Plants used in Wechiau Community Hippopotamus Sanctuary in Northwest Ghana

Alex Asase and Alfred A. Oteng-Yeboah

Research

Abstract

An ethnobotanical study of plants used by the indigenous people living in the Wechiau Community Hippopotamus Sanctuary in northwestern Ghana was conducted using structured and semi-structured interviews, and participant-observation methods. A total of 77 species of plants in 27 families were identified as commonly used by the communities in the sanctuary. The plants were reported used in 7 out of the 13 major plant-use categories defined by Cook (1995). The plants were mostly used as medicines (61%), materials (38%), fuel (33%), and human food (26%). The results of this study show that a larger proportion of the plants in the sanctuary are used by the communities as their sources of livelihoods and cultural activities. This demonstrates the need for ethnobotanical data for management of community-based conservation sites in the development of strategies for sustainable use of plants.

Introduction

Many communities in Ghana, especially those living in rural parts of the country, still use a diversity of species of plants in their day-to-day activities. Knowledge about the uses of these species has been passed from one generation to another, usually through verbal communication, apprenticeship and family inheritance (Dokosi 1969). Because of changes in lifestyles as well as ecosystem and habitat losses, this knowledge is being rapidly lost (Mshana *et al*. 2001). The traditional knowledge about the uses of plants in Ghana has been surveyed by Irvine (1961), Abbiw (1990), Dokosi (1998), and Mshana *et al*. (2001). Despite these contributions, there are few community-based studies that document the uses made by specific communities of the species they have currently available in the vicinity of their villages. Oteng-Yeboah (1999) suggested that the traditional uses of plants within Ghana should be documented through extensive ethnobotanical studies throughout the country. This documentation is of cultural and economic importance as it provides a better understanding of the role plants play in the lives of the communities and why it is so important to conserve plant diversity.

The Wechiau Community Hippopotamus Sanctuary in Ghana contains 22 communities with an estimated population of 2,969 people (Ghana Statistical Service 2005). The communities living within and around the sanctuary are largely people from the Wale and Brifo (commonly called Lobi) ethnic groups. Other ethnic groups such as Hausa, Ewe, and Daagare also live within the sanctuary. The majority of the people in the sanctuary are subsistence farmers with **bambara** beans (*Vigna subterranea* (L.) Verdc.), corn (*Zea mays* L.), millet (*Pennisetum americanum* (L.) Leeke), guinea corn (*Sorghum bicolor* (L.) Moench), groundnuts (*Arachis hypogaea* L.) and yams (*Dioscorea* species) as the main food crops (Asase, 2005). Non-Timber Forest Products are principally shea

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nuts (*Vitellaria paradoxa C.F. Gaertn.*) and **dawadawa** (*Parkia biglobosa* (Jacq.) R. Br. ex G. Don). These are usually collected by women and processed into oil and spices, respectively, for the local markets. Other activities of economic importance that usually involve women are beer (**pito**) brewing from seeds of *S. bicolor*, and pottery. Currently there is very little known about the cultural and medicinal uses of plants by people in these communities. The recent influx of tourists as a result of the rapid development of ecotourism activities in the sanctuary will most likely lead to acculturation away from indigenous knowledge about plant uses. An ethnobotanical study was undertaken at the request of the local people to document the different uses of their flora.

The main objective of this paper is to present the information collated. It is also hoped that the information will assist those developing management and conservation strategies for sanctuary as a tourist resort. Conservation of habitats will enable the communities to have access to the plants that support their livelihoods and cultural activities in the Wechiau Community Hippopotamus Sanctuary in northern Ghana (Asase & Oteng-Yeboah 2007).

Materials and Methods

Study area

The Wechiau Community Hippopotamus Sanctuary is about 42 km southwest of Wa in the northern part of Ghana. The area is located at about latitude 09° 49.762' N and longitude 02° 40.965' W, and covers an area of 40 km^2 along the banks of the Black Volta River (Figure 1). The terrain is generally flat with a few isolated rocky hills. The sanctuary area has one rainy season between June and October each year with a peak period in August and a dry season from November to March. The average annual rainfall is 1034 mm and average temperature is about 11 ^oC. Asase and Oteng-Yeboah (2007) recorded 227 species of plants in the sanctuary.

Brief history and culture of Wale and Brifo people

Historically, the Brifo (Lobi) people were the first to occupy the banks of the Black Volta River in Ghana (Gurun Naa Banda Naa pers. comm.). They were later displaced into Burkina Faso around the 17th century by the Wale people from the Dagbon area in the Northern Region of Ghana. Currently, the Wale people are the main landowners in the sanctuary. The Brifo people migrated back across the Black Volta River into Ghana in the 19th Century to escape the French military laws in Burkina Faso (Naa Danyagri Walaman-I Seubah II pers. comm). They have since remained loyal to the Wale chiefs and land priests (**tendaamba**).

Traditionally, both the Wale and Brifo people believed in a supreme god. However, many of the traditional beliefs of the Brifo people are focused around ancestors, animistic spirits, idols and bush spirits (**kontoma**). The Brifo people, therefore, often have shrines around their homes that include carvings, animal skulls from sacrifices, cowry shells, feathers, stones, sticks and fetish objects (Asase 2005). About 90% of the Brifo people in the sanctuary are believers of traditional religion. However, the traditional believes of the Wale people in the sanctuary have been influenced by Islam and Christianity more than those of the Brifo people (Asase 2005).

The daily lives of the Wale and Brifo people include consumption of local beer (**pito**) and local gin (**akpeteshie**) except for devout Christians and Muslims. Popular local dishes include **kapala** (made from pounded yam and eaten with vegetable soup or stew), and **tuo zaafi** (made from maize or millet and also eaten with vegetable soup or stew). Funerals and markets are the dominant social networks for all of the people in the area. Nighttime gatherings are when they exchange stories about their ancestors and are the means through which historical and cultural beliefs are passed on from one generation to another.

Methods

The Wechiau Community Hippopotamus Sanctuary Management Board (SMB) was consulted and community meetings were held to explain the objectives of the study in order to obtain the consent of the people before data collection. People were interviewed using a combination of structured interviews, semi-structured interviews, and participant observation techniques (Martin 1995). Locally trained guides served as interpreters during the interviews. A questionnaire was designed to obtain data on the following: species being used, local names, plant parts used, how the plant was used, collection sites and the frequency each species was used. Semi-structured interviews involved interviewing people individually in the field where they normally collected their plants. SMB agreed to identify individuals with higher levels of plant knowledge so that they could be interviewed in the field. In addition, observations about plants being used for fuel wood, carving of stools and crafts were made during each field expedition. Each species of plant encountered during the study was collected and deposited at the Ghana Herbarium (GC) at the Department of Botany, University of Ghana in Legon. Preliminary field identifications of the plants were authenticated by comparison with already identified specimens at GC and by the use of relevant literature (Asase & Oteng-Yeboah 2007, Hutchinson & Dalziel 1954-1972).

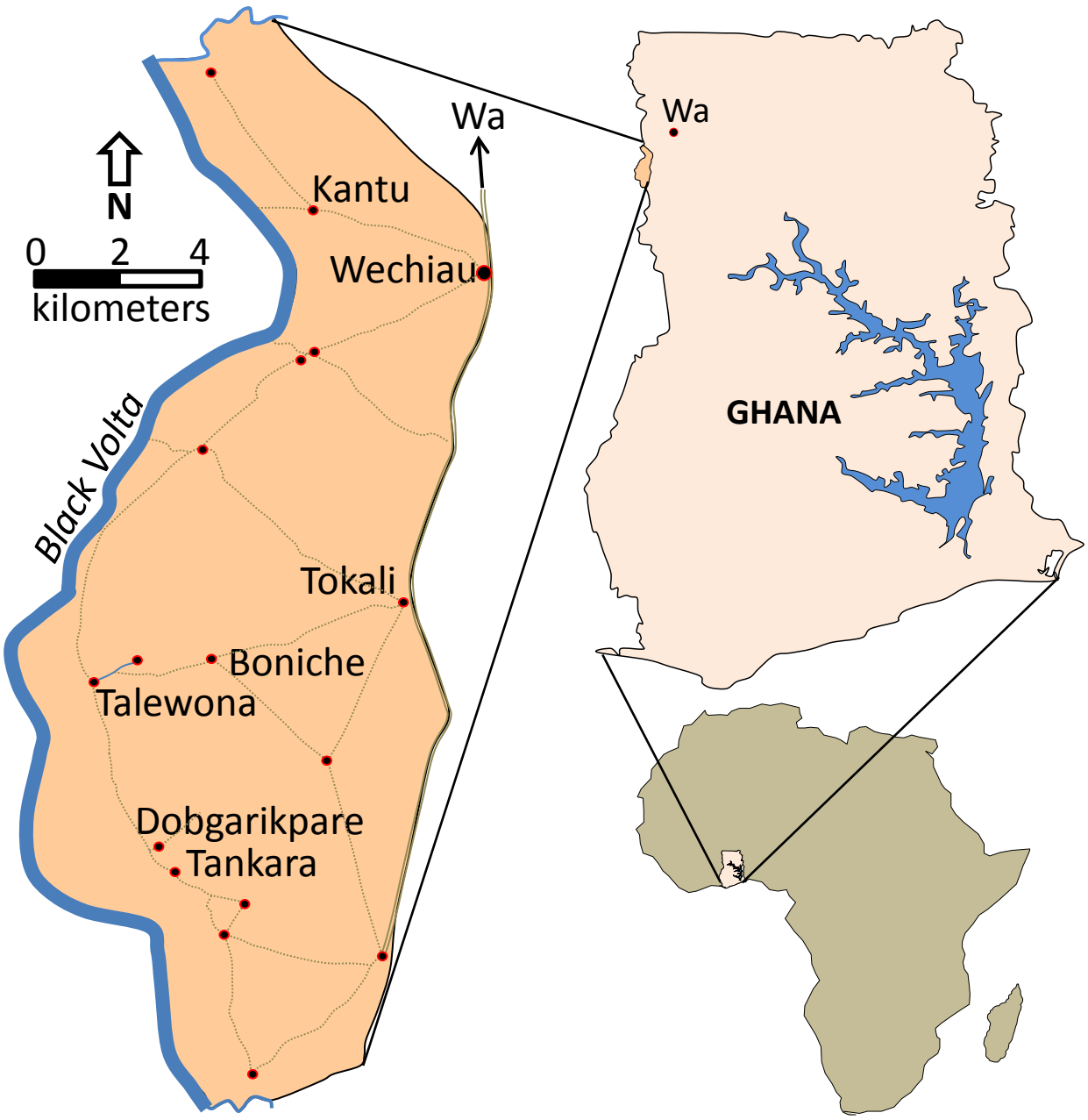

Figure 1. Wechiau Community Hippopotamus Sanctuary in northwest Ghana.

Data analysis

Uses of plant species were classified according to the categories identified by Cook (1995). The data was also analysed using descriptive statistical methods (Martin 1995).

Results

In total, 88 people from seven communities (Wechiau, Tokali, Kantu, Talewona, Tankara, Boniche and Dobgarikpare) living in the sanctuary were interviewed over a period of three years. The structured interviews involved members of 44 households and a total of 117 questionnaires were completed. Six herbalists and two chiefs identified by the SMB as having a lot of knowledge about the uses of plants were interviewed using semi-structures interviews.

General plant use and diversity

A total of 77 species of plants belonging to 27 families (Table 1) were identified as commonly used by commu-

Table 1. Species of plants used in Wechiau Community Hippopotamus Sanctuary in northern Ghana. Categories of use as defined in Cook (1995) with taxonomic families, habit (growth form), local names and how they are being used. Red species are not native to Africa.

Species (voucher number)	Family (habit)	Local Names (Language)	Categories of use and how used
Acacia gourmaensis A. Chev. (AA 001)	Fabaceae (small tree)	**Goupiela** (Wale)	(1) Fuel: Stem and branches used as fuel wood.
Acacia nilotica (L.) Willd. ex Delile (AA002)	Fabaceae (small tree)	**Gousagla** (Wale)	(1) Fuel: Stem and branches used as fuel wood.
Acanthospermum hispidum DC. (GC 47761)	Asteraceae (herb)	**Bwongor** (Lobi)	(1) Animal food: Leaves used to feed goats, sheep, pigs and cattle.
Adansonia digitata L.(AA003)	Malvaceae (tree)	**Tuo** (Wale)	(1) Medicine: Soak stem bark, use decoction to bath children 3-4 times daily for health growth. (2) Food: Fruits eaten and leaves used as vegetables.
Afraegle paniculata (Schum. & Thonn.) Engl. (GC 47780)	Rutaceae (small tree)	N.A	(1) Medicine: Boil roots and drink decoction as required for malaria.
Afzelia africana Sm. (GC 47762)	Fabaceae (tree)	**Kakala** (Lobi)	(1) Medicine: Boil roots and drink as required for fevers. (2) Animal food: Leaves used to feed goat and sheep. (3) Materials: Stem and / or branches used for carving sculpture, xylophones, drums, roofing and beams. (4) Fuel: Stem and branches used as fuel wood and charcoal (5) Social uses: Leaves are used for secret spiritual rituals.
Andropogon sp. (AA 004)	Poaceae (herb)	N.A	(1) Animal food: Whole plant used to feed goats, sheep, pigs and cattle.
Annona senegalensis Pers. (AA 005)	Annonaceae (shrub)	**Baatanga**	(1) Medicine: Grind stem and root bark, add to lotion, and smear on affected parts of the body to treat skin rashes. (2) Food: Fruit eaten. (3) Materials: Stem and / or branches for roofing.
Anogeissus leiocarpus (DC.) Guill. & Perr. (GC 47763)	Combretaceae (tree)	**Sinsinrah** (Lobi), **Siirah** (Wale)	(1) Medicine: Boil leaves and drink infusions for malaria. (2)Fuel: Stem and branches used as fuel wood (3). Stem and branches used for roofing.
Azadirachta indica A. Juss. (GC47764)	Meliaceae (tree)	**Akagyatia** (Lobi)	(1) Medicine: (a) Pound leaves, sieve and use for enema for fevers / malaria, also boil leaves and drink infusions. (b) Twigs used for cleaning teeth.
Balanites aegyptiacus (L.) Delile (AA 006)	Zygophyllaceae (small tree)	**Gango** (Wale)	(1) Medicine: Boil leaves with twigs, drink infusion for malaria. (2) Materials: Stem and / or branches for making stools, shaft of implements such as hoes, knives and cutlass. (3) Vertebrate Poison: Roots use to stupidity fishes.
Blighia sapida K.D. Koenig. (AA 007)	Sapindaceae (tree)	N.A	(1) Medicine: Boil leaves and used infusion to treat cuts when bleeding.
Bombax costatum Pellegr. & Vuillet (AA 007)	Malvaceae (tree)	**Fula** (Wale)	(1) Food: Leaves used as vegetable (2) Materials: Stem and / or branches for making walking sticks.

Species (voucher number)	Family (habit)	Local Names (Language)	Categories of use and how used
Bridelia ferruginea Benth. (AA 008)	Phyllanthaceae (small tree)	N.A	(1) Medicine: Boil stem bark and drink infusion for malaria.
Burkea africana Hook. (AA 009)	Fabaceae (small tree)	**Gberime** (Lobi)	(1) Medicine: (a) Boil roots and use decoction to wash mouth for sore mouths. (b) Twigs used as chewing stick. (2) Fuel: Stem and / or branches used for fuel wood.
Carica papaya L. (GC47765)	Caricaceae (small tree)	N.A	(1) Medicine: Boil leaves and drink as desired and use for steam baths to treat malaria.
Cassia sieberiana DC. (GC47799, AA)	Fabaceae (Small tree)	**Vabine** (Wale)	(1) Medicine: (a) Boil root and drink decoctions for stomachaches. (b) Boil root and drink decoctions for fever. (2) Materials: Stem and / or branches for roofing houses.
Ceiba pentandra (L.) Gaertn. (AA 010)	Malvaceae (tree)	N.A	(1) Food: Leaves used as vegetable.
Cissus sp. (AA 011)	Vitaceae (climber)	N.A	(1) Materials: Stem and / or branches used as binding material in mortar.
Cochlospermum planchoni Hook.f. ex Planch. (AA 012)	Bixaceae (shrub)	**Gbelon** (Wale)	(1) Materials: Stem bark used in making ropes.
Cochlospermum tinctorium A. Rich. (GC 47766)	Bixaceae (shrub)	**Gbelonbile** (Wale)	(1) Medicine: Boil pounded roots and drink infusion for fevers. (2) Materials: Stem bark used in making ropes.
Combretum ghasalense Engl. & Diels. (GC 47767)	Combretaceae (small tree)	**Popal** (Lobi), **Kpamara** (Wale)	(1) Medicine: (a) Boil leaves and drink infusion for stomachaches (b) Pound dried leaves and add powder to cuts. (2) Animal food: Leaves for feeding goats, sheep, pigs and cattle. (3) Materials: Stem for roofing.
Combretum molle R. Br. ex. G. Don. (AA 013)	Combretaceae (small tree)	N.A	(1) Fuel: Stem and / or branches used as fuel wood.
Combretum sp. (AA 014)	Combretaceae (small tree)	**Kpekakra** (Lobi)	(1) Fuel: Stem and / or branches used as fuel wood.
Crossopteryx febrifuga (Afzel. ex. G. Don.) Benth. (AA 0015)	Rubiaceae (tree)	**Dodoyiele** (Wale)	(1) Medicine: Boil leaves and drink infusions for malaria. (2) Fuel: Stem and / or branches used as fuel wood. (3) Materials: Branches used for roofing and carving xylophones and drums.
Cymbopogon citratus (DC.) Stapf	Poaceae (herb)	N.A	(1) Medicine: (a) Boil leaves and drink infusion 2-3 times daily fever. (b) Boil leaves, and drink and bath infusion after child birth.
Daniellia oliveri (Rolfe) Hutch. & Dalziel (AA 016)	Fabaceae (tree)	N.A	(1) Medicine: Make hole in seed and use as necklace for child continuously crying. (2) Fuel: Stem and / or branches used as fuel wood. (3) Materials: Branches used for making stools and shaft of implements such as hoes, knives and cutlass
Detarium microcarpum Guill. & Perr. (AA 017)	Fabaceae (small tree)	**Kpagra** (Lobi)	(1) Medicine: Boil leaves and drink infusion for malaria. (2) Food: Fruit eaten raw. (3) Materials: Stem and / or branches used for carving sculpture, stools and roofing.

Species (voucher number)	Family (habit)	Local Names (Language)	Categories of use and how used
Dichrostachys glomerata (Forssk.) Chiov. (GC 47769)	Fabaceae (shrub)	**Gbegire** (Wale)	(1) Materials: Stem used for making walking sticks.
Diospyros mespiliformis Hochst. ex. A. DC. (AA 018)	Ebenaceae (tree)	**Gar** (Lobi), **Gaa** (Wale)	(1) Medicine: (a) Pound leaves and add to soup, and drink for stomachaches. (b) Pound root bark and add powder to cuts. (2) Food: Fruit eaten raw. (3) Fuel: Stem and / or branches used as fuel wood. (4) Materials: Stem and / or branches for roofing, pillars and carving stools. (5) Social uses: The leaves are used for secret spiritual rituals.
Ficus gnaphalocarpa (Miq.) Steud. ex Miq. (AA 019)	Moraceae (tree)	**Konkon** (Lobi)	(1) Medicine: Pound roots and drink infusion for malaria. (2) Animal food: Leaves for feeding goat, sheep, pigs and cattle.
Gardenia ternifolia Schumach. & Thonn. (GC 47771)	Rubiaceae (shrub)	**Dajeda** (Lobi), **Dajugo** (Wale)	(1) Medicine: Boil leaves and twigs, drink as desired for malaria. (2) Food: Fruit eaten raw
Grewia carpinifolia Juss. (AA 020)	Malvaceae (small tree)	**Youle** (Lobi), **Bayole** (Wale)	(1) Food: Stem bark use as a flocculant and fruit eaten raw. (2) Animal food: Leaves used for feeding goats, sheep, pigs and cattle. (3) Fuel: Stem and / or branches used for fuel wood (4) Materials: Sap from stem used for painting or decoration of houses.
Haematostaphis barteri Hook.f. (GC47772)	Anacardiaceae (small tree)	**Dole** (Lobi), **Genbereni** (Wale)	(1) Medicine; Boil leaves of Pseudocedrela kotschyi and Ficus ghaphalocarpa. Drink mornings and evenings and massage body for malaria. (2) Food; Fruit eaten raw
Hibiscus asper Hook.f. (AA 021)	Malvaceae (herb)	**Biri** (Lobi), **Bere** (Wale)	(1) Medicine; Boil leaves and wash eyes with infusion after cobra spits into the eye. (2) Food; Leaves used as vegetable. (3) Materials; Stem bark used in making rope.
Hyptis spicigera Lam. (GC47773)	Lamiaceae (herb)	**Donbeleva** (Lobi)	(1) Medicine; Boil leaves and drink infusions for malaria.
Indigofera pulchra Willd.	Fabaceae (herb)	**Balesama** (Wale)	(1) Medicine; Boil whole plants, drink and massage body for malaria.
Jatropha curcas L. (GC47775)	Euphorbiaceae (shrub)	**Nato** (Lobi)	(1) Medicine: (a) Pound leaves with twigs, boil and use decoction to treat cuts and wounds. (b) Boil leaves and use decoction to wash mouth for sore gums.
Jatropha gossypiifolia L. (GC 47776)	Euphorbiaceae (shrub)	**Natuor** (Lobi)	(1) Medicine: Boil leaves with leaves of Combretum ghaselensis and whole plant of Ocimum canum, and drink for malaria and use for steam baths.
Khaya senegalensis (Desv). A. Juss. (GC47777)	Meliaceae (tree)	**Koke** (Wale)	(1) Medicine: Boil stem bark and drink for anaemia. (2) Materials: Stem used for roofing and making canoes
Lannea acida A. Rich. (GC47778)	Anacardiaceae (tree)	**Manvora** (Lobi), **Sunsugere** (Wale)	(1) Food: Fruit eaten raw. (2) Fuel: Stem and / or branches used as fuel wood.

Species (voucher number)	Family (habit)	Local Names (Language)	Categories of use and how used
Lannea kerstingii Engl. & K. Krause (AA 022)	Anacardiaceae (tree)	**Gbentore** (Wale)	(1) Food: Fruit eaten raw. (2) Fuel: Stem and / or branches used as fuel wood. (3) Materials: Branches used for carving stools and shaft of hoes.
Leucas martinicensis (Jacq.) R.Br. (GC47779)	Lamiaceae (herb)	**Donbeleva** (Lobi)	(1) Medicine: Boil whole plant with Hyptis spicigeria and drink as required fever.
Mangifera indica L. (GC 47780)	Anacardiaceae (tree)	**Mango**	(1) Medicine: (a) Boil stems barks and drink as required for stomachaches. (b) Boil stems barks and drink as required for fever.
Maytenus senegalensis (Lam.) Exell. (AA 023)	Celastraceae (Shrub)	N.A	(1) Fuel: (a) Stem and / or branches use as fuel wood. (2) Materials: Stem and / or branches used for making paddles for canoes.
Mitragyna inermis (Willd.) Kuntze (GC 47799)	Rubiaceae (tree)	**Yeila** (Lobi), **Yiele** (Wale)	(1) Medicine: Boil leaves and drink infusion and also used for stem-baths to treat malaria. (2) Fuel: Stem and / or branches use as fuel wood. (3) Materials: Branches for carving stools, and roofing house and as beams
Monanthotaxis sp. (GC 47781)	Annonaceae (climber)	N.A	(1) Medicine: (a) Boil leaves and drink 3 times daily for stomachaches. Massage body with decoction. (b) Boil roots and drink infusion as required for malaria.
Moringa oleifera Lam. (AA 024)	Moringaceae (small tree)	N.A	(1) Food: Leaves used as vegetable.
Nauclea latifolia Sm. (GC 47782)	Rubiaceae (small tree)	**Gongan** (Lobi), **Gounge** (Wale).	(1) Medicine: Boil root bark and drink infusions malaria. (2) Food: Fruit eaten raw. (3) Materials: Branches for making walking sticks, paddles of local canoes, cooking spoons and pestles used for pounding food.
Ocimum canum Sims (GC47800)	Lamiaceae (herb)	**Worobangnui** (Lobi)	(1) Medicine: Boil whole plant with leaves of Azadirachta indica, Combretum ghaselensis and Mitrgyana inermis and drink for malaria.
Ostryoderris stuhlmannii (Taub.). Dunn. ex Harms.	Fabaceae (tree)	N.A	(1) Medicine: Boil leaves with that of Combretum sp and Pericopsis laxiflora, and drink as required for malaria.
Ozoroa insignis Delile (GC47783)	Anacardiaceae (small tree)	**Datoa** (Wale)	(1) Medicine: Boils leaves and twigs, and drink for malaria.
Parinari polyandra Planch. ex Benth. (GC47784)	Chrysobalanaceae (small tree)	**Bongekapala** (Wale)	(1) Fuel: Stem and/ or branches used as fuel wood. Brifo women are not supposed to use this as fuel wood before they give birth as it is feared they will abort the child.
Parkia biglobosa (Jacq.) R. Br. ex G. Don (GC 47785)	Fabaceae (tree)	**Dowa** (Wale)	(1) Medicine: (a) Boil leaves and drink infusion and bath for fever (b) Boil leaves and drink infusion and bath for headaches. (2) Food: Pulp of fruit eaten raw and seed used as a spice. (3) Fuel: Stem and / or braches used as fuel wood and in making charcoal. (4) Materials: Stem used for roofing and carving stools
Paullinia pinnata L. (GC 47786)	Sapindaceae (climber)	**Chiau** (Lobi)	(1) Medicine: Boil leaves and drink. Bath mornings and evenings to treat malaria.

Species (voucher number)	Family (habit)	Local Names (Language)	Categories of use and how used
Pericopsis laxiflora (Benth. ex Baker) Meeuwen (GC 47787)	Fabaceae (small tree)		(1) Medicine: Boil leaves with that of Combretum sp and Pericopsis laxiflora, and drink as required
Piliostigma thonningii (Schumach). Milne-Redh. (AA 025)	Fabaceae (small tree)	**Bouna** (Lobi), **Ambagenie** (Wale)	(1) Medicine: Boil leaves and decoction to wash cuts. (2) Fuel: Stem and / or branches used for fuel wood. (3) Materials: Stem bark for making rope and stem for roofing.
Prosopis africana (Guill. & Perr.) Taub. (AA 026)	Fabaceae (tree)	**Kpalitia** (Lobi)	(1) Medicine: (a) Pound leaves and put into cuts. (b) Twigs used as chewing stick. (2) Materials: Branches used to make cooking spoons and pestles for pounding food.
Pseudocedrela kotschyi (Schweinf) Harms. (GC 47798)	Meliaceae (tree)	**Kpela** (Wale)	(1) Medicine: (a) Boil leaves and stem bark and drink infusion for malaria. (b) Clean the teeth as chewing stick.
Pterocarpus erinaceus Poir. (GC 47789)	Fabaceae (tree)	**Lirun** (Lobi), **Buniya** (Wale)	(1) Medicine: Chop root and add to leaves, soak in water and use decoction to wash eyes. (2) Animal food: Leaves used to feed goats and sheep. (3) Materials: branches used for carving stools, xylophone and drums, and for roofing house and as beams (4) Social uses: The decoctions of the leaves and roots of this plant are used by carvers to wash their face and this was believed to enable them carve properly.
Pterocarpus santalinoides L'Hér. ex DC. (AA 027)	Fabaceae (tree)	N.A	(1) Food: Fruit eaten raw.
Ricinus communis L. (GC 47790)	Euphorbiaceae (small tree)	**Beton** (Lobi)	(1) Medicine: Squeeze leaves in a pot to ferment. Bath with fermented solution to treat malaria.
Saba senegalensis (A. DC.) Pichon. (AA 028)	Apocynaceae (climber)	**Ora** (Wale)	(1) Food: Fruit eaten raw. (2) Materials: Stem used in making basket for carrying stuff.
Senna occidentalis (L.) Link. (GC 47791)	Fabaceae (shrub)	N.A	(1) Medicine: Boil leaves drink and bath decoction to treat malaria.
Sterculia setigera Delile (GC 47792)	Malvaceae (small tree)	**Bulinyie** (Wale)	(1) Medicine: Boil leaves and drink to treat malaria. (2) Fuel: Stem and branches used for fuel wood.
Strophanthus hispidus DC. (AA 029)	Apocynaceae (shrub)	**Yap** (Lobi)	(1) Vertebrate poison: Used as arrow poison
Strychnos innocua Delile (GC47793)	Loganiaceae (small tree)	**Kolan** (Lobi), **Polea** (Wale)	(1) Medicine: Boil leaves and drink as required to treat malaria.
Strychnos spinosa Lam. (GC47794)	Loganiaceae (small tree)	**Dajekokora** (Lobi), **Polane** (Wale)	(1) Medicine: Boil leaves and drink. Grind twigs, add to pomade and smear on body for malaria.
Tamarindus indica L. (GC 47795)	Fabaceae (tree)	N.A	(1) Food: Fruit eaten raw and leaves used in preparation of porridge (2) Animal food: Leaves used to feed goats, sheep, pigs and cattle. (3) Fuel: Stem and / or branches use as fuel wood.(4) Materials: Branches used for roofing and beams.

Species (voucher number)	Family (habit)	Local Names (Language)	Categories of use and how used
Terminalia avicennioides Guill. & Perr. (AA 030)	Combretaceae (small tree)	**Bueare** (Lobi)	(1) Medicine: (a) Chew root and shallow sap for coughs. (b) Boil leaves and use as infusion to wash eyes. (2) Fuel: Stem and / or branches used as fuel wood. (3) Materials: Branches for making stools, shaft of implements such as hoes, knives and cutlass, and for roofing.
Terminalia macroptera Guill. & Perr. (AA 031)	Combretaceae (tree)	**Vapiala** (Wale)	(1) Fuel: Stem and / or branches used as fuel wood. (2) Materials: Stems used for roofing and beams.
Tridax procumbens L. (AA 032)	Asteraceae (herb)	**Jentari** (Lobi)	(1) Food: Whole plant use as vegetable (2) Animal food: Whole plant used to feed pigs.
Triumfetta sp. (AA 033)	Malvaceae (herb)	N.A	(1) Social uses: It is believed that the wood of when used as fuel wood causes headaches.
Vernonia amygdalina Delile (GC 47796)	Asteraceae (small tree)	**Jankpantire** (Lobi)	(1) Medicine: Boil leaves in a maize dough solution and drink for malaria.
Vitellaria paradoxa C.F. Gaertn. (AA 034)	Sapotaceae (tree)	**Tongtia** (Lobi), **Taanga** (Wale)	(1) Medicine: Smear oil from seed around boil to help burst. (2) Food: Fruit pulp eaten and cooking oil extracted from seeds (3) Animal food: Leaves used to feed goats, sheep, pigs and cattle. (4) Fuel wood: Stem and / or branches use as fuel wood and making charcoal. (5) Materials: Stem and / or branches used for carving shafts of hoes and for making beams and roofing. (6) Social Uses: At Birifo funerals the partner of the deceased holds a bunch of leaves.
Ximenia americana L. (AA 035)	Ximeniaceae (shrub)	**Liama** (Lobi)	(1) Medicine: (a) Grind root bark and add to cuts and wounds; (b) Pound leaves, soak and smear decoction on body to treat body rashes. (c) Boil leaves and use infusion to wash mouth and treat toothache. (2) Food: Fruit eaten raw (3) Materials: Stem bark used to soften animal skin when making leather (4) Fuel: Stem and / or branches used as fuel wood
Zanthoxylum zanthoxyloides (Lam.) Zepern. & Timler (AA 036)	Rutaceae (shrub)	N.A	(1) Social use: In war, twigs held in front to tame enemy.

nities in the sanctuary. Thus 34% of the 227 plant species recorded in the sanctuary (Asase & Oteng-Yeboah 2007) are being used by the communities in their day-to-day activities. A high proportion of the species being used are trees of which 49% were large tree species and 29% smaller trees. The other species being used included shrubs (13%), herbs (6%), climbers (2%), and grasses (2%). The use of plants from different growth forms is indicative of the fact that the indigenous people are very knowledge about the use of their flora diversity.

The species were reported being used in seven out of the thirteen major plant-use categories defined by Cook (1995). The majority of species were used as medicines (61%) followed by materials (38%), fuel (33%) and food (26%). A smaller number of species were used as fodder (12%), social uses (9%) and vertebrate poisons (3%). Of the 77 species, *V. paradoxa* had the greatest diversity of uses (six use categories). The importance of *V. paradoxa* to the indigenous people living in savanna areas cannot be overemphasized. Two species of plants, *Afzelia africana* Sm. and *Diospyros mespiliformis* Hochst. ex A. DC., were being used in five different use categories. The majority of species (38/77) were reported as being used in only one category. Of the 77 species reported being used in the sanctuary, 13 are not native species to Africa. Although widespread in Ghana these are known to have

originated from the Americas, Asia, and Australia (Mabberly 2002).

Medicinal use

In this study, 52 species of plants (23% of plants in the sanctuary) were reported as being used for the treatment of ailments. A majority of medicinal species were used to treat: infections and fevers (46), digestive (8) and skin (7) disorders, pain (4), and respiratory system (1). The majority (81%) of the 52 species were prepared singly for treatments. *Nauclea latifolia* Sm., *Mitragyna inermis* (Willd.) Kuntze, *Cassia sieberiana* DC. and *Ximenia americana* L. were among the most frequently mentioned plants. Trees provide a high proportion of the medicinal plants and the most frequently used part of the plants for medicines are the leaves (65%), roots (12%) and stem / branches (10%). The greatest diversity in terms of number of growth forms (Figure 2) and plant parts used (Figure 3) was recorded for the medicinal use category.

Wild foods for humans

25 wild species were reported being eaten in the sanctuary. Fruits and leafy vegetables formed 60% and 24%, respectively. Wild fruits were often eaten as snacks by farmers, hunters, field workers and children. The most preferred fruits were obtained from *Adansonia digitata* L., *A. senegalensis*, *Haematostaphis barteri* Hook.f., *P. biglobosa*, *Tamarindus indica* L., *Saba senegalensis* (A. DC.) Pichon., *V. paradoxa* and *X. americana*. Leafy vegetables were used in the preparation of soups and sauces and were mostly obtained from *A. digitata*, *Bombax costatum* Pellegr. & Vuillet, *Ceiba pentandra* (L.) Gaertn., and *Moringa oleifera* Lam. Seeds of *P. biglobosa* were used as a condiment, and edible cooking oil was obtained mainly from seeds of *V. paradoxa.* Other species used as food included the use of the leaves of *T. indica* in the preparation of porridge to make it taste sour.

Animal food

Livestock production is an important component of the farming system in the sanctuary. Ten species were used as fodder to feed goats, sheep, cattle and pigs. With the exception of *Andropogon* sp., all the species used to feed livestock were trees and shrubs, and were used fresh. Leaves formed 70% of the plant part used and the leaves of *Pterocarpus erinaceus* Poir. and *A. africana* were the

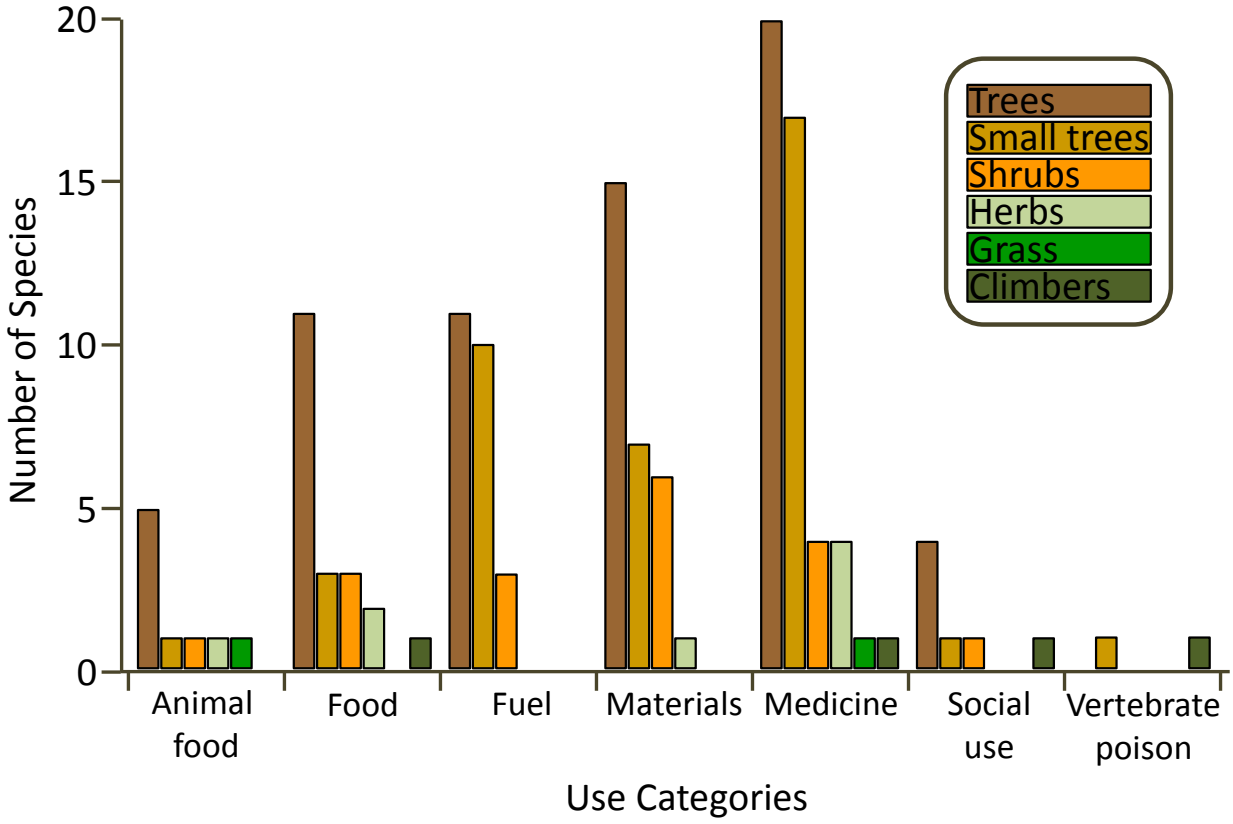

Figure 2. Relationships between plant use categories and growth forms for 77 useful plants in Wechiau Community Hippopotamus Sanctuary in northwest Ghana.

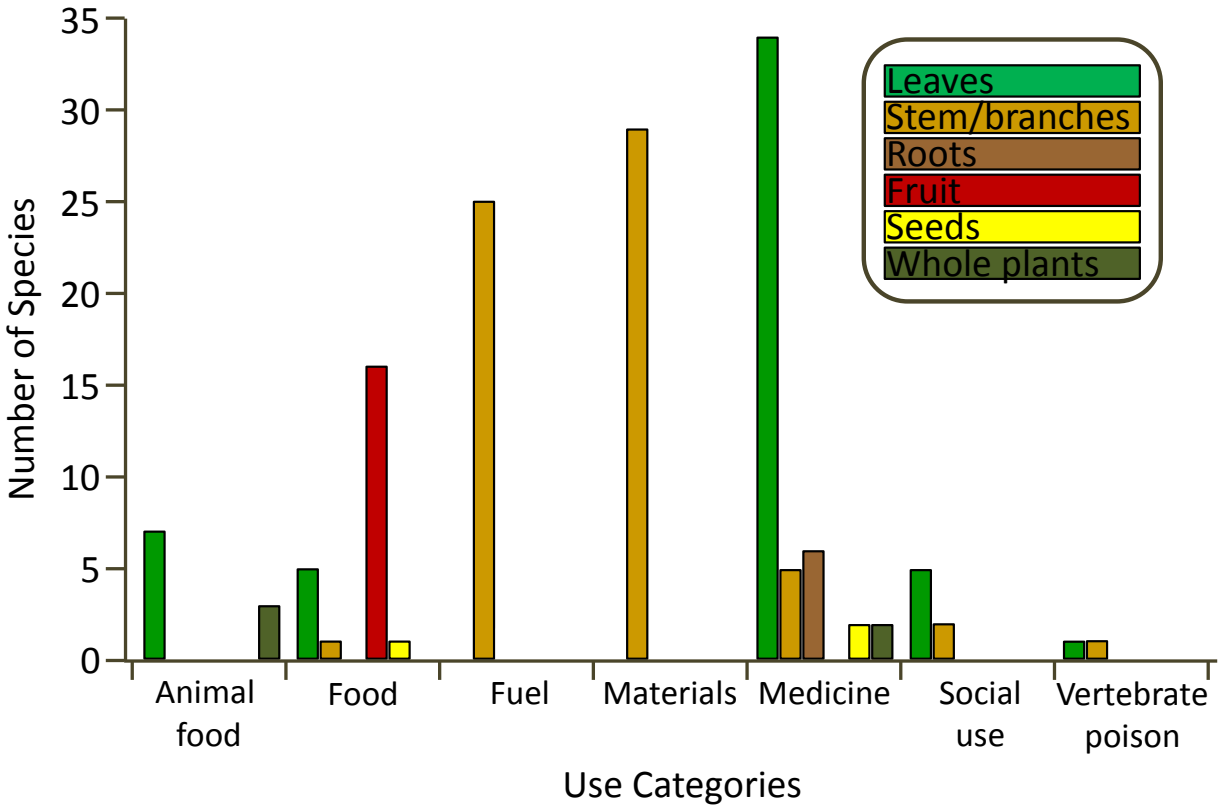

Figure 3. Relationships between plant use categories and parts used for 77 useful plants in Wechiau Community Hippopotamus Sanctuary in northwest Ghana.

most frequently used, although whole plants of *Tridax procumbens* L. and *Andropogon* sp. were fed to livestock.

Fuel wood

The stems and branches of 24 species of shrubs and trees were used as fuel in the raw state and for charcoal production. The most frequently used species were *V. paradoxa*, *Anogeissus leiocarpus* (DC.) Guill. & Perr., *Lannea acida* A. Rich., *Crossopteryx febrifuga* (Afzel. ex G. Don.) Benth., *Terminalia macroptera* Guill. & Perr., *P. erinaceous* and *Daniellia oliveri* (Rolfe) Hutch. & Dalziel.

Material use

Overall, 29 species of plants were reported as being used as raw materials. The stem and branches of the plants were the parts used (Figure 3). About 69% (20/29) plants were reported being used in construction of houses. The species were mostly used in roofing and beams in building mud houses. Preferred species were *P. erinaceus* and *Terminalia* spp. The communities believed that these plants were resistant to insect attacks. About 52% of the plants were used in making various tools and implements such as walking sticks, shafts of hoes, and canoes. Some of the plants were also used in carving sculptures, drums and xylophones. The famous Lobi sculptures are carved from *A. africana* and *D. microcarpum*. Xylophones and drums are made from *A. africana*, *C. febrifuga*, and *P. erinaceous*. These products are made mainly for local consumption.

Social use

In the present study, six plant species were identified as being used for spiritual / magic / superstition and ceremonial purposes. As an example, leaves of *Zanthoxylum zanthoxyloides* (Lam.) Zepern. & Timler are held in front of enemies to tame them in war situations. In another example, the wood of *Triumfetta* sp. is not to be used by pregnant women.

Vertebrate poison

Two species of plants were reported as being used as poisons. *Balanites aegyptica* is used to stupify fish and *Strophanthus hispidus* DC. is used as an arrow poison.

Discussion

Medicinal use

It is estimated that 70-95% of the world's rural population relies on plants for their health care (Hamilton 2004).

Plants play a very important role in the delivery of primary health care in Ghana (Mshana *et al*. 2001, PORSI 1992). In Africa many communities rely on trees for their medicines and they mainly use root or stem bark, material that if over harvested can result in the death of the plant (Sofowora 1993). Thus it is of interest that within the sanctuary, although bark is used as medicines, a high proportion of leaves are also used.

The diversity of plant growth forms and parts used for the medicine category is similar to that reported in the Henguan Mountains in southwest China (Weckerele *et al*. 2006). It is important to note that some of the plant-use categories involved the use of only certain plant parts. For example, fuel wood and materials were obtained from only stems / branches of the plants. Animal food was also obtained from either whole plants or leaves.

Comparing the data in this study with that in the available literature on medicinal plants of Ghana (Abbiw 1990, Irvine 1961, Mshana *et al*. 2000, PORSPI 1992) shows that many of the plants are used for the treatment of similar ailments in other parts of the country. For example, stem bark of *Annona senegalensis* Pers. has been reported used to treat skin ulcers (Mshana *et al*. 2000); a decoction of the root of *C. sieberiana* together with other plants is used to treat stomachache (Abbiw 1990); and stem bark of *Khaya senegalensis* (Desv). A. Juss. is used to treat anaemia (Mshana *et al*. 2000). A few of the medicinal plant uses in the sanctuary were, however, not recorded for Ghana, although these uses have been recorded in other parts of Africa (Burkill 1997). For example, *Burkea africana* Hook., *Combretum ghasalense* Engl. & Diels. and *Monanthotaxis* sp. are used for treatment of digestive system disorders but this has not been previously recorded for Ghana. Similarly, this is the first report on use of *Terminalia avicennioides* Guill. & Perr. for the treatment of coughs, and *C. ghaselense* for the treatment of cuts and wounds in Ghana. We also report the use of *Balanites aegyptiacus* (L.) Delile and *Cymbopogon citratus* (DC.) Stapf for the treatment of malaria in the sanctuary. In this paper we do not go into details about the anti-malarial plants in the sanctuary as these data have already been published (Asase *et al*. 2005). There appears to be local differences in the uses of species within Ghana. For example, most of the species used by communities in the guinea savanna zone of northern Ghana to treat nervous disorders (e.g., *Maytenus senegalensis* (Lam.) Exell., *Gardenia ternifolia* Schumach. & Thonn.), genito-urinary problems (e.g., *Detarium microcarpum* Guill. & Perr., *Entada africana* Guill. & Perr.), and muscular-skeletal systems (e.g., *P. biglobosa* , *V. paradoxa*) (Oteng-Yeboah 1999) also occurred in the sanctuary, but the people in the sanctuary did not report them as being used to treat those ailments.

Wild foods for humans

Wild foods consumed by humans are important nutritional supplements of rural people in many parts of the world (Abbiw 1990, Harris & Mohammed 2003, Sundriyal & Sundriyal 2001, Sundriyal *et al*. 2004). The uses of *P. biglobosa* (condiment) and *V. paradoxa* (cooking oil) are common in most parts of West Africa (Burkill 1997). The stem bark of *Grewia carpinifolia* Juss. is used as a flocculant in making local beer, as reported by Oteng-Yeboah (1999). Edible foods in the wild may present the cheapest source of vitamins, protein, minerals and other nutrients compared to conventional food crops. Therefore, these complement other foods eaten by people living in the sanctuary area. Many of the wild edible foods being eaten in the sanctuary are of local importance only. However, a few species including *A. digitata*, *T. indica*, *P. biglobosa* and *V. paradoxa* are of international importance (Kristensen & Lykke 2003). There has been a growing interest to evaluate various wild edible plants for their nutritional value (Ifon 1980). Nevertheless, the nutritive value of many of the wild food plants used in the sanctuary has not yet been investigated.

Animal food

The species of plants reported used to feed animals in the sanctuary have been previously documented elsewhere (Abbiw 1990, Burkill 1997). According to McGinnies *et al*. (1971) shrubs are of higher quality than grass, and browse species are higher in protein, phosphorus and carotene. In contrast, grasses are superior to shrubs in energy yielding qualities. In the sanctuary area, *P. erinaceus*, *A. africana*, *T. procumbens*, and *Andropogon* sp. are abundant and may represent cheap sources of food for livestock.

Fuel wood

Two species, *V. paradoxa* and *P. erinaceous*, reported as useful fuel wood in the sanctuary, are also reported as important fuel wood plants among the Guorounsi villages around the Nazinga Game Ranch in south central Burkina Faso (Kristensen & Lykke 2003). It has also been established by Nerquaye-Tetteh *et al*. (2002) that *T. avicennoides*, *A. leiocarpus*, *C. ghansalense,* and *P. erinaceous* have good fuel wood qualities which supports their use in the sanctuary. Although the people interviewed had clear preferences for certain species for fuel, they used a wide selection of plants. This supports other findings where a range of species are used as fuel wood because no species are being specifically cultivated for that purpose. This is a result of those species that make good firewood having been overharvested and are now scarce (Grundy *et al*. 1993, Lykke 2000).

The use of plants for fuel has been noted to be the major contributor to deforestation besides timber extraction and agriculture in tropical Africa (Allen & Barnes 1985, Ander-

sen & Fishwick 1984, Hosier & Milukas 1989). In the sanctuary area, the use of plants for fuel for cooking, warmth, preservation of food and other uses may be the only viable alternative for most of the people because it is cheaper, accessible and locally available. It is therefore important to regulate collection of plants for fuel within the protected area of the sanctuary to ensure sustainable use.

Material use

The direct use of forests includes products that may be obtained from it in the form of raw materials (Abbiw 1990). Sanctuary communities believed that *P. erinaceus* and *Terminalia* spp. are resistant to insect attack. A similar remark about these species was made by Kristensen and Lykke (2003) in a study of the Guorounsi villages around the Nazinga Game Ranch in south central Burkina Faso. Products (e.g., sculptures, drums, xylophones) are made mainly for local consumption and it might be worth exploring foreign markets after some amount of value addition.

Social use

Since ancient times humans have used plants not only as food sources, but also as part of their ritual and healing practices (De Feo 2004). The use of plants in spiritual / magic / superstition and ceremonies is a very common practice in Africa and other cultures (McLaughlin 1973) and has been reported here from the sanctuary communities.

Vertebrate poison

Use of *B. aegyptica* to stupidity fish is documented for other areas in Ghana (Abbiw 1990, Irvine 1961) supporting its use in the sanctuary for the same purpose. The sap from species of *Strophanthus* contains sporothanthis, sarmento-cyerin and trigonelline that cause death by paralysis of the heart (Abbiw 1990) supporting the value of these in the sanctuary as arrow poisons.

Conclusions

The present study has shown that a large proportion of plants are used by the communities living in the sanctuary area as their sources of livelihoods and cultural activities. The study has focused on plants that are frequently utilized by the people. The local use of some plants, especially those used for medicines, foods and materials, is a valuable addition to ensure the health and safety of the people as well as for additional income generation. The current documentation forms the basis for development of sustainable use and management strategies as well as future comparative studies on changes in plant utilization as a result of socioeconomic development in the area.

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Declaration of Interest

The authors declare no conflicts of interest.

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