BIODIVERSITY MANAGEMENT PLAN

AMBALARA FOREST RESERVE

NORTHERN SAVANNAH BIODIVERSITY CONSERVATION PROJECT (NSBCP)

JULY 2007

BIODIVERSITY MANAGEMENT PLAN
AMBALARA FOREST RESERVE

PART 1: DESCRIPTION

1.1. Location and Extent

Ambalara Forest Reserve lies in the Wa District of Upper West Region. The Wa-Kunbungu motor road crosses the reserve between Kandea and Katua.

The Reserve lies between Longitude 2° 0' and 2° 10' West and Latitude 9° 53'and 10° 07' North.

(Survey of Ghana map references are: North C-30 North C-30 and North C-30) .
J K Q

The Reserve has an area of 132.449 km^2

1.2 Status

The Ambalara Forest Reserve was recommended to be constituted under local authority Bye laws in 1955 and was constituted in 1957.

The Ambalara Forest Reserve was created to ensure the supply of forest produce for the local people in perpetuity. It has therefore been managed naturally with little or no interventions for the benefit of the people domestically.

1.3 Property/Communal Rights

There is no individual ownership of the land. The Wa Naa and his sub-chiefs, the Busa Naa and Kojokpere Naa have ownership rights over the land.

1.4 Administration

1.4.1 Political

The Forest Reserve is within the jurisdiction of Wa District Assembly of Upper West Region.

Greater part of the reserve, 117.868 km^2 lies within the Busa – Pirisi – Sing – Gulle Local Council with headquarters at Busa. A smaller portion 14.581 km^2 North of the Ambalara River lies within the Issa – Kojokpere Local Council with headquarters at Kojokpere.

1.4.2 Institutional/Statutory Bodies and Their Responsibilities

The FSD Regional Office located in Wa has oversight responsibility for the management of the reserve while the day-to-day management of the reserve primarily rests on the FSD District Manager with his office also located at Wa and the Range Officers and their quarters located at Nadowli. Members of communities that fringe the reserve and who have interests and various stakes in the management of the reserve constitute the Community Natural Resource Management Committee (CNRMC). Members of the

CNRMCs assist the Forest Services Division (F.S.D) personnel in patrols and protection of the reserve, awareness creation and sensitization of the various communities on various management options and opportunities both inside and outside the forest reserve. They report all offences detected in the reserve to the various Range Supervisors, District or Regional Manager. This committee serves as the hub for all community based natural resources management programs in all the fringe communities

The Wa District Assembly and its environmental sub-committee with representation from relevant decentralized agencies and departments are responsible for identifying environmental problems and prescribing solutions and implementing them in consultation with the DM.

1.4.3 Profile of local communities

About eight communities have been identified as lying within a distance of 6-7 Km from the reserve boundary. The largest is Busie with a population of about 4000. the people within these communities belong to a number of ethnic groups. The main focal languages are Dagaare, Sissali and Wali bur Gonja, Kassim, Tanpulima and Hausa are also spoken in particular settlements.

The traditional authority structure is diverse. For example the chief of Katua, the Katua Naa who is himself answerable to the Busa Naa is also the chief and overall head of Motigu. At Jafian, the overall head is the Tendana who is a Sissala and the Dagaaba chief is therefore answerable to him. The settler community of Dolindoyiri is reported not to have awell defined social structure. The usual women's leader (Magazia), Youth leader and members of the District Assembly are active and assist the traditional ruler in most of the communities.

theCenter for the Development of People (CEDEP) is active at Kande, Action Aid and NADMO at Motigu. Localorganised groups include the Kumbungu Group and the Suntaa Nuntaa Kanyiri Women's group at Katua, Suntaa and Sunzele farming groups at Kande.

About 95% or more of the people in each fringe communities are small time farmers. In all of them also some women engage more or less full time in processing dawadawa and shea butter and pito brewing.

The NSBCP has started a number of interventions in all the communities. They include:

- Institution of Community Natural Resource Management Committees;
- Participation in the management of the reserve
- Awareness creation and training in agro-forestry practices and in biodiversity conservation and sustainable use
- Formation of Traditional Healers Association and support to their activities
- Sustained wildfire management and prevention education
- Cultivation of cover crops and leguminous plants
- Rehabilitation of degraded areas
- Community dedicated forests have been set up in some communities e.g. Jafian and Katua

1.5 Past Management

There had been no past management plan for the reserve but the objectives for the creation of the reserve was to ensure the provision of forest cover to protect the head waters of some tributaries of the Ambalara River, which drains into the White Volta, as well as supply of forest produce for the local people in perpetuity.

The Ambalara Forest Reserve has therefore been managed naturally with little or no interventions for allowing the people to collect a number of goods for domestic consumption.

1.5.1 Protection and Research

The reserve boundaries, which are cut and pillared, are cleaned according to a Boundary Maintenance Schedule, which ensures that all parts of the external boundary are cleaned twice a year. On a daily bases, Forest Guards patrol the reserve boundaries to ensure that no illegal activities take place in the reserve.

No specific research activities have been carried out in the reserve.

1.5.2 Production

Up to now, no area has specifically been zoned for production. The reserve has not been recognized to have a timber production potential and no plantations have been established. Currently, there are no structured programmes for the production and harvest of NTFPs in the reserve. However, NTFPs are harvested from the reserve from the reserve largely for domestic consumption. Currently, no permit is issued for NTFP collection. The level of extraction of NTFPs is low and there is no involvement of the CNRMC.

1.5.3 The dependence on the local people on the reserve

The neighboring communities depend on the reserve for a large variety of tangible and intangible goods and services. Common among them are a variety fruits (Shea fruits, Dawadawa fruits) and medicinal plants, poles and amelioration of the harsh environmental conditions.

1.6 Environmental Features

1.6.1 Physical

Climate:

Rains commence in April and extend to October with the bulk of the precipitation occurring in August and September.

The total annual rainfall recorded varies between 767 mm and 1357 mm. The rainfall pattern is erratic. See Appendix 2.

Table 1: Monthly average rainfall (mm) recorded over the last 10 years (1992-2001).

Jan.	Feb.	Mar.	April	May	June	July
7.33	8.47	16.05	75.25	131.54	183.04	139.18

Aug.		Sept.		Oct.	Nov.	Dec.	Total
299.24		212.15		84.77	5.4	0.83	1163.29

The highest average temperature occurs during March (25.02°C – 37.94°C) and the lowest during August (22.09°C – 29.67°C).

Table 2: Monthly Average Temperature. (°C) recorded over the last 10 years (1992-2001)

Jan.	Feb.	Mar.	April	May	June
27.55	29.5	31.61	30.8	29.21	27.39

July	Aug.	Sept.	Oct.	Nov.	Dec.
26.34	25.84	26.26	27.86	28.46	27.6

The dry season is characterized by the harmattan which is a dust laden wind blowing from the northeast from December to March.

Geology and Soils

The geological formation underlying the area is granite and gneiss. Greater part of the area has weathered into soils of sand or sandy clay. There is considerable number of small areas of bare rock outcrop without any soil cover.

Topography, Relief and Drainage

There are ranges of hills trending north-east to south-west in the northern sector of the reserve and another range trending north-south in the southern half of the reserve near where the road leading from Kandea to Katua through the reserve. The general elevation varies from 166m to 330m above sea level.

The tributaries of Ambalara River flows through the Ambalara Forest Reserve. There is periodic water logging on the flat lands in the reserve.

1.6.2 Biological Resources

There is only one vegetation type existing in the area. This is Tropical Savannah Woodland (Burth Davy's Classification). Along the river courses and where the water table is sufficiently high during the rainy season, fringing forests occur. The vegetation in the fringing forest is more or less two-storey and the trees show greater diameter and height than those in general savannah woodland.

The most common tree species in the reserve include:

Acacia mellifera
Acacia dudgeoni
Datarium senegalensis
Afzelia africane
Vitallaria paradoxa
Parkia filicoides
Entanda sudanica
Diospyros mispiliformis
Anona senegalensis
Lannea acida
Lannea barteri
Combretum spp
Pterocarpus erinaceus
Kyaya senegalensis

The general health of the growing stock appears to be good. Tree boles are fairly straight though there are many utilizable poles. The annual burning of grasses thwarts the efforts of regeneration as well as injuring mature trees over extensive areas.

Although formal fauna surveys have not been done, information gathered from fringe communities and some forest guards indicates that the area is a habitat for most of the animal species recorded in other reserve in the region such as the Kulpawn Biodiversity Reserve about 50Km to the north.

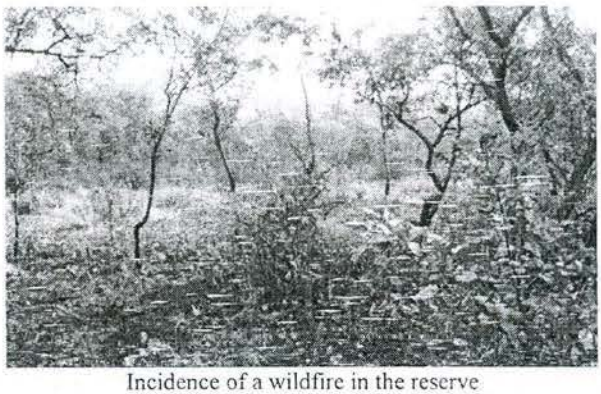
a) *Neotragus pygmaeus*
b) *Erythrocebus patas*
c) *Crictomys gambianus*
d) *Eimacens spp*
e) *Ptilopachus petrosus*
f) *Hippotragns equines*

Others like Green monkeys, Grasscutters and Hares have also been sited in the reserve.

1.7 Pressures and Threats

Wildfires, grazing of cattle, illegal farming and high collection of NTFPs are the main pressures and threats affecting the Ambalara Forest Reserve. In view of the nature of these pressures and factors relating to the socio-economic activities of the fringing communities, all four pressures are likely to continue to be threats to the biological resources of the reserve in the near future.

Wildfires:

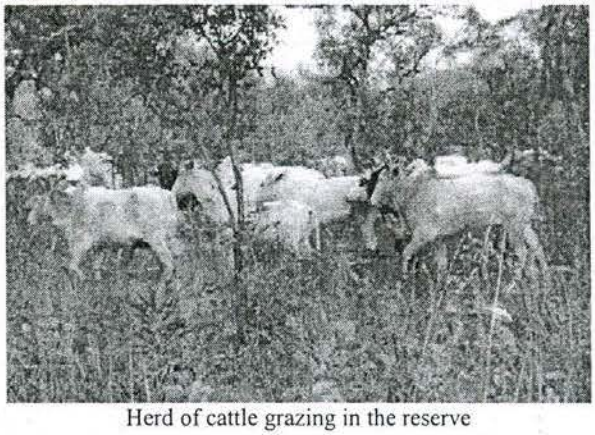


Incidence of a wildfire in the reserve

The wildfire recurs in most parts of the reserve annually. In particular, areas close to existing settlements, farms hunting as well as cultural/festival grounds are most affected. Their occurrence begins usually from about mid-October and by the middle of March most areas inside and outside the reserve is already burnt. These fires are all human-caused (anthropogenic in nature). They are frequently set by people from fringe communities who are using fires in their legitimate normal occupation as well as those who are following illegal activities. In the process large tracts of forest and off-reserve lands are burnt destroying un-quantifiable amount of resources. Currently there is a systematic programme of wildfire education in the fringing communities but no fire volunteer squads have been formed.

Grazing:

Cattle, sheep and goats belonging to the local people are taken into the reserve and sometimes allowed to graze freely in the reserve. Currently, there is no permit system to regulate grazing in the reserve.



Herd of cattle grazing in the reserve

Illegal farming:

Four illegal farms had been recorded between B.P.8 and B.P.10 but the farms have since been abandoned.

NTFP Collection:
NTFPs are scattered all over the reserve and in the surrounding off-reserve areas near settlements. Common NTFPs include; shea fruits, dawadawa fruits, tree leaves and vegetables, grasses, twines, firewood, medicinal plants etc. There is a permit system for the collection/harvesting of NTFPs but this is normally abused. Constant pressure on the resource coupled with annual wildfires keep NTFP numbers low. There has not been any legal action on any offender so far.

1.8 Socio-cultural and economic significance

1.8.1 Community Ranking of Resources

The table below shows how members of the communities lying close to the reserve rank the importance of certain goods and services they derive or think that could derive from the forest reserve. The importance that communities place on the reserve as a potential farmland is instructive.

Type of Resource	Community Ranking of Resources in Order of Importance							
	Jan	Mot	Kan	Kat	Dol	Klun	Ducie	Tosa
Farm land	1	1	1	-	1	1	1	1
Rain fall	4	-	4	-	-	3	-	-
Bushmeat	4	3	2	1	4	2	3	1
Tree logs	3	3	4	-	-	4	5	5
Sacred groves	-	-	4	-	-	5	1	5
Water bodies	2	3	3	-	-	4	-	4
Natural vegetation	4	3	5	-	-	5	5	-
Fruits/Nuts	2	1	2	2	2	2	3	2
Firewood	3	2	1	3	3			
Tree leaves as vegetable	4	4	4	1	-	3	2	4
Clay, Slicks, Stores, Grass, Twines	-	5	5	1	1	5	5	4
Medicinal plants	2	2	2	2	2	1	1	1

1= Highly important
2= Important
3= Of little importance
4= Not important
-= No clear response

1.8.2 Stakeholder Analysis

Stakeholder	Role/Resp.	Right	Returns	Relations	Presence/ Importance
FSD	Lead role in reserve management in consultation with major stakeholders. Legal responsibility to advice on cons, and management off-reserve.	Formal Management Rights	Currently no returns	Currently very good with most stakeholders	Range Supervisors/ Forest Guards resident in fringe communities, DM resident in Lawra
District Assembly	Legal responsibility for local development. Little practical Involvement in management or represented on District Assembly quarterly meeting	Formal right to be informed and represented in management of reserve		Formal	Presence of assembly member; working activity in community
Stakeholder	**Role/Resp.**	**Right**	**Returns**	**Relations**	**Presence/ Importance**
Traditional Rulers	Mobilization of communities for sensitization, awareness creation and education	Traditional ownership of reserve land	No NTFP Collection	Good cooperation with FSD/other stakeholders recently	Highly visible: Kandea Naa and Katua Naa
CFCs/ CNRMC	Community mobilization for protection and detection of offences	Arrest of offenders but not backed by legislation	Nil but support with some incentives	Very good in all communities	Community members and one focal person for M & E
Traditional Healers	Currently little involvement in the restoration of medicinal plants	Traditionally to collect medicinal plants	Medicinal plant parts/ Medicines	Organize relations with FSD though THA	
NGOs (Suntaa Nuntaa)	Mobilization for community education	Nil	Existence value	Little presence in communities	Only occasionally seen in community
GNFS	Involvement in wildfire management education. Training of fire volunteer squads	Nil currently	Nil	Cooperation at institutional Level	Little presence in communities
MOFA	Extension advice to farmers. No direct role in reserve management	Nil	Nil	Good institutional level; trusted by farmers	Extension officers located x km from reserve

1.9 Infrastructure

1.9.1 Within the reserve

About 5 km of the main Wa – Kandea-Katua motor road traverses the southern portion of the reserve. The road is untarred but motorable throughout the whole year.

1.9.2 Within Fringing Communities

A few of the communities e.g. Janfian have no schools; the majority have primary schools; Katua has a Junior Secondary School. Every community has more than one Traditional Birth Attendant and several Traditional Healers. Occasionally they receive visiting Community Health Nurses from larger communities.

Sources of water range from seasonal streams (e.g. Jafian), perennial streams (e.g. Dolindoyiri) to boreholes. However at the time of the survey of the communities, the boreholes at Kande and Motingu were not functional.

1.10 Management Resources

1.10.1 Staff

The District Manager in-charge of the Lawra Forest District has direct oversight responsible for the management of the Ambalara Forest Reserve.

On the average, the DM spends fire days/month on reserve fringe communities.

There is one Range Supervisor in charge of the Kande –Kojokpere Range and two Forest Guards who are responsible for the day to day patrolling, monitoring, protection and other management operations within the reserve.

1.10.2 Office and Communication Equipment

The district has no telephone facility. The NSBCP has provided the district with a computer, a fax machine and a photocopier, which will be installed when there is electricity in the district office.

1.10.3 Transport

There is one serviceable pickup and 9 serviceable motorbikes in the district.

1.10.4 Finance

Annual recurrent budget over (say last 3-5 years) averages about ¢900 Million Actual expenditure. Percentage of budget provided is only about 5-6%

Capital expenditure is catered for by the Regional

Self generated income – Nil

Non-GoG sources of income/other support –FSDP II and NSBCP.

PART II EVALUATION

2.0 Evaluation

2.1 Sizes and Site Design

The Ambalara Forest Reserve has an area of 132.45 km^2. For conservation of biological diversity, this is moderately good. There is, however, poor connectivity with other protected areas (PAs), the nearest PA being the Ambalara Forest Reserve, which is about 50 km north of Ambalara Forest Reserve.

2.2 Pressures: Forces/Events Damaging Resources in the Reserve

Considering the legal and illegal activities as they occur in the reserve against the management objectives of the Ambalara Forest Reserve, the following are identified as pressures causing some damage to the biological and (or) cultural resources of the reserve.

2.2.1 General Assessment of Pressures on the Ambalara

Factor	Pressure	Assessment
a) Range	Wildfires	Widespread
	Grazing	Localized
	Illegal farming	Localized
	NTFP Collection	Scattered
b) Impact	Wildfires	Moderate
	Grazing	Mild
	Illegal farming	Mild
	NTFP Collection	Mild
c) Permanence of effect	Wildfires	Medium term
	Grazing	Short term
	Illegal farming	Short term
	NTFP Collection	Short term
d) Trend	Wildfires	Sharp decrease
	Grazing	Sharp decrease
	Illegal farming	Sharp decrease
	NTFP Collection	Sharp decrease

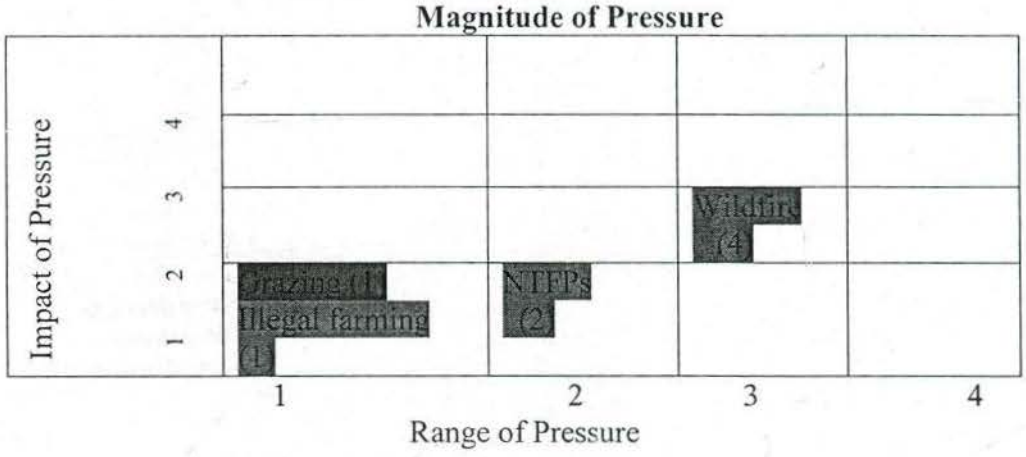
2.2.2 Assessment of magnitude and Degrees of Pressures on the Reserve

The magnitude and degree of the four pressures identified above was assessed as follows.

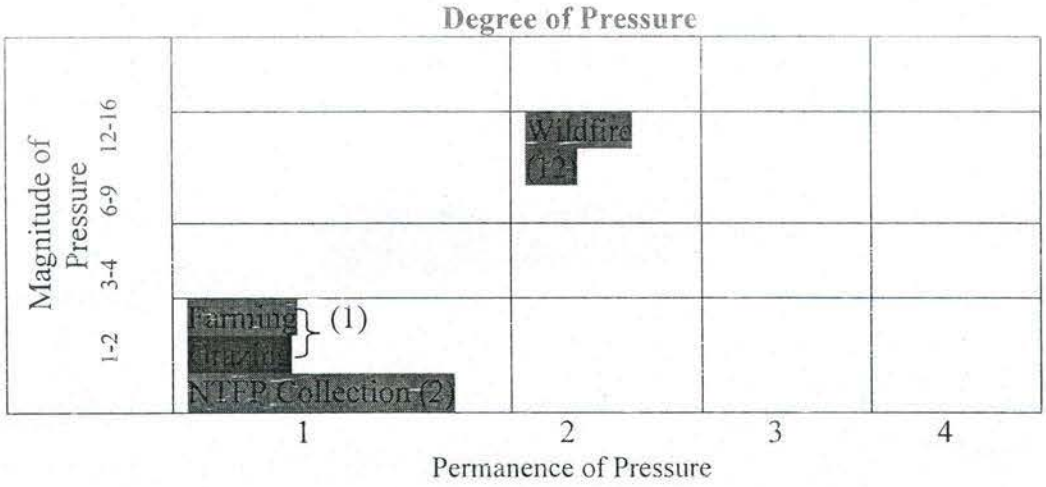
Assessment of magnitude and Degrees of Pressures

Factor	Assessment	Possible Score	Factor Score			
			Wildfire	Grazing	Illegal farming	NTFP Collection
a. Range	Throughout Widespread Scattered Localized	4 3 2 1	3	1	1	2
b. Impact	Severe High Moderate Mild	4 3 2 1	2	1	1	1
c. Magnitude	Range Score x Impact Score		6	1	1	2
d. Permanence of effect	Permanent Long Term Medium Term Short Term	4 3 2 1	2	1	1	1
e. Degree Score	Magnitude Score x Permanence Score		12	1	1	2

The magnitude of each of the four pressures is illustrated on the matrix below. On the matrix, a high magnitude pressure will appear towards the top right hand corner and a low magnitude pressure towards the lower left hand corner. Magnitude scores between 1-2 is considered very low, 3-4 low, 6-9 moderately high and 12-16 high. It will thus be seen that the magnitude of each of the four identified pressures is low to moderately high (score 1-6)



When the permanence of effect of the pressures is taken into account as well as the magnitude, the degree of each of the four pressures is still quite low as shown in the matrix below.



The overall degree of the pressures exerted on the biological and cultural resources of reserve is the sum of the degree of each of the identified pressures = ∑12+1+1+2 = 16, which is quite low.

2.3 Threats

When the nature of the legal and illegal activities that are causing pressures on the forest as well as the possibilities of managing them are considered, all the four pressure are judged as likely to continue to exert negative influence on the biological and /or cultural resources that are to be threats in the near future. No addition threats were identified.

2.3.1 General Assessment of threats

Factor	Threat	Assessment	Score
a. Range	Wildfires	Scattered	3
	Grazing	Localized	1
	Illegal Farming	Localized	1
	NTFP Collection	Scattered	2
b. Impact	Wildfires	Moderate	2
	Grazing	Mild	1
	Illegal Farming	Mild	1
	NTFP Collection	Mild	1
c. Permanence of effect	Wildfires	Medium Term	2
	Grazing	Medium Term	2
	Illegal Farming	Short Term	1
	NTFP Collection	Medium Term	2
d. Likelihood of occurring or increasing in the next 10 years	Wildfires	Very likely	3
	Grazing	Near Certain	4
	Illegal farming	Somewhat Likely	2
	NTFP Collection	Possible	1

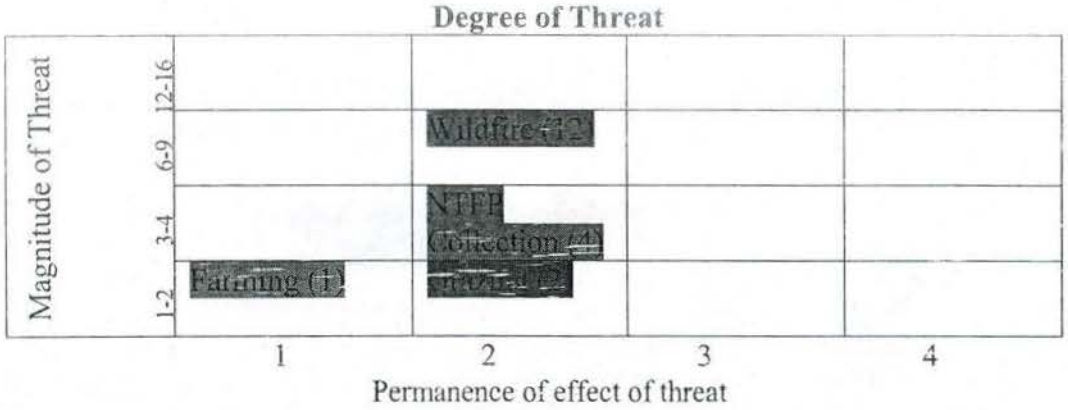
2.3.2 Magnitude, Degree and Urgency of threats

These are determined as on the table below.

Factor	Assessment	Possible Score	Factor Score			
			Wildfire	Grazing	Illegal Farming	NTFP Collection
a. Range	Throughout Widespread Scattered Localized	4 3 2 1	3	1	1	2
b. Impact	Severe High Moderate Mild	4 3 2 1	2	1	1	1
c. Magnitude	Range Score x Impact Score		6	1	1	2
d. Permanence	Permanent Long Term Medium Term Short Term	4 3 2 1	2	2	1	2
e. Degree	Magnitude Score x Permanence Score		12	2	1	4
f. Likelihood	Near Certain Very Likely Somewhat Likely Possible	4 3 2 1	3	4	2	1
g. Urgency	Magnitude of Threat x Likelihood		18	4	2	2

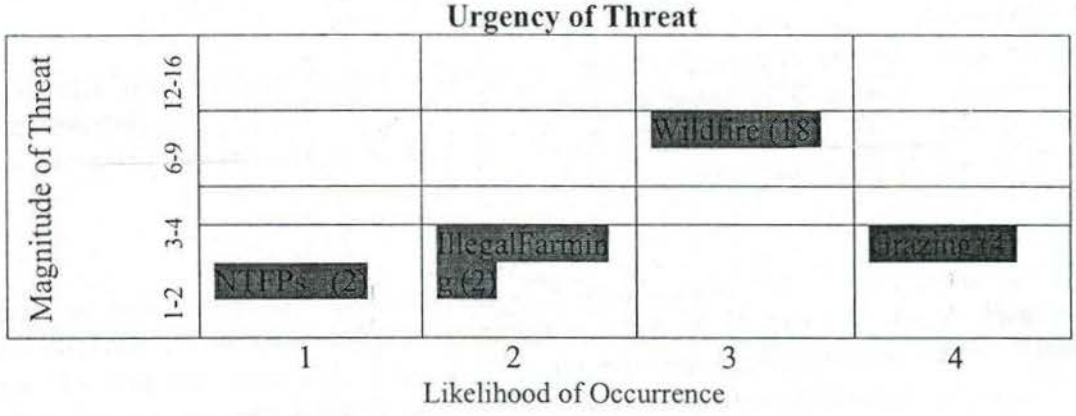
The **magnitude** of each of the identified threats that have the potential of causing some damage to the biological resources of the reserve (namely; wildfires, illegal farming, and grazing and NTFPs collection) is very low to moderately high)

The **degree** of threat of each of the four threats is shown on the matrix below. On the matrix the most serious threats (scores 36-48) will be at the top right hand corner and the least serious threats (scores 1-2) at the bottom left hand corner. The degree of threat is assessed as 1 for illegal farming, grazing at score 2, NTFPs collection at score 4 and wildfires at score 12).



The overall degree of threat is the sum of the degree of all identified threats = ∑degrees of threat for wildfires + NTFPS collection + Grazing +Illegal farming =∑12+4+2+1=19

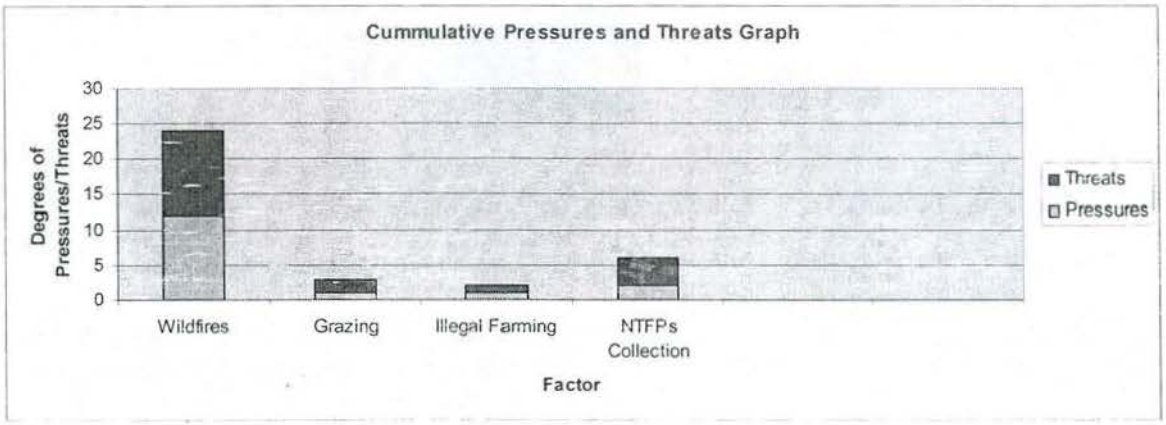
The **urgency** of each of the identified threats (scores 1-2 to 48-64) is assessed from the product of the magnitude of the threat and the likelihood that the threat will actually occur or increase in the next 10 years. The results are presented on the urgency matrix below.



The overall urgency of threat = Σ urgency of threat for wildfires + grazing+ illegal farming + NTFPs collection = Σ18+4+2+2 =26.

2.3.3 Cumulative Threats and Pressures

Although there are four pressures and threats, each is fairly small and their cumulative effect (=overall degrees of pressures=overall degree of threats = 19+26 =45, is fairly low.



2.4 Biological Resource

2.4.1 Diversity

In the absence of formal biological surveys, this assessment of biological diversity and conservation importance is based on knowledge derived from general observation and informal surveys by the staff of the Forest Services Division and on deductions from formal surveys in other protected areas in the ecozone.

Flora

The vegetation in the Ambalara Forest Reserve is fairly similar to that of Kupawn Tributaries Forest Reserve some 50 Km to the north. Vascular plant diversity in the Ambalara was moderately high: 349 species in 75 families. The most common tree species recorded in that reserve are observed to be present also in the Ambalara. *Afzelia Africana, Khaya senegalensis* and *Vitellaria paradoxa* listed in the IUCN Red Data List as threatened are found in the reserve.

Fauna

The large mammal species mentioned by the forestry workers in this Reserve those recorded in the faunal surveys in the Ambalara Forest Reserve. Although the Wild dog, *Lycaon pictus*, which is categorized as Endangered on the IUCN Red Data List has not been mentioned by the workers, its presence in the Kulpawn, the Mawbia and the Sinsangblegbini further south, suggest that it may probably be present in this Reserve also.

There is no much information on the reptilian, amphibian or bird populations in the Reserve.

2.4.2 Naturalness

The Ambalara Forest reserve is a natural forest reserve. The reserve is located in the general setting of Guinea Savannah Woodland with no significant modification. Since reservation, it has been subject only to the natural regeneration processes with minimal intervention other than human caused wildfires.

2.4.3 Rarity/Endemism

No rare or endemic species have been described

2.4.4 Fragility and Replaceability

The likelihood of the reserve recovering from persistent pressures is very low. Although it is not particularly unique, the degradation of the surrounding woodlands would make it difficult to find a replacement if destroyed.

2.4.5 Biological Importance

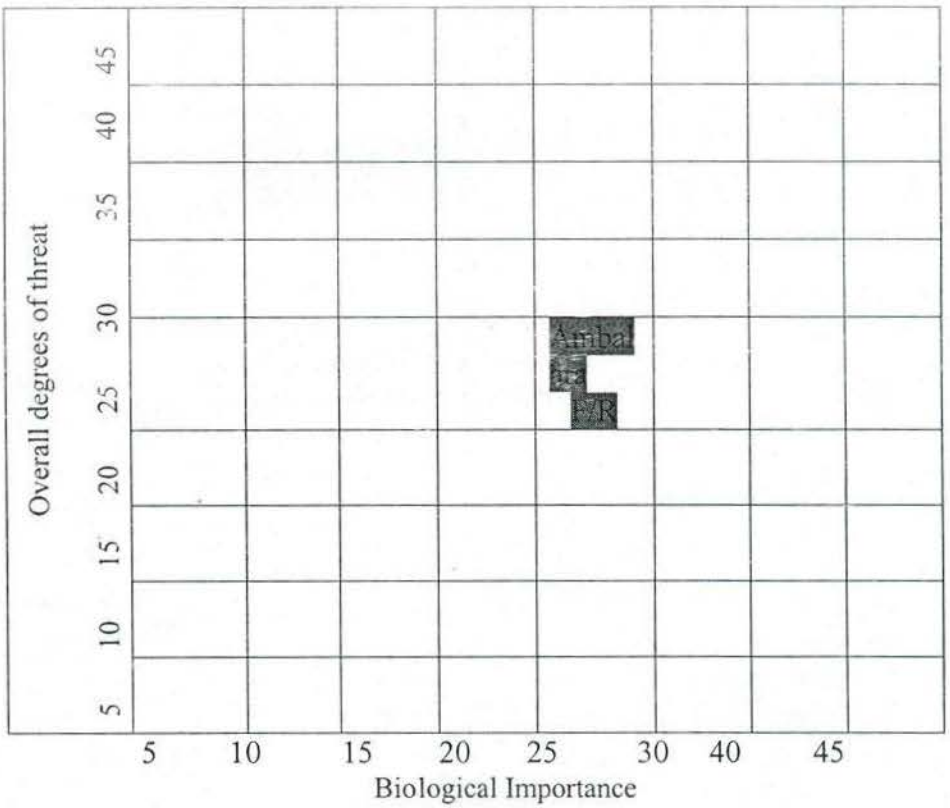
Factor	Assessment Y,m/y,m/n,n,u.	Score
a) The reserve contains globally threatened ecosystems.	n	0
b) Reserve contains globally threatened or endangered ecosystems.	m/y	3
c) Reserve contains regionally or locally rare, threatened or endangered species	m/y	3
d) Reserve has high level of biodiversity.	y	5
e) Reserve has high level of endemic species.	u	0
f) Reserve provides a critical landscape function.	m/y	3
g) Reserve is large enough to support minimum viable population of population of umbrella spp. or is relatively large for the region.	m/n	1
h) Reserve contains exemplary and intact ecosystems.	m/y	3
i) The reserve significantly contributes to the overall representativeness of the reserve system	m/y	3
Biological Importance (Total)		21

The Reserve has Biological Importance (BI) value of 21 on a scale where the minimum is zero and the maximum 45.

Key

y=yes (5); m/y= mostly yes (3); m/n= mostly no (1); n = no (0); u= unavailable/(0) - unknown

2.4.6 Biological Priority



The matrix above shows that the reserve has only a medium biological importance and is subject only to a fairly low degree of threat. On the basis of its biological resources, therefore, the Ambalara Forest Reserve rates medium priority.

2.5 Intrinsic Appeal

There is no feature of special intrinsic appeal

2.6 Social and Economic Value

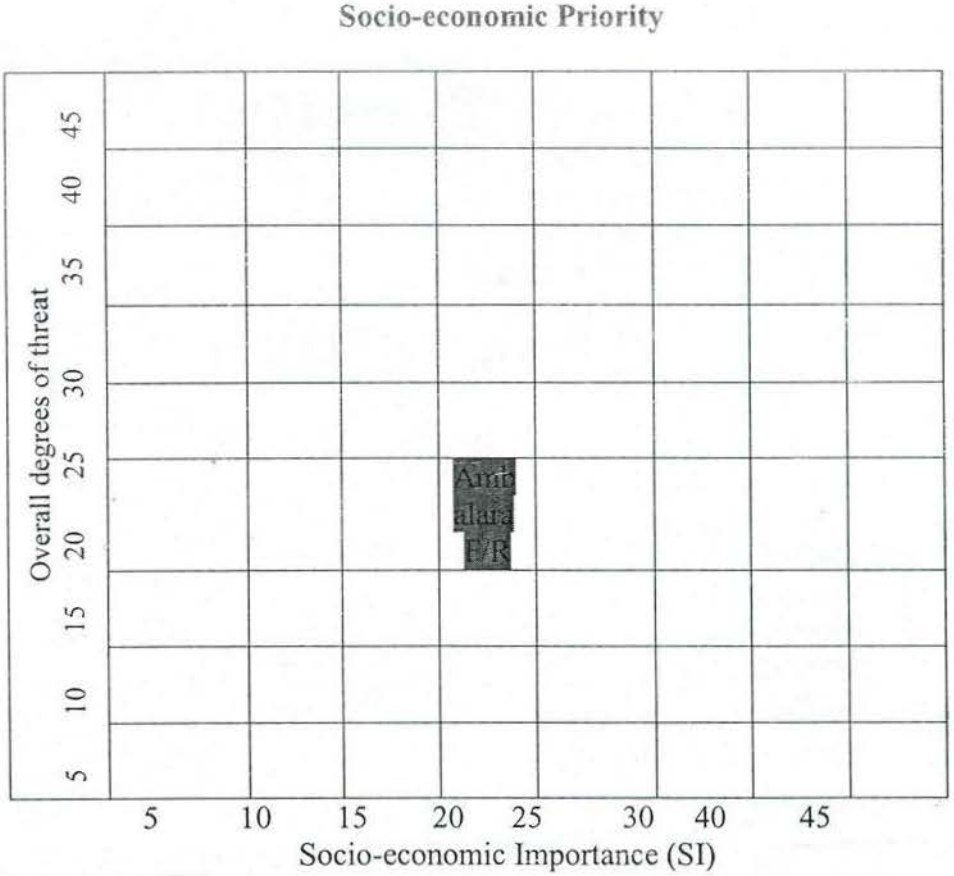
The socio-economic importance of the reserve can be measured in terms of the dependence of community members on the reserve for the following goods and services; medicinal plants, bush meat, thatch grasses and building poles, various fruits and nuts as well as leafy vegetables.

2.6.1 Socio-Economic Importance

Factor	Assessment y,m/y,m/nn,u.	Score
a. Reserve provides socio-economic opportunities for people living in the reserve.	m/y	3
b. Reserve demonstrates opportunities for sustainable development, consistent with the reserve management objectives.	m/y	3
c. Reserve has high level of subsistence and/or traditional use by the local communities.	m/y	3
d. Reserve has spiritual or religious significance.	n	0
e. Reserve has unusual features of esthetic importance.	n	0
f. Reserve contains species of high social or economic value.	m/y	5
g. Reserve has a high value for education and/or scientific value.	m/n	1
h. Reserve has high recreational value.	n	0
i. Functions of the ecosystem within the reserve contributes significant social or economic benefits eg. Water recharge areas.	m/y	3
Socio-economic Importance (Total)		18

The reserve has a total Socio-economic Importance (S1) value of 18 on a scale where the maximum score would be 45 and the lowest zero.

2.6.2 Socio-economic Priority



The matrix above suggests that given its rather low socio-economic importance and the fact it is not subject to a high overall degree of threat, the Ambalara Forest Reserve does not carry very high priority in terms of socio-economic value.

2.6.3 Potential Value

On account of its isolation from the other protected areas, the reserve has a potential existence value especially if the off-reserve forest becomes considerably degraded.

2.7 Recorded History and Management

Nil

2.8 Education and Public awareness

The on-going Northern Savannah Biodiversity Conservation Project (NSBCP) provides opportunity for using the reserve for intensifying education of the people in the fringing communities on the values of forest and biodiversity conservation.

2.9 Recreation

The reserve does not have a high potential for recreation in the short term

2.10 Research

Formal surveys of the flora and fauna and studies on their interdependence would benefit the management of the reserve.

SWOT ANALYSIS

ELEMENT	STRENGTH	WEAKNESSS	OPPORTUNITIES	THREATS	NEXT STEPS
Management Context (appropriateness of design; status of legislation; biological/socio-economic importance; status of pressures and threats)	Legally constituted under byelaws; Boundaries demarcated, pillared, undisputed clear ownership; Natural savannah woodland with little modification; Pressures and threats moderate and decreasing.	Isolated from other protected areas	General increased recognition of value of maintaining existing protected woodlands	High number of fringing communities; Populations dependent on woodland resources.	Formalize involvement of CNRMCs in protection of the reserve.
Management Planning	Has been managed under annual programmes with monthly, quarterly, annual reports. Ongoing activities to develop management plans	No written management plan for long management	Project resources available for management planning. Communities participating in management planning process		Complete and begin implementing management plan
Inputs	Management and field staff in place	Percentage of desired recurrent budget provided very low	Some financial support from FSDP 11/ NSBCP	Risk of dependence on short term donor funded projects	Source other funds e.g. Youth Unemployment, Women Microprojects

ELEMENT	STRENGTH	WEAKNESSS	OPPORTUNITIES	THREATS	NEXT STEPS
Management Processes	Adequately protected against encroachment	No active management of resources	Interest in planting off reserve on own lands		Manage to enhance productive capacity
Outputs	Meeting subsistence needs of local people	NTFP quantities not very high. In adequate knowledge of sustainable harvesting of some wildlide	Global interest in forest biodiversity conserved		Pursue alternative livelihood activities to reduce pressure on reserve and provide income for community members
Outcomes (effectiveness of maintenance of long term integrity; benefits, contribution to regional/national development environment	Integrity and naturalness of reserve maintained; contributing to biodiversity conservation	Low contribution to general socio-economic development	Acknowledgement of potential contribution of reserve management to job creation/poverty reduction	High short-term expectation of community members	Intensify involvement /commitment of other stakeholders

PART III: MANAGEMENT PRESCRIPTIONS

3.1 Overall Aim

To maintain the Ambalara Forest Reserve as a protected area and to ensure the conservation and sustained use of its resources for the benefit of its owners, the fringing communities and the general society.

3.2 Primary Objectives

To achieve the overall aim the following primary objectives are prescribed;

3.2.1 Maintain the territorial integrity of the reserve and protect and appropriately enhance its biological and cultural resources;

3.2.2 Ensure optimum flow of benefits to the reserve owners and fringe communities.

3.2.3 Strengthen the capacity of key stake holders to participate in reserve management and biodiversity conservation

3.2.4 Pursue activities to attract funding support for the management of the reserve.

3.2.5 Encourage and promote studies and research into the resources of the reserve and systems and strategies for their management for biodiversity conservation and sustainable utilisation

3.2.6 Maintain the long term environmental services of the reserve, including its contribution to global carbon cycles, local climate amelioration and maintenance of soil and water resources

3.3 Operational Objectives and Major Activities/Prescriptions

The operational objectives to be pursued and the major activities to be undertaken to achieve the outputs implied in each primary objective are set out below.

Primary Objective 1. Maintain the territorial integrity of the reserve, and protect and appropriately enhance its biological and cultural resources.

1.1 Establish and implement an effective protection strategy

111. Keep external boundaries open and clear and restore/replace all broken/defaced boundary pillars.

112. Regularly patrol the reserve and deal with offenders as prescribed by law and locally agreed convention/byelaws

113. Implement a wildfire management strategy that will involve, among others, the prevention, detection, suppression and appropriate use of fires with the participation of key stakeholders.

1.2 Develop and follow a restoration programme to rehabilitate all degraded areas

121. Map out degraded areas from field reports, satellite imagery and ground surveys.

122. Undertake enrichment planting and micro plantations, using taungya and agroforestry techniques with the involvement of fringe community farmers where appropriate.

113. Encourage natural regeneration in areas by excluding wildfires.

1.3 Develop and implement a species-habitat management programme.

131. With the involvement of appropriate partners, undertake studies and surveys to understand Wildlife species and habitat relations within the reserve.

132. Identify and protect habitats critical to maintaining and enhancing populations of key wildlife species, those of global/national interest.

133. Agree with fringe communities to collaboratively implement strategies for the limitation of grazing within reserve.

134. With the support of key stakeholders regulate removal of resources (NTFPs, wildlife animals) from the reserve to maintain populations and diversity.

Primary Objective 2. Ensure optimum flow of benefits to the reserve owners and fringe communities.

21 Establish structures for consultation, negotiation and effective participation in reserve management by and among stakeholders

211. In consultation with key stakeholders, clarify their representation and roles on the overall management and coordination of management activities.

212. Establish a protocol for the formal functioning of the coordinating institutions. (e.g. schedule of/procedures of meetings, etc.)

213. Support and resource the community level forest management committees to function effectively.

214. Train stakeholders/stakeholder institutions in negotiating skills and dispute management.

2.2 In collaboration with fringe communities and appropriate stakeholders formulate and implement guidelines for the harvesting of biological resources from the reserve.

221. Agree with local communities, a protocol for regulating the collection of NTFPs from the reserve.

222. Using the information available from the faunal survey as a guide, agree with local communities a community group ways of meeting some of their needs for wild animal reserves including bushmeat (e through Harvesting quotas) within the requirement for conservation and sustainable utilization.

223. Collaboratively enforce the wildlife laws, especially as they relate to protected species, hunti methods and hunting licenses.

2.3 Support and enhanced the conservation of locally beneficial plants/animals speci within designated community conservation areas within the reserve.

231. Establish and collaboratively manage a community conservation and resource use area in compartment close to each fringe community.

232. Within the community conservation and recognized community groups (eg. THAs) to collect, multipl manage and harvest locally useful (eg. medicinal, leafy vegetable and fruit tree) plants.

233. Link the on-reserve areas with community conservation and development activities.

2.4 Establish mechanisms for ensuring equitable distribution of benefits arising fron reserve management and biodiversity conservation

241. Obtain agreement among stakeholders of existing management and biodiversity conservation right and responsibilities.

242. Using a negotiable and consultative mechanism, establish modalities for the equitable distributions o various benefits between and within stakeholder groups, taking into account existing rights an responsibilities arising from management plan implementation.

243. Encourage a wide range of fringe community members and biodiversity conservation and development activities from which they may obtain benefits.

2.5 Promote alternative livelihood activities to improve income and health within fringe communities

251. Maintain and enhance the practice of involving locally paid labour in reserve protection and other management activities.

252. Assist communities to manage and enhance supplementary income generating activities facilitated by various projects.

253. Assist communities to identify and develop additional viable micro enterprises especially those related to biodiversity conservation and developments eg. Bee keeping, small scale game domestication, medicinal plants and products development, handicraft.

254. Introduce the cultivation and use of Morringa (M. oleifera) by households as a nutrition and health supplement.

255. Assist fringe community members to take advantage of available facilities for accessing credit and for developing capacity for establishing and managing small scale business enterprises

256. Seek opportunities for linking fringe communities to national and district programme for poverty alleviation, youth employment. etc.

Primary Objective 3. Strengthen the capacity of key stake holders to participate in reserve management and biodiversity conservation

3.1 Strengthen the community level participating institutions

311 Review the functions of the community Natural Resource Management Committee (CNRMCs) and provide support for their effective functioning.

312 Provide training, funding and other support to all community level Forest Management Committees.

313 Establish mechanisms for maintaining effective linkages between the CNRMCs and FMCs, their community members and other local level organizations, NGOs, etc.

3.2 Implement a public education and awareness creation programme on biodiversity conservation.

321 Review on-going programmes and implement revised programme.

322 Implement a biodiversity conservation education programme for basic schools in fringe communities with the support of the formal educational authorities.

323 Encourage the formation of environmental clubs in junior/senior high schools in neighbouring communities and encourage them to use the Ambalara Forest Reserve as a field laboratory.

3.3 Provide support to local communities for biodiversity conservation and development activities on and off-reserve.

331 Provide training in tree nursery establishment.

332 Encourage and support nursery establishment for on-reserve and off-reserve activities within appropriate and willing communities.

333 Provide training in techniques for cultivation of woodlots, medicinal plants propagation and sustainable harvesting, etc.

Primary Objective 4.0 Pursue activities to attract funding support for the manageme of the reserve.

4.1 Market the potential and needs of the reserve to local and national agencies

411 Integrate management of the Reserve into the medium term development plan of the Wa Distr Assembly.

412 Seek sponsorship for public and private agencies and corporate bodies for specific manageme activities

Primary objective 5.0 Encourage and promote studies and research into the resources of the reserve and systems and strategies for their management for biodiversity conservation and sustainable utilisation

5.1 Identify research needs

5.1.1 Determine and categorise management information needs

5.1.2 Identify and establish key researchable areas

5.1.3 Explore the possibility of establishing Permanent Sample Plots for the study of savannah woodland vegetation dynamics

5.2 Develop strategies for meeting research needs

5.2.1 Identify major research partners and prioritise with them the major areas for study and research

5.2.2 Establish MoUs with research partners, outlining among others, conditions for access to the reserve and research sites, collaboration with and capacity building for the management authority, use of research results

5.2.3 Encourage partners to seek funding etc within general framework of the MoUs

5.3.4 Develop capacity within the management authority for application and dissemination in user friendly form of research results

Primary Objective 6.0 Maintain the long term environmental services of the reserve, including its contribution to global carbon cycles, local climate amelioration and maintenance of soil and water resources

6.1 Maintain effectiveness of the reserve as a carbon sink and reduce its contribution to carbon dioxide emission

- *Identify degraded portions of the reserve for rehabilitation*
- *Establish community nurseries of recommended species for rehabilitation*
- *Plant out and tend seedlings to establish*
- *Provide satellite irrigation systems/water points to water planted seedlings*

6.2 Regulate legal removals of biological resources to maintain biomass and carbon pools

- *Establish a permit system for harvesting NTFPs and medicinal plants from the reserve*
- *Establish a closing system for hunting*
- *Put in place protocols to monitor the removal and use of biological resources especially through grazing*

6.3 Protect areas critical to maintaining regulated flow of streams and reducing soil erosion

- *Identify and map out all sensitive and fragile ecosystems (including perennial streams, wetlands and areas with slopes >30%) within and around the reserve*
- *Where appropriate pillar and (or) flag and sign-post all sensitive and fragile areas within the area to create awareness and for educational purposes*
- *Raise seedlings of recommended species and plant up all sensitive and fragile areas with the support of fringe communities, NGOs and other stakeholders*
- *Liaise with land owners to create a buffer off-reserve and put in place appropriate interventions such as buffer plantings*

PART IV: WORK PROGRAMMES

To ensure consistent implementation of activities and prescriptions towards achieving the overall aim and management objectives of the reserve, the proposed years/period for the implementation of each activity is given a priority rating from 1-3; with priority 1 ranking first.

Activity No.	Primary & Operational Objective	2007	2008	2009	2010	2011
1 Maintain the territorial integrity of the reserve, and protect and appropriately enhance its biological and cultural resources.						
1.1 Establish and implement an effective protection strategy						
	Keep external boundaries open and clear and restore / replace all broken/defaced boundary pillars.					
	Regularly patrol the reserve and deal with offenders as prescribed by law and locally agreed convention/byelaws					
	Implement a wildfire management strategy that will involve, among others, the prevention, detection, suppression and appropriate use of fires with the participation of key stakeholders					
1.2 Develop and follow a restoration programme to rehabilitate all degraded areas						
	Map out degraded areas from field reports, satellite imagery and ground surveys.					
	Undertake enrichment planting and micro plantations, using taungya and agroforestry techniques with the involvement of fringe community farmers where appropriate.					
	Encourage natural regeneration in areas by excluding wildfires.					
1.3 Develop and implement a species-habitat management programme.						
	With the involvement of appropriate partners, undertake studies and surveys to understand Wildlife species and habitat relations within the reserve.					
	Identify and protect habitats critical to maintaining enhancing populations of key wildlife species, those of global/national interest.					
	Agree with fringe communities to collaboratively implement strategies for the limitation of grazing within reserve.					
	With the support of key stakeholders regulate removal of resources (NTFPs, wildlife animals) fro to maintain populations and diversity.					

Project. No.	Description	2007	2008	2009	2010	2011
	2. Ensure optimum flow of benefits to the reserve owners and fringe communities.					
21 Establish structures for consultation, negotiation and effective participation in reserve management by and among stakeholders						
	In consultation with key stakeholders, representation and roles on the overall management and coordination of management activities.					
	Support and resource the community level forest management committees to function more effectively.					
	Train stakeholders/stakeholder institutions in negotiation skills and dispute management.					
	Establish a protocol for the formal functioning of the coordinating institutions. (e.g. schedule of/procedures of meetings, etc.)					
2.2 In collaboration with fringe communities and appropriate stakeholders formulate and implement guidelines for the harvesting of biological resources from the reserve.						
	Agree with local communities, a protocol for regulating the collection of NTFPs from the reserve.					
	Using the information available from the faunal survey as a guide, agree with local communities and community group ways of meeting some of their needs for wild animal reserves including bushmeat (eg. through Harvesting quotas) within the requirement for conservation and sustainable utilization.					
	Collaboratively enforce the wildlife laws, especially as they relate to protected species, hunting methods and hunting licenses.					
2.3 Support and enhanced the conservation of locally beneficial plants/animals species within designated community conservation areas within the reserve.						
	Establish and collaboratively manage a conservation and resource use area in selected compartments close to each fringe community.					
	Within the community conservation and					

	community groups (eg. THAs) to collect, multiply, manage and harvest locally useful (eg. medicinal, leafy vegetable and fruit tree) plants.					
	Link the on-reserve areas with community conservation and development activities.					
2.4 Establish mechanisms for ensuring equitable distribution of benefits arising from reserve management and biodiversity conservation						
	Obtain agreement among stakeholders of existing management and biodiversity conservation rights and responsibilities					
	Using a negotiable and consultative mechanism, establish modalities for the equitable distributions of various benefits between and within stakeholder groups, taking into account existing rights and responsibilities arising from management plan implementation.					
	Encourage a wide range of fringe community biodiversity conservation and development Activities from which they may obtain benefits.					
2.5 promote alternative livelihood activities to improve income and health within fringe communities						
	Maintain and enhance the practice of involving locally paid labour in reserve protection and other management activities.					
	Assist communities to manage and enhance supplementary income generating activities facilitated by various projects.					
	Assist communities to identify and develop additional viable micro enterprises especially those related to biodiversity conservation and developments eg. Bee keeping, small scale game domestication, medicinal plants and products handicraft.					
	Introduce the cultivation and use of Morringa (M. oleifera) by households as a nutrition and health supplement.					
	Assist fringe community members to take advantage of available facilities for accessing credit and for developing capacity for establishing small scale business enterprises					
	Seek opportunities for linking fringe communities to national and district programme for poverty alleviation, youth employment. etc.					

Project. No.	Description	2007	2008	2009	2010	2011
	3.0 Strengthen the capacity of key stake holders to participate in reserve management and biodiversity conservation					
3.1 Strengthen the community level participating institutions						
	Review the functions of the community Natural Resource Management Committee (CNRMCs) and provide support for their effective functioning.					
	Provide training, funding and other support to all community level Forest Management Committees.					
	Establish mechanisms for maintaining effective linkages between the CNRMCs and FMCs, their community members and other local level organizations, NGOs, etc.					
3.2 Implement a public education and awareness creation programme on biodiversity conservation.						
	Review on-going programmes and implement revised programme.					
	Implement a biodiversity conservation education programme for basic schools in fringe communities with the support of the formal educational authorities.					
	Encourage the formation of environmental clubs in junior/senior high schools in neighbour communities and encourage them to use the Ambalara Forest Reserve as a field laboratory.					
3.3 Provide support to local communities for biodiversity conservation and development activities on and off-reserve.						
	Provide training in tree nursery establishment.					
	Encourage and support nursery establishment for on-reserve and off-reserve activities within appropriate and willing communities.					
	Provide training in techniques for cultivation of woodlots, medicinal plants propagation and sustainable harvesting, etc.					

Project. No.	Description	2007	2008	2009	2010	2011
	4. Pursue activities to attract funding support for the managen reserve.					
4.1 Market the potential and needs of the reserve to local and national agencies						
	Integrate management of the Reserve into the development plan of the Wa District Assembly.					
	Seek sponsorship for public and private corporate bodies for specific management Activities					

Project. No.	Description	2007	2008	2009	2010	2011
	5.0 Encourage and promote studies and research into the resources of the reserve and systems and strategies for their management for biodiversity conservation and sustainable utilisation					
5.1 Identify research needs						
	Determine and categorise management information needs					
	Identify and establish key researchable areas					
	Explore the possibility of establishing Permanent Sample Plots for the study of savannah woodland vegetation dynamics					
5.2 Develop strategies for meeting research needs						
	Identify major research partners and prioritise with them the major areas for study and research					
	Establish MoUs with research partners, outlining among others, conditions for access to the reserve and research sites, collaboration with and capacity building for the management authority, use of research results					
	Encourage partners to seek funding etc within general framework of the MoUs					
	Develop capacity within the management authority for application and dissemination in user friendly form of research results					

Project. No.	Description	2007	2008	2009	2010	2011
	6.0 Maintain the long term environmental services of the reserve, including its contribution to global carbon cycles, local climate amelioration and maintenance of soil and water resources					
6.1 Maintain effectiveness of the reserve as a carbon sink and reduce its contribution to carbon dioxide emission						
	Identify degraded portions of the reserve for rehabilitation					
	Establish community nurseries of recommended species for rehabilitation					
	Plant out and tend seedlings to establish					
	Provide satellite irrigation systems/water points to water planted seedlings					
6.2 Regulate legal removals of biological resources to maintain biomass and carbon pools						
	Establish a permit system for harvesting NTFPs and medicinal plants from the reserve					
	Establish a closing system for hunting					
	Put in place protocols to monitor the removal and use of biological resources especially through grazing					
6.3 Protect areas critical to maintaining regulated flow of streams and reducing soil erosion						
	Identify and map out all sensitive and fragile ecosystems (including perennial streams, wetlands and areas with slopes >30%) within and around the reserve					
	Where appropriate pillar and (or) flag and sign-post all sensitive and fragile areas within the area to create awareness and for educational purposes					
	Raise seedlings of recommended species and plant up all sensitive and fragile areas with the support of fringe communities, NGOs and other stakeholders					
	Liaise with land owners to create a buffer off-reserve and put in place appropriate interventions such as buffer plantings					

PART V: PARTICIPATORY MONITORING & EVALUATION OF MANAGEMENT PRESCRIPTIONS

5.1 Constitute a monitoring team

Considering the peculiarity of the Northern Savannahs the Forestry Commission (FC) should as a matter of urgency reinforce monitoring and surveillance of the implementation of outlined in these plans to ensure sustainable management of the reserves for environmental amelioration and especially the socio-economic benefits of the numerous forest dependent communities.

It is important that the Forestry Commission institute a participatory monitoring programme with the involvement of key stakeholders (e.g fringe communities, District Assemblies, CRMCs, Traditional Authorities, & NGOs, Research Institutions, THAs etc).

5.2 Determine parameters and indicators for monitoring

Indicators for monitoring should be drawn from the M & E Framework of the NSBCP taking into consideration species/habitat change and ecosystem dynamics as well as natural resource use trends and associated social and economic dynamics within the forest fringe communities.

5.3 Feedback

Recommendations of M & E will be incorporated into the management of the reserve and more especially the implementation of current prescriptions.

5.4 Review of management activities and planning process.

The implementation of prescriptions in the Management Plan shall be reviewed annually and the over all effectiveness of the Management Plan reviewed after five years of implementation.

A Management Plan Review Committee shall be constituted with representation from the following institutions, organizations and agencies: FSD, GWS, NSBCP,MOFA, EPA THAs, WD, NGOs, EPA, members from forest fringe communities, CBOs, civil society groups as well as all identifiable organizations)

5.5 Logical Framework for Monitoring and Evaluation

Primary Objective 1.0 Maintain the territorial integrity of the reserve, and protect and appropriately enhance its biological and cultural resources.				
Operational Objectives	**Prescriptions/Actions**	**Means of Verification**	**Responsible Institutions**	**Risks/ Assumptions**
1.1 Establish and implement an effective protection strategy	Keep external boundaries open and clear and restore / replace all broken/defaced boundary pillars.			
	Regularly patrol the reserve and deal with offenders as prescribed by law and locally agreed convention/byelaws			
	Implement a wildfire management strategy that will involve, among others, the prevention, detection, suppression and appropriate use of fires with the participation of key stakeholders			
1.2 Develop and follow a restoration programme to rehabilitate all degraded areas	Map out degraded areas from field reports, satellite imagery and ground surveys.			
	Undertake enrichment planting and micro plantations, using taungya and agroforestry techniques with the involvement of fringe community farmers where appropriate.			
	Encourage natural regeneration in areas by excluding wildfires.			

1.3 Develop and implement a species-habitat management programme.	With the involvement of appropriate partners, undertake studies and surveys to understand Wildlife species and habitat relations within the reserve.			
	Identify and protect habitats critical to maintaining a enhancing populations of key wildlife species, those of global/national interest.			
	Agree with fringe communities to collaboratively implement strategies for the limitation of grazing within reserve.			
	With the support of key stakeholders regulate removal of resources (NTFPs, wildlife animals) fror to maintain populations and diversity.			

Primary Objective 2. Ensure optimum flow of benefits to the reserve owners and fringe communities.

Operational Objectives	**Prescriptions/Actions**	**Means of Verification**	**Responsible Institutions**	**Risks/ Assumptions**
21 Establish structures for negotiation and effective participation in reserve management by and among stakeholder	In consultation with key stakeholders, representation and roles on the overall management and coordination of management activities.			
	Support and resource the community level forest management committees to function effectively.			

	Train stakeholders/stakeholder institutions in negotiating skills and dispute management.			
	Establish a protocol for the formal functioning of the coordinating institutions. (e.g. schedule of/procedures of meetings, etc.)			
22 In collaboration with fringe communities and appropriate formulate and implement guidelines for the harvesting of biological resources from the reserve.	Agree with local communities, a protocol for regulating the collection of NTFPs from the reserve.			
	Using the information available from the faunal survey as a guide, agree with local communities and community group ways of meeting some of their needs for wild animal reserves including bushmeat (eg. through Harvesting quotas) within the requirement for conservation and sustainable utilization.			
	Collaboratively enforce the wildlife laws, especially as they relate to protected species, hunting methods and hunting licenses.			
23 Support and enhanced the conservation of locally beneficial plants/animals species within designated community conservation areas within the reserve.	Establish and collaboratively manage a conservation and resource use area in a compartment close to each fringe community.			
	Within the community conservation and community groups (eg. THAs) to collect, multiply, manage and harvest locally useful (eg. medicinal, leafy vegetable and fruit tree) Plants.			
	Link the on-reserve areas with community conservation and development activities.			

2.5 Establish mechanisms for ensuring equitable distribution arising from reserve management and biodiversity conservation	Obtain agreement among stakeholders of existing management and biodiversity conservation rights and responsibilities			
	Using a negotiable and consultative mechanism, establish modalities for the equitable distributions of various benefits between and within stakeholder groups, taking into account existing rights and responsibilities arising from management plan implementation.			
	Encourage a wide range of fringe community members and biodiversity conservation and development activities from which they may obtain benefits.			
2.6 promote alternative livelihood activities to improve health within fringe communities	Maintain and enhance the practice of involvinglocally paid labour in reserve protection and other management activities.			
	Assist communities to manage and enhance supplementary income generating activities facilitated by various projects.			
	Assist communities to identify and develop additional viable micro enterprises especially those related to biodiversity conservation and developments eg. Bee keeping, small scale game domestication, medicinal plants and products development, handicraft.			

	Introduce the cultivation and use of Morringa (*M. oleifera*) by households as a nutrition and Health supplement.			
	Assist fringe community members to take advantage of available facilities for accessing credit and for developing capacity for establishing and managing small scale business enterprises			
	Seek opportunities for linking fringe communities to national and district programme for poverty alleviation, youth employment. etc.			

3.0 Strengthen the capacity of key stake holders to participate in reserve management and biodiversity conservation				
Operational Objectives	**Prescriptions/Actions**	**Means of Verification**	**Responsible Institutions**	**Risks/ Assumptions**
3.1Strengthen the community level participating institutions	Review the functions of the community Natural Resource Management Committee (CNRMCs) and provide support for their effective functioning.			
	Provide training, funding and other support to all community level Forest Management Committees.			

	Establish mechanisms for maintaining effective linkages between the CNRMCs and FMCs, their community members and other local level organizations, NGOs, etc.			
3.2 Implement a public education and awareness creation programme on biodiversity conservation.	Review on-going programmes and implem Revised programme.			
	Implement a biodiversity conservation education programme for basic schools in fringe communities with the support of the formal educational authorities.			
	Encourage the formation of environmental clubs in junior/senior high schools in neighbouring communities and encourage them to use the Ambalara Forest Reserve as a field laboratory.			
3.3Provide support to local communities for biodiversity conservation and development activities on and off-reserve.	Provide training in tree nursery establishment.			
	Encourage and support nursery establishment for on-reserve and off-reserve activities within appropriate communities.			
	Provide training in techniques for cultivation of woodlots, medicinal plants propagation and sustainable harvesting, etc.			

Primary Objective 4.0 Pursue activities to attract funding support for the management of the reserve				
Operational Objectives	**Prescriptions/Actions**	**Means of Verification**	**Responsible Institutions**	**Risks/ Assumptions**
4.1 Market the potential and needs of the reserve to local and national agencies	Integrate management of the Reserve into the development plan of the Wa District Assembly.			
	Seek sponsorship for public and private & corporate bodies for specific management Activities			

Primary Objective 5.0 Encourage and promote studies and research into the resources of the reserve and systems and strategies for their management for biodiversity conservation and sustainable utilisation				
Operational Objectives	**Prescriptions/Actions**	**Means of Verification**	**Responsible Institutions**	**Risks/ Assumptions**
5.1 Identify research needs	Determine and categorise management information needs			
	Identify and establish key researchable areas			
	Explore the possibility of establishing Permanent Sample Plots for the study of savannah woodland vegetation dynamics			
5.2 Develop strategies for meeting research	Identify major research partners and prioritise with them the major areas for study and research			

needs	Establish MoUs with research partners, outlining among others, conditions for access to the reserve and research sites, collaboration with and capacity building for the management authority, use of research results			
	Encourage partners to seek funding etc within general framework of the MoUs			
	Develop capacity within the management authority for application and dissemination in user friendly form of research results			

Primary Objective 6.0 Maintain the long term environmental services of the reserve, including its contribution to global carbon [illegible] exploration and maintenance of soil and water resources

Operational Objectives	Prescriptions/Actions	Means of Verification	Responsible Institutions	Risks/ Assumptions
6.1Maintain effectiveness of the reserve as a carbon sink and reduce its contribution to carbon dioxide emission	Identify degraded portions of the reserve for rehabilitation			
	Establish community nurseries of recommended species for rehabilitation			
	Plant out and tend seedlings to establish			

	Provide satellite irrigation systems/water points to water planted seedlings			
6.2 Regulate legal removals of biological resources to maintain biomass and carbon pools	Establish a permit system for harvesting NTFPs and medicinal plants from the reserve			
	Establish a closing system for hunting			
	Put in place protocols to monitor the removal and use of biological resources especially through grazing			
6.3 Protect areas critical to [illegible] regulated flow of streams and reducing soil erosion	Identify and map out all sensitive and fragile ecosystems (including perennial streams, wetlands and areas with slopes >30%) within and around the reserve			
	Where appropriate pillar and (or) flag and sign-post all sensitive and fragile areas within the area to create awareness and for educational purposes			
	Raise seedlings of recommended species and plant up all sensitive and fragile areas with the support of fringe communities, NGOs and other stakeholders			
	Liaise with land owners to create a buffer off-reserve and put in place appropriate interventions such as buffer plantings			

Appendix 1: List of Flora Sp[illegible] in th[illegible] balara Forest Reserve

ACANTHACEAE
Asystasia gangetica T. Anders

{Vernacular name: DABGANI: N'chemlun}
Herb or perennial semi-woody plan[illegible] up to a metre high.

Hygrophila borellii J.K. Morton
Herb

Hygrophila senegalensis T. Anders
Herb, erect; of savanna swamps and other wet places.

Lepidagathis laguroides T. Anders
Herb, coarse and woody.

Monechma buttneri Lindau
Herb

Nelsonia canescens (Lam.) Spreng
A decumbent herb, softly pubescent, in shaded places, often along streams.

ALISMATACEAE

Burnatia enneandra Micheli
An aquatic herb, growing from rhimatous rootstock.

Limnophyton angolensis Buchen
Aquatic herb.

Sagittaria guayanensis Kunth.
Aquatic herb with floating leaves, small rootstock.

AMARANTHACEAE

Celosia trigyna Linn.
Annual herb, very variable, decumbent and sprawling or erect and scandent; open areas only

AMARYLIDACEAE

Crinum glaucum A. Chev.
Herb with bulbs and thick, stiff glaucous leaves; flowers, pure white.

Pancratium trianthum
Herb with bulbs, gregarious; flower white.

Pancratium tenuifolium Hoschst
(= P. hirtum)
Herb with bulbs; flowers white, opens during the night, scented.

Scadoxus multiflorus (Martyn)Raf.
A fleshy herb with large bulbs, appearing during the raining season.

ANACARDIACEAE

Haematostaphis barteri Hook.f.
Tree, to 25ft high with glaucaus foliage; leaves and pendulous panicles of creamy flowers crowded at ends of branchlets; young parts red; fruits plum-like, smooth, deep red, edible; mostly on rocky places

Lannea acida A. Rich
Tree up to 18ft high, with blackish, fissured bark; young parts with pinkish floccose indumentum; often in rocky hills.

Lannea velutina A. Rich.
Tree up to 20ft high; flowers yellow.

Sclerocaya birrea (A. Rich.) Hochst.
Tree up to 40ft. high, with grey fissured bark, stout branchlets and pale foliage; flowers greenish-white or reddish; fruits yellow, thick-skinned, resembling small mangoes.

ANNONACEAE

Annona glauca Schum. & Thonn.
Shrub up to 5ft high; fruits smooth yellow when ripe; edible.

Annona senegalensis Pers.
Shrub or small tree; fruits smooth yellow when ripe; edible.

Hexalobus monopetalus
Small tree

APOCYNACEAE

Saba comorensis
Liana, often on banks of strems

Strophanthus hispidus DC
Liana
Strophanthus samentosus DC
Liana, or scandent shrub with glabrous foliage.

ARACEAE

Amorphallus dracontiodes N.E. Br.

Fleshy stemless plant with leaves arising from a tuber, spathe with variegated colour appearing before the leaves; common in seasonally wet places

Anchomanes welwitschii Rendle
Large herb with stout prickly stem.

Culcasia saxatilis A. Chev.
Erect, profusely branched herb, favouring riverine sites.

Stylochiton barteri N.E. Br.
Small herbaceous plant with short rootstock.

ARALIACEAE

Cussonia barteri Seemann
Tree with tortuous truck, very thick corky bark; completely defoliated during dry season.

ASCLEPIADACEAE

Aspidoglossum interruptum (E. Mey)Bullock
Annual herb from a woody rootstock

Brachystelma constrictum
Erect perennial herb

Caralluma dalziellii N.E. Br.
A succulent perennial, erect sparsely branched, with quadrangular branches.

Kanahia laniflora (Forsk.)R. Br.
Woody erect shrub, often along seasonal streams.

Oxystelma bornouense R. Br.
Climber,commonly riverine.

Pachycarpus lineolata (Dec'ne)Bullock
Erect, simple stemmed perennial.

ASTERACEAE (COMPOSITAE)

Vernonia colorata
Shrub, 3m tall, with white flowers

Vernonia perrottetii
Erect herb with linear leaves.

Vernonia purpurea
Erect shrub with purplish capitula

BALANITACEAE (ZYGOPHYLLACEAE)

Balanites agyptiaca (Linn.)Del.
Tree, variable, with pendulous fruit; favouring wet places.

Tribulus terretris L.
A trailing herb, woody below, more or less pubescent.

BIGNONIACEAE

Kigelia africana (Lam.)Benth.
Tree, variable, with pendulous fruit, favouring wet places.

Sterospermum kunthianum Cham.
Tree; rare straight trunk and cooked branches, inflorescence pink or purplish.

BOMBACACEAE

Adansonia digitata Linn.
Tree with enormous squat trunk

Bombax costatum Pellegr. & Vuillet
Tree with straight trunk, slightly thickened at base, thick corky bark, spiny when young.

BORAGINACEAE

Heliotropium indicum Linn.
Herb

CAPANULACEAE

Cephalostigma perrottetii
Erect annual herb; common in cultivated fields.

Lightfootia hirsuta
Small heavily branched annual herb; common in cultivated fields.

CAPPARIDACEAE

Boscia cf salicifolia Oliv.
Tree, about 10 tall; leaves elongate – lanceolate or linear, very acute at base, up to 12 cm long and 1 – 1.5cm wide.

Cadaba farinosa Forsk.
Shrub, usually branching from the base.

Capparis erythrocarpos Isert
Shrub, thorny and heavily branched with recurved hooks, usually scandent.

Cleome viscosa Linn.
Erect herb of waste places with viscous foliage.

Ritchiea reflexa (Thonn.)Gilg. &Benedict
Scrambling or erect shrub; often in abandoned farms.

CELASTRACEAE

Hippocratea africana (Willd.)Loes. ex Engl.
Liane with green twigs and bright green leavesl flowers fragrant. Very variable species.

Maytenus senegalensis (Lam.)Exell.
Shrub or small tree; young shoots often red; flowers whitish; fruit red.

CHRYSOBALANACEAE

Parinari curatellifolia Planch.
Tree, often stunted, bole and branches twisted.

Maranthes polyandra (Bent.)Prance
(= Parinari polyandra)
Tree with twisted bole.

COCHLOSPERMACEAE

Cochlospermum planchonii Hook.f.
Shrub with bright yellow flowers, appearing during the rainy season.

Cochlospermum tinctorium A. Rich.
Small shrubby plant with annual shoots arising from a perennial rootstock; flowers in dry season.

COMBRETACEAE

Anogeissus leiocarpus (DC.)Guill. & Perr.
Tree with straight tapering bole.

Combretum aculeatum Vent
Shrub, sometimes riverine.

Combretum collinum
Scandent shrub, very variable. Subspecies have been described.

Combretum ghaselense

Combretum molle R. Br. ex G. Don
Small tree or shrub with straight regular bole

Combretum nigricans Lepr.
Small tree with smooth bark, often with twisted bole.

Combretum paniculatum

Combretum sericeum G. Don
Small tree with erect shoots from a perennial woody, creeping rootstock.

Pteleopsis suberosa Engl. & Diels
Small tree or shrub

Quisqualis indica Linn.
Scandent shrub

Terminalia avicennoides Guill. & Perr.
Small tree with short bole, sometimes bushy from base.

Terminalia laxiflora Engl.
Tree, short, bole usually crooked with dark grey, deeply fissured scaly bark

Terminalia macroptera Guill. & Perr.
Tree, short bole, thick black, deeply fissured bark.

Terminalia mollis Laws.
Tree, short low branching, crooked bole with rough corky bark.

COMMELINACEAE

Commelina benghalensis Linn.
Herb, prostrate or scrambling. Several varieties exist..

CONNARACEAE

Rourea coccinea (Thonn. ex Schum.)Benth.
(= Bysocarpus coccineus)
Shrub or climber, often deciduous, flowers white, mature fruits red with yellow aril and black seed; in thickets.

CONVOLVULACEAE

Evolvulus alsinoides Linn.
Herb, bushy, of open dry waste places with numerous small sky-blue flowers.

Evolvulus nummularius (Linn.)Linn
Herb, perennial prostrate herb, often of waste places

Ipomoea asarifolia
Long trailing herbaceous perennial vine of sandy areas and waste places

Ipomoea aquatica Forsk
Aquatic trailing or floating vine, usually perennial.

Jaquemontia tamnifolia (Linn.)Griseb
Slender annual twiner

Lepistemon owariense
Twiner, robust perennial

Merremia hederacea
Slender prostrate or twining herb

CRASSULACEAE

Kalanchoe lanceolata
Succulent herb with yellow-pink flowers.

CURCUBITACEAE

Cucumis melo
Herbaceous annual climbing or trailing herb

Momordica cissoides Planch.
Climbing or trailing herb

Mukia maderaspatana (Linn.)M.J. Roem
Annual scandent or trailing herb

Trochomeria macrocarpa (Sond.)Hook.f.
Herbaceous annual liane from perennial fleshy, tuberous rootstock.

CYPERACEAE

Afrotrilepis pilosa (Boeck.)J. Rayal
Tussocky sedge with dark persistent bases; growing in damp pockets on rocks.

Ascolepis capensis (Kunth.)Ridley
Sedge common in wet places

Ascolepis protea Welw.
Sedge on rocky places

Cyperus alternifolius
Sedge

Cyperus ambilis Vahl
Tufted annual sedge

Fimbristylis alboviridis C.B. Cl
Sedge, tufted; very variable habit

Fuirena stricta Steaud.
Sedge, slender, tufted plant; of swamps and rice fields.

Kyllinga bulbosa P. Beauv.

Mariscus alternifolius Vahl.
Sedge, tufted rhizomatous with closely packed swollen culm-bases, common in damp grassy places.

Mariscus luridus C.B. Cl.
Sedge, slender with crowded red or brown spikelets; on riverbanks

Mariscus squarrosus (Linn.)C.B. Cl.
Annual sedge, of open grounds.

Pycreus acuticarinatus (Kuck.) Cherm.
Sedge. Growing in tuftes from a stout blackish rhizome; of wet grassland.

Scirpus isolepis (Nees)Boeck
Sedge, small densely tufted, with narrow wiry leaves at the base.

Scleria bulbifera Hochst. ex A. Rich
Sedge, perennial; stem base forming a small tuberous swelling.

Scleria depressa (C.B. Cl)Nelmes
Sedge, robust perennial, leaves sharply edged; of swamps.

DICHAPETALACEAE

Dichapetalum madagascariense Poir
Shrub or small tree, common in Ghana. Breteler, (1973, 1978, 1979) has joined the West African tree (D. guinense) with various trees and lianes in the widespread D. madagascariense. Occurs as a pioneer in South East Outlier forest (Swaine et al.1990), but common as an understorey in Semi-deciduous forests.

DIOSCOREACEAE

Dioscorea abbyssinica
Climber, non-spiny, twining.

Dioscorea dumentorum Pax
Climber, twining, from shallow-seated annual tubers in cluster; spiny stem.

Dioscorea lecardii De Willd.
Climber, unarmed, twining from deeply rooted tuber protected by spiny roots.

DIPTEROCARPACEAE

Monotes kerstingii
Shrub or small tree; locally abundant.

EBENACEAE

Diospyros elliotii (Hiern)F. White
Small tree pink stemmed.

Diospyros mespiliformis Hochst. ex ??
Tree, tall with straight bole and dark-coloured bark.

Diospyros monbuttensis Gurke
Small tree or shrub, rarely straight, stems with yellowish-brown scales.

EUPHORBIACEAE

Acalypha sp
Annual herb; weed of cultivated fields.

Bridelia ferruginea Benth.
Tree with crooked bole.

Chrozophora senegalensis (Lam.)A. Juss. ex Spreng.
Shrub, sometimes prostrate; in seasonally flooded plains and riverbanks.

Croton lobatus Linn.
Annual herb; woody at base.

Croton pseudopulchellus Pax
Shrub of rocky hilly places; leaves with shinning silvery undersurface.

Euphorbia aegyptiaca Boiss
Prostrate herb on riverbanks and other sandy places.

Euphorbia baga A. Chev.
Perennial herb with short erect undergroung or partly exposed stems from stout woody rootsock.

Euphorbia balsamifera Aiton
Erect shrub, branches succulent and and glabrous, heavily branched from base; commonly used as hedge.

Euphorbia convolvuloides Hotchst. Ex. Benth.
Erect herb of waste places

Euphorbia thymifolia Linn.
Annual spreading, prostrate herb.

Hymenocardia acida Tul.
Small tree or shrub, twisted stem, with characteristic rough rusty-red bark.

Margaritaria discoidea (Baill.)Webster
Tree with spreading crown, bole clear and unbuttressed..

Phyllanthus amarus Schum. & Thonn.
A glabrous herb; weed of cultivation.

Phyllanthus capillaris Schum. & Thonn.
Small shrub, with slender stems; flowers white; on rocks and by streams.

Phyllanthus fraternus Webster
Herbaceous weed.

Phyllanthus maderaspatensis Linn.
Herb or woody undershrub; weed of cultivation.
Phyllanthus pentandrous Schum. et Thonn.
Woody herb

Phyllanthus reticulatus Poir
Shrub

Sapium grahamii (Stapf.)Prain
Semi-woody herb, (suffrutex) arising from creeping rootstock, with milky juice.

Securinega virosa (Roxb. Ex Willd.)Baill.
Shrub with numerous branches arising from base and spirally arranged upwards

Tragia akwapimensis Prain
Herbaceous trailing plant with stinging hairs.

Tragia benthamii Bak.
Herbaceous trailing plant with stinging hairs.

FICOIDACEAE (AIZOACEAE)

Trianthema portulacastrum Linn.
Prostrate herb

FLACOURTIACEAE

Dovyalis zenkeri Gilg.
(=D. afzelii)
Shrub or small tree.

Flacourtia flavescens Willd.
Shrub, favouring rocky places

Oncoba spinosa Forsk
Thorny shrub or small tree, heavily branched

GRAMINAE (POACEAE)

Andropogon fastigiatus Sw
Annual; in shaloow and sandy soils and old farmlands.

Andropogon gayanus var. gayanus
A tall perennial; in seasonal swamps and flooded plains.

Axonopus flexuosus (Peter)CE Hubbard ex. Troupin
A robust stoloniferous perennial; common in swampy places.

Bothriochloa bladhii (Retz)S.T. Blake
Tufted perennial grass.

Chrysochloa hindsii CE Hubbard
Stoloniferous annual grass, culms very variable; in seasonally flooded sites.

Chrysopogon aciculatus (Retz)Trin.
Perennial sward-forming grass, with prostrate stems, nodal rooting, short erect culms.

Coix lacryma-jobi Linn.
Coarse, erect, annual grass; of stream banks amd moist places.

Cymbopogon giganteus Chiov.
Losely tufted perennial grass; culms erect, sometimes stilt-rooted.

Cymbopogon proximus
A coarse erect aromatic bunchgrass

Dactyloctenium aegyptium (Linn.) P. Beauv.
Loosely tufted or stoloniferous annual grass; prostrate or ascending.

Diheteropogon amplectens (Nees) WD Clayton
Perennial grass, short rhizome bearing culms.

Diheteropogon hagerupii Hitchc.
Annual grass; of dry or gravelly sites.

Eleusine indica (Linn.)Gaertn.
Tufted annual grass

Heteropogon contortus (Linn.)P. Beauv.
An untidy tufted perennial grass; spikelets with awns.

Imperata cylindrica (Linn.)Raeuschel
A vigorous rhizomatous perennial grass basally tufted.

Loudetia annua (Stapf.)CE Hubbard
An annual grass, culms erect; of ditches and other humid places

Loudetia arundinacea (Hochst.)Steud.
Robust tufted perennial grass

Rhynchelytrum repens
Annual or short-lived perennial grass.

Rottboellia exaltata
Annual grass of variable height, stilt-rooted at base.

Setaria longiseta P. Beauv.
A loosely tufted perennial grass of shady places

Sorghastrum bipennatum (Linn.) P.Beauv.
A weak-stemmed annual grass with bunched culms; in damp soils.

Sorghum arundinaceum (Desv.)Stapf.
A tufted annual grass or biennials, very variable morphology

GUTTIFERAE (HYPERICACEAE)

Psorospermum corymbiferum
Shrub or small tree. Varieties have been described.

ICACINACEAE

Icacina senegalensis Juss, A.
Suffrutex with pubescent or glabrous leafy shoots growing from large fleshy tuber with long roots.

Rhaphiostylis beninensis Planch.
Climbing shrub

IRIDACEAE

Gladiolus dalenii Van. Gel
Erect robust herb with sword-like leaves, growing from a woody corm; of rocky places.

Gladiolus gregarious Welw. Ex. Baker
Slender perennial herb with erect leaves and inflorescence growing from woody corm; of moist places.

LAMIACEAE (LABIATAE).

Hoslundia opposita Vahl.
Erect or scrambling shrub; common on old cultivated fields.

Hyptis lanceolata Poir
Herb, erect, aromatic, much-branched; of damp sites and roadsides.

Hyptis suaveolens Poit
Herb, stout strongly aromatic, flowers blue; of waste and cultivated places.

Ocimum canum Sims
Annual aromaticherb

Solenonostymon latifolius (Hochst.) J.K. Morton
Erect, rarely creeping annual herb with terminal violet inflorescence.

Tinnea barteri Gurke
Erect semi-woody herb with terminal spike of purple flowers.

LEGUMINOSAE: CAESALPINOIDEAE

Afzelia africana Sm.
Large tree

Burkea africana Hook
Tree with clean straight bole and ascending branches.

Chamaecrista mimosoides (Linn.)Greene
(= Cassia mimosoides Linn.)
Herb, very polymorphic.

Chamaecrista rodundifolia (Perse)Greene
(=Cassia rotundifolia)
Protrate herb.

Daniellia oliveri (Rolfe)Hutch. & Dalz.
Tree, unbuttressed, but with root fluting at base.

Detarium microcarpum Guill. & Perr.
Tree with twisted bole and spreading crooked branches

Detarium senegalense J.F. Gmelin
Tree, relatively unbutressed bole.

Erythrophloem africanum (Welw. ex Benth.)Harms
Tree with straight trunk and spreading crown.

Mezoneuron benthamianum Baill.
Woody spiny climber

Parkinsonia aculeata Linn.
Spiny shrub with conspicuous yellow flowers.

Piliostigma reticulatum (DC)Hochst.
(= Bauhinia thonningii)
Tree, with short bole, bearing dense evergreen crown

Piliostigma thonningii (Schum.)Milne-Redhead
Scrambling shrub, sometimes a tree, with short twisted bole and branches.

Tamarindus indica Linn.
Tree, stout bole, low-branching with dense, dark evergreen crown.

LEGUMINOSAE: MIMOSOIDEAE

Acacia gourmaensis A. Chev.
Shrub or small tree; branches numerous with hook-like spines.

Acacia hockii De Willd.
Tree, sparsely branched.

Acacia nilotica (Linn.)Willd.
Tree, short bole, low-branching and densely domed crown; of damp sites and riverbanks.

Acacia senegal (Linn.)Willd.
Low-branched shrub or small tree, short bole and grey fissured bark with many thorny branches.

Acacia seyal Del.
Shrub or small tree, spreading branches

Acacia sieberiana DC
Tree, straight bole, branches with short massive long spines.

Dichrostachys cinerea)Linn.)Wight & Arn.
(= D. glomerata (Forssk.)Chiov.
Shrub, short, sometimes twisted, spiny, low-branching forming thickets.

Entanda abyssinica Steaud. ex Rich.
Tree, low-branching, spreading crown leafless in dry season.

Etandra africana Guill. & Perr.
Small tree, low-branching, wide crown deciduous.

Mimosa pigra Linn.
Scrambler with strongly prickled stems, foliage sensitive

Parkia biglobosa (Jacq.)R. Br. ex Don
Tree, not buttressed, low-branching, large wode-spreading crown, flowering while leafless, pendulous capitate flowers, long fruit pods.

Prosopis Africana Tree

LEGUMINOSAE: PAPILIONOIDEAE

Abrus precatorius Linn.
A twining herbaceous plant thickets in swamps.

Aeschynomene indica Linn.
Undershrub in grassy swamps

Alysicarpus glumaceus (Vahl) DC
Shrubby annual of grassy places.

Cajanus kerstingii Harms
A shrub, much branched.

Centrosema plumieri

Crotalaria retusa Linn.
Herbaceous, semi-woody plant in waste palces.

Dalbergia afzeliana G. Don
Liana. Not spiny when older, but otherwise confused with D. hodtilis and D. cf. pachycarpa when young.

Dalbergia hostilis Benth.
Straggling, climbing or erect shrub or small tree.

Desmodium gangeticum (Linn.)DC
Woody herbaceous plant.

Eriosema laurentii De Willd.
Herbaceous ro semi-woody undershrub of moist places. Previously included in E. glomerata.

Erythrina senegalensis DC
Tree, trunk with corky bark bearing reurved prickles.

Galactia tenuiflora (Willd.)Wight & Arn.

Lonchocarpus laxiflorus
Small tree with pink or bluish purple decorative flowers.

Mucuna poggei Taub.
Large liane; of sub-montane grassland.

Pericopsis laxiflora (Benth.)Meeuwen
Small to medium-sized tree, bearing crooked, drooping branches..

Pterocarpus erinaceus Poiret
Tree, slightly buttressed with straggling branches

Uraria picta (Jacq.)Bak.
A woody herb, with single fibrous stems.

Vigna multinervis Hutch. & Dalz.
Perennial herb, climbing or trailing slender stems.

Vigna radiata (Linn.)Wilczek
Erect or semi-erect annual with a slight twinning tendency.

Zornia glochidiata Reich. Ex DC
Annual herb, branching or straggling.

LILIACEAE

Aloe buettneri A. Berg
Perennial herb with rosette of fleshy leaves; margin sharply.

Aloe macrocarpa
Perennial herb with rosette of fleshy leaves, margin sharply toothed; among rocks in upland locations.

Asparagus flagellaris (Kunth) Bak
Scandent plant with arching spiny branchlets; in thickets and woodlands.

Chlorophytum blepharophyllum Sch. ex. Bak
Herb with pale-brown flowers; of stony moist places.

Gloriosa simplex Linn.
Climbing herb

LOGANIACEAE

Strychnos innocua
Shrub or small tree, often much-branched, fruits globose.

Strychnos spinosa
Small tree or shrub with recurved prickles, sometimes fluted, with globose, orange-size fruits.

LORANTHACEAE

Tapinanthus dodeneifolius (DC) Danser
Epiphytic parasite; leaves opposite or alternate. Very variable.

Tapinanthus farmari (Sprague) Danser
Epiphytic parasite; perianth rose-red with blood-red ring just below base of lobes outside.

MALVACEAE

Hibiscus asper Hook.f.
Erect fibrous herb, often red-tinged in parts and armed with small spine-tipped tubecles, flowers yellow with purple centre.

Hibiscus micranthus Linn.f.
Undershrub, with stiff, straight, scabrid branches; stipules almost spiny; flowers small.

Sida acuta L.
A woody herb perennial; much-branched; flowers pale yellow.

Sida linifolia Juss
A stiff erect more or less hairy weed; flowers white, sometimes pink; petals red-purple at the base.

Urena lobata Linn.
Woody herb or shrubby; flowers rose-pink or yellow; variables forms exist.

Wissadula amplissima
Erect herb; leaves hoary beneath; flowers yellow or orange to reddish.

MELIACEAE

Khaya senegalensis
Tree with shining foliage, up to 100ft. high, with wide dense crown and thick stem; sepals pale green; petal and stamina tube cream; fruits 4-valved.

Pseudocedrella kotchyi
Tree, 20 –30ft. high, bark grey, fisurred; panicles of fragrant white flowers; foliage grey-silvery when young; fruits erect; often gregarious on heavy soils.

Trichilia emetica
Tree up to 30ft high, with fissured corky bark; flowers pale green except for fawn anthers, ripe fruits crimson.

MORACEAE
Ficus abutilifolia
Tree, to 50ft. or more high; on rocky hills.

Ficus platyphylla
Tree, large, with rusty or pinkish-brown bark and large grey scally patches; foliage and figs often tinged pink; often epiphytic at first.

Ficus sur Forssk.
(= Ficus capensis Thunb.)
Small tree; very variable, with figs bone in abundant clusters on trunk; branchelets or softly pubescent.

Ficus gnaphalocarpa (Miq.)Steud. ex Rich.
Tree, with pale trunk and widespreading crown; pilose branchlets and scabrid leaves; generally by streams.
MYRTACEAE
Eugenia subherbacea A. Chev.
Shrub with annual stems after burning; flowers fairly large, white fragrant; fruit succulent
NYCTAGINACEAE
Boerhavia diffusa
Annual herb.

OPILIACEAE
Opilia celtidifolia (Guill. & Perr.)Endlv. ex. Walp.
Woody climber; sometimes semi-erect with straight branches; flowers small, greenish-white; fruits ovoid ripening yellow.
PEDALIACEAE

Sesamum alatum Thonning
Herb, erect with sulcate 4-angled stems finely glandular when young; flowers pink or bright red with spotted throat.

Sesamum radiatum Schum. & Thonn.
Herb, erect with glandular hairs and unpleasant smell; flowers purplish-pink.
POLYGALACEAE

Securidaca longipedunculata Fres.
Shrub or small tree up to 5m high, with pale bark; leaves broadly elliptic, rounded at tip; flower purple, fragrant; fruit winged, about 5cm. long.

POLYGONACEAE
Polygonum senegalensis Meisn.
Perennial, erect or semi-decumbent, 1-3m high, in riverbeds, swamps etc.; flowers pink and white.
RHAMNACEAE
Ziziphus mauritiana Lam. (Chs)
Tree or shrub; flowers cream; fruits reddish-brown; edible.

RUBIACEAE

Borreria radiata DC.
Erect hispid herb, half-woody below, stems often reddish-purple, about 1 ft. high with leaves radiating from congested terminal heads; flowers white or mauve,

Borreria scabra (Schum. & Thonn.)K. Schum.
Erect herb with or without braches, scabrid and coarsely pubescent, about 1ft. high; flowers white, sometimes pink.
Chassalia sp

Crossopteryx febrifuga Fenzl.
Tree or shrub up to 30ft ft. high with scaly bark; variable in leaf-shape and indumentum; flowers creamy-white, sickly scented; fruits blackish.

Feretia apodanthera Del.
A bushy shrub, up to 15ft high, with sweetly scented flowers abundant on short lateral shoots usually appearing before the leaves.

Gardenia aqualla Stapf. & Hutch.
Shrub, to 9ft high; flowers yellow, fragrant.

Gardenia ternifolia Schum. & Thonn.
Shrub, 5-15ft. high; flowers fragrant, white opening at night, turning yellow next day; fruits fibrous, grey-green, long persistent.

Mitracarpus scaber Zucc.
Annual herbs, half-woody at base, erect, with terete branches; flowers white.

Mitragyna inermis (Willd.)Korth.
Low-branching tree 20 - 40ft. high with scaly bark; flower heads white; usually on wet heavy clay.

Nauclea latifolia Sm.
Straggling shrub or small tree about 10ft. high; flowers white fragrant; fruits reddish.

Oldelandia corymbosa Linn.
Erect and diffusely branched herb, nearly glabrous, up to 1ft. or more high; flowers white or mauve; a weed of cultivated fields.

Pavetta crassipes K. Schum.
Shrub, glabrous, with stout squarish branchlets covered with pale corky bark which splits and falls off; leaves often in threes; flowers greenish-white, fruits black.

Polyspharia arbuscula K. Schum.
Shrub or small tree, up to 12ft. high; flowers cream, sweet-scented; ripe fruits red.
RUTACEAE
Afraegle paniculata
Tree up to 50ft. high, with grey-green branchlets, white fragrant flowers and hard-shelled orange-like fruits 2-4ins. in diameter.

Zanthoxylum xanthoxyloides
Tree up to 40ft. high, with shinning aromatic foliage and bark; branchlets and leaf-rchis armed with sharp recurved prickles; flowers cream-white.
SAMYDACEAE
Dissomeria crenata
Small tree up to 40ft. high; mainly along streamsides; flowers white.

SAPINDACEAE
Allophyllus africanus
Shrub, sometimes small tree, about 5m tall; flowers cream-white, ripe fruits red.

Allophyllus spicatus (Poir.)Radlk.
Shrub with pendulous inflorescence; calyx green, petals white; ripe fruits red; in rocky places and along streams.

Blighia sapida Koning
Tree, up to 25m high, with spreading crown and ribbed branchelets; flowers greenish-white, fragrant; capsules bright red when ripe, opening to expose 3 shining black oblong seeds, each with yellow or whitish arils; native in forest outliers in the savanna regions.

Cardiospermum glandiflorum Swartz.
Herbaceous climber with creamy-white fragrant flowers, a pair of tendrils at the apex of the inflorescence and more or less 3-angled bladdery fruits.

Cardiospermum halicacabum Linn.
A slender climber with a pair of tendrils at the apex of the inflorescence with clustered more or less 3-angled fruits.

Paulina pinnata Linn.
Woody or semi-woody climber with tendrils; fruits red-capsular; more or less 3-angled.
SAPOTACEAE
Vittelaria alnifolia (Baker)Roberty
(Malacantha alnifolia)
Small tree or shrub with scaly bark; flowers in clusters, dense in leaf axils of fallen leaves.

Vittelaria paradoxa subsp. paradoxa
(Butyrospermum paradoxum)
Tree with tufted leaves; bark cracking in squares; flowers white.
SCROPHULARIACEAE
coparia dulcis Linn.
Erect shrubby weed; flowers white or bluish, usally 4 petals, densely bearded inside.

Striga hermanotheca (Del.) Benth.
Erect semi-parasite herb about 0.5m high; flowers bright pink.

Striga linearifolia (Schum. & Thonn.) Hepper
Erect herb, simple or little-brached from the base, stems ribbed or square 0.3m high; flowers pale pink, pale, lilac or white in rather dense spikes; in moist areas.
SIMAROUBACEAE
Hannoa undulata Planch.
Tree with grey corky bark; deeply furrowed; ripe fruits black.
SOLANACEAE
Datura metel Linn.
Erect-brached herbaceous undershrub, about 1m high, with white or wine-purple flowers.
SPHENOCLEACEAE
Sphenoclea zeylanica
Succulent herb with spongy stems; flowers white in congested spikes; in marshy areas.
STERCULIACEAE

Sterculia setigera
Tree up to 40ft. high, deciduous, bark rough, young branches softly tomentose; flowers dull red or yellowish-green with red streaks; fruiting carpels usually 4-5.

Waltheria indica
Erect herb or shrub to 7ft. high; leaves ovate to lanceolate, rounded or subcordate at base; stem and undersurface leaves densely stellate-tomentose; petals yellow turniong orange or brown with age.
ILIACEAE
Corchorus olitorius
Herb, more or less glabrous, often woody at base,
Leaves lanceolate or ovate-lanceolate; flowers yellow; capsule 5-valved, abruptly narrowed to the apex.

Grewia carpinifolia
Scrambling shrub to 15ft. high; leaves oblong-ovate to oblong-obovate, very laxly and minutely pubescent beneath; flowers golden-yellow, sweet scented; fruits yellow.

Grewia cissoides
Shrub, subherbaceuos after burning, with wrinkled leaves and yellow flowers.

Grewia mollis
Small tree or shrub; up to 20ft. high; leaves pale greenish-white beneath; flowers yellow; fruits black when ripe.
ULMACEAE

Trema orientalis
Tree to 40ft. high; mainly in regrowth vegetation; leaves distichous, ovate rounded or subtruncate; flowers opolygamous, glomerate in leaf axils.

VERBERNACEAE
Clerodendron alatum Gurke
Erect sub-herbaceous plant; flowers blue-purple with the upper corolla lobes white; inflorescence a thyrsoid panicle.

Clerodendron capitatum Schum. & Thonn.
Erect or scrambling shrub with long petiolar thorns and white flowers in globose terminal heads.

Lantana trifolia Linn. (cross-checked with L. rhodescensis Moldenke)
A woody herb of open grassland, leaves in three or occasionally opposite; penduncles short; flowers minute usually mangenta or purple; fruits crimson or purple.

Starchytapheta indica Linn. & Vahl.
Herb, simple or slightly branched, often rather succulent; flowers pale blue with or without a white centre; in moist places.

Vitex chrysocarpa Planch. ex Benth.
Small spreading tree; indumentum pale yellow, flowers violet in penduncled cymes; mostly on banks of rivers.

Vitex doniana Sweet
Tree with glabrous branches and 5-foliate, coriaceous leaves.
VITACEAE
Ampelocissus grantii (Bak.)Planch.
Climbing or trailing herb from perennial rootstock; flowers yellow; often among rocks.

Ampelocissus leonensis (Hook.f.)Planch.
Climber with stout but scarcely woody stems, pubescent and with purple gland-tipped setae; flowers green, ripe fruits purple.

Ampelocissus multistriata (Bak.)Planch
Large herbaceous climber with glabrous striate stems; inflorescence crowded, reddish, fruits smooth, grape-like.

Cissus adenocaulis Stead ex. A. Rich
Fleshy herbaceous climber with striate stems; flowers reddeish; fruits glabrous, purplish or balck.

Cissus cornifolia (Bak.)Planch
Herbaceous plant with woody base and erect or suberect annual shoots appearing after fires; flowers greenish appearing on leafless shoots; fruits black-purple.

Cissus corylifolia (Bak.)Planch
Erect herb, stems thick and succulent, from a stout rootstock; calyx green in bud, becoming purple, petals yellow.

Cissus flavicans (Bak.)Planch.
Perennial herb, with stout underground stock sending up stout annually branched stems covered with glandular hairs; fruits and leaflet margins purplish-red; open flowers cream; whole plant sticky.

Cissus palmatifida (Bak.) Planch.
Trailing or climbing plant, with suberect stems at first, often purple-tinged; flowers yellow; ripe fruits black.

Cissus rufescens Guill & Perr.

Perennial herb with underground stock and prostrate creeping annual stems; stems amd petioles crimson; flower-buds red, open flowers yellow.

ZINGIBERACEAE

Aframomum baumannii K. Schum.

Herb, rhizomatous, stems about 2m high; flowers narrow in short inflorescence; fruits pink.

Appendix 2: List of Birds of Ambalara Forest Reserve

Scientific Name	Common Name	Rarity	Conservation Status	Presence
ARDEIDAE				
Bubulcus ibis	Cattle Egret	C	WP	1
Butorides striatus	Green-backed Heron	C		1
Ardea cinerea	Grey Heron	C		1
THRESKIORNITHIDAE				
Threskiornis aethiopicus	Sacred Ibis	U		1
ACCIPITRIDAE				
Aviceda cuculoides	African Cuckoo Hawk	U	WP	1
Milvus migrans	Black Kite	C	WP	1
Necrosyrtes monachus	Hooded Vulture	C	WP	1
Gyps africanus	African White-backed Vulture	U	WP	1
Trigonoceps occipitalis	White-headed Vulture	R	WP	1
Terathopius ecaudatus	Bateleur	U	WP	1
Circus pygargus	Montagu's Harrier	U	WP	1
Micronisus gabar	Gabar Goshawk	C	WP	1
Melierax metabates	Dark Chanting Goshawk	C	WP	1
Accipiter badius	Shikra	C	WP	1
Butastur rufipennis	Grasshopper Buzzard	C	WP	1
Kaupifalco monogrammicus	Lizard Buzzard	C	WP	1
Lophaetus occipitalis	Long-crested Eagle	U	WP	1
FALCONIDAE				
Falco biarmicus	Lanner Falcon	U	WP	1
Falco peregrinus	Peregrine Falcon	U	WP	
PHASIANIDAE				
Ptilopachus petrosus	Stone Partridge	C		1
Francolinus bicalcaratus	Double-spurred Francolin	C		1
OTIDIDAE				
Eupodotis senegalensis	White-bellied Bustard	C		1
Eupodotis melanogaster	Black-bellied Bustard	C		1
PTEROCLIDIDAE				
Pterocles quadricinctus	Four-banded Sandgrouse	U		1
COLUMBIDAE				
Treron calva	African Green Pigeon	C		1
Turtur abyssinicus	Black-billed Wood Dove	C		1
Streptopelia semitorquata	Red-eyed Dove	C		1
Streptopelia vinacea	Vinaceous Dove	C		1
Streptopelia senegalensis	Laughing Dove	C		1
PSITTACIDAE				
Poicephalus senegalus	Senegal Parrot	C	GS	1
Psittacula krameri	Rose-ringed Parakeet	C		1
MUSOPHAGIDAE				

Musophaga violacea	Violet Turaco	C	GS	1
Crinifer piscator	Western Grey Plantain-eater	C		1
CUCULIDAE				
Oxylophus jacobinus	Jacobin Cuckoo	C		1
Oxylophus levaillantii	Levaillant's Cuckoo	C		1
Centropus senegalensis	Senegal Coucal	C		1
STRIGIDAE				
Otus senegalensis	African Scops Owl	U		1
Ptilopsis leucotis	White-faced Owl	C		1
Bubo africanus	Spotted Eagle Owl	U		1
CAPRIMULGIDAE				
Caprimulgus climacurus	Long-tailed Nightjar	C		1
Macrodipteryx longipennis	Standard-winged Nightjar	U		1
APODIDAE				
Cypsiurus parvus	African Palm Swift	C		1
Apus pallidus	Pallid Swift	C		1
Apus affinis	Little Swift	C		1
ALCEDINIDAE				
Halcyon chelicuti	Striped Kingfisher	C		1
Alcedo cristata	Malachite Kingfisher	C		1
MEROPIDAE				
Merops hirundineus	Swallow-tailed Bee-eater	R		1
Merops bulocki	Red-throated Bee-eater	C		1
Merops albicollis	White-throated Bee-eater	C		1
CORACIIDAE				
Coracias cyanogaster	Blue-bellied Roller	C	GS	1
Coracias abyssinicus	Abyssinian Roller	C		1
PHOENICULIDAE				
Phoeniculus purpureus	Green Wood-hoopoe	U		1
Rhinopomastus aterrimus	Black Wood-hoopoe	R		1
BUCEROTIDAE				
Tockus erythrorhynchus	Red-billed Hornbill	C		1
Tockus nasutus	African Grey Hornbill	C		1
CAPITONIDAE				
Pogoniulus chrysoconus	Yellow-fronted Tinkerbird	C		1
Lybius vieilloti	Vieillot's Barbet	C		1
Lybius dubius	Bearded Barbet	C	GS	1
INDICATORIDAE				
Indicator indicator	Greater Honeyguide	U		1
Indicator minor	Lesser Honeyguide	U		1
PICIDAE				
Campethera punctuligera	Fine-spotted Woodpecker	C		1
Picoides obsoletus	Brown-backed Woodpecker	C		1
Dendropicos goertae	Grey Woodpecker	C		1
HIRUNDINIDAE				

Hirundo preussi	Preuss's Cliff Swallow	R		1
Hirundo smithii	Wire-tailed Swallow	U		1
Hirundo rustica	Barn Swallow	C		1
MOTACILLIDAE				
Motacilla flava	Yellow Wagtail	C		1
CAMPEPHAGIDAE				
Campephaga phoenicea	Red-shouldered Cuckoo-shrike	U		1
Coracina pectoralis	White-breasted Cuckoo-shrike	U		1
PYCNONOTIDAE				
Pycnonotus barbatus	Common Bulbul	C		1
TURDIDAE				
Cossypha niveicapilla	Snowy-crowned Robin Chat	U		1
Cossypha albicapilla	White-crowned Robin Chat	U	GS	1
Cercomela familiaris	Familiar Chat	U		1
Turdus pelios	African Thrush	C		1
SYLVIIDAE				
Hippolais pallida	Olivaceous Warbler	C		1
Hippolais polyglotta	Melodious Warbler	C		1
Cisticola erythrops	Red-faced Cisticola	C		1
Cisticola cantans	Singing Cisticola	C		1
Cisticola lateralis	Whistling Cisticola	C		1
Prinia subflava	Tawny-flanked Prinia	C		1
Camaroptera brachyuran	Grey-backed Cameroptera	C		1
Eremomela pusilla	Senegal Eremomela	C	GS	1
Sylvietta brachyuran	Northern Crombec	C		1
Hypergerus atriceps	Oriole Warbler	C	GS	1
MUSCICAPIDAE				
Melaenornis edolioides	Northern Black Flycatcher	C		1
Melaenornis pallidus	Pale Flycatcher	C		1
Muscicapa aquatica	Swamp Flycatcher	U		1
Ficedula hypoleuca	Pied Flycatcher	C		1
MONARCHIDAE				
Terpsiphone viridis	African Paradise Flycatcher	C		1
PLATYSTEIRIDAE				
Platysteira cyanea	Common Wattle-eye	C		1
Batis senegalensis	Senegal Batis	C		1
TIMALIIDAE				
Turdoides plebejus	Brown Babbler	C		1
PARIDAE				
Parus (leucomelas) guineensis	White-shouldered Black Tit	C		1
REMIZIDAE				
Anthoscopus parvulus	Yellow Penduline Tit	U	GS	1
SALPORNITHIDAE				
Salpornis spilonotus	Spotted Creeper	R		1
NECTARINIIDAE				

Chalcomitra senegalensis	Scarlet-chested Sunbird	C		1
Hedydipna platura	Pygmy Sunbird	C		1
ZOSTEROPIDAE				
Zosterops senegalensis	Yellow White-eye	C		1
LANIIDAE				
Corvinella corvina	Yellow-billed Shrike	C	GS	1
MALACONOTIDAE				
Malaconotus blanchoti	Grey-headed Bush-shrike	C		1
Tchagra senegala	Black-crowned Tchagra	C		1
Dryoscopus gambensis	Northern Puffback	C		1
Nilaus afer	Brubru	C		1
PRIONOPIDAE				
Prionops plumatus	White Helmet-shrike	C		1
ORIOLIDAE				
Oriolus auratus	African Golden Oriole	C		1
DICRURIDAE				
Dicrurus adsimilis	Fork-tailed Drongo	C		1
STURNIDAE				
Lamprotornis chloropterus	Lesser Blue-eared Starling	C		1
Cinnyricinclus leucogaster	Violet-backed Starling	C		1
PASSERIDAE				
Petronia dentate	Bush Petronia	U	GS	1
PLOCEIDAE				
Plocepasser superciliosus	Chestnut-crowned Sparrow Weaver	U		1
Ploceus heuglini	Heuglin's Masked Weaver	U	GS	1
Ploceus cucullatus	Village Weaver	C		1
Anaplectes rubriceps	Red-headed Weaver	U		1
Euplectes hordeaceus	Black-winged Red Bishop	C		1
Euplectes macrourus	Yellow-mantled Widowbird	C		1
ESTRILDIDAE				
Lagonosticta senegala	Red-billed Firefinch	C		1
Estrilda caerulescens	Lavender Waxbill	C	GS	1
Estrilda melpoda	Orange-cheeked Waxbill	C		1
Uraeginthus bengalus	Red-cheeked Cordon-bleu	C		1
Lonchura cucullata	Bronze Mannikin	C		1
VIDUIDAE				
Vidua chalybeate	Village Indigobird	C		1
FRINGILLIDAE				
Serinus mozambicus	Yellow-fronted Canary	C		1
EMBERIZIDAE				
Emberiza tahapisi	Cinnamon-breasted Rock Bunting	C		1
Emberiza cabanisi	Cabanis's Bunting	U		1
				123

Appendix 3: List of Large Mammals of Ambalara Forest Reserve showing number of individuals an relative abundances of species recorded during transect surveys.

SCIENTIFIC NAME	COMMON NAME	Number of Individuals	Relative Abundance (%)
PRIMATES			
Cercopithecidae			
Cercopithecus patas	Patas Monkey	4	28.57
LAGOMORPHA			
Leporidae			
Lepus capenis	Cape Hare	1	7.14
Lepus saxatilis	Scrub Hare	2	14.29
RODENTIA			
Sciuridae			
Euxerus erythropus	Striped Ground Squirrel	2	14.29
CARNIVORA			
Herpestidae			
Herpestes sanguinea	Slender Mongoose	1	7.14
ARTIODACTYLA			
Bovidae			
Tragelaphus scriptus	Bushbuck	2	14.29
Sylvicapra grimmia	Bush Duiker	1	7.14
Kobus kob	Kob	1	7.14
	Total	**14**	**100.00**