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Volume, value and floristic diversity of Gabon's medicinal plant markets

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ABSTRACT

Ethnopharmacological relevance: African medicinal plant markets offer insight into commercially important species, salient health concerns in the region, and possible conservation priorities. Still, little quantitative data is available on the trade in herbal medicine in Central Africa. The aim of this study was to identify the species, volume, and value of medicinal plant products sold on the major domestic markets in Gabon, Central Africa.

Materials and methods: We surveyed 21 herbal market stalls across 14 of the major herbal medicine markets in Gabon, collected vouchers of medicinal plants and documented uses, vernacular names, prices, weight, vendor information and weekly sales. From these quantitative data, we extrapolated volumes and values for the entire herbal medicine market.

Results: We encountered 263 medicinal plant products corresponding with at least 217 species. Thirteen species were encountered on one-third of the surveyed stalls and 18 species made up almost 50% of the total volume of products available daily, including the fruits of *Tetrapleura tetraptera* and seeds of *Monodora myristica*. Although bark comprised the majority of the floristic diversity (22%) and the highest percentage of daily stock (30%), the resin of IUCN red-listed species *Aucoumea klaineana* represented 20% of the estimated daily volume of the entire herbal market. Plants sold at the market were mainly used for ritual purposes (32%), followed by women's health (13%), and childcare (10%). The presence of migrant herbal vendors selling imported species, especially from Benin, was a prominent feature of the Gabonese markets.

Conclusion: An estimated volume of 27 t of medicinal plant products worth US$ 1.5 million is sold annually on the main Gabonese markets. *Aucoumea klaineana* and *Garcinia kola* are highlighted as frequently sold species with conservation priorities. The herbal market in Gabon is slightly higher in species diversity but lower in volume and value than recently surveyed sub-Saharan African markets.

1. Introduction

The role of medicinal plants as non-timber forest products (NTFPs) in Africa has been well established in conservation, ethnobotany and sustainable development literature (Cunningham, 1993; Shackleton and Shackleton, 2004; Ticktin, 2004; Gaoue and Ticktin, 2007). The sale and trade of these plants form part of the informal economy of many African countries and contribute to the economic wellbeing of plant vendors, many of whom are women (Dold and Cocks, 2002; Jusu and Sanchez, 2013; Quiroz et al., 2014). Medicinal plants make substantial contributions to the income of plant vendors involved in the industry as well as to the health of consumers; the majority of sub-Saharan African populations use traditional medicine to meet their healthcare needs (Anyinam, 1995). This pattern is prevalent in rural communities, where health clinics are often poorly equipped (Pouliot, 2011), but also in urban centers, where biomedical treatment is readily available in hospitals and health centers (Cocks and Dold, 2006; Osamor and Owumi, 2010).

The combined effects of the profitability of medicinal plants, the high demand by local populations, and the fact that most plants are harvested from the wild (Schippmann et al., 2002) have contributed to the concern that commercialized species may be

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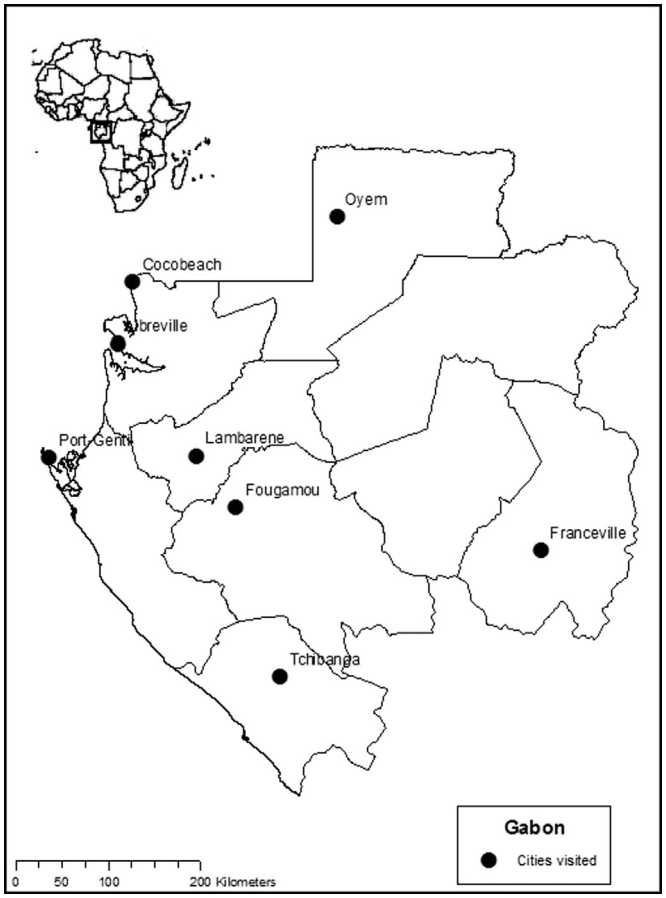

Fig. 1. Map of Gabon with market cities visited during our quantitative market survey in 2012.

overexploited resources. In several African countries, there is evidence that the commercial harvest of herbal medicine to meet a growing urban population has become an environmentally destructive activity (Cunningham, 1993; Dold and Cocks, 2002). Market sellers in Western Africa have been shown to use a larger variety of plants and more vulnerable species than harvesters who collect plants for personal use (Towns et al., 2014), suggesting that studying the medicinal plant trade is useful in investigating the exploitation of wild plants of a larger area (Cunningham, 2001; Williams et al., 2009). Studying the medicinal plant market can contribute to improved decision-making in sustainable land-use management and livelihoods (Jusu and Sanchez, 2014).

Before focused efforts can be made on estimating the effect of commercial plant harvesting on the surrounding vegetation, baseline figures are needed on the species, value, quantities, and characteristics of the marketplaces in question. Recently, quantitative surveys of herbal markets have become available for African countries, including South Africa (Williams et al., 2000; Dold and Cocks, 2002; Williams et al., 2009), Tanzania (McMillen, 2008), Morocco (El-Hilaly et al., 2003), Benin (Quiroz et al., 2014), Ghana (Van Andel et al., 2012) and Sierra Leone (Jusu and Sanchez, 2013). Much less information, however, is available on markets in the Central African region, including Cameroon (Betti, 2002) and Equatorial Guinea (Ondo, 2001). Gabon is of special interest to conservation given its unique biodiversity (Olson and Dinerstein, 1998) and its current ranking as the country with the highest rate of loss of primary forest in Africa (FAO, 2010), but little information is available on its herbal medicine trade.

In order to fill the gap of knowledge on Gabonese commercialized medicinal plant species, we conducted a market survey in the major cities of Gabon. The aim of our study was to identify the species, volume, and value of medicinal plant products sold domestically on major markets in Gabon. We also sought to identify the most frequently sold species and plant parts and the most salient health concerns treated by plants sold at the market. Given Gabon's lower population density and higher standards of living than other African countries, we hypothesized that the Gabonese medicinal plant markets would be smaller in volume and floristic diversity than those in West Africa, Tanzania and South Africa. The outcomes of this market survey can be used to identify priority species for conservation, contribute to an understanding of the role of medicinal plant sales on the socioeconomic wellbeing of market vendors, and highlight the populations' salient health concerns.

2. Materials and methods

2.1. Study area

Gabon is located in Central Africa, bordering the Atlantic Ocean to the west, the Republic of the Congo to the east and south, and Equatorial Guinea and Cameroon to the north. Up to 80% of Gabon has been estimated to be covered with forest (Sosef et al., 2006), with approximately 65% considered primary forest and remaining land consisting of swamps, mangroves, and savannas (FAO, 2010). The Gabonese population is around 1.6 million people, mainly of Fang, Bapounou, Nzebi, and Obamba ethnic groups (CIA, 2013).

Data collection took place between June and November 2012, in which we visited major herbal medicine markets in the provinces of Estuaire, Woleu-Ntem, Haut-Ogooué, Ngounié, Moyen-Ogooué, Ogooué-Maritime, and Nyanga. We started our data collection in the capital city of Libreville, visiting the two main medicinal plant markets several times a week to speak with vendors and purchase plant species to be processed into botanical vouchers. This regular contact built up the trust necessary to begin our quantitative market surveys and familiarized us with the most common commercial species, local names, and salient health concerns treated with herbal medicine in Gabon. We then conducted a systematic quantitative survey of 21 market stalls, across 14 markets, in major and regional cities in Gabon: Libreville (pop. 619,000), Port-Gentil (pop. 80,000), Franceville (pop. 56,000), Oyem (pop. 38,000), Lambaréné (pop. 24,000), Tchibanga (pop. 24,000), Fougamou (pop. 4100), and Cocobeach (pop. 1200) (Fig. 1).

2.2. Quantitative market survey

Following the methodology carried out in market surveys in Ghana (Van Andel et al., 2012) and Benin (Quiroz et al., 2014) and the guidelines for ethnobotanical market inventories (Cunningham, 2001), we began our quantitative survey by counting the number of herbal medicine stalls at each marketplace ($n=192$). We categorized the stalls into five different types: (1) herb stalls (including barks and woody plant parts), (2) spice stalls (with dual purpose food/medicinal fruits and seeds including the palm wine bark *Garcinia kola*), (3) Bwiti stalls (plants used in spiritual practices and ceremonies), (4) ambulant vendors (market vendors on foot), and (5) Beninese herbal stalls (migrants from Benin selling imported plant species). We also collected general data on each market, including type of products sold and number of open days per week.

We then sampled individual stalls by randomly inviting 21 vendors to participate in our market survey. We counted the number of products sold, recorded the price of each product, collected ethnobotanical data of each product (local name, medicinal use, and preparation), tallied the total amount of sales units per stall (bags, bundles, bottles, and individual pieces), and