



Potentials for Promoting Oil Products Identified from Traditional Knowledge of Native Trees in Burkina Faso

Amadé Ouédraogo, Anne Mette Lykke, Benjamin Lankoandé and Gabin Korbéogo

Research

Abstract

Oil products from native trees are far from fully exploited in West Africa. Only well-known species like shea (*Vitellaria paradoxa* C.F. Gaertn.) and oil palm (*Elaeis guineensis* Jacq.) receive attention. We used quantitative questionnaires in 12 villages in Western Burkina Faso to assess the knowledge of four ethnic groups on 28 tree species and how their oil is used. Sixteen species were used the most. Among them, *V. paradoxa*, *E. guineensis*, *Carapa procera* DC., *Pentadesma butyracea* Sabine and *Lophira lanceolata* Tiegh. ex Keay received the most citations. Oils were used for soap (22%), food (21%), medicine (19%), body care (18%) and hair care (14%). Significant differences were found among ethnic groups concerning knowledge and preferences of oil products. Apart from the well-known species, *C. procera*, *L. lanceolata* and *P. butyracea* appear to be promising species for promotable oil products and a number of less known species may show potentials as well.

Introduction

People in sub-Saharan Africa, especially the poorest sectors of rural society, depend on non-timber forest products (NTFPs) for daily consumption and income generation. For these people, NTFPs are also a source for improving food security through diversification of livelihood strategies (Shackleton & Shackleton 2004). Increased focus on the importance of NTFPs is leading to increased interest for commercialization as an engine for rural growth and improved national incomes (Belcher & Schreckenberg 2007). The growing commodification of NTFPs is mainly linked to the ongoing social move from subsistence lifestyles to cash economies in rural areas (Cunningham 2001). Until now, research on promoting NTFPs has mainly focused on the humid tropics (De Caluwé *et al.* 2009), while the semi-arid savanna environment has re-

ceived less attention (Schreckenberg 1999). A few NTFPs from Africa are already to a large extent commercialized. Concerning oil products, the most well known are palm oil (*Elaeis guineensis* Jacq.), which has been traded since the early nineteenth century (Lynn 1997), and shea butter (*Vitellaria paradoxa* C.F. Gaertn.), which is the third most important national export product in Burkina Faso (Saussey *et al.* 2008, Schreckenberg 2004) and was used as a commodity during pre-colonial times (Saul *et al.* 2003). However, there are other varieties of oil seeds in tropical Africa which are part of traditional food systems, but whose nutritional and economic values have not been completely determined and are far less exploited for both humans and livestock (Lohlum *et al.* 2010). Some of these species can become potential sources of industrial oil (Fariku & Kidah 2008, Lohlum *et al.* 2010) and, thus, are promising products for large commercialization. In Burkina Faso, there is a high number of NTFPs with potential for transformation (Belem *et al.* 2007, Spry-Levertton 2009), for instance oils products that traditionally were mainly extracted by women from local tree species and used on a subsistence basis (Saussey *et al.* 2008).

Correspondence

Amadé Ouédraogo and Benjamin Lankoandé, Department of Plant Biology and Physiology, University of Ouagadougou, Ouagadougou, BURKINA FASO.
o_amade@yahoo.fr, lankoandehatina@yahoo.fr
Anne Mette Lykke, Department of Bioscience, Aarhus University, Aarhus, DENMARK. aml@dmu.dk
Gabin Korbéogo, Department of Sociology, University of Ouagadougou, Ouagadougou BURKINA FASO.
kgabin1@hotmail.com

Ethnobotany Research & Applications 11:071-083 (2013)

Published: July 17, 2013

www.ethnobotanyjournal.org/vol11/i1547-3465-11-071.pdf

As a result of increased cultivation of exotic cash crops like groundnut and cotton, use habits of local people have changed and some local oil resources have been fully or partially abandoned. Traditional knowledge on the use of native resources is only verbally transferred from one generation to another, making it vulnerable (Nadembega *et al.* 2011, Saussey *et al.* 2008) and making an exchange between communities critical (De Caluwé *et al.* 2009). Traditional knowledge on native resources can be very detailed (Gaoue & Ticktin 2011) and, therefore, useful for product development, but although many studies have focused on traditional knowledge of plant resources in general (Lykke *et al.* 2004, Mbayngone & Thiombiano 2011, Mertz *et al.* 2001, Zerbo *et al.* 2011), very few have focused on oil products apart from shea butter and palm oils (Chalfin 2004, Maranz *et al.* 2004, Teklehaimanot 2004). As there is potential for promotable new oil products from native trees in West Africa (van der Vossen & Mkamilo 2007, Weber *et al.* 2010), this study aims at identifying promotable local oil tree species and people's preferences for their use in different usage categories.

Methods

Study area

The study was carried out in the western part of Burkina Faso, which exhibits the highest phytodiversity in the country (Schmidt *et al.* 2005). The studied villages were located in two provinces, Comoé and Kéné Dougou, located between 9°30'-12°00' N and 2°50'-5°30' W (Figure 1). The area has a south-Sudanian climate with 900-1100 mm range of mean annual rainfall and two contrasting seasons (Fontes & Guinko 1995). The rainy season lasts 6-7 months on average, from May or June to November with 90 rainy days. The vegetation consists of a mosaic of savannas, dry forest and patches of gallery forests and is characterized by Sudanian and Guinean species (Gnoumou *et al.* 2011, Sambaré *et al.* 2011). More than 15 ethnic groups live in the two regions (Pigeonnière & Jomni 1998), with the Cascades being the least populated region of Burkina Faso (INSD 2008). Main human activities are agriculture (subsistence and cash crops) and livestock rearing. Besides these two income-generating activities, the use of renewable natural resources has significant direct or indirect value in local households' economy: food, construction materials, medicine, aesthetic or symbolic uses.

Data collection

Informants from four principal ethnic groups were interviewed in 12 villages. Four villages were considered for each native ethnic group: Tiéfo, Gouin and Sénoufo; non-indigenous Fulani informants were interviewed in all 12 villages. A total of 12 people were interviewed per ethnic group (native ones and Fulani) in each village; six females

and six males randomly chosen irrespective of age, education level and profession. Structured interviews on native oil tree species were addressed to 288 informants. Twenty-eight species were selected (see Appendix) on the basis of literature and available knowledge. Voucher specimens of the species are identified and available in triplicate at the Herbarium of the University of Ouagadougou (OUA). During interviews, fresh materials were shown to respondents in order to crosscheck the identification of species. The list was open for new species to be added by informants. Questionnaires concerned use of oil for different purposes (food, skin care, hair care, soap, medicine and other uses). The preference ranking (Cotton 1996) of the informants concerning the different uses for each category was assessed on a three level scale (0 = not useful, 1 = a bit useful, 2 = very useful).

Data analysis

All questionnaire data were compiled in two tables; 1) informant by species use and 2) informant by informant characteristics. Differences in percentage of citations among ethnic groups were tested by an overall Chi square test followed by a number of Chi Square tests for paired comparisons among the four ethnic groups. Chi square tests were also performed to test for significant differences in species preferences among ethnic, village, gender, matrimonial, residential, religious, age, professional and educational groups. Statistical significance was tested at the 5% level. The statistical software used was JMP 9.0 (SAS 2010). Nonmetric Multidimensional Scaling (NMS) was performed for multivariate comparisons of informants in a use preference space. The NMS was based on a main matrix (288 informants by six use variables) and a second matrix with the nine social groups mentioned above as explanatory variables. The NMS was based on Euclidian distances. Multivariate analysis was carried out in PC-ORD (McCune & Mefford 2011).

Results

Ethnic knowledge of local oil trees

Of the 28 tree species selected for questionnaires, 16 were confirmed to be known as oil plants with citation percentages of more than 0.3, corresponding to at least 10 informants (Table 1). Five species were well cited, with citation percentages between 5 and 44%. The remaining 12 less cited species only accounted for about 2% of citations. Informants from the four ethnic groups (Tiéfo, Gouin, Sénoufo and Fulani) showed different knowledge levels concerning local oil uses. Tiéfo and Fulani had significantly lower citation percentages than the two other ethnic groups for oil utilization in the five use categories. Sénoufo informants significantly showed the highest citation percentages of oil used for skin care, hair care, soap and other uses (Table 2). The citations of species accord-

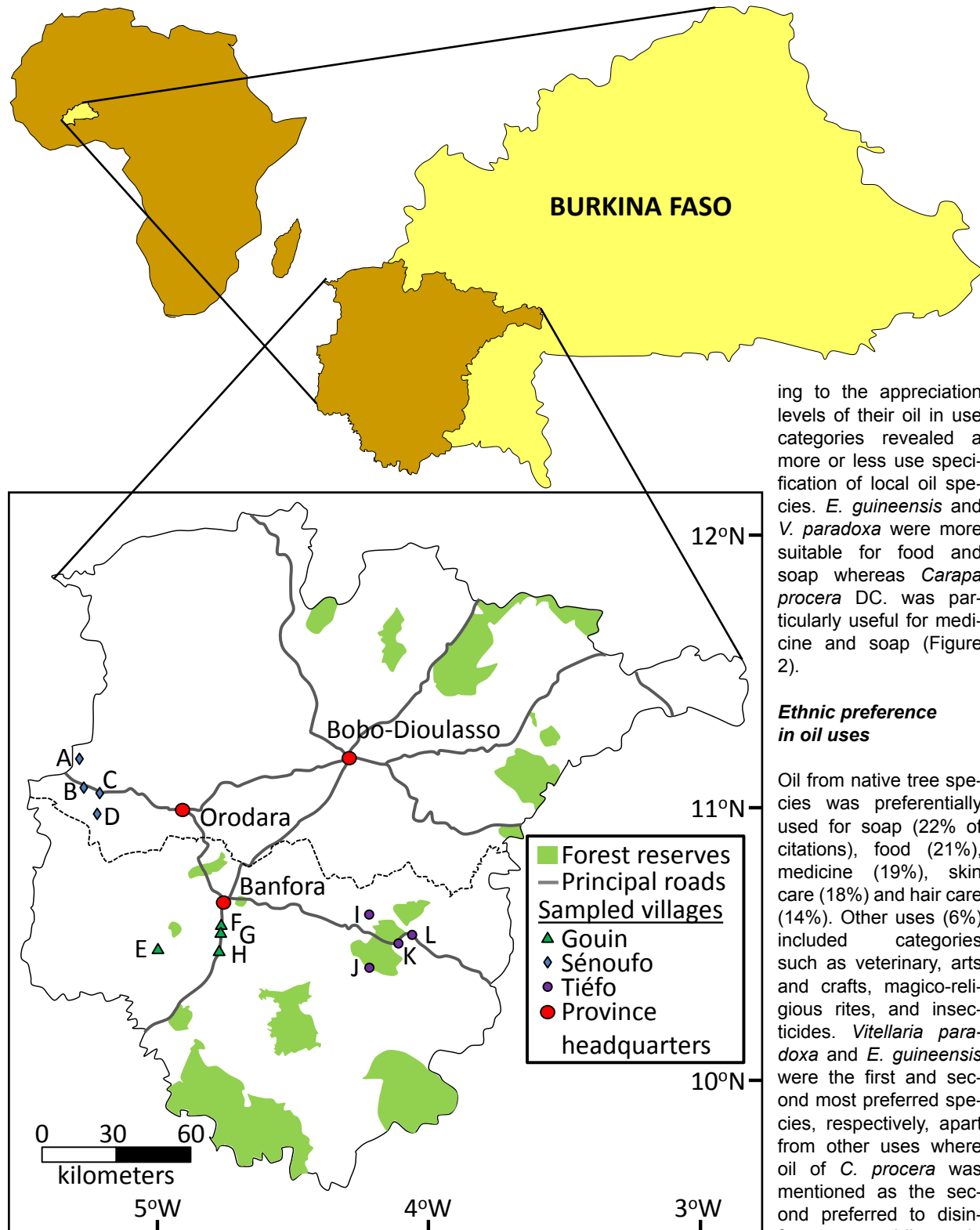


Figure 1. Comoé and Kéné Dougou provinces of western Burkina Faso. Villages: (A) Sintasso, (B) Koloko, (C) Mahon, (D) Kangala, (E) Soubaka, (F) Bounouna, (G) Siniéna, (H) Diarabakoko, (I) Djanga, (J) Kadjo, (K) Fougangoué, (L) Dandougou.

ing to the appreciation levels of their oil in use categories revealed a more or less use specification of local oil species. *E. guineensis* and *V. paradoxa* were more suitable for food and soap whereas *Carapa procera* DC. was particularly useful for medicine and soap (Figure 2).

Ethnic preference in oil uses

Oil from native tree species was preferentially used for soap (22% of citations), food (21%), medicine (19%), skin care (18%) and hair care (14%). Other uses (6%) included categories such as veterinary, arts and crafts, magico-religious rites, and insecticides. *Vitellaria paradoxa* and *E. guineensis* were the first and second most preferred species, respectively, apart from other uses where oil of *C. procera* was mentioned as the second preferred to disinfect crops and livestock. This species is also the third most cited for skin care, hair care, soap and

Table 1. Ranking of oil species in use categories based on number and percent of citations in Comoé and KénéDougou provinces of western Burkina Faso. Citations for a species in a use category is the number of informants who cited the species. The maximum value of each species for a use category is 288 (total number of informants). The percentages relate to the total citation numbers of all 28 species in the six use categories.

Rank	Species	Use Categories						Total	%
		Food	Skin care	Hair care	Soap	Medicinal	Other		
1	<i>Vitellaria paradoxa</i> C.F. Gaertn.	285	257	202	279	268	149	1440	43.9
2	<i>Elaeis guineensis</i> Jacq.	234	136	125	169	124	16	804	24.5
3	<i>Carapa procera</i> DC.	6	61	44	89	91	25	316	9.6
4	<i>Lophira lanceolata</i> Tiegh. ex Keay	46	38	35	61	34	4	218	6.6
5	<i>Pentadesma butyracea</i> Sabine	32	35	32	36	29	4	168	5.1
6	<i>Blighia sapida</i> K.D. Koenig	26	9	6	9	10	1	61	1.9
7	<i>Adansonia digitata</i> L.	14	4	2	5	6	3	34	1.0
8	<i>Khaya senegalensis</i> (Desr.) A. Juss.	0	4	1	17	8	3	33	0.9
9	<i>Borassus akeassii</i> Bayton, Ouédr. & Guinko	8	6	3	8	6	0	31	0.9
10	<i>Detarium microcarpum</i> Guill. & Perr.	4	3	1	5	12	3	28	0.7
11	<i>Balanites aegyptiaca</i> (L.) Delile	2	3	2	11	5	0	23	0.6
12	<i>Sclerocarya birrea</i> (A. Rich.) Hochst.	3	3	3	6	5	0	20	0.5
13	<i>Lannea microcarpa</i> Engl. & K.Krause	1	3	2	6	3	0	15	0.4
14	<i>Azelia africana</i> Sm. ex Pers.	1	3	3	2	4	1	14	0.4
15	<i>Daniellia oliveri</i> (Rolfe) Hutch. & Dalziel	2	2	2	2	5	1	14	0.4
16	<i>Raphia sudanica</i> A. Chev.	5	1	2	2	2	0	12	0.4
17	<i>Ceiba pentandra</i> (L.) Gaertn.	1	0	0	2	4	0	7	0.2
18	<i>Parinari curatellifolia</i> Planch. ex Benth.	1	1	0	2	2	1	7	0.2
19	<i>Trichilia emetica</i> Vahl	0	1	1	2	3	0	7	0.2
20	<i>Lannea barteri</i> (Oliv.) Engl.	1	1	0	1	2	0	5	0.2
21	<i>Ximenia americana</i> L.	0	1	1	2	3	0	5	0.2
22	<i>Lannea acida</i> A. Rich.	1	0	0	1	1	0	3	0.1
23	<i>Lannea velutina</i> A. Rich.	1	1	0	1	2	0	3	0.2
24	<i>Maranthes polyandra</i> (Benth.) Prance	0	0	0	1	2	0	3	0.1
25	<i>Pseudocedrela kotschyi</i> (Schweinf.) Harms	1	0	0	0	2	0	3	0.1
26	<i>Sterculia setigera</i> Delile	0	1	0	1	1	0	3	0.1
27	<i>Securidaca longipedunculata</i> Fresen.	0	0	0	1	0	0	1	0.0
28	<i>Zanthoxylum leprieurii</i> Guill. & Perr.	0	0	0	0	1	0	1	0.0

Table 2. Percentages of citations of oil species per ethnic group and use categories. Percentages correspond to the informants per ethnic group who cited species for a use category. Values followed by letters are significantly different between ethnic groups at $p < 0.05$ (χ^2 test).

Use Categories	% of Citations per Ethnic Groups				Use Categories	% of Citations per Ethnic Groups			
	Tiéfo	Gouin	Sénoufo	Fulani		Tiéfo	Gouin	Sénoufo	Fulani
Food	48.7b	68.9a	62.2a	64.9a	Soap	52.7c	67.1b	84.9a	60.4b
Skin care	45.5c	64.6b	73.7a	37.7d	Medicine	56.0b	71.3a	70.5a	44.6c
Hair care	37.5c	53.7b	68.5a	24.8d	Other uses	10.2b	18.9a	23.1a	22.4a



Figure 2. Citations in two appreciation levels (a bit or very) for plants used for oil per species and six use categories in Comoé and KénéDougou provinces of western Burkina Faso.

Ethnobotany Research & Applications

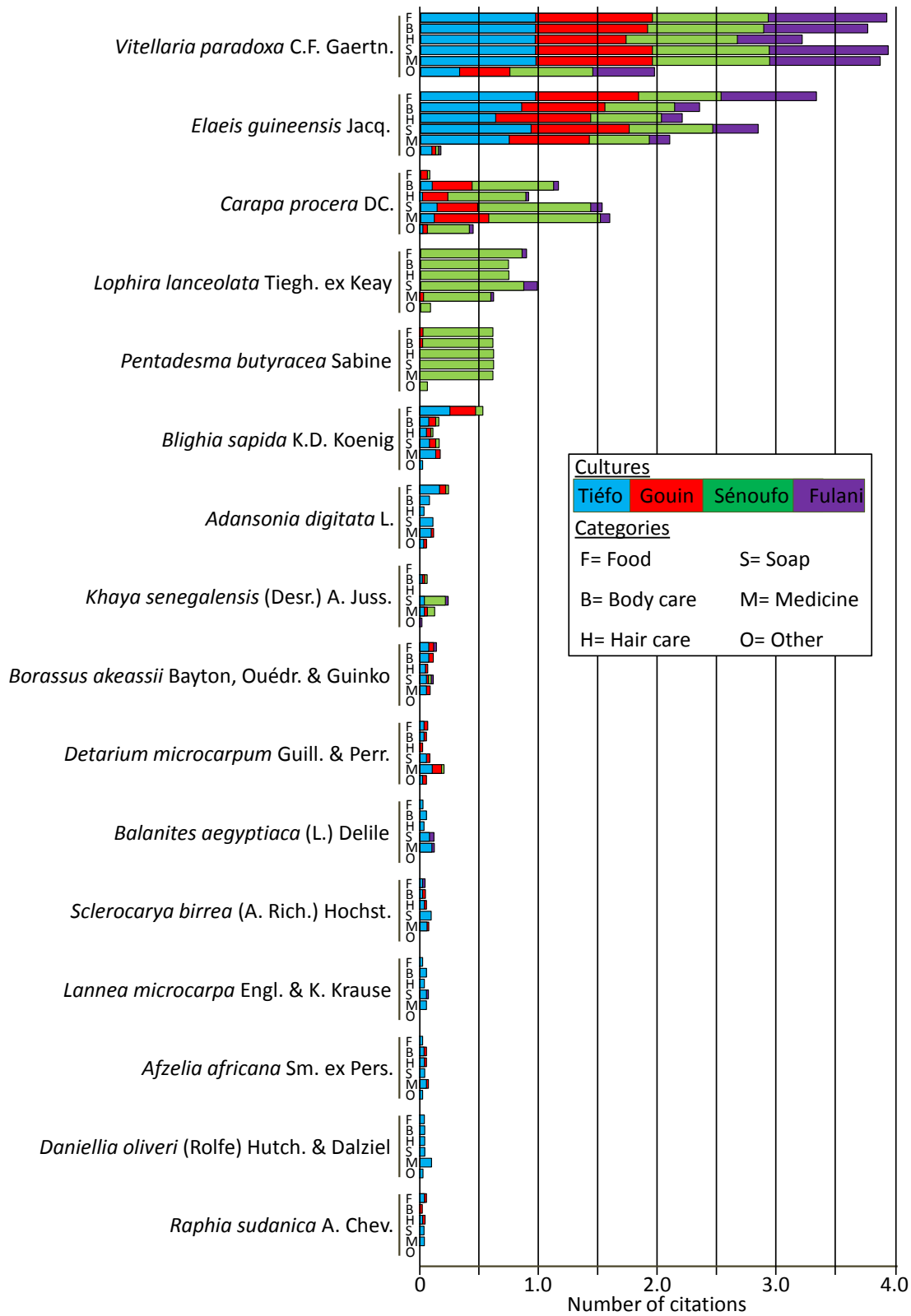


Figure 3. Use citation frequencies by ethnic groups per species and use category in Comoé and Kéné Dougou provinces of western Burkina Faso. The citation frequencies range from 0 (no informants) to 1.0 (100% of informants) for each of the four ethnic groups, and are summed across all ethnic groups to yield a potential maximum of 4.0 (if all informants cited a use for a species).

medicine. Oil from *Lophira lanceolata* Tiegh. ex Keay was the third preferred for food and the fourth for other uses. *Pentadesma butyracea* Sabine ranked as the fourth oil utilization for food and the fifth for others uses. Except for *L. lanceolata* and *P. butyracea*, which were not mentioned at all by Tiéfo and to a lesser extent by Gouin and Sénoufo, the five most preferred species were cited by the four ethnic groups for all use categories (Figure 3). *P. butyracea* and *L. lanceolata* were primarily cited by Sénoufo and very rarely by Fulani. In general, the frequencies of use citations were similar for *V. paradoxa* and *E. guineensis* in Gouin, Sénoufo and Tiéfo ethnic groups, while *C.*

procera was more frequently cited by Sénoufo and by far by Gouin. Among the less cited species, *Ceiba pentandra* (L.) Gaertn., *Parinari curatellifolia* Planch. ex Benth., *Trichilia emetica* Vahl and *Ximenia americana* L. received mention for the highest use. They were involved predominantly in medicine, soap and skin care.

Ethnic groups' comparison through oil species and use categories

Informants from the four ethnic groups showed differences concerning preferences for oil (Figure 4). The Sé-

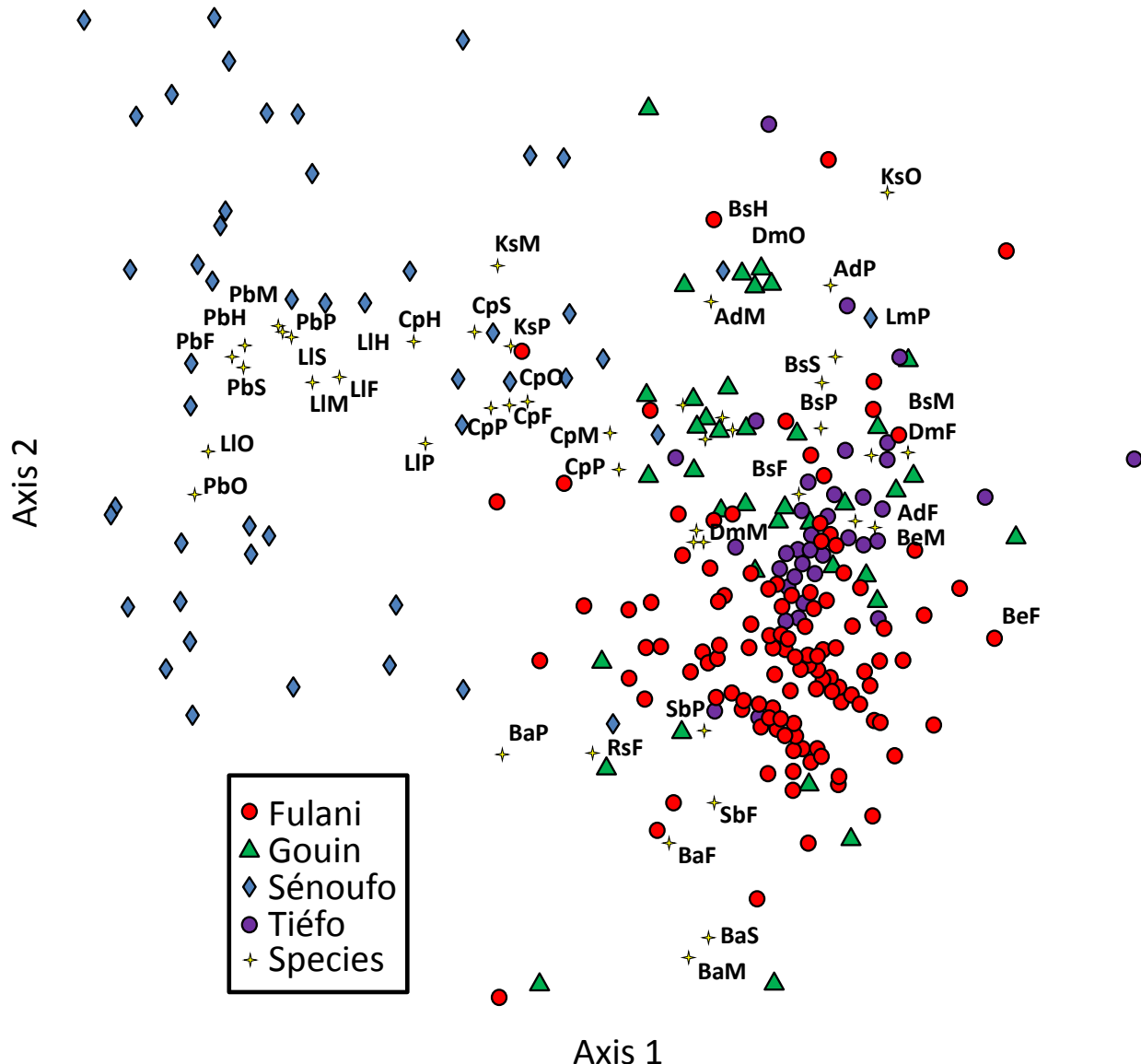


Figure 4. Non-metric multidimensional scaling (NMS) of informants based on their preferences for oil uses in Comoé and Kéné Dougou provinces of western Burkina Faso. **(Ad)** *Adansonia digitata* L., **(Ba)** *Borassus akeassii* Bayton, Ouédr. & Guinko, **(Be)** *Balanites aegyptiaca* (L.) Delile, **(Bs)** *Blighia sapida* K.D. Koenig, **(Cp)** *Carapa procera* DC., **(Dm)** *Detarium microcarpum* Guill. & Perr., **(Do)** *Daniellia oliveri* (Rolfe) Hutch. & Dalziel, **(Eg)** *Elaeis guineensis* Jacq., **(Ks)** *Khaya senegalensis* (Desr.) A. Juss., **(LI)** *Lophira lanceolata* Tiegh. ex Keay, **(Lm)** *Lannea microcarpa* Engl. & K. Krause, **(Pb)** *Pentadesma butyracea* Sabine, **(Rs)** *Raphia sudanica* A. Chev., **(Sb)** *Sclerocarya birrea* (A. Rich.) Hochst.

noufo group was isolated from the other ethnic groups on the NMS diagram; they had the most varied uses of oil species. *Lophira lanceolata* and *P. butyracea* were used almost exclusively, and *C. procera* was mainly used by Sénoufo in almost all the six use categories. The Fulani were relatively grouped on the NMS diagram with some overlap with Tiéfo and Gouin mainly caused by a common use of *Balanites aegyptiaca* (L.) Delile. In most cases, Fulani mentioned fewer species than the other ethnic groups and used the most popular species, *V. paradoxa* and *E. guineensis*, less than other ethnic groups. Tiéfo and Gouin had a large overlap in the NMS diagram, i.e., many uses in common, e.g., *Adansonia digitata* L., *Blighia sapida* K. D. Koenig, and *Detarium microcarpum* Guill. & Perr. Tiéfo used relatively few species, but mentioned some uses of species not mentioned by the other groups, species like *Lannea microcarpa* Engl. & K. Krause. Some species were known by very few informants; *Borassus akeassii* Bayton, Ouéd. & Guinko, *C. pentandra*, *Khaya senegalensis* (Desr.) A.Juss. and *Sclerocarya birrea* (A. Rich.) Hochst.

Discussion

Local knowledge and commonly used oils

Indigenous people often possess broad knowledge on the resources in their environment (De Caluwé *et al.* 2009, Dove 2006, Gaoue & Ticktin 2011). As far as oil products are concerned, people use oils from various plants for diverse purposes. However, local knowledge of oil trees is relatively limited in the Fulani, Gouin, Sénoufo and Tiéfo ethnic groups of Burkina Faso; only 16 species out of 28 oil species listed were frequently cited and only five species received high citations frequencies ($\geq 5\%$). People's preferences are focused on species where oils are well-known and currently used. Thus, use citations were concentrated on *V. paradoxa* and *E. guineensis*. One reason could be that many species have primary uses that are different from oil (van der Vossen & Mkamilo 2007), so people do not really consider them as oil species. Less cited species are only mentioned by people with a broad knowledge of species' uses, who mention them as non-common oils used for medicine, veterinary purposes and bio-pesticides. The well-known oil species are the ones that are more accessible (Lucena *et al.* 2007) and have been promoted from early pre-colonial time to the present. This implies that there is a close relationship between the utilitarian or socio-economic needs and local people's knowledge of their environment (Korbéogo 2011). There is, therefore, an important unexploited potential of diversification of oil uses in the western part of Burkina Faso, as also mentioned in relation to other resources from the area (Ouoba *et al.* 2006, Traoré *et al.* 2011).

Ethnic differences

Our results revealed that ethnic differences determine the use of local resources, as described in previous studies (De Caluwé *et al.* 2009, Dove 2006). The Sénoufo's knowledge was significantly higher than that of the other ethnic groups. According to the indigenous cultural schemes, Sénoufo people are animists, have the reputation of possessing mythic powers, and very good knowledge of their natural environment (Traoré *et al.* 2011).

Some similarities of knowledge were noticed in autochthonous ethnic groups, e.g., Tiéfo and Gouin, caused by social and cultural interactions, including cooperation in oil production and local landscapes that are shared collection areas. This interpretation is consistent with Avocénou-Ayisso *et al.* (2012), who found comparable knowledge about the use of *P. butyracea*'s oil in different native ethnic groups of neighboring villages. There is also knowledge sharing between autochthons and migrants, illustrated by common knowledge between Tiéfo and Fulani for the use of *B. aegyptiaca*. The indigenous knowledge of Fulani varies according to localities (Gaoue & Ticktin 2009), which shows that their lifestyle is influenced by native population knowledge.

Potentials for production and commercialization of less used species

Apart from the commonly-used species, *V. paradoxa* and *E. guineensis*, certain under-utilized species were highly mentioned for a few particular oil uses; this is the case for *C. procera* and *L. lanceolata*, mainly preferred for soap by all ethnic groups and for medicinal and veterinary uses by Sénoufo and Gouin. The bio-pesticide, veterinary and medicinal use of *C. procera*'s oil was also reported by Weber *et al.* (2010), who described an important economic potential in West Africa, one example could be its use as a natural repellent in the cultivation of organic cotton. Commercialization of new products based on traditional knowledge is an opportunity to uplift the poor and marginalized people (Welford & Le Breton 2008). The seeds of *L. lanceolata* yield 40-50% oil suitable for cooking and cosmetics and exhibit good fuel properties compared to those of commercial grade diesel (Fariku & Kidah 2008, Lohlum *et al.* 2010). Although the oil is mainly traded on a local scale, with a price ranging from U.S.\$ 2-3 per liter in Cameroon (van der Vossen & Mkamilo 2007), *L. lanceolata* is a potential source of industrial oil (Lohlum *et al.* 2010) and a promising asset for large-scale commercialization.

Pentadesma butyracea is a rare, relatively unknown species in Burkina Faso (Lebrun & Stork 1991) the butter of which is recognized as being suitable for food and cosmetics and an important source of income for women involved in its exploitation in Benin (Avocénou-Ayisso *et al.* 2009, 2012, Sinsin *et al.* 2003). Cosmetic oils have become more popular around the world, and the predicted growing demand (Gruenwald & Galizia 2005) is a good

opportunity to promote such a local species. However, for future large production there is a need to develop strategies to promote the conservation of natural populations and plantations because of its scarcity. *Pentadesma butyracea* is unknown by most of Tiéfo and Fulani because of its absence in their area; on the other hand it occurs in the surrounding riparian forests of some Sénoufo villages, where informants were almost the only ones to mention it.

The relatively poor oil content of seeds, e.g., from *A. digitata* and *D. microcarpum* (Kyari 2008, Osman 2004), and the difficulty in extracting oil are reasons why people may be less interested in certain potential oil species. Another reason is the loss of traditional knowledge required to extract the oil. This latter reason was also pointed out by Tabuti (2007) as a cause of the abandonment of some native food plants by local people of Uganda. However, for *A. digitata* and *D. microcarpum* the average percentage of their citations by informants suggests that improved extraction techniques of oil will enhance their use. Such techniques are expected to be developed by local factories with growing interest in native trees' oil production in Burkina Faso.

Conclusion

People's indigenous knowledge overlaps with their preferences for resource uses; for native oils the most cited species were also ones which are preferred in broader uses. Apart from the well known shea butter tree and oil palm, this study has highlighted three less known native species with immediate potential for promotable oil products in Burkina Faso: *C. procera*, *L. lanceolata* and *P. butyracea*. The oil from these species is used for many purposes, including food, skin care and hair care, but especially in soap. The oils from *C. procera* and *L. lanceolata* are also recognized by informants to have medicinal, veterinary and pesticide properties that are less known. A number of other species are identified as oil plants by a few people, and chemical investigations could prove them to be useful for new products, which could enhance local livelihoods.

Acknowledgement

The authors are grateful to Danida (10-002AU) for funding the collaborative research project QualiTree in which frame work this study was carried out. We are thankful to the local population from the 12 villages for their consent and cooperation, and to Hubert Coulibaly for his assistance on the field.

Literature cited

Avocénou-Ayisso, C., B. Sinsin, A. Adégbidi, G. Dossou & P. Van Damme. 2009. Sustainable use of non-timber forest products: Impact of fruit harvesting on *Pentadesma butyracea* regeneration and financial analysis of its prod-

ucts trade in Benin. *Forest Ecology and Management* 257 (8):1930-1938.

Avocénou-Ayisso, C., T.H. Avohou, M. Oumorou, G. Dossou & B. Sinsin. 2012. Ethnobotany of *Pentadesma butyracea* in Benin: A quantitative approach. *Ethnobotany Research & Application* 9:151-166.

Belcher, B. & K. Schreckenber. 2007. Commercialisation of non-timber forest products: A reality check. *Development Policy Review* 25(3):355-377.

Belem, B., B.M.I. Nacoulma, R. Gbangou, S. Kambou, H.H. Hansen, Q. Gausset, S. Lund, A. Raebild, D. Lompo, M. Ouedraogo, I. Theilade & I.J. Boussim. 2007. Use of non wood forest products by local people bordering the "Parc National Kaboré Tambi", Burkina Faso. *The Journal of Transdisciplinary Environmental Studies* 6(1):1-21.

Chalfin, B. 2004. *Shea Butter Republic*. Routledge, London.

Cotton, C.M. 1996. *Ethnobotany: Principles and applications*. John Wiley & Sons, New York, New York.

Cunningham, A.B. 2001. *Applied Ethnobotany. People, wild plant use and conservation*. Wold Wildlife Fund, Earthscan Publications Ltd., London.

De Caluwé, E., S. De Smedt, A.E. Assogbadjo, R. Samson, B. Sinsin & P. Van Damme. 2009. Ethnic differences in use value and use patterns of baobab (*Adansonia digitata* L.) in northern Benin. *African Journal Ecology* 47:433-440.

Dove, M. 2006. Indigenous people and environmental politics. *Annual Review of Anthropology* 35:191-208.

Fariku, S. & M. Kidah. 2008. Biomass potential of *Lophira lanceolata* fruit as a renewable energy resource. *African Journal of Biotechnology* 7(3):308-310.

Fontes, J. & S. Guinko. 1995. *Vegetation and Land Use's Map of Burkina Faso. Explanatory note*. Ministry of French Cooperation, Toulouse, France.

Gaoue, O.G. & T. Ticktin. 2009. Fulani knowledge of the ecological impacts of *Khaya senegalensis* (Meliaceae) Foliage Harvest in Benin. *Economic Botany* 63(3):256-270.

Gnoumou, A., F. Bognounou, K. Hahn & A. Thiombiano. 2011. Woody plant diversity and stand structure in the Comoe-Leraba Reserve, Southwestern Burkina Faso (West Africa). *Journal of Biological Sciences* 1-13.

Gruenwald, J. & M. Galizia. 2005. *Market Brief in the European Union for Selected Natural Ingredients Derived*

- from *Native Species, Adansonia digitata L., Baobab*. United Nations Conference on Trade and Development, Programme. Geneva, Switzerland.
- Korbéogo, G. 2011. Socio-cultural strategies of biodiversity conservation. Pp. 430-433 in *Biodiversity Atlas of West Africa. Volume 2. Burkina Faso*. Edited by A. Thiombiano & D. Kampmann. BIOTA program, Ouagadougou.
- Kyari, M.Z. 2008. Extraction and characterization of seed oils. *International Agrophysics* 22:139-142.
- Lebrun, J-P. & A.L. Stork. 1991. *Énumération des Plantes à Fleurs d'Afrique Tropicale. Généralité et Annonaceae à Pandaceae, Volume I*. Conservatoire et Jardin botaniques de la Ville de Genève, Geneva.
- Lohlum, S.A., G.H. Maikidi & M. Salomon. 2010. Proximate composition, amino acid profile and phytochemical screening of *Lophira lanceolata* seeds. *African Journal of Food Agriculture Nutrition and Development* 10(1):1-12.
- Lucena, R.F.P., E.L. Araujo & U.P. Albuquerque. 2007. Does the local availability of woody *Caatinga* plants (Northeastern Brazil) explain their use value? *Economic Botany* 61(4):347-361.
- Lykke, A.M., M.K. Kristensen & S. Ganaba. 2004. Valuation of local use and dynamics of 56 woody species in the Sahel. *Biodiversity and Conservation* 13:1961-1990.
- Lynn, M. 1997. *Commerce and Economic Change in West Africa: The palm oil trade in the nineteenth century*. Cambridge University Press, Cambridge, England.
- Maranz, S., W. Kpikpi, Z. Wiesman, A.D.S. Sauveur & B. Chapagain. 2004. Nutritional values and indigenous preferences for Shea fruit (*Vitellaria paradoxa* C.F.Gaertn.f.) in African agroforestry parklands. *Economic Botany* 58(4):588-600.
- Mbayngone, E. & A. Thiombiano. 2011. Dégradation des aires protégées par l'exploitation des ressources végétales: cas de la réserve partielle de faune de Pama, Burkina Faso (Afrique de l'Ouest). *Fruits* 66:187-202.
- McCune, B. & M.J. Mefford. 2011. *PC-ORD Multivariate Analysis of Ecological Data, version 6*. MjM Software Design, Gleneden Beach, Oregon.
- Mertz, O., A.M. Lykke & A. Reenberg. 2001. Importance and seasonality of vegetables consumption and marketing in Burkina Faso. *Economic Botany* 55(2):276-289.
- Nadembega, P., I.J. Boussim, J.B. Nikiema, F. Poli & F. Antognoni. 2010. Medicinal plants in Baskoure, Kouritenga Province, Burkina Faso: An ethnobotanical study. *Journal of Ethnopharmacology* 133:378-395.
- Osman, M.A. 2004. Chemical and nutrient analysis of baobab (*Adansonia digitata*) fruit and seed protein solubility. *Plant Foods for Human Nutrition* 59:29-33.
- Ouoba, P., J. Boussim & S. Guinko. 2006. Le potentiel fruitier de la forêt classée de Niangoloko au Burkina Faso. *Fruits* 61(1):71-81.
- Pigeonnière, A. & S. Jomni. 1998. *Atlas du Burkina Faso*. Editions du Jaguar, Paris.
- Sambaré O., Bognounou F., Wittig R., Thiombiano A., 2011. Woody species composition, diversity and structure of riparian forests of four watercourses types in Burkina Faso. *Journal of Forestry Research* 22:145-158.
- SAS. 2010. *JMP, version 9*. SAS Institute Inc., Cary, North Carolina.
- Saul, M., J.-M. Ouadba & O. Bognounou. 2003. The wild vegetation cover of Western Burkina Faso. Colonial policy & post-colonial development. Pp. 121-159 in *African Savannas. Global narratives and local knowledge of environmental change*. Edited by T.J. Bassett & D. Crummey, Portsmouth, New Hampshire.
- Saussey, M., P. Moity-Maizi & J. Muchnik. 2008. Nouvelles formes de reconnaissance des femmes burkinabè dans la production collective de beurre de karité. *Cahiers Agricultures* 17:582-586.
- Schmidt, M., H. Kreft, A. Thiombiano, G. Zizka. 2005. Herbarium collections and field data-based plant diversity maps for Burkina Faso. *Diversity and Distributions* 11(6):509-516.
- Schreckenberg, K. 1999. Products of a managed landscape: non-timber forest products in the parklands of the Bassila region, Benin. *Global Ecology and Biogeography* 8:279-280.
- Schreckenberg, K. 2004. The contribution of shea butter (*Vitellaria paradoxa* C.F. Gaertner) to local livelihoods in Benin. Pp. 91-114 in *Forest Products, Livelihoods and Conservation. Case studies of non-timber forest product systems. Volume 2*. Edited by T. Sunderland & O. Ndoye. Center for International Forestry Research, Jakarta.
- Shackleton, C. & S. Shackleton. 2004. The importance of non-timber forest products in rural livelihood security and as safety nets: a review of evidence from South Africa. *South African Journal of Science* 100:658-664.
- Sinsin, B. & T.A. Sinadouwirou. 2003. Valorisation socio-économique et pérennité du *Pentadesma butyracea* Sabine en galeries forestières au Bénin. *Cahiers Agricultures* 12(2):75-79.

- Spry-Leverton, J. 2009. *Développer les Cultures de Valeur, Créer des Emplois Stables. Le PNUD appuie la valorisation de produits forestiers non ligneux au Burkina Faso*. PNUD, Ouagadougou.
- Tabuti, J.R.S. 2007. Status of non-cultivated food plants in Bulamogi County, Uganda. *African Journal of Ecology* 45:96-101.
- Teklehaimanot, Z. 2004. Exploiting the potential of indigenous agroforestry trees: *Parkia biglobosa* and *Vitellaria paradoxa* in sub-Saharan Africa. *Agroforestry Systems* 61:207-220.
- Traoré, L., I. Ouédraogo, A. Ouédraogo & A. Thiombiano. 2011. Perceptions, usages et vulnérabilité des ressources végétales ligneuses dans le Sud-Ouest du Burkina Faso. *International Journal of Biological and Chemical Sciences* 5(1):258-278.
- Van der Vossen, H.A.M. & G.S. Mkamilo. 2007. *Plant Resources of Tropical Africa 14. Vegetable oils*. PROTA Foundation, Wageningen, The Netherlands.
- Weber, N., P. Birnbaum, P-M. Forget, M. Gueye & D. Kenfack. 2010. L'huile de Carapa (*Carapa* spp., Meliaceae) en Afrique de l'Ouest: Utilisations et implications dans la conservation des peuplements naturels. *Fruits* 65:343-354.
- Welford, L. & G. Le Breton. 2008. Bridging the gap: Phytotrade Africa's experience of the certification of natural products. *Forests Trees and Livelihoods* 18:69-79.
- Zerbo, P., J. Millogo-Rasolodimby, O. Nacoulma-Ouedraogo & P. Van Damme. 2011. Plantes médicinales et pratiques médicales au Burkina Faso: Cas des San. *Bois et Forêts des Tropiques* 65:41-53.

Appendix 1. Structured interviews on Native oil tree species selected from the literature and available knowledge that were addressed to 288 informants in two provinces, Comoé and Kenedougou, western Burkina Faso.

Species	Vernacular names				Uses of oil					
	Fulani	Gouin	Sénoufo	Tiéfo (including Dioula names)	Food	Skin care	Hair care	Soap	Medicinal	Other
Anacardiaceae										
<i>Lannea acida</i> A. Rich.	Bembeh	Tchogbamaga	Begu	Bembé	X		X	X	X	
<i>Lannea barteri</i> (Oliv.) Engl.	Pegoubakoro	Korpigui	Beguèbinbinguin	Poyi	X		X	X	X	
<i>Lannea microcarpa</i> Engl.	Pegouhi	Tchogbamaga/ Korpingou	-	Peku	X	X	X	X	X	
<i>Lannea velutina</i> A. Rich.	Pegoubakoro	Gbarpugu	Fedouting	Poyissiima	X		X	X	X	
<i>Sclerocarya birrea</i> (A. Rich.) Hochst.	Béri/Heedi	Yargnilango	Zanlourguin	Kuna	X	X	X	X	X	
Areaceae										
<i>Borassus akeassii</i> Bayton, Ouédr. & Guinko	Lébbé/Dubé	Kohèrè	Yènin	Sébé	X	X	X	X	X	X
<i>Elaeis guineensis</i> Jacq.	Kokodié	Kacayanga	Setguin/Kanli	Téhi	X	X	X	X	X	X
<i>Raphia sudanica</i> A. Chev.	Gudé gulèn/ Kaagani	Kahèrè	Patguin	Ban	X	X	X	X	X	
Ciusiaceae										
<i>Pentadesma butyracea</i> Sabine	Golombi	Nantèrè	Gnalguin		X	X	X	X	X	X
Chrysobalanaceae										
<i>Maranthes polyandra</i> (Benth.) Prance	Djidohi	Fiyélé	Tabringuin	Tututchema			X	X	X	
<i>Parinari curatellifolia</i> Planch. ex Benth.	Silansèmodjè	Yoma	Debroting	Tutu	X	X	X	X	X	X
Fabaceae										
<i>Afzella africana</i> Sm. ex Pers.	Lengahi/ Gayohi	Koormi	Tchetguin	Lengué	X	X	X	X	X	X
<i>Daniellia oliveri</i> (Rolfe) Hutch. & Dalziel	Djebèhi/ Sanahi	Nieni	Sourguin	Sana	X	X	X	X	X	X
<i>Detarium microcarpum</i> Guill. & Perr.	Konkehi	Palogu/ Kpayingo	Pkayarguin	Tamakumba	X	X	X	X	X	X
Malvaceae										
<i>Adansonia digitata</i> L.	Bohki	Tchoualè	Zetguin	Sira	X	X	X	X	X	X
<i>Ceiba pentandra</i> (L.) Gaertn.	Bantinehi	Poopogu	Silineguin	Bana	X		X	X	X	X

Species	Vernacular names				Uses of oil					
	Fulani	Gouin	Sénoufo	Tiéfo (including Dioula names)	Food	Skin care	Hair care	Soap	Medicinal	Other
<i>Sterculia setigera</i> Delile	Bobori	Popongo	Kourkonin	Kongossira		X		X	X	
Meliaceae										
<i>Carapa procera</i> DC.		Kooya	Gouingai	Gobi, Gogo	X	X	X	X	X	X
<i>Khaya senegalensis</i> (Desr.) A. Juss.	Kahi	Pengou	Welguin	Djala		X	X	X	X	X
<i>Pseudocedrela kotschy</i> (Schweinf.) Harms	Titore	Playilo	Sourgnoupouguin	Kurugbè	X				X	
<i>Trichilia emetica</i> Vahl	Soulafinsan	Koropigui	Koutrkouguin	Sulafinsa		X	X	X	X	
Ochnaceae										
<i>Lophira lanceolata</i> Tiegh. ex Keay	Badkarédjè	Karongou	Sontguin	Samashii	X	X	X	X	X	X
Polygalaceae										
<i>Securidaca longipedunculata</i> Fresen.	Djorohi	Gbangbanbèrè	Filimbé	Djoro				X		
Rutaceae										
<i>Zanthoxylum lepreurii</i> Guill. & Perr.	-	Tchaatèrè	-	Wooho					X	
Sapindaceae										
<i>Bignonia sapida</i> K.D. Koenig	Késadjè	Pingou	Koutguin	Farafinsa	X	X	X	X	X	X
Sapotaceae										
<i>Vitellaria paradoxa</i> C.F. Gaerth.	Bori/Karehi	Mussungo	Yakoro	Shii	X	X	X	X	X	X
Ximeniaceae										
<i>Ximonia americana</i> L.	Tchahouli/Bunié	-	Gbagbaguin	Miniguali		X	X	X	X	
Zygophyllaceae										
<i>Balanites aegyptiaca</i> (L.) Delile	Tanni	Zinguénin	Zeguenin	Zéguénin	X	X	X	X	X	X

