords: conservation, flora, Ifon Forest Reserve, Nigeria, REDD, vegetation

Introduction

Ondo State lies in the lowland forest eco-region of South-western Nigeria where the forests are dominated by members of the Leguminosae and Meliacae families (Keay, 1952); many of which are timber species. The climate is tropical with two distinct seasons. The rainy season lasts from March to October while the dry season runs from November to February. There is a brief cold spell of dry harmattan winds in December and January. The realisation of the colonial administration for the need to conserve the forest led to the demarcation of some areas of the forest for the protection of timber and other forest resources. However, the harvesting of timber in these areas was allowed under a special concession and with permit. One of such designated areas is the Ifon Forest Reserve, which covered an area of 282.35 km^2 at inception (Ezealor *et al.*, 2013).

Ifon Forest Reserve (IFR) (Figure 1) was listed in the Western Region gazette No. 2 of 4/1/1951 as a wildlife sanctuary when the current Ondo State was a province in the defunct Western Region of Nigeria. It lies between latitudes 6^{o}54'–7^{o}15' N and longitudes 5^{o}39'–5^{o}55' E and covers an area of about 282.3 km^2 north of Ifon town and south of Idoani and Idosale towns. Ipele and Omialafara towns are located on its western boundaries (Figure 1). IFR lies over a basement of Benin sands and crystalline rocks so the soil is well drained by the Ose and Owena rivers and their tributaries (NCF, 2007).

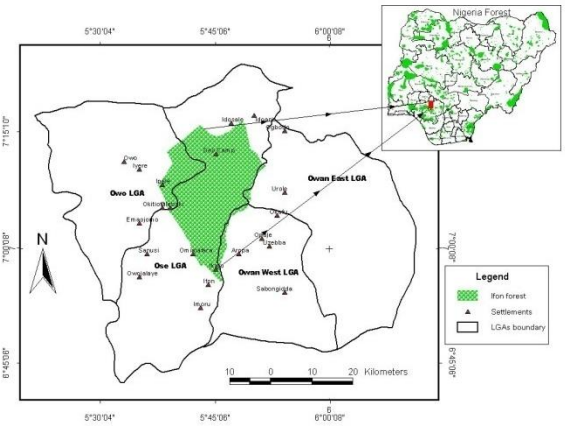

Figure 1: Map of Ondo State showing Ifon Forest Reserve

When the forest was gazetted it was rich in biodiversity and species endemism was high, which made it a global priority for conservation but unfortunately the motive of the Government then was revenue generation through logging operations. The forest was poorly managed by the State Ministry of Agriculture and Natural Resources (Usman and Adefalu, 2010). Concessionaires were appointed by

the Government for logging on a commercial scale without any management or regeneration plan (NCF, 2007). Logging activities were complemented by illegal slash and burn agriculture, grazing and burning of forests by hunters and honey harvesters.
These anthropogenic activities have resulted in forest loss and fragmentation. Observation from satellite imagery showed that at least 50% of the original forest has been lost and fragmentation had caused the introduction of non-forest species in the areas that had been over-cultivated. These anthropogenic activities have also resulted in the loss of forest and wildlife. This has generated a lot of concern over the effects of deforestation on the climate and other ecosystem services. Thus, the objective of this study is to conduct a vegetation survey of IFR to determine its conservation status to enable stakeholders develop a sustainable management strategy for it.

Materials and Methods
IFR was bisected into two by an imaginary line running from the northern end to the southern end. Another line perpendicular to the first one was established thus dividing the Reserve into four sections. Twenty sampling points (five in each section) were randomly located in forest fragments in each quarter. Data was collected in the forest fragments using an adapted point-centred quarter method (Mueler-Dombois and Ellenberg, 1974). This method allows a lot of data to be generated within a short time (Akinsoji, 2003; Cottam and Curtis, 1956).

At each sampling point, all the trees (dbh > 15 cm) within a 3 m radius were enumerated and recorded. Species were identified using Flora of West Tropical Africa (Hutchinson and Dalziel, 1954, 1958) and Nigerian Trees (Keay *et al*., 1960, 1964). Some were identified by their vernacular names using Gbile (1984) while those that could not be identified were taken to the Forestry Research Institute of Nigeria (FRIN) herbarium in Ibadan for identification and confirmation.

Results and Discussion
The Ifon Forest Reserve (IFR) is now a mosaic of patches of forest fragments, derived savanna, farms and abandoned farmlands in various stages of recovery. The transformation of this hitherto high forest has been mainly due to slash and burn agriculture coupled with shifting cultivation. Keay (1952) had noted that farming is the greatest enemy of the forest. Other causes are lack of management plan and implementation, inadequate protection, poorly motivated and inadequately trained forestry officials and unchecked logging (Akinsoji and Obot, 2013). Even some of the forestry officials might be implicated in illegal logging as was observed elsewhere by Fowler *et al.* (2002). A total of 119 species distributed in 49 families were encountered during the survey (Table 1). Table 2 shows the species distribution by Family.

Forest Fragments
A total 84 species distributed in 38 Families were observed in the fragmented forest patches (Table 1). The dominant species belong in Leguminosae, Sterculiaceae, Meliaceae and Moraceae families. These included those reported for South-western Nigeria forests by Keay (1952). Where the forest fragments were large enough, forest stratification was observed. There were three tree strata, a shrub stratum and a herb stratum. The highest stratum called emergent, consisted of the tallest trees which exceeded 35 m in height.

Some species represented in this stratum were *Ceiba pentandra, Milicia excelsa, Khaya grandifoliola* and *Terminalia superba.* The next layer was constituted by the canopy layer, which included species such as *Pterygota mildbraedii, Tetrapleura tetrapetra, Trilepisium madagascariense* and *Malacantha alnifolia*. Their crowns touch one another thus forming a complete cover over the layers below. Their crowns were also draped by various climbers, which tended to bind crowns of many trees together.

The other tree stratum is the understorey represented by species such as *Pycnanthus angolensis, Olax subscorpioidea, Psychotria peduncularis* and *Cola millenni*, which are adapted to the limited amount of light that filters through the canopy layer. Some characteristics of the trees observed included tall large trunks, light thin barks (peeling off in some species), buttress roots, stilt roots, leaves with drip tips and some leaves with epiphyllous algae. These characteristics are typical for forest trees and they have been observed elsewhere (Richards, 1966; Whitmore, 1975). Investigation from the Reserve edge communities revealed that in addition to timber extraction, some income-generating non-timber forest products are being extracted from *Irvingia gabonensis* (fruit and seed), *Brachystegia eurycoma*, (seed), *Garcinia kola* (seed), *Piper guineense* (leaf and seed), *Tetrapleura tetrapetra* (fruit and seed) and *Xylopia aethiopica* (fruit and seed).

The shrub stratum consists of plants such as *Abrus precatorius, Cnestis ferrugunea, Solanum torvum* and young individuals of the upper strata trees. The herb layer consists of non-woody plants, which rarely exceed 1 m in height. These include *Commelina* sp., *Aframomum* sp., *Costus* sp. and *Palisota hirsuta*.

Table 1: Species List of Ifon Forest Reserve (IFR), Ondo State, Nigeria

(a) Forest (* = On the IUCN Red Data Species List)

S/N	Species Lists	Life Form	Family	Importance
1.	*Abrus precatorius* Linn.	Shrub	Papilionaceae	Medicinal
2.	*Acanthus montanus* Linn.	Shrub	Acanthaceae	Medicinal
3.	*Aframomum melegueta* K. Schum	Herb	Zingiberaceae	Medicinal
4.	*Albizia zygia* (D. C.) J. F. Machr.	Tree	Mimosaceae	Timber
5.	*Alchornea cordifolia* (Schum & Thonn.) Mul. Arg.	Shrub	Euphorbiaceae	Medicinal
6.	*Alchornea laxiflora* (Benth.) Pax & K. Huffm	Shrub	Euphorbiaceae	Medicinal
7.	*Alstonia boonei* De Wild.	Tree	Apocynaceae	Medicinal
8.	*Ancistrocarpus densitospinosus* Oliv.	Tree	Tiliaceae	Medicinal
9.	*Antiaris toxicaria* Leach	Tree	Moraceae	Timber
10.	*Aubrevillea kerstingii* (Harms) Pellegr.	Tree	Mimosaceae	Medicinal
11.	*Blighia sapida* Koenig	Tree	Sapindaceae	Edible
12.	*Blighia unijugata* Bak.	Tree	Sapindaceae	Medicinal
13.	*Bombax bounopozense* P. Beauv.	Tree	Bombacaceae	Timber
14.	*Brachystegia eurycoma* Harms.	Tree	Caesalpiniaceae	Timber
15.	*Brachystegia* sp. Benth.	Tree	Caesalpiniaceae	Medicinal
16.	*Calyptrochillum* sp. Kraenzl.	Herb/Epiphytic	Orchidaceae	Medicinal
17.	*Campylospermum flavum* Schum & Thonn.	Tree	Ochnaceae	Medicinal
18.	*Canarium schwenfurthii* Engl.	Tree	Burseraceae	Timber
19.	*Ceiba pentandra* (Linn.) Gaertn.	Tree	Bombacaceae	Timber
20.	*Celtis zenkeri* Engl.	Tree	Ulmaceae	Timber
21.	*Celtis phillipensis* Rendle	Tree	Ulmaceae	Medicinal
22.	*Chrysophyllum albidum* G. Don	Tree	Sapotaceae	Edible
23.	*Clerodendron* sp. Linn.	Shrub	Verbenaceae	Medicinal
24.	*Cnestis ferruginea* D. C.	Woody/Climber	Connaraceae	Medicinal
25.	*Cola gigantea* A. Chev.	Tree	Sterculiaceae	Timber
26.	*Cola millenii* K. Schum.	Tree	Sterculiaceae	Medicinal
27.	*Combretum* sp. Loefl.	Tree	Combretaceae	Timber
28.	*Connarus griffonianus* Baill.	Woody/Climber	Connaraceae	Medicinal
29.	*Cordia milleni* Bak.	Tree	Boraginaceae	Timber
30.	*Costus* sp. Linn.	Herb	Costaceae	Medicinal
31.	*Culcasia scandens* P. Beauv.	Herb/Climber	Araceae	Medicinal
32.	*Desplastia devweri* De Wild & Th. Dur.	Tree	Tiliaceae	Medicinal
33.	*Dialium guinense* Willd.	Tree	Caesalpiniaceae	Timber/Edible
34.	*Entada gigas* (Linn.) Fawcet & Rendle	Woody/Climber	Mimosaceae	Medicinal
35.	*Entandrophragma angolense* (Welw.) C. D. C.	Tree	Meliaceae	Timber
36.	*Erythrophleum suaveolens* (Guill & Perr.) Brenan	Tree	Caesalpiniaceae	Medicinal
37.	*Ficus thonningii* Blume	Tree	Moraceae	Medicinal
38.	*Ficus* sp. Linn.	Tree	Moraceae	Medicinal
39.	*Garcinia kola* Heckel	Tree	Clusiaceae	Medicinal
40.	*Hallea ciliata* Aubr. & Pellegr.	Tree	Rubiaceae	Timber
41.	*Harungana madagascariense* Lam ex Poir	Tree	Hypericaceae	Timber
42.	*Irvingia gabonensis* Aubr-Leonite ex O'Rorke*	Tree	Irvingiaceae	Edible
43.	*Khaya grandifoliola* C. D. C.*	Tree	Meliaceae	Timber
44.	*Khaya ivorensis* A. Chev.	Tree	Meliaceae	Timber
45.	*Kigelia africana* (Lam.) Benth.	Tree	Bignoniaceae	Medicinal
46.	*Lecaniodiscus cupanoides* Planch. Ex. Benth	Tree	Sapindaceae	Edible
47.	*Lophira alata* Banks ex Gaertn. F.	Tree	Ochnaceae	Timber
48.	*Malacantha alnifolia* (Baker) Pierre	Tree	Sapotaceae	Medicinal
49.	*Mansonia altissima* A. Chev.	Tree	Sterculiaceae	Timber
50.	*Marantochloea purpurea* (Radkl.) Milne-Redh.	Tree	Marantaceae	Medicinal
51.	*Megaphrynium macrostachya* Milne-Redh.	Herb	Marantaceae	Medicinal
52.	*Mesoneuron benthamianum* Baill.	Scrambling/Shrub	Caesalpiniaceae	Medicinal
53.	*Milicia excelsa* (Welw.) C. C. Berg*	Tree	Moraceae	Timber
54.	*Monodora tenuifolia* Benth	Tree	Annonaceae	Edible
55.	*Musanga cecropioides* R. Br.	Tree	Moraceae	Medicinal
56.	*Napoleona vogelli* Hook & Planch	Tree	Lecythidaceae	Medicinal
57.	*Nesogordonia papaverifera* (A. Chev.) R. Capuron	Tree	Sterculiaceae	Medicinal
58.	*Olax subscorpioidea* Oliv.	Tree	Olacaceae	Medicinal
59.	*Palisota hirsuta* (Thonb.) K. Schum.	Herb	Commelinaceae	Medicinal

60.	*Physalis angulata* Linn.	Herb	Solanaceae	Medicinal
61.	*Piper giuneensis* Linn.	Herb	Piperaceae	Edible/Medicinal
62.	*Piptadeniastrum africanum* (Hook. F.) Brenan	Tree	Mimosaceae	Timber
63.	*Platycerium angolense*	Herb/Epiphytic	Polypodiaceae	Medicinal
64.	*Polysphaeria arbuscula* K. Schum.	Tree	Rubiaceae	Medicinal
65.	*Psychotria peduncularis* (Salisb.) Steyarn.	Tree	Rubiaceae	Medicinal
66.	*Pterocarpus erinaceus* Poir.	Tree	Papilionaceae	Timber
67.	*Pterygota macrocarpa* K. Schum.	Tree	Sterculiaceae	Timber
68.	*Pycnanthus angolense* (Welw.) Warb	Tree	Myristicaceae	Medicinal
69.	*Ricinodendron heudelotii* (Baill.) Pierre ex Pax	Tree	Euphorbiaceae	Edible/Timber
70.	*Sarcophrynium brachystachys* (Baill.) K. Schum.	Herb	Marantaceae	Medicinal
71.	*Solanum torvum* Sw. Prod.	Herb	Solanaceae	Medicinal
72.	*Sterculia tragacantha* Lindl.	Tree	Sterculiaceae	Oil
73.	*Strombosia pustulata* Oliv.	Tree	Olaceaceae	Timber
74.	*Tabernaemontana pachysiphon* Stapf.	Tree	Apocynaceae	Medicinal
75.	*Terminalia superba* Engl & Diels.	Tree	Combretaceae	Timber
76.	*Tetrapleura tetrapetra* (Schum. & Thonn.) Taub	Tree	Mimosaceae	Edible/Medicinal
77.	*Trichilia preuriana* A. Juss	Tree	Meliaceae	Timber
78.	*Trilepisium madagascariense* D. C.	Tree	Moraceae	Timber
79.	*Triplochiton scleroxylon* K. Schum	Tree	Sterculiaceae	Timber
80.	*Uvaria chamae* P. Beauv	Woody/Climber	Annonaceae	Medicinal
81.	*Voacanga africana* Stapf.	Tree	Apocynaceae	Medicinal
82.	*Xylopia aethiopicum* (Dunal) A. Rich.	Tree	Annonaceae	Edible/Medicinal
83.	*Zanthoxylum gilletii* (De Wild) Waterm.	Tree	Rutaceae	Medicinal
84.	*Zanthoxylum zanthoxyloides* (Lam.) Zepernick & Timler	Tree	Rutaceae	Timber/Medicinal

(b) Savanna

S/N	Species Lists	Life Form	Family	Importance
1.	*Afzelia Africana* Sm.	Tree	Caesalpiniaceae	Timber
2.	*Andropogon tectorum* Schum & Thonn.	Herb	Poaceae	Medicinal
3.	*Annona senegalensis* Pers.	Shrub	Annonaceae	Medicinal
4.	*Anogeissus lieocarpus* (DC) Guill & Perr.	Tree	Combretaceae	Timber
5.	*Borassus aethiopum* Mart. Munch.	Tree	Arecaceae	Timber
6.	*Bridelia ferruginea* Benth	Tree	Euphorbiaceae	Medicinal
7.	*Burkea africana* Hook	Tree	Caesalpiniaceae	Medicinal
8.	*Calotropis procera* (ait.) Ait. F. Hort.	Shrub	Asclepiadaceae	Medicinal
9.	*Chromolaena odorata*	Herb	Asteraceae	
10.	*Crossopteryx febrifuga* (Afzel. Ex. G. Don) Benth.	Tree	Rubiaceae	
11.	*Cussonia barteri* Seeman	Tree	Araliaceae	
12.	*Daniellia oliveri* (Rolfe) Hutch. & Dalz.	Tree	Caesalpiniaceae	
13.	*Eragrostis* sp. Wolf.	Herb	Poaceae	
14.	*Hyparrhenia* sp. Fourn.	Herb	Poaceae	
15.	*Imperata cylindrical* (Linn.) P. Beauv.	Herb	Poaceae	
16.	*Khaya senegalensis* (Desr.) A. Juss.	Tree	Meliaceae	Timber
17.	*Parkia biglobosa* (Jacq.) R. Br. Ex. Don	Tree	Mimosaceae	Edible
18.	*Lannea schimperi* (Hochst. Ex. A. Rich) Engl.	Tree	Ancardiaceae	
19.	*Lophira lanceolata* Van Tiegh. Ex Keay	Tree	Ochnaceae	
20.	*Monotes kestingii* Gilg in Engl.	Tree	Dipterocarpaceae	
21.	*Panicum maximum*	Herb	Poaceae	
22.	*Pericopsis laxiflora* (Benth. Ex.Bak.) Harms.	Tree	Papilionaceae	
23.	*Pennisetum purpureum*	Herb	Poaceae	
24.	*Piliostigma thonningii* (Schum.) Milne-Redhead	Tree	Caesalpiniaceae	
25.	*Pterocarpus erinaceus* Poir.	Tree	Papilionaceae	Timber
26.	*Sacrocephallus latifolis* (Sm.) Bruce	Shrub	Rubiaceae	
27.	*Schizachyrium brevifolius* (Sw.) Nees ex Buse	Herb	Poaceae	
28.	*Setaria* sp. P. Beauv	Herb	Poaceae	
29.	*Tephrosia vogelli* Hook f.	Shrub	Papilionaceae	
30.	*Terminalia avicennoides* (Guill & Perr.)	Tree	Combretaceae	Timber
31.	*Terminalia laxiflora* Engl.	Tree	Combretaceae	Timber
32.	*Tridax procumbens* Linn.	Herb	Asteraceae	Medicinal
33.	*Uapaca togoensis* Pax	Tree	Euphorbiaceae	
34.	*Vitellaria paradoxa* Gaern. f.	Tree	Sapotaceae	Edible/Medicinal
35.	*Vitex doniana* Sweet	Tree	Verbenaceae	Timber/Edible

Other life forms observed were climbers (*Piper* sp., *Uvaria* sp., *Combretum* sp., *Entanda gigas* and *Diocloea reflexa*, epiphytes (*Platycerium stemaria, Culcasia scandens*, orchids, bryophytes and lichens) and forest floor forms. Where the forest canopy was broken and the gaps allowed light to penetrate to the forest floor, there was abundant growth of tree seedlings, grasses and forbs.

Table 2: Plant Species Distribution by Family

S/N	Family	No. of Species
1.	Acanthaceae	1
2.	Anacardiaceae	1
3.	Annonaceae	3
4.	Apocynaceae	3
5.	Araceae	1
6.	Araliaceae	1
7.	Arecaceae	1
8.	Asclepiadiaceae	1
9.	Asteraceae	2
10.	Bignoniaceae	1
11.	Bombacaceae	2
12.	Boraginaceae	1
13.	Burseraceae	1
14.	Caesalpiniaceae	9
15.	Clusiaceae	1
16.	Combretaceae	5
17.	Commelinaceae	1
18.	Connaraceae	2
19.	Costaceae	1
20.	Dipterocarpaceae	1
21.	Euphorbiaceae	5
22.	Hypericaceae	1
23.	Irvingiaceae	1
24.	Lecythidaceae	1
25.	Marantaceae	3
26.	Meliaceae	5
27.	Mimosaceae	6
28.	Moraceae	6
29.	Myristicaceae	1
30.	Ochnaceae	3
31.	Olacaceae	2
32.	Orchidaceae	1
33.	Papilionaceae	5
34.	Piperaceae	1
35.	Poaceae	8
36.	Polypodiaceae	1
37.	Rubiaceae	5
38.	Rutaceae	2
39.	Sapindaceae	3
40.	Sapotaceae	3
41.	Solanaceae	2
42.	Sterculiaceae	7
43.	Tiliaceae	2
44.	Ulmaceae	2
45.	Verbenaceae	2
46.	Zingiberaceae	1
Total number of species		119

Derived Savanna

Where the forest had been cleared for farms and the land had been repeatedly cultivated without being allowed to sufficiently fallow, the forest had been converted to derived savanna (Keay, 1952). This was common along the IFR boundary, which was closest to the communities surrounding it. Some derived savanna patches were also present deep inside the Reserve. These were due to abandoned farmlands that were not allowed to fallow before being cultivated over a period of long farming cycles.

A total of 35 species distributed in 18 Families were encountered in the savanna (Table 1b). The more common typical savanna species found were *Daniellia oliveri, Sarcocephalus latifolius, Borassus aethiopum* and *Terminalia* sp. and many grasses including *Imperata cylindrica, Panicum maximum, Andropogon* sp. and forbs such as *Aspilia africana* and *Tridax procumbens.*

Farms and Abandoned Farmlands

Some farms were found inside the IFR. The major crops were maize (*Zea mays*), beans (*Vigna unguiculata*), yam (*Dioscorea* sp.), banana (*Musa sapientum*), plantain (*Musa paradisiaca*), cassava (*Manihot esculentum*) and melon (*Cucumeropsis mannii*) as well as vegetables and various fruits. Active farming was also noticed as new forest patches had just been cleared and burned (Figure 2).

Figure 2: Land cleared and burned for farming

There were also many patches of abandoned farmlands in various stages of regrowth. The early stages were characterised by the presence of grasses such as *Imperata cylindrica* and a few small herbs with scattered trees left from previous farms. Other patches at later stages of regrowth had dense regrowths of species such as *Chromolaena odorata* and *Vernonia conferta* with several herbs forming tangled masses of foliage around crowns of young trees. At much later stages, early successional tree

species such as *Musanga cecropioides* would become dominant and gradually succession will proceed (provided farming is not continued) until a secondary forest is established (Mabberley, 1983).

Ecology and Conservation Issues

The abandoned farmlands in different stages of succession barring any further disturbances would eventually revert to forest. The fragmented forests are secondary forests in a successional continuum. The fact that seedlings were seen under the canopies of many trees and their effective dispersal mechanisms indicated that the regeneration of species was taking place. The implication of these is that the forest can still recover from anthropogenic activities. However there is a serious threat to the recovery process as long as farming and unchecked or regulated logging are not enforced. During this brief study, many logging sites as well as timber-laden vehicles were sighted (Figure 3) and there was no evidence of patrol by forestry officials.

Figure 3: Timber-laden lorry found inside the Reserve

Conclusion

There is an urgent need to restore the biotic integrity of the Ifon Forest Reserve and the State Government must adopt a new management approach. First, there must be a moratorium put in place on logging for 20 years. The management model being recommended for the IFR is the Participatory Forest Management (PFM) approach, which involves the participation of all the stakeholders particularly the forest edge communities whose livelihoods traditionally revolve around and depend on the forest reserve. The PFM is based on the premise that once communities realise that their livelihoods depend on the health of the forest, they would want to protect it.

Thus the PFM concept is based on creating awareness and providing conditions to enable them operate the management model. This management practice should be complemented with exploiting ecotourism potentials to enhance revenue generation. Restoration of the forest could also qualify the State to participate in the United Nations' Reduced Emissions from Deforestation and Forest Degradation (REDD), REDD+ and carbon trading programmes. PFM has been successfully practiced in Tanzania (Blomley and Ramadhani, 2006; Blomley *et al*., 2008).

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