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Species Profiles of Some Useful Plants in Omo Biosphere Reserve in Nigeria

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Abstract

Ecological ethnobotany was conducted in Omo Biosphere Reserve, Nigeria in order to elucidate the basic ecological and cultural variables needed for the conservation and restoration of some useful plants utilised in the reserve. Permanent sample plots of 25 m by 25 m each were laid out randomly in four sites in the reserve. Data on both vegetation and soil in each site were collected by random sampling method. Quantitative Ethnobotany was carried out using the Participatory Rural Appraisal (PRA) technique. The target species were Carpolobia lutea *G. Don,* Dioscoreophyllum cumminsii *(Stapf) Diels,* Irvingia gabonensis *(Aubry-Lecomb ex O'Rorke) Baill.,* Myrianthus arboreus *P. Beauv.,* Sphenocentrum jollyanum *Pierre,* Spondias mombin *L.* Tetrapleura tetraptera *Taub. and* Xylopia aethiopica *(Dunal) A. Rich. The species were selected because they are indigenous, non-timber and highly utilised in ethnomedicine and nutrition. A total of 132 woody species in 39 families were identified. Most of the target species were found only in the transition zone in very low densities of about two to five per hectare.* Spondias mombin *was found only in cultivated areas. The target species tolerate moderately acidic soils; majority flowered in the dry season and fruited during the rainy season. They were harvested from the wild and used in the treatment of many ailments including malaria, yellow fever, worms, cough, infertility, gonorrhoea and diabetes. The inclusion of some of the species in conservation and restoration programmes in the reserve is suggested.*

Key words: Conservation, non-timber forest plants, ethnomedicine, Omo Biosphere Reserve.

Introduction

The value of plants as source of pharmaceutically active substances can never be over emphasised. This is one of the major reasons for conserving natural habitats and tropical forests, which contain the largest number of biodiversity (Brown, 1992). However, the tropical forests are fast dwindling in land area due to land use change and over-exploitation. Current estimates reveal that African forests are the most depleted of all global tropical regions, with only about 30% of their original forest area still remaining (Sayer *et al.*, 1992). The United Nations Food and Agricultural Organization (FAO) data show that West African forests are being lost faster than those of any other region, with the highest rates in Nigeria, Cote d'Ivoire and Senegal (FAO, 1984).

A review of the Nigeria's land use shows that about 84% of the original forest estate has been lost in the last 100 years (Oguntala, 1999, unpublished seminar paper). The

remaining forests now exist in fragmented and discontinuous units inside the forest reserves (Isichei, 1995). Annual deforestation rates of between 300,000 ha (FAO 1986) and 350,000 ha (the Nigerian Environmental Study/Action Team – NEST, 1991) have been reported for Nigeria in the last two decades. The Government, research institutions, communities and individual conservationists have undertaken numerous initiatives to reduce the rate of forest loss in Nigeria. Most of the initiatives have however, met with limited and/or short-lived success (the Forestry Management, Evaluation and Co-ordinating Unit – FORMECU, 1998).

In many tropical areas, the application of sustainable development concepts to the utilisation of forests resources has been demonstrated to be a better option for the conservation and restoration of the dwindling natural forests. Strategies for sustainable utilisation of forests include enhancing the status of traditional herbal-based medicine and maximising the value of non-timber forest products (NTFPs) (Pearce and Brown, 1994). Forest conservation through sustainable utilisation of the forest resources plays a strong role in the framework of the Convention on Biological Diversity (CBD). This has prompted a revival of research interest in non-timber forest plant products (NTFPPs) as a strategy for sustainable management of their habitats. Peters (1994) has opined that sustainable exploitation of NTFPs is the only integrated approach to forest use and conservation. However, it may be asserted that any level of sustainable exploitation in the complex tropical rain forest is highly dependent on the extent of knowledge of the ecology and biology of the inhabiting species, which is presently, inadequate. Understanding the species life histories, phenology and increased education and research into the regeneration of biological resources that are currently utilised and/or are potentially utilisable (Isichei, 1995) are equally crucial.

In Nigeria, interest in high forests has been in timber species and this has remained the focus of most ecological studies in the forest reserves. As such, there is paucity of data on the ecology and utilisation of the non-timber plant species of the reserves. Hawthorne (1995a) stressed that successful maintenance of biodiversity in natural forests within forest reserves requires that the ecological, biological and socio-economic importance of each species be fully understood.

Target organisms in agriculture and managed forests should be groups of species needed for maintaining the integrity and function of the world's ecosystems, improving human health, increasing the world's food supply, as well as the least known and endangered species (UNESCO, 1994). In most countries, indigenous food crops have been neglected for too long (Plotkin, 1990; Zedan, 1995). There is the need therefore, for researchers to focus on indigenous wild edible forest products (Okafor, 1993). Such studies are needed to provide baseline data on the indigenous plants of the reserves. The data are expected to raise the status of non-timber plant resources from the reserves in terms of economic value, provide information on the basic ecological, biological and cultural variables needed for the conservation and restoration of such species as well as encourage the practice of domesticating and cultivating the species.

Biosphere Reserves are *in situ* conservation areas established to help reconcile the conservation of biodiversity with its sustainable use. One challenge in the conservation and management of biosphere reserves today is the integration of local communities and alternatives to foster economic and human development that are socio-culturally and ecologically sustainable (UNESCO, 2002). Dike (1992) recommended highly targeted enrichment of the forest gaps by desirable woody species while Oguntala (1999, unpublished seminar paper) suggested reforestation of degraded sites in biosphere reserves. There is the need therefore to prepare species ecological and utilisation profiles to aid choice of species for given areas, appropriate mixtures of species for agro-forestry and cultural resilience of the biosphere reserves. The aim of this paper is

to provide some ecological and utilisation profiles of eight indigenous multipurpose plant species utilised in Omo Biosphere Reserve, Nigeria.

Materials And Methods

The study area

The study was conducted in Omo Biosphere Reserve, Nigeria. The reserve is situated in Ogun State in southwestern Nigeria [6°35′ & 7°05′ N, 4°05′ & 4°40′ E]. The Nigerian Government legally gazetted it as a forest reserve in 1925 and UNESCO upgraded it to a biosphere reserve in 1977. The reserve is fragmented into a central 460 ha Strict Nature Reserve (SNR), 340 ha SNR-Buffer (SNR-B) and a Biosphere Extension Area (BEA) of about 14,200 ha. The BEA consists of plantations of exotic and native species and patches of mature secondary forests. Within the BEA, near Oloji farm settlement (in the East-North-East of the reserve) is the Walsh System experimental plot (WSP) of the Forest Research Institute of Nigeria (FRIN). The WSP plot covers an area of about 4.05 ha and was 48 years old in the year 2000 when this research was conducted. Several other studies have discussed the history, location, population, topography, geology, climate and vegetation of the biosphere reserve in detail (Isichei, 1995; Weeks, 1997; BRAAF, 1998; Ahuama, 2004).

The study species

The species studied are the under storey, non-timber, multipurpose species that play vital roles in local cultures, particularly ethnomedicine and nutrition, not only in the present study area but also in other parts of Nigeria (Grill, 1992). They are *Dioscoreophyllum cumminsii* (Stapf) Diels (Menispermaceae) [protein sweetener], *Tetrapleura tetraptera* Taub. (Leguminosae-Mimosoideae) and *Xylopia aethiopica* (Dunal) A. Rich. (Annonaceae) [noted for their spicy and medicinal properties] and *Carpolobia lutea* G. Don (Polygalaceae), *Myrianthus arboreus* P. Beauv. (Moraceae), *Irvingia gabonensis* (Aubry-Lecomb ex O'Rorke) Baill. (Ixonanthaceae), *Sphenocentrum jollyanum* Pierre (Menispermaceae) and *Spondias mombin* L. (Anacardiaceae) that are utilised as food, medicine and/or industrial raw materials.

Ecological studies

The experimental design followed the randomised block type. Four sites namely the SNR, SNR-B, BEA and the WSP at Oloji were subjectively chosen (Fig. 1). The aim was to cover the different fragments of natural forests and differing degrees of disturbance in the reserve for comparative purposes. Three main sample plots of 25 m by 25 m each were laid out randomly in each site. Within each main plot a central sub-plot of 2 m by 25 m was established and used for ground flora inventory. All macrophytes ≥ 2 m and < 2 m in height encountered within each main plot and sub-plot respectively were enumerated and identified. Species that could not be identified on the field as well as voucher specimens were collected in a plant press and taken to FRIN's herbarium for identification and deposition. Plant nomenclature followed Keay (1989) for the trees/shrubs and Hutchinson and Dalziel (1954-72) for the ground flora.

Ten soil samples were taken randomly with a probing metal soil auger in each main plot. The samples were taken from the 0 to 15 cm and 15 to 30 cm layers at each sampling point as topsoil and subsoil respectively. The soil samples were collected into labelled polythene bags and taken to the laboratory. In the laboratory, stones and gravel were removed and large lumps broken into small pieces. The samples were spread out on sheets of paper on the laboratory benches to air dry. The air-dried soil samples were bulked by layers per plot and mixed thoroughly to homogenise. They were then ground with a mortar and pestle to crush the particles only, sieved through a 2 mm mesh and

pH determined immediately in 1: 2 $CaCl_2$ suspension using a pH meter. The samples were taken to the Soil Science Laboratory, Obafemi Awolowo University, (O.A.U.), Ile-Ife, Nigeria for physico-chemical analyses. The following soil parameters were determined: textural class, percentage moisture, organic matter, total nitrogen, available phosphorus, exchange acidity, potassium, and sodium ions. However, Atomic Absorption Spectrometry (AAS) was used to determine available calcium and magnesium at the Centre for Energy Research and Development (CERD), OAU., Ile-Ife, Nigeria. In both laboratories, analytical procedures followed the methods contained in the IITA Manual Series No 7 (Tel and Rao, 1982). Cation exchange capacity (CEC) was determined by the summation method in which all exchangeable cation species (including exchange acidity) were added and percentage base saturation (PBS) computed from there (Buol and Hole, 1980).

From the primary data collected, community and species attributes were assessed. Indices of species similarity and diversity were computed for the sites using the Sorensen and Shannon-Wiener formulae respectively. The vegetation and soil data were subjected to canonical correspondence analyses using the computer programme CANOCO version 3.12 (Ter Break, 1991). Analysis of variance (ANOVA) was used to test the significance of the soil data and Duncan's Multiple Range Test (DMRT) used to separate the mean values.

Ethnobotanical studies

Quantitative ethnobotany was conducted in a 0.2-hectare plot in the WSP plot at Oloji following the methods of Martin (1995). The two main techniques used in data collection were Participatory Rural Appraisal (PRA) and artefact/interview method. The survey team was made up of the researchers, a local tree identifier, a forester and 20 local guides (14 men, 6 women) selected from the enclave. All possible uses of each species by each field guide were elicited through repetitive questioning. Categories of use were established. Voucher specimens of the target species were taken to the enclave and one adult per household interviewed on the local uses of the various parts of each specimen presented to them. Interviewees were at least 30 years old. On the whole, 48 adults were interviewed on the local uses of the target species (20 field guides and 28 household adults)

The species profiles

The data and information obtained on each target species during the entire study were summarised as the species profiles. The technique of Hawthorne (1995a) was adapted and used in the preparation of the profiles, which are textual summaries on each target species. The common name refers to the common English name while the local name is the local name in the study area or the Yoruba name. Ecological guild stands for the regeneration niche while conservation priority refers to the Red List Category (IUCN, 2001). Botanical descriptions are morphological briefs to aid field identification. The profiles contain two main sub-headings, ecology and utilisation of the targets with reference to this study. Distribution denotes overview of spatial occurrence in Omo Biosphere Reserve and in Nigeria. The microclimatic conditions are typical and culled from Dike (1992). Inventory refers to the constancy value while plant count is the number of plants/individuals recorded in all the plots where each occurred. Data on regeneration and phenology were extracted from Ahuama (2004). Information on utilisation was presented in the following order; food, medicine, construction/timber, fuel wood and other uses like chewing stick, brooms, trap setting and divination.

Results and Discussion

Ecological studies

One hundred and thirty seven species (≥ 2 m in height) were enumerated out of which 132 in 39 families were identified to species level. Many of the target species occurred in very low densities mostly outside the plots in the BEA where minimal quantitative data was obtained. Out of the eight species under study, only the two under storey species, *Carpolopia lutea* and *Spenocentrum jollyanum* were encountered in all the sites. Very old and senile individuals of *Tetrapleura tetraptera* were observed in the SNR-B and BEA. *Dioscoreophyllum cumminsii*, *Myrianthus arboreus*, *Irvingia gabonensis*, *Spondias mombin* and *Xylopia aethiopica* were found only in the BEA. *Spondias mombin* was found only in fallows, agro-forestry farms and around enclaves. This is not surprising as the species is often cultivated for shade and its edible fruits.

The species composition, density and diversity of the four study sites were compared. Results showed that in terms of species composition and density, the SNR-B and BEA were the most similar, followed by SNR and WSP while SNR-B and WSP were the least similar (Table 1). The trend of species diversity reflected species composition, number of individuals and density. On the average, these attributes were higher in the BEA and WSP than in the SNR and SNR-B. Out of the 132 species identified, 46 in 19 families occurred in the SNR, 49 in 21 families in the SNR-B, 75 in 30 families in the BEA while 65 species in 25 families were recorded in the WSP.

The soils were either acidic or slightly acidic. Analysis of variance carried out on the soil data showed significant difference in the available phosphorus, CEC and sand content of the sites ($P \leq 0.01$). Duncan's Multiple Range Test on the mean values separated the sites with respect to their organic matter, CEC, sand and clay contents only. The organic matter and sand contents of the SNR-B differed significantly from those of the other sites (Table 2). The low organic matter of this site might imply lower rate of productivity (lower litter production, foliage cover and biomass) (Ekanade, 1991) probably due to its high sand content. Thus the ordination diagrams showed that available phosphorus, CEC and sand content were the major factors determining the distribution of species in the sites (Fig. 2). Edaphic factors (Clark *et al.*, 1998) and probably the degree of disturbance (Connell, 1978) might therefore be a major reason for the variations observed in species composition, density and diversity among the sites.

In most plots, many of the canopy species were observed to be very senile thus under storey herbs like *Culcasia saxatilis* A. Chev., *Dracaena deisteliana* Engl., *D. sanderiana* Sander ex Masters and *Memecylon afzelii* G. Don were the most abundant ground flora species. *Chromolaena odorata* (L.) King & Robinson was observed to be the dominant herb species of the fallow plot. Previous reports Tamajang (1946) and Dike (1992) have reported similar observation in Omo. The low density of seedlings and saplings of canopy species among the ground flora may be attributed to the low natural regeneration rate of such species in the forest under storey (Onyeachusim, 1985; Peters, 1994; Weeks, 1997). This emphasizes the importance of gaps in the regeneration of many forest species. Agyeman *et al.*, (1999) argued that light is the principal limiting factor in rain forest environments. BRAAF (1998) documented that natural regeneration studies in Omo have proved that moderate canopy opening and climber cutting enhance regeneration and growth of seedlings, saplings and poles of tree species.

In addition, the dearth of many of the target species in the SNR and SNR-B coupled with the fact that even the species that occurred in them were very senile imply that the density and distribution of the target species and many other utilised species in the reserve are favoured by anthropogenic disturbances. Brown (1990) critically analysed secondary tropical forests and concluded that matured secondary forests are suitable sites for most

utilised tropical species. Moderate anthropogenic disturbance of the biosphere extension areas therefore, becomes a necessity in this era of biodiversity conservation (Connell, 1978) and sustainable management of natural resources (Peters, 1994).

Ethnobotanical studies

The ethnobotanical data showed that 93.75% of the tagged plants representing 88.24% of species ≥ 2 cm in height in the 0.2 ha plot were utilised. A total of 60 useful species were identified, about 68% had multiple uses, 50% were medicinal, 40% were timber and construction species, 53% were sources of firewood while 45% were used for other purposes. The target species were medicinal, had edible fruits and were put to various other uses. They were harvested from the wild and used in the treatment of many ailments including malaria, yellow fever, worms, cough, infertility, gonorrhoea and diabetes. These results are consistent with Boom (1989) and BRAAF (1998) despite differences in plot sizes. Results equally confirm that local people depend wholly on the wild natural resources for their livelihood (Balick and Cox 1996; Cunningham 2001; Cunningham and Hamilton, 2002).

The species profiles

Carpolobia lutea G. Don Family: Polygalaceae

X 0.19

Plate 1. *Carpolobia lutea*

Local name: Osunsun

Guild: Shade-bearer Conservation priority: Least concern.

Description:

Evergreen, small, under storey shrub of about 5 cm high. Crown could be partly exposed in disturbed forests or fully over shadowed in undisturbed ones. Characteristic of mature forests or late secondary succession in West Africa. Leaves simple, alternate and heterophyllous (Plate 1). Inflorescence a raceme with 2-7 flowers. Fruits green, turning red or orange when ripe. Seeds 1-3, contained in sweet edible pulp.

Ecology:

Common in Omo Biosphere Reserve. Found in the SNR, SNR-B, BEA, WSP and in the old plantations. High forest, derived savanna and Southern Guinea savanna. Thrives in acidic or slightly acidic, sandy clay or sandy clay loam soil. Optimum temperature ranges from 24°C to 30°C, relative humidity from 90% to 98% (rainy season) and 90% to 92% (dry season), photon flux density from 0.40 w^2 in the morning to 0.007 w^2 in the evening (for the month of March) and wind speed (at a height of 1 m) from 0.1 to 0.2 ms^{-1} in May. Flowers and fruits continuously during the dry season (October-March). Fruits fall directly under the mother plant but birds and other animals that feed on the fruits presumably help in dispersing them. Regenerates in shade with very low germination rate. Seedlings and saplings establish and thrive under shade. Stem cuttings

coppice well, attaining a height of about 5 cm within 3 months of growth. Inventory 33.3% while plant count was five. Mean GBH 6.67 cm, height 3.9 m.

Utilization:

The ripe fruit pulp is sweet and edible. A decoction of the root bark and that of *Microdesmis puberula* Hook. F. ex Planch is taken as aphrodisiac. The combination is similarly used for making local soup, which is believed to stop dizziness when eaten. The roots are believed to have potency for manifesting the effects of curses on people, and are therefore chewed while cursing. The decoction of the leaves and those of *Strombosia pustulata* Oliv. and *Pergularia daemia* (Forsk.) Chiov. is taken (half glass cup thrice daily) for the treatment of yellow fever. A decoction of the leaves and stem bark is used for the treatment of rheumatism. An infusion of the leaves, the dry seeds of *Xylopia aethiopica* and *Capsicum annum* L. seeds is used to cure stomach ache. The leaves are used with snail and tortoise to make concoction. The meat is later fried and the used oil is rubbed on the body to treat general body pain. The seeds, *Microdesmis puberula* seeds, the shells of tortoise and snail plus crocodile scales are used to make a concoction. The later is rubbed round incisions at the back and waist for the treatment of back and waist pain. The decoction of the leaves plus those of *Baphia nitida* Lodd. the seed of *Aframomum melegueta* K. Schum. and a piece of antelope meat is given to arrest miscarriage. The stem is very good for firewood. The root is used as chewing stick. Defoliated twigs are used as broom. Currently, demand is for the roots and twigs for medicinal purposes.

Dioscoreophyllum cumminsii (Stapf) Diels (Syn. *D. lobatum* (C. H. Wright)
Family: Menispermaceae

X 0.18

Plate 2. *Dioscoreophyllum cumminsii*

Common name: Serendipity berry
Local name: Omu-aja
Guild: Shade-bearer Conservation priority: Data deficient.

Description:

Dioecious, annual, under storey liana found in intermediate (neither early nor late) semi-deciduous secondary forests. Leaves usually at the far end of the pubescent stems, simple, entire or digitately 3-lobed (Plate 2). Male flowers green, solitary on the axis of the raceme. Female flowers pedicellate and crowded in the upper part of the raceme. Fruits green, turning red when ripe, crowded in a pendulous bunch containing 80 – 120 individual fruits (Plate 2). Seeds horse-shoe shaped, embedded in very sweet pulp.

Ecology:

Occur in the BEA in Omo. Restricted to the high forest zone. Requires moderately acidic and sandy. Females thrive in deeper shades than males, which may be completely

exposed. Microclimatic condition are same as for *Carpolobia lutea*. Flowers June-August and fruits July-October. Fruits are poorly dispersed. They fall straight to the forest floor, directly under the mother plant. Man and birds that consume them disperse a few. Males regenerate by asexual subterranean tubers, which sprout immediately the rains come (within 20 days). Females sexually by seeds under deep shade or gap free patches. Germination of seeds is very difficult and occurs after a long stay in the soil (4-6 months). Germination process is inhibited by light but this can be overcome by soaking the seeds in 0.5% gibberellic acid (GA_3) for 2 hours before sowing. One-leaf stem cuttings (cut just before or immediately after inflorescence) coppice well and can give rise to either sex irrespective of the mother plant. Seedlings and juveniles do not require shade for growth. Both cohorts and genets require staking for optimum performance. Inventory and plant count were nil

Utilization:

The ripe fruit pulp is sweet and edible. The tubers are equally sweet and eaten like yam tubers. A decoction of the ripe fruit is given as treatment for diabetes. Ripe fruits are used to set traps. The tubers and fruits are intensively sweet; the sweetening substance is a protein (monellin), which is 3000 times as sweet as sucrose. The plant could therefore be the apple of agro- and pharmaceutical industries.

Irvingia gabonensis (Aubry-Lecombe ex O'Rorke) Baill. (Syn. *I. barteri* Hook F.)
Family: Ixonanthaceae

X 0.14

Plate 3. *Irvingia gabonensis*

Common name: Wild/bush mango, duiker nut Local name: Oro
Guild: Non-pioneer light demander (N.P.L.D.) Conservation priority: Near Threatened.

Description:

Large, evergreen tree of the upper canopy. Crown emergent, dense, compact and spherical. Leaves alternate, elliptic to obovate (Plate 3). Flowers yellow to greenish-white in clustered racemes or small panicles among leaves or on the younger branches. Fruits yellow, smooth skinned and largely ellipsoid (Plate 3). Occur in gaps in matured forests and farmlands. Two varieties have been characterised; var. *excelsa* (Mildbr.) Okafor and var. *gabonensis* (Mildbr.) Okafor. Characterisation was based on the differences observed in the fruits/seeds. See utilities below.

Ecology:

Found in the BEA near river Omo but can occur in any part of the reserve with good deep soil to support extensive root systems. Occur in the high forest, derived and Southern Guinea savannas. Requires slightly acidic to neutral soil. Microclimatic condition in a gap in Omo: Temperature; 30 – 36°C between 10.00 am and 3.00 pm for both rainy and dry seasons; for other times of the day, it lies between 25 and 28°C for the rainy season and 25 to 30°C for dry season. Relative humidity; 70 – 80% between 10.00 am and 3.00 pm for rainy season and 60 – 70% for dry season; for other times of the day, it lies between 92 and 98% (rainy season) and 80 to 92% (dry season). Photon flux density; 1 w^2 in the morning and 40 w^2 in the evening (for the month of March). Wind speed (at a height of 1 m); ranged from 0.25 to 0.50 ms^{-1} in May. Var. *excelsa* flowers July-August and fruits November-February while var. *gabonensis* flowers October-February and fruits May-July. Fruits fall directly below the mother tree. Dispersed by rodents, elephants and other animals that feed on the fruits. Germination is normal in both shade and gaps. Requires light to grow beyond the sapling stage. The fruits should be fermented to give optimum germination within 1-2 months. Inventory and plant count were nil.

Utilization:

Var. *gabonensis* has sweet edible, scantly fibrous fruit pulp that is eaten like that of mango (*Mangifera indica* L.). The seeds are less slimy and are used to thicken local soup. Var. *excelsa* has bitter, inedible, very fibrous fruit pulp and very slimy, oily and tasty cotyledon preferred as a local soup thickener. The decoction of the leaves is given as treatment for liver problems and that of the stem bark is used as febrifuge. The wood is very hard and used in constructing canoes and many household implements like mortar and pestle. The wood/branches are used as firewood. The seed shells are used in divination. Var. *gabonensis* is regarded as the indigenous mango of Africa. The oil content of the seeds of both varieties is very high. There is very high demand nationally and internationally for the fruits/seeds of both varieties, which are sold to generate income. The fruit is being grown commercially in many parts of mid-western and western Nigeria.

Myrianthus arboreus P. Beauv. Family: Moraceae

X 0.14

Plate 4. *Myrianthus arboreus*

Local name: Ibisere

Guild: Cryptic pioneer/Shade-bearer Conservation priority: Least concern.

Description:

Medium-sized deciduous tree of the lower canopy that thrives in damp locations in secondary vegetations. It however survives into the under storey in matured forests. Small trees usually exposed while large ones may be exposed from above, partly exposed or fully overshadowed. Leaves large, alternate and compound. Male flowers

yellow, covering the terminal branches of panicles (Plate 4); female flowers green and densely aggregated. Fruits irregularly globose, fleshy, composed of many polygonal segments, each being an individual fruit containing one seed (Plate 4).

Ecology:

Found in the BEA in Omo; in fallows, farmlands and in the pockets of forest. Thrives in the forest zone, derived and Guinea savannas. Soil and microclimatic condition: Same as for *Irvingia gabonensis* above. Flowers January-April, July-August and fruits April-June, November-December. Fruits fall directly bellow the mother tree and are dispersed by primates like elephants that eat the fruits. Requires light to regenerate and establish but once established, can thrive under the storey. Germinates in gaps but seeds are very recalcitrant. Stem cuttings do not coppice well but can be propagated by budding. Inventory 25%; plant count nine; mean GBH 67.0 cm; height 10.33 m.

Utilization:

Very young leaves are used as vegetable in making local melon soup. The fruit pulp is sweet and edible. A decoction of fallen dried leaves and the stem bark of *Prosopis africana* (Guill. & Perr.) Taub. is used to treat malaria. The decoction of the dry leaves alone is used in the treatment of yellow fever. An infusion of the leaves, *Cochorus olitoris* L. and *Megaphrynium macrostachyum* (Benth) Milne-Redh. is given during labour for safe delivery. The leaves and those of *Combretum* Loeft. are used to cook dry maize. The maize is then eaten. This is believed to be able to eliminate smallpox in the family. The decoction of the stem bark is drunk and used to bath as a remedy for general weakness of the body. Root bark and *Aframomum melegueta* seeds and fowl legs are roasted and ground. The powder is rubbed into incisions made round the two ankles for the prevention of witchcraft. The dry young leaves are used in making local black soap while the fresh old leaves are used for roofing and wrapping kola. The edible sweet fruit can be utilised by agro-industries. The root and stem barks as well as the dry leaves are the peach of many community healers and could be sold to generate income.

Sphenocentrum jollyanum Pierre Family: Menispermaceae

X 0.17

Plate 5. *Sphenocentrum jollyanum*

Local name: Akerejupon

Guild: Shade-bearer Conservation priority: Least concern.

Description:

A woody herb/shrub of about 1.5 m. Never reaches 2 m. Characteristic of late secondary or matured forests. Stem completely unbranched. Leaves alternate, simple and very heterophyllous (Plate 5). Flowers white and cauliflorous. Fruits stalkless, green, turning orange when ripe and on the lower part of the stem.

Ecology:
Common in Omo. Occur in the SNR, SNR-B, BEA and WSP. High forest, derived and Guinea savanna. Soil and microclimatic condition: Same as for *Carpolobia lutea* above. Flowers and fruits at irregular intervals, more than twice per year. Fruits fall straight to the forest floor under the mother plant. Germination is normal, no special requirement. 90% obtainable within 12 days after planting, Stem cuttings coppice well in both shaded and unshaded environments. Inventory 58.33%; plant count 28.
Utilization:
The ripe fruit pulp is sweet and children eat it. The fresh leaves are ground with the fresh husk of maize together with local black soap. The mixture is used as local tooth powder, rubbed on the body and used to bath babies to prevent witchcraft. Fresh leaves are used with other complex ingredients to kill and curse people to go mental. An infusion of ground ripe fruit is used as vermifuge. The decoction of the root bark and fruit is aphrodisiac. The root is chewed for the same purpose. An infusion of the root bark, *Allium cepa* L. leaves, *Piper guineensis* Schum. & Thonn. seeds, salt and potash is used as remedy for malaria. It is believed that when the taproot is chewed with 7 or 8 seeds of *Aframomum melegueta* it gives the power to hypnotize others and make them abide by one's commands. The unripe fruit pulp is used as gum. The root is used as chewing stick. The industrial potential for gum, dental powder and aphrodisiac production is high.

Spondias mombin L.
Family: Anacardiaceae


X 0.25

Plate 6. *Spondias mombin*
Common name: Hog plum, mombin Local name: Iyeye
Guild: Swamp but pioneer Conservation priority: Data deficient.
Description:
Lower canopy, medium-sized deciduous tree that occurs in secondary vegetations. Leaves alternate, compound with about nine pairs of opposite leaflets (Plate 6). Flowers greenish-white, small, in much branched terminal panicles. Fruits yellow, ellipsoid or ovoid with a thin skin and acid pulp surrounding a large stone (seed). It is often cultivated for shade and its edible fruits.
Ecology:
Common in the BEA in Omo, occurring in fallows, agro forestry farms and around the enclaves. Occur in the high forest and savannas. Soil and microclimatic condition are as reported for *Irvingia gabonensis* above but it tolerates less fertile soil than *Irvingia*. Flowers and fruits at irregular intervals more than twice per year. Fruits fall straight to the forest floor, are eaten by bats, which presumably disperse them. Seeds are very

recalcitrant. Germination is very difficult and in gaps. Propagation is easy by stem cuttings which coppice well and easily within one month after planting. Inventory nil; plant count nil.

Utilization:

The fruit pulp has an acrid taste and is edible. Fresh leaves are chewed to treat dizziness. Infusion of the fresh leaves is used to treat gonorrhoea. Fresh leaves extract is applied to wounds to stop bleeding and used as eye ointment. Decoction of the leaves and stem bark is given as a remedy for fever. An aqueous extract of the leaves is put into a big basin. The puerperian mother sits inside the basin. This is a therapy for arresting excess bleeding after birth. The decoction of ground stem bark and *Capsicum annum* seed is given as vermifuge. The juicy fruit could be a source of raw material for beverage industries. The leaves, barks and sap are indispensable in traditional medicine in many West African countries. Its commercial potential could thus be very high.

Tetrapleura tetraptera (Schum. & Thonn.) Taub. (Syn. *T. thonningii* Benth.)
Sub-family: Leguminosae-mimosoideae

X 0.16

Plate 7. *Tetrapleura tetraptera*

Local name: Aidan, aridan

Guild: Pioneer Conservation priority: Data deficient.

Description:

Medium-sized deciduous tree of the lower canopy with feathery foliage. Occurs in open secondary vegetations. Flowers creamy or pink, sometimes orange. Fruits dark purple-brown, about 15 cm long or more with four longitudinal ridges forming winged pods (Plate 7).

Ecology:

Found in the SNR-B, BEA and WSP in Omo. Thrives in the high forest and savannas. Soil and microclimatic condition: Same as for *Irvingia gabonensis* above. Flowers and fruits twice per year (rainy and dry seasons). Fruits are poorly dispersed as they fall directly under the mother tree. Requires light to regenerate in the open, gaps or gap edges and seedlings fail to establish under shade. Germination is erratic without pre-germination treatments. Acid (H_2SO_4) and hormonal (gibberellic acid) treatments give the best results. Stem cuttings coppice well within 2 weeks after planting in open environments. Under shade, offshoots die within 7 days and new ones emerge. Inventory 8.3%; plant count one.

Utilization:

The dry fruits (pods) are used with or without the seeds to spice local soups, porridges and other meals. A cold-water infusion of the wings of the dry pods and the open dry fruits of *Xylopia aethiopica* is given as a remedy for cough. The wings of the pods, open dry fruits of *Xylopia aethiopica* and *Croton zambesicus* Mull. Arg. leaves are ground and roasted with gunpowder. The smoke while roasting is believed to drive away evil spirits. A mixture of the smashed wings of the pods, the leaves of *Crassocephyallum biafrae* (Oliv. & Hern) S. Moore and 'Lovinda' (from the Hausa people) is ground and rubbed on the body to prevent witchcraft. The pod is ground with palm oil and used in bone setting. The seeds are ground and used as arrow poison. The wings, seeds of *Piper guineensis* are ground with black soap and used as a remedy for children's skin diseases. The aqueous extract of the pods and *Crinum jagus* (Thomps.) Dandy bark is used as anticonvulsant and molluscide. A cold-water infusion of the pods, *Allium cepa* leaves, *Piper guineensis* seeds and *Allium sativum* L. is used as a remedy for dysentry. The wood is good firewood.

T. tetraptera is a very popular spicy and medicinal plant both nationally and internationally. The fruits are being harvested commercially.

Xylopia aethiopica (Dunal) A. Rich. Family: Annonaceae

X 0.18

Plate 8. *Xylopia aethiopica*

Common names: African pepper, Guinea pepper (Cooper & Record. Dalziel); Ethiopian pepper (Dalzielm Oliver); Spice tree (Sierra Leone, Dalziel).

Local name: Eerun, Erunje

Guild: Pioneer Conservation priority: Data deficient.

Description:

Small evergreen tree thriving in the lower canopy of secondary forest with spreading crown. Has a preference to swampy microhabitats. Leaves alternate and simple, elliptic to oblong, gradually acuminate, obtuse or rounded at base, up to 15 cm long and 6 cm broad. Shiny above and glaucous beneath (Plate 8). Flowers greenish-white and fragrant. Fruit about 5-7 cm long and 5 mm thick, stalkless, a cluster of very numerous narrow dark brown carpels. Each fruit has light constriction between seeds that are peppery with aril at base.

Ecology:

Found in the BEA in Omo, in old fallows and farmlands. Thrives in the high forest, derived and Guinea savannas. Soil and microclimatic condition: Same as for *Irvingia gabonensis* above. Flowers March-October and fruits July-December. Fruits are poorly dispersed. Fall directly under the mother plant. Regenerates in the open by seeds. Inventory nil; plant count nil.

Utilization:
The dry fruits are used as spice in soups, porridges and numerous other dishes.
A cold-water infusion of open dry fruits and the wings of the dry pods of *Tetrapleura tetraptera* are given as a remedy for cough. Open dry fruits, the wings of the pods of *T. tetraptera* and *Croton zambesicus* leaves are ground and roasted with gunpowder. The smoke while roasting is believed to drive away evil spirits. An infusion of the dry seeds, those of *Capsicum annum* and the leaves of *Carpolobia lutea* is used to cure stomach ache. The stem is used as firewood. A spicy and medicinal species of international repute. Highly exploited for commercial purposes.

Conclusion

In the last two decades, interest has grown globally in non-timber forest products as a strategy for sustainable management of the dwindling natural forests. Unprocessed medicinal plants have been known to play a vital role in the health of indigenous people who depend mainly on traditional medicine. Like in many other African countries (Botha *et al.*, 2004), the bulk of utilised forest plants in Nigeria is harvested from the wild populations (Lowe, 1984; Isawumi, 1993; Morakinyo, 1996), which combined with increased pressure on habitats, means that many species are now threatened. About 189 plant species including *Irvingia gabonensis* are already threatened in Nigeria (IUCN, 2004).

This refers to species that have been evaluated using the IUCN (2001) criteria. The list might not have been exhaustive as many species are yet to be evaluated. Extensive cultivation and domestication of utilised low-density wild species therefore are necessary to ensure sustainable supply. The species profiles documented in this paper provide some of the key specific information needed in the conservation and restoration of the target species in the Omo Biosphere Reserve.

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Table 1. Sorensen's index of species similarity among the four study sites in Omo Biosphere Reserve, Nigeria.

S/N	Sites Combination	Index of Similarity
1	SNR/SNR-B	30.14
2	SNR/BEA	28.13
3	SNR/WSP	35.71
4	SNR-B/BEA	36.96
5	SNR-B/WSP	25.81
6	BEA/WSP	30.63

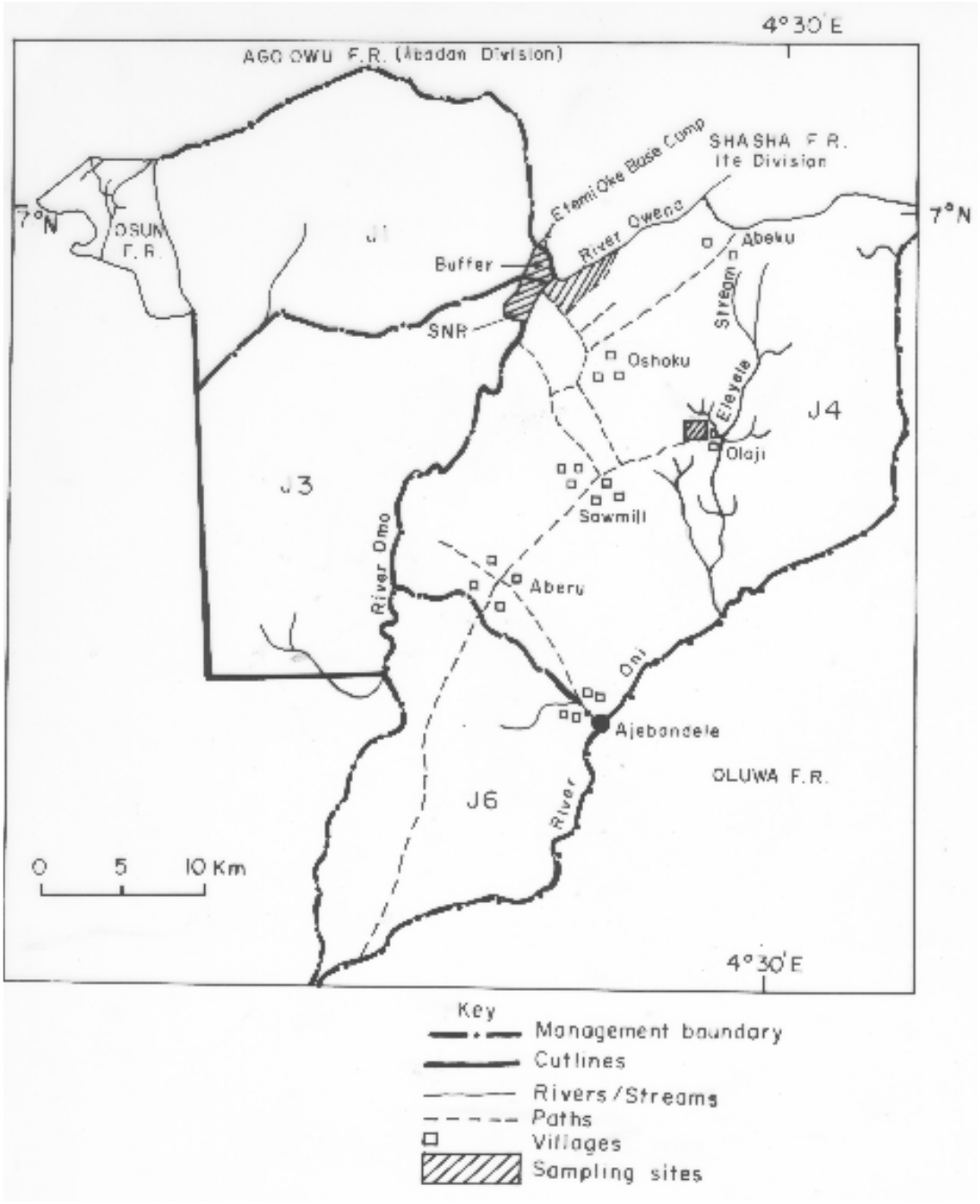
Table 2. Results of Analysis of Variance on the degree of variation in the soil parameters of the four study sites in Omo Biosphere Reserve, Nigeria. (Means with the same letters in the same row are not significant).

Parameter	SNR	SNR-B	BEA	WSP	Coefficient of variation
PH	5.66[a]	5.29[a]	4.91[a]	4.85[a]	15%
Organic matter	4.32[a]	2.12[b]	3.97[a]	3.85[a]	18.25%
% Moisture	39.11[a]	39.78[a]	50.53[a]	43.76[a]	13.48%
TN	0.20[a]	0.19[a]	0.20[a]	0.21[a]	13.91%
P	0.03[a]	0.03[a]	0.04[a]	0.13[a]	4.95%
CEC	1.77[b]	1.31[c]	1.33[c]	2.16[a]	7.6%
PBS	68.81[a]	71.47[a]	66.72[a]	58.77[a]	14.24%
% Sand	59.17[b]	62.17[a]	54.67[b]	48.00[c]	5.39%
% Clay	27.17[b]	24.5[b]	31.33[a]	36.33[a]	15.79%

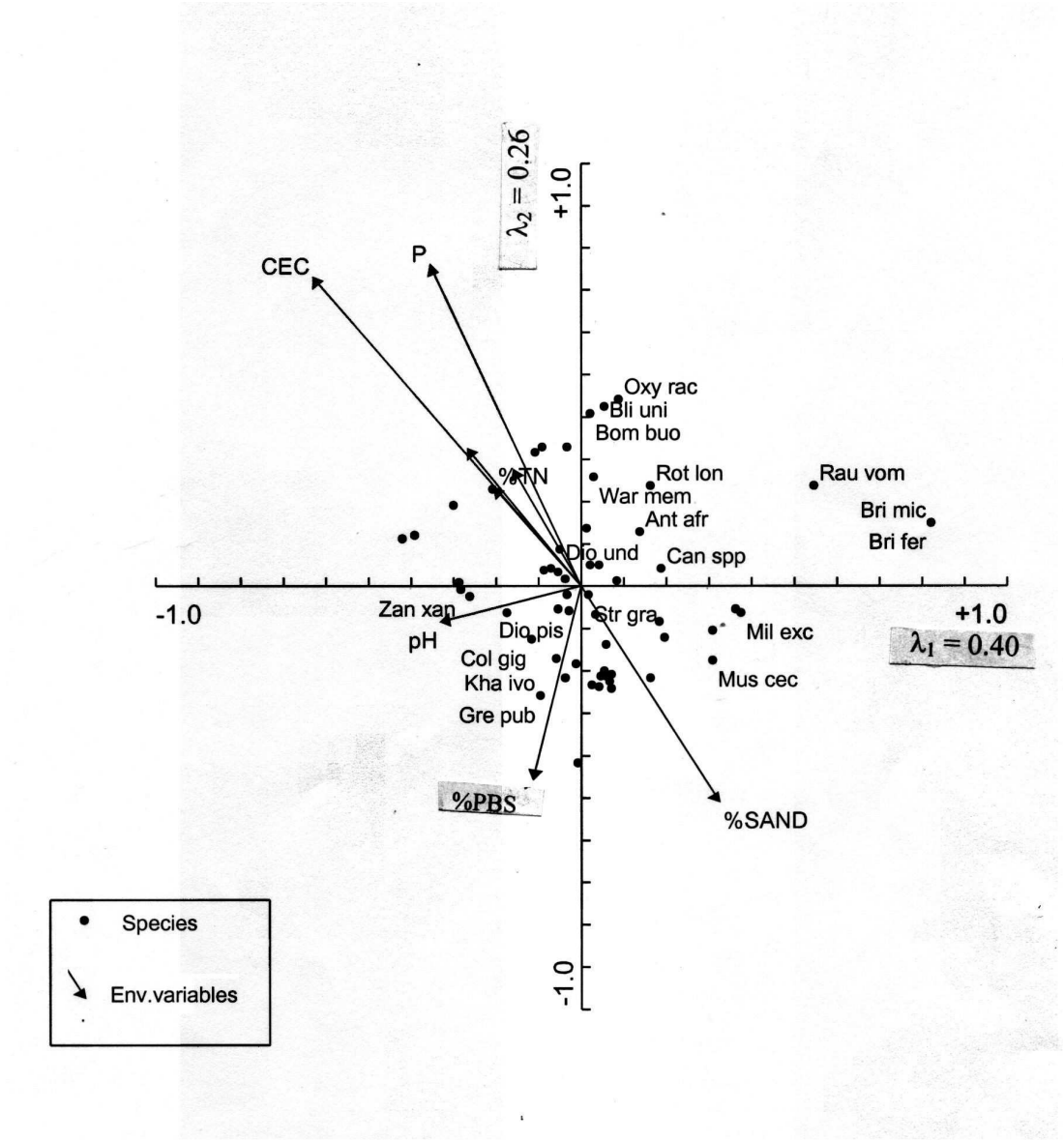
Figure legends

Fig. 1. Details of Omo Biosphere Reserve Showing Major Rivers, Management Blocks and Sampling Sites. (Map adapted from BRAAF, 1998).

Fig. 2. Species-Environmental Biplot from the Canonical Correspondence Analysis (CCA) of the four study sites in Omo Biosphere Reserve, Nigeria. Closed circles represent Species and arrows Environmental (soil) Variables. The soil variables shown are: CEC = Cation exchange capacity, P = Phosphorus, PBS = Percentage base saturation, %sand = Percentage sand, TN = Total nitrogen and pH. The first three letters of the genus and the specific names list the species. The species shown are: Ant afr = *Antiaris Africana*, Bli uni = *Blighia unijugata*, Bom buo = *Bombax buonopozense*, Bri fer = *Bridelia ferruginea*, Bri mic *Bridelia micrantha*, Can spp = *Canthium spp.*, Col gig = *Cola gigantea*, Dio pis = *Diospyros piscatoria*, Dio und = *Diospyros pseudomespilus* (Syn *D. undabunda*), Gre pub = *Grewia pubescens*, Kha ivo = *Khaya ivorensis*, Mil exc = *Milicia excelsa*, Mus cec = *Musanga cecropioides*, Oxy rac = *Oxyanthus racemosus*, Rau vom = *Rauvolfia vomitoria*, Rot lon = *Rothmannia longiflora*, Str gra = *Strombosia grandifolia*, War mem = *Warneckea memecyloides*, Zan xan = *Zanthoxylum xanthoxyloides*.



Obioh & Isichei, Fig. 1



Obioh & Isichei, Fig. 2