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REVISITING TREE SPECIES AVAILABILITY AND USAGE IN THE FERLO REGION OF SENEGAL: A RATIONALE FOR INDIGENOUS TREE PLANTING STRATEGIES IN THE CONTEXT OF THE GREAT GREEN WALL FOR THE SAHARA AND THE SAHEL INITIATIVE

Khoudia Niang[1,2], Moustapha Bassimbe Sagna[1,2], Ousmane Ndiaye[1,2], Amath Thiaw[1,2], Aly Diallo[1,2], Leonard E. Akpo[1], Minda Mahamat Saleh[1], Ndiack Diome[1], Sékouna Diatta[1,2], Madiara Ngom Faye[1], Mathieu Gueye[3], Aliou Guissé[1,2,4] and Deborah Goffner *[,2, 4]

[1]Department of Plant Biology, Faculty of Sciences, Laboratoire d'Ecologie et Ecohydrologie, Cheikh Anta Diop University, Dakar-Senegal
[2]Tessékéré Human-Environment Observatory, Dakar, Senegal
[3]Laboratory of Botany, Department of Botany and Geology UMI 3189, IFAN Ch. A. Diop, Dakar, Senegal
[4]International CNRS Research Unit n° 3189 'Environment, Health, and Society' Marseille, France

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ABSTRACT

In the last several decades, the Sahel has undergone desertification due to a combination of climatic and anthropogenic factors. In order to identify the most appropriate native tree species for reforestation activities, woody species inventories were performed and coupled to ethnobotanical surveys in the vicinity of four villages (Tessékéré-Forage, Widou-Thiengoly, Labgar, and Lougré-Thiolly) in the Ferlo region of the Senegalese Sahel. In general, the region is characterized by a low degree of biodiversity with only 20 tree and shrub species represented by 13 different families. Questionnaires and semi-structured interviews with local populations identified seventeen tree species that are commonly used for food, construction, energy, health, commerce, and handicrafts. The most highly cited tree species was *Balanites aegyptiaca* which was also the most abundant in the study region. In contrast, other species including *Grewia bicolor*, *Ziziphus mauritiana*, *Adansonia digitata*, and *Sclerocarya birrea* came under the categories of most highly cited for their various uses but have become rare in nature, making them ideal candidates for reforestation trials. This study is particularly timely in that the Ferlo region is currently undergoing major ecological restoration efforts in the framework of the Great Green Wall for the Sahara and the Sahel Initiative.

* Corresponding author

E-mail: deborah.goffner@gmail.com (Deborah GOFFNER)

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1 Introduction

In arid and semi-arid regions of Africa, both climate change and anthropogenic factors exert tremendous pressure on natural resource availability to the point of threatening the extinction of some plant species that are vital for the everyday lives of local populations in these regions. In the 1970s and 80s, the Sahel was faced with several bouts of severe drought which exacerbated the situation for local populations. The Ferlo region of Northern Senegal, the heart of the Senegalese Sahel, was no exception (Miehe et al., 2010). The Ferlo extends from approximately 16°15 to 14°30 North in latitude and 12°50 to 16° West in longitude, with a surface area ranging from 56 269 km² (DEFCCS, 1999) to 70 000 km² (CSE, ROSELT/OSS 2002), making it one of the largest eco-geographical regions in Senegal. It is characterized by tree and shrub savanna vegetation. Its quasi-exclusive use for grazing contributes, albeit to a debatable extent, to ecosystem degradation.

In response to dwindling forest cover (the FAO currently estimates the deforestation rate in Senegal at 45,000 hectares/year) and ecosystem degradation, several national reforestation projects throughout the African continent have been implemented in the past decades with variable degrees of success (Woodfine & Jauffret, 2009). In 2007, an unprecedented political agreement was adopted, The Great Green Wall Initiative for the Sahel and the Sahara Initiative (GGW) (Dia & Diang, 2010). For the first time, eleven African countries situated in the Sahel region (Senegal, Mauritania, Mali, Burkina Faso, Nigeria, Niger, Chad, Sudan, Ethiopia, Eritrea, and Djibouti) agreed to joined forces in a pan-African reforestation project with the ambition of creating a continuous series of restored ecosystems across the African continent from east to west, totaling more than 7000 km (Dia & Diang, 2010). The major objective of the GGW is to restore degraded ecosystems in a way that provides environmental benefits, and at the same time, contributes to the well-being of local populations through more abundant and well-adapted ecosystem services.

Within the GGW context, emphasis has been given on revisiting the availability and local uses of indigenous tree species in the Sahel. to The present study was conducted in the Senegalese Ferlo region for two reasons; firstly, Senegal is already active in terms of GGW *de novo* reforestation activities, making our research outputs immediately transferable for large-scale planting in the short term; and secondly, it is along the GGW path. In this study, tree and shrub species were inventoried to determine their availability in the surrounding areas of four selected villages (Tessékéré-Forage, Widou-Thiengoly, Labgar, and Lougré-Thiolly) and these data were coupled to ethnobotanical surveys to assess the value of the different tree species for local populations. Since local populations mainly depend on naturally-occurring tree and grass species to meet many basic human and animal needs (i.e. food, fuel, health, and construction), this timely study participates in the GGW impetus towards improved livelihoods in a sustainable fashion.

2 Materials and Methods

2.1 General description of the Ferlo region of the Senegalese Sahel

The Ferlo region is located in the north of Senegal and occupies a surface area of roughly 70,000 km^2. The climate is semi-arid with an average annual rainfall of approximately 300mm/year (Miehe et al., 2010). The study areas have two seasons; i.e. a short rainy season from July to September and a long dry season from October to July. Figure 1 illustrates the extent of landscape contrast between the two seasons. The vegetation is characterized by open grasslands and sparsely populated, often thorny, small trees and shrubs.

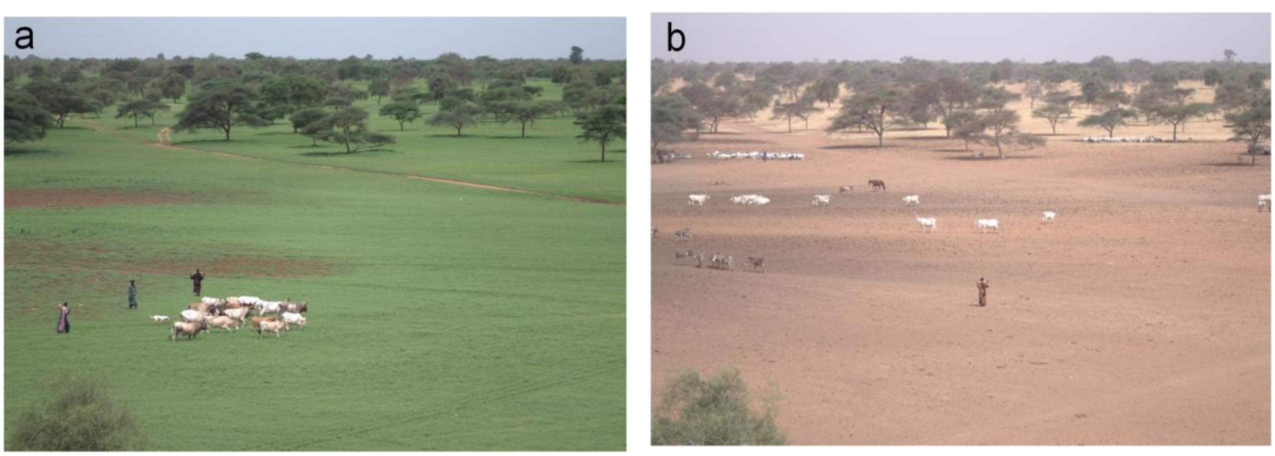

Figure 1 Panaromic view of the surrounding area of Widou Thiengoly. Photographs were taken from exactly the same point in August 2010 (a) during the rainy season and (b) April 2011 during the dry season.

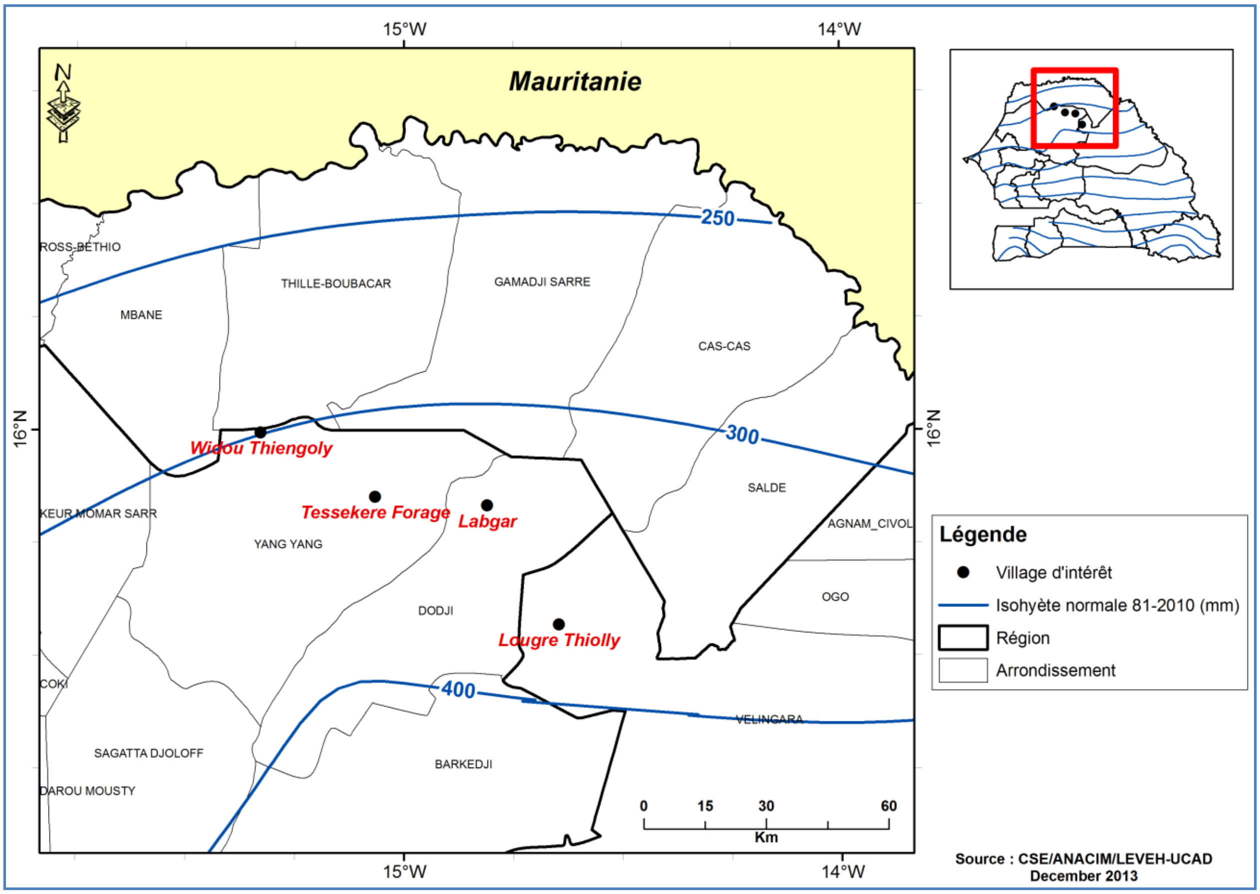

Figure 2 Geographic locations of the four study villages in the Ferlo region in Northern Senegal.

From a demographic standpoint, the Ferlo is mainly composed of Fulani (90%) and Wolof (8%) ethnic groups. The main economic activity is livestock husbandry.

2.2 Ecological characterization of woody species in four study sites

The surrounding areas of Tessékéré-Forage, Widou-Thiengoly, Lougré-Thiolly, and Labgar were selected for this study (Figure 2). Data were collected from fifteen 50m x 50m plots, all within a 10-km radius of each of the four villages (60 plots in total). Tree density was defined as the total number of individual trees/ha. Canopy cover was calculated as the sum of all of the individual tree canopy surface areas. Species richness was defined as the total number of different tree species identified in all 15 plots surrounding a given village. The species evenness index (ranging from 0-1 for minimal to maximal evenness) which describes the relative abundance of the different species that comprise a given population was calculated according to Devineau et al. (1984). A natural regeneration event was defined as any tree or shrub with a diameter ≤ 10 cm at 30 cm above soil level.

2.3 Ethnobotanical surveys

Ethnobotanical data were collected in the four study villages. In each village, the authorization of the village chief and the head of the rural community was requested prior to interviewing local villagers. A total of 129 randomly selected people were interviewed, either at home or at the local weekly markets. Semi-structured questionnaires pertaining to tree use were employed during the interviews. Due to the limited number of trees in the area, most plants were easily identified by their common and/or traditional names. Ethnobotanical data were pooled from the four villages to comprise a unique dataset. The informant consensus factor was calculated according to Heinrich et al. (1998).

Table 1 Description of woody vegetation cover of the four study sites in the Ferlo region of the Senegalese Sahel. For each village, data were compiled from 15 plots (50x 50m each) within a 10-km radius from the village.

Parameters	Tessékéré-Forage	Widou-Thiengoly	Labgar	Lougré-Thiolly
Tree density (individuals/ha)	91	78	40	63
Canopy cover (m²/ha)	1257.06	1959.90	712.56	934.79
Species richness	14	10	11	13
Species evenness index	0.62	0.46	0.47	0.61

3 Results

3.1 Ecological characterization of woody species

General ecological parameters were calculated to characterize the vegetation cover in plots in the vicinities of Tessékéré-Forage, Widou-Thiengoly, Labgar, and Lougré-Thiolly (Table 1). Tree density (individuals/ha) was highest in Tessékéré-Forage and it was followed by Widou-Thiengoly, Lougré-Thiolly and finally Labgar whereas Widou-Thiengoly had the highest canopy cover which was followed by Tessékéré-Forage, Lougré-Thiolly and Labgar. In both Labgar and Lougré-Thiolly, canopy cover was less than half of Widou-Thiengoly (712.56 m^2/ha and 934.79 m^2/ha respectively vs. 1959.90 m^2/ha). Furthermore, tree species richness (i.e. number of different species) was also reported maximum in Tessékéré-Forage while Lougré-Thiolly was characterized by intermediary diversity, whereas Widou-Thiengoly and Labgar exhibited lower levels of species richness. The species evenness index followed similar trends as species richness with a more even species distribution in Tessékéré-Forage and Lougré-Thiolly compared to Widou-Thiengoly and Labgar.

The trees and shrubs present at the four study sites were characterized in detail (Table 2). When considering the four study sites all together, 20 species from 13 different families were identified. With the exception of the *Mimosaceae, Asclepiadaceae,* and *Combretaceae,* all of the other families were represented by a single species. In keeping with data shown in Table 1, the plots in the vicinity of Tessékéré-Forage had the greatest number of trees (340), followed by Widou-Thiengoly (292), Lougré-Thiolly (237), and Labgar (152).

Table 2 Tree and shrub occurrence in the four study sites. Species are listed from most to least abundant. Data were collected from the same plots as described in Table 1.

TREE SPECIES	FAMILY	Total number of individuals	Tessékéré-Forage	Widou-Thiengoly	Labgar	Lougré-Thiolly
Balanites aegyptiaca (L.) Del.	*Balanitaceae*	485	57	213	110	105
Calotropis procera Ait.	*Asclepiadaceae*	131	119	12	0	0
Boscia senegalensis (Pers.) Lam.	*Capparidaceae*	128	109	1	18	0
Acacia senegal (L.) Willd.	*Mimosaceae*	96	3	22	0	71
Acacia tortilis var. *raddiana*	*Mimosaceae*	58	7	21	10	20
Sclerocarya birrea (A. Rich.) Hochst.	*Anacardiaceae*	27	21	5	0	1
Acacia seyal Del.	*Mimosaceae*	20	3	12	1	4
Combretum glutinosum Perr.	*Combretaceae*	19	4	2	0	13
Ziziphus mauritiana Lam.	*Rhamnaceae*	11	5	2	4	0
Grewia bicolor Juss.	*Tiliaceae*	10	1	0	2	7
Anogeissus leiocarpus (DC.) G.et Perr.	*Combretaceae*	7	0	0	0	7
Leptadenia pyrotechnica (Forsk.)	*Asclepiadaceae*	7	7	0	0	0
Adansonia digitata L.	*Bombacaceae*	5	1	2	1	1
Dalbergia melanoxylon G. et Perr.	*Papilionaceae*	4	0	0	4	0
Guiera senegalensis J.F. Gmel.	*Combretaceae*	4	2	0	0	2
Dichrostachys glomerata (Forsk).	*Mimosaceae*	3	0	0	0	3
*Adenium obesum (*Forsk.) Roem.et Sc.	*Apocynaceae*	2	1	0	1	0
Pterocarpus lucens Lepr.	*Casuarinaceae*	2	0	0	0	2
Kigelia africana (Lam.) Renth.	*Bignoniaceae*	1	0	0	0	1
Prosopis chilensis (Mol.) Stuntz.	*Mimosaceae*	1	0	0	1	0
TOTAL		**1021**	**340**	**292**	**152**	**237**

Table 3 Natural regeneration of woody species in the four study sites. Species are listed from most to least abundant. Data were collected from the same plots as described in Table 1.

Tree species	Number of events	Tessékéré-Forage	Widou-Thiengoly	Labgar	Lougré-Thiolly
Balanites aegyptiaca (L.) Del.	1091	95	660	120	216
Boscia senegalensis (Pers.) Lam.	307	282	2	23	0
Calotropis procera Ait.	131	94	12	25	0
Ziziphus mauritiana Lam.	47	1	0	0	46
Acacia senegal (L.) Willd.	46	0	3	0	43
Feretia apodanthera Del.	22	0	0	0	22
Acacia tortilis var. raddiana	18	1	15	2	0
Acacia seyal Del.	18	1	3	4	10
Dichrostachys glomerata (Forsk).	13	0	0	0	13
Grewia bicolor Juss.	10	0	0	0	10
Guiera senegalensis J.F. Gmel.	2	0	0	0	2
Leptadenia pyrotechnica (Forsk.)	1	0	1	0	0
TOTAL	**1706**	**474**	**696**	**174**	**362**

Of the 1021 trees in the four study sites, nearly half was comprised of *Balanites aegyptiaca* (485). Although *B. aegyptiaca* was present in all four sites, it clearly dominated the vegetation of Widou-Thiengoly, with *Acacia senegal* and *Acacia tortilis* following far behind. *B. aegyptiaca* was also the dominating species in Labgar, accounting for 100 of the 152 inventoried trees. These data are in keeping with the low species richness and evenness indexes reported for both Widou-Thiengoly and Labgar (Table 1). In contrast, Tessékéré-Forage had a relatively few *B. aegyptiaca* (57), as compare to *Caloptropis procera* (119) and *Boscia senegalensis* (109) that each accounted for roughly a third of the total number of trees (340) in the site. These two species were relatively infrequent in the other sites. Moreover, the large majority of *Sclerocarya birrea* (21 of 27 in total) and all of the *Leptadenia pyrotechnica* (7) were also inventoried in Tessékéré-Forage, in keeping with the relatively high species diversity and evenness indexes for Tessékéré-Forage (Table 1). Interestingly, despite the relatively low tree density observed in the surroundings of Lougré-Thiolly (234 trees), the vegetation was quite diversified. Although *B. aegyptiaca* made up roughly half the population, there was also a high proportion (nearly one third of the population) of *A. senegal* and some of the rarer species were either relatively abundant (*Combretum glutinosum, Grewia bicolor*) or exclusively found *(Anogeissus leiocarpa, Dichrostachys glomerata, Pterocarpus lucens, Kigelia africana* in Lougré-Thiolly. It is interesting to note that *C. procera* and *B. senegalensis* were both absent from this site. Finally, for 10 of the 20 woody species identified, ≤ 7 individuals were surveyed when considering all four zones together (corresponding to the sixty study plots).

An important characteristic that contributes to the abundance of an individual species in forest stands is its capacity to naturally regenerate either via reproductive (seed dispersal) and/or vegetative (lignotubers, rhizomes or roots) means. Only twelve tree/shrub species were able to regenerate when considering all four sites together (Table 3). Widou-Thiengoly exhibited the highest regeneration capacity albeit largely dominated by *B. aegyptiaca*, followed by Tessékéré-Forage, Lougré-Thiolly, and Labgar. As a general rule, the tree species with the highest regeneration capacity (*B. aegyptiaca*, *B. senegalensis*, and *C. procera*), were those that were most abundant in adult tree populations (for comparison, see Table 2), although several exceptions were observed. On the one hand, no regeneration events were observed for some of the relatively abundant species in adult stands (i.e. *S. birrea* in Tessékéré-Forage and *A. tortilis* in Lougré-Thiolly), and on the other hand, for several species which exhibited relatively high regeneration potential (i.e. *Z. mauritiana and Feretia apodanthera* in Lougré-Thiolly), no adult individuals were inventoried (Tables 2 and 3).

3.2 Ethnobotanical uses of woody plants in the Ferlo

Local populations were interviewed in order to determine the woody species that were most commonly used and for which purpose(s). Seventeen species were cited for at least one use (Table 4). Food was the most highly cited category (244 of the 875 total number of citations: 28%); other major categories in order of importance were energy (21%), health (20%), and construction (19%). Some minor use categories such as industry, commerce, and handicrafts were also reported. For each use category, the informant consensus factor was high (between 0.88 – 0.95) with the exception of handicrafts (0.57), indicating consensus among informants as to which tree species were used for each category.

When considering all use categories combined, the tree with the greatest number of citations was *B. aegyptiaca* (210 of the 875 total citations). It was most highly cited for food (mainly fruit), wood for household energy, and medicinal purposes. Its wood was also cited for construction and fruits are gathered and sold at local markets.

Table 4 Tree and shrub use category citations from ethnobotanical surveys in the four study sites. The parts of the plants used are indicated for each use category.

Tree Species	Total N° Citations	Food	Energy	Health	Construction	Industry	Commerce	[1]Misc	Handicrafts
Balanites aegyptiaca	210	79[F, L]	43[Br]	41[F, B]	25[Br]	0	14[F]	8[L, B, R]	0
Grewia bicolor	132	15[F]	32[Br]	32[B]	41[Br]	0	0	12[B]	0
Ziziphus mauritiana	92	45[F]	14[Br]	15[L, Br, F]	12[Br]	0	6[F]	0	0
Adansonia digitata	84	44[F, L]	4[Br]	2[F, B]	25[Br]	5[B]	4[F]	0	0
Sclerocarya birrea	72	28[F]	15[Br]	17[B, F, L]	7[Br]	0	0	0	5[T]
Acacia senegal	67	10[G]	7[Br]	9[G, B, R]	8[Br]	30[G]	0	3[Br]	0
Acacia tortilis	64	3[G]	30[Br]	13[B, L]	15[Br]	0	0	3[F]	0
Guiera senegalensis	39	0	8[Br]	25[L]	6[Br]	0	0	0	0
Boscia senegalensis	34	14[F]	3[Br]	10[F, L]	4[Br]	0	3[F]	0	0
Calotropis procera	33	0	14[Br]	7[L, Br, Sa]	12[Br]	0	0	0	0
Pterocarpus lucens	14	0	7[Br]	0	6[Br]	0	0	0	1[T]
Combretum glutinosum	10	0	2[Br]	6[L, F]	2[Br]	0	0	0	0
Acacia seyal	9	1[G]	2[Br]	0	2[Br]	4[G]	0	0	0
Acacia nilotica	5	1[G]	1[Br]	0	1[Br]	1[G]	0	0	1[T]
Combretum aculeatum	4	1[L, F]	1[Br]	2[L, F]	0	0	0	0	0
Faidherbia albida	4	1[G]	1[Br]	1[L]	0	0	0	0	1[T]
Tamarindus indica	2	2[F]	0	0	0	0	0	0	0
TOTAL	**875**	**244**	**184**	**180**	**166**	**40**	**27**	**26**	**8**

[1]MISC: Miscellaneous: Mainly undefined mystical use; F : Fruit, L : Leaves, G : Gum, Br : Branches, R : Root, Sa : Sap, B : Bark, T : Trunk

The second most highly cited species was *G. bicolor* (132 citations). Its main attribute is its excellent wood quality. It was the most highly cited species for construction and second only to *B. aegyptiaca* for household energy. *G. bicolor* was also highly cited species for medicinal purposes. Unlike *B. aegyptiaca, G. bicolor* is rare in the zone (only 10 inventoried trees, 7 of which were located in Lougré-Thiolly, see Table 2). The next three most highly cited tree species were *Z. mauritiana, A. digitata, S. birrea;* all three used for their fruit. *A. senegal,* the sixth most highly cited species, is mainly appreciated for the production of gum Arabic and therefore constitutes a potential source of income for local populations. Like *G. bicolor*, *A. tortilis* is the seventh most highly cited species and is especially appreciated for its wood quality (mainly for household energy). *Guiera senegalensis,* the eighth most cited species, is mainly used for medicinal purposes with 25 of its 39 total citations falling into the health use category.

Finally, livestock grazing is an essential feature in the daily lives of people in the Ferlo, and during the dry season herders are dependent on trees as a source of forage when grass is limiting. Nineteen woody species were commonly used as forage with *B. aegypytiaca*, *G. bicolor*, and *A. tortilis* being the three most highly cited. *B. aegyptiaca* was the most cited tree species for all livestock with the exception of goats for which *G. bicolor* and *A. tortilis* were more highly cited (Table 5).

Discussions

Combining ecological and ethnobotanical data for a given geographical zone provides critical indicators for land management decisions that can directly benefit local populations. The study presented herein in the Ferlo region of Senegal is particularly timely in that GGW reforestation activities are in full swing with 5000 hectares planted each year since 2008 (Pap Sarr, personal communication). Until now, *B. aegypytiaca*, *A. senegal*, *A. tortilis*, and *Acacia nilotica* have been planted. Although these species are of interest to local populations, they are many other highly prized, ecologically well-adapted, indigenous woody species that could be integrated into the GGW reforestation protocol. These include *G. bicolor*, *Z. mauritiana, A. digitata, S. birrea*, and *G. senegalensis*. The relative infrequency of adult trees and their low natural regeneration capacities make them ideal candidates for reforestation; they could be available in the short term for use by local populations while at the same time participating in long term species conservation.

Only 20 woody species belonging to 13 different families were inventoried in the study zone. Although the vegetation survey data presented herein are not exhaustive, they are, however, representative of tree populations in the four study sites.

Table 5 Tree species used for forage consumption.

Tree and shrub species		Number of use citations			
Species	Total number of citations	Sheep	Cattle	Goats	Horses/mules
Balanites aegyptiaca	223	90	83	34	16
Grewia bicolor	178	57	53	58	10
Acacia tortilis	178	55	52	59	12
Adansonia digitata	141	43	43	44	11
Sclerocarya birrea	136	45	42	44	5
Ziziphus mauritiana	135	49	40	40	6
Acacia senegal	114	41	36	36	1
Calotropis procera	94	31	28	30	5
Guiera senegalensis	81	27	28	24	2
Boscia senegalensis	71	22	22	22	5
Pterocarpus lucens	36	12	12	11	1
Acacia seyal	26	9	9	7	1
Combretum glutinosum	17	7	4	6	0
Faidherbia albida	13	4	4	3	2
Acacia nilotica	12	5	5	2	0
Prosopis chilensis	12	4	2	3	3
Combretum aculeatum	7	2	2	2	1
Azadirachta indica	3	1	1	1	0
Tamarindus indica	3	1	1	1	0
TOTAL	**1480**	**505**	**467**	**427**	**81**

When considering the four study sites together, the *Mimosaceae* (5 species), *Combretaceae* (3 species), and *Asclepiadaceae* (2 species) families were the most highly represented in the zone. The most abundant tree species were *B. aegyptiaca*, *C. procera*, and *B. senegalensis*. These data are in agreement with a recent floristic study performed in the Ferlo (Ndiaye et al., 2013).

The number of woody species is low compared to other reported studies describing other so-called "poor, degraded ecosystems" in West Africa. For example, in a study that compared ethnobotanical knowledge of three ethnic groups in the sub-Sahelian region of Burkina Faso, a total of 120 woody plant species were identified in the zone. Ninety of them (belonging to 32 families) were used by local populations (Sop et al., 2012). However, in this study, the zone benefited from an average rainfall of 500-650 mm /year and is located at the phyto-geographical transition between the Sahelian and Sudanian zones. The vegetation was comprised of a mix between Saharan, Sahelian, and Sudanian components, thereby explaining its high degree of biodiversity.

Even if the four different study sites are characterized by low plant biodiversity, there are, however, some interesting differences in tree populations among the sites. For example, Labgar exhibited the lowest adult tree density, biodiversity, and natural regeneration potential of the four study sites. This is likely due to anthropogenic factors including its localization at the intersection of transhumance corridors with high human and animal passage and a non-negligible Maure population living in the vicinity. Maures own camels and they exert additional grazing pressure on the landscape around Labgar. Lougré-Thiolly, situated to the southeast of the other villages has a slightly higher annual precipitation (Figure 2). This likely contributes to a more diverse, more even adult tree population, and a relatively diverse regeneration potential with the presence of some species (i.e., *A. leiocarpa*, *C. glutinosum*, *P. lucens*) that are more characteristic of the richer eco-geographic Sahelo-Sudanian zone (Arbonnier, 2004). Interestingly the species composition of the adult tree populations in the four sites did not necessarily reflect the species compositions of the natural regeneration events. To the extent by which this phenomenon is due to climatic factors (i.e. unpredictable, low rainfall and/or increasing temperature) and/or anthropogenic pressure (i.e., selective grazing or differences in species resistance to trampling) must be addressed in future studies.

The perceived decrease in availability and biodiversity of tree and shrub vegetation has been reported at the regional level in Sahelian West Africa (Senegal, Burkina Faso, and Niger) (Wezel & Lykke, 2006). In this study, local populations were asked to classify each tree species in terms of its availability: increased, unchanged, decreased, or disappeared in recent years as compared to the past. 79% of the species were perceived as decreased or disappeared, most of which were of socioeconomic importance. A list of endangered species (defined as "disappeared" from at least 10 of the 23 villages studied) was established: *Lannea acida, A. senegal, Acacia seyal, Acacia ehrenbergiana, A. digitata, B. senegalensis, Ceiba pentandra, Dalbergia melanoxylon, Ficus gnaphalocarpa, G. bicolor, Khaya senegalensis, Maerua crassifolia, P. lucens, S. birrea, and Tamarindus indica.* Interestingly, there was a high degree of overlapping between our field data in the Ferlo (identification of several useful, low abundance species) and the human perception data at the regional level (Wezel & Lykke, 2006), reinforcing that these species constitute excellent candidates for field trials in the framework of reforestation projects like the GGW.

B. aegyptiaca is extremely drought resistant and by far the most abundant woody species in the study zone. *B. aegyptiaca* also possesses an array of natural regeneration strategies by seed, root suckers, and coppicing (El-Nour, 1994). In contrast to many other species that cannot withstand livestock-induced pressure, *B. aegyptiaca* actually thrives as a result of continual animal passage of the silvopastoral Ferlo region since the passage of fruits/seeds through animals' digestive tracts facilitates seed germination (Von Maydell, 1986). It is also the most highly cited species for its multiple uses (food, medicine, construction, energy, and local commerce). In the sub-Sahel of Burkina Faso, *B. aegyptiaca* was also classified as the most useful species according to all three different ethnic groups interviewed (Sop et al., 2012). In fact, it is even documented that human beings have been using *B. aegyptiaca* for thousands of years (Von Maydell, 1986; Hall, 1992).

The consumption of wild fruits is a means to diversify food intake during periods of food shortage, especially during the dry season (Fentahun & Hager, 2009). *B. aegyptiaca* produces a yellow date-like fruit, with a healthy, mature tree producing up to 10,000 fruits annually (National Research Council, 2008). The pulp is eaten fresh or dried. It contains 64 – 72% carbohydrates, approximately 10% protein, in addition to saponins, vitamin C, and other minerals (Abu Al-Futuh, 1983; Sagna et al., 2014). The seed kernel is rich in oil (up to 46.7% on a dry weight basis) and high in unsaturated fat with a fatty acid composition similar to soybean oil (Chapagain et al., 2009). Beyond its use for human consumption, these authors concluded that *B. aegyptiaca* seed kernels from the Israeli Arava desert could be used as a bioresource for sustainable biodiesel production. All together, its highly extensive geographic distribution throughout Africa and the Arabian Peninsula (Arbonnier, 2004), its adaptability to arid environments, and its usefulness for numerous purposes make *B. aegyptiaca* a model tree species for dryland restoration. Finally, fruit and seed traits (morphology and chemical composition) exhibit a high degree of intraspecific variability (Abasse et al., 2011; Elfeel, 2010), suggesting that genetic gain via domestication is a realistic goal.

In conclusion, through a combination of ecological characterization and applied ethnobotany in the Senegalese Sahel, we have identified a number of indigenous woody species for which conservation is a priority. This timely study provides invaluable information for the GGW that is currently "under construction" in the study zone in that it places local populations' benefits at the heart of short-term (i.e. identification of which species to plant) and long-term (i.e. domestication of a number of selected fruit tree species) reforestation strategies. One obvious choice for domestication efforts is *B. aegyptiaca* which thrives in arid environments and produces a number of highly-valued, provisioning ecosystem services. Finally, field experiments are currently underway to test the feasibility of large-scale reintroduction of the "candidate" tree species identified herein in collaboration with the Senegalese National Green Wall Agency.

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