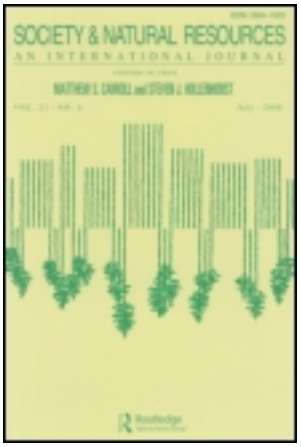

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Chiefs and Trees: Tenures and Incentives in the Management and Use of Two Multipurpose Tree Species in Agroforestry Parklands in Northern Ghana

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Chiefs and Trees: Tenures and Incentives in the Management and Use of Two Multipurpose Tree Species in Agroforestry Parklands in Northern Ghana

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*Amid growing concerns about the perceived population decline of shea (*Vitellaria paradoxa*) and locust bean (*Parkia biglobosa*) trees in the agroforestry parklands, this article explores the impacts of differing tree tenure regimes on their management and use. Using a case study of two communities in Northern Region, Ghana, the study shows that the differing institutional arrangements governing the ownership, access, and use of these two species have led to different sets of incentive structures that have contrasting effects on the management of these species. Shea, in general, seemed to fare much better than locust bean under the current customary regulations. The research finds that in the absence of proper incentives, old and dying locust bean trees might not be replaced by young ones, thereby further jeopardizing its population, and along with it a variety of benefits it accrues to these rural communities.*

Keywords locust bean, property rights, shea, tree tenure

The management and utilization of resources in agroforestry are influenced by both land and tree tenure systems,[1] especially where land and tree tenure are distinct, and rights to one do not necessarily lead to rights to the other. However, most studies on tenure systems in agroforestry in Sub-Saharan Africa (and elsewhere) have focused primarily on land tenure security, investments, and productivity in these landscapes. These studies generally posit that security of tenure encourages investments in the land because legally secure tenure gives the owners more incentive to invest in

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"their" land, and that entitlement documents allow owners to obtain loans or guaranteed investments easily by using land as collateral (Ault and Rutman 1979; Feder and Noronha 1987; Sjaastad and Bromley 1997). However, most studies of tenure security and investments, and their subsequent impact on productivity, have not produced clear results (Bruce and Migot-Adholla 1994; Besley 1995; Brasselle et al. 2002). Furthermore, some scholars have questioned the direction of causal relationship between tenure security and investments, stating that investments on the land, such as tree planting or development of physical infrastructures, are just as likely to lead to greater tenure security, as tenure security is to lead to greater investments on the land (Besley 1995; Sjaastad and Bromley 1997). As Sjaastad and Bromley (1997, 559) conclude: "Tenure security is a result, as well as a cause of land use decisions."

The incentives that encourage investments on land become particularly important when such investments are an integral part of the land use systems—such as trees in agroforestry. Moreover, agroforestry systems are affected not only by land tenure but also by tree tenure regimes in place, both of which often have complex institutional arrangements based on the prevailing customary and statutory tenure systems.[2] It is often the case that having a certain bundle of rights does not necessarily guarantee access to resources—it is how individuals and households exercise their rights vis-à-vis other individuals and households in the society, often bounded by institutions such as marriage, lineage, and chieftaincy (Berry 1988; 1989; 1997). Furthermore, land and tree tenure could be distinct such that the ownership, access, and use rights to perennial trees like shea and locust bean could belong to different (and multiple) individuals or groups than those who hold the rights to land (Fortmann 1985; Boffa 1999). Although various systems of land and tree tenures have been studied across West African agroforestry parklands, very little is understood about how these tenure systems and other socioeconomic factors affect the management of valuable tree species like shea and locust bean in these parklands. This article examines one such case in the Dagomba land[3] in Northern Ghana, where shea and locust bean trees are managed under different tenure structures. More specifically, it examines the incentives in the present institutional arrangements with regards to these trees, and explores how these incentives influence household behavior in managing these trees.

This article is structured as follows. The context for this study and the main research questions are outlined in the next section. The methodology of data collection and analysis is described in the section after next. Results are presented thereafter, followed by a discussion of the findings and a summary of the major conclusions.

Managing Agroforestry Parklands: Incentives and Constraints

Agroforestry parklands, often referred to as "farmed parklands," are the main feature of semihumid and semiarid landscape in West Africa where socioeconomically important trees are left scattered in the cultivated fields or fallow (Pullan 1974). Human land use practices have shaped these landscapes, and in Northern Ghana, shea and locust bean are two common tree species left in these parklands (Pullan 1974; Lovett and Haq 2000). Although selective preservation of these valuable trees has been ongoing for hundreds of years (Lovett and Haq 2000; Maranz and Wiesman 2003), intensification of agriculture and population pressure, among other socioeconomic processes, are thought to have decreased the overall number of trees

in these parklands in recent years (Blench 1999; Boffa 1999). Shea and locust bean trees are generally retained for their economic benefits; however, they may also be kept on the farmlands as a result of tenure restrictions that prevent cutting of these trees, such as by migrant farmers (Augusseau et al. 2006).

Shea (*Vitellaria paradoxa*) and locust bean (*Parkia biglobosa*) are often referred to as associate tree species because they are found to grow together and with almost identical distribution range across Africa on the Sudanian and Guinean savannah vegetation zones of Sub-Saharan Africa, north of the equator (White 1983; Hall et al. 1996; 1997). Both species form an almost continuous belt from Senegal in the west to Uganda in the east (Hall et al. 1996; 1997). These trees grow 10–20 m in height; both species mature relatively late, with first fruiting occurring only after 15–20 years (Hall et al. 1996; 1997).

People living in semihumid and semiarid zones of Sub-Saharan Africa have traditionally used shea butter as their main cooking fat and for purposes ranging from medicinal to traditional ceremonial use (Chalfin 2004; Lovett and Haq 2000). Moreover, shea also provides a major source of cash income to many rural households through the sale of its fruits, nuts, and locally processed butter. In recent years, the demand for shea butter on international markets has made shea an international commodity (Chalfin 2004). In contrast, the locust bean is still extensively traded and used locally to prepare a condiment called *dawadawa*, which is used in soups and stews. In Northern Ghana, although not as populous as shea trees, the locust bean is still considered important economically and for its traditional uses, and *dawadawa* is still the favored condiment for many rural households. Moreover, studies in other West African countries show that locust bean trees provide one of the highest sources of nonfarm income for rural households (Hall et al. 1997; Teklehaimanot 2004). It is thus clear that these two species have the potential to provide significant economic incentives to the households to preserve them in their farmlands.

In addition to the economic benefits, shea and locust bean trees provide additional benefits, such as defense against erosion, moisture retention, and higher nutrient content in the soil (Boffa et al. 2000). However, studies have also shown that both trees could have negative impacts on the crops (Kessler 1992; Kater et al. 1992). Thus farmers have to make a trade-off between benefits and costs of having trees on their farmlands when making management decisions regarding these trees. As Bruce and Fortmann (1988) posit, preservation, protection, and planting of trees will not occur if these activities are costly, and unless people get the right kind of incentives. Furthermore, it is often the case that the prevailing systems of tenure make these activities costly (Bruce and Fortmann 1988). Thus, the selection of a particular tree species to keep on the farmed parklands, and the decision to plant or remove others, could be driven not just by economic concerns but also by institutional and other sociopolitical factors.

Under the customary tree tenure regime in the Dagomba traditional area, shea trees belong to the landholder using the land. In contrast, locust bean trees come under the domain of the chiefs—and usually, there is a "tree chief," *Dohannaa*, in each community who has full tenure rights over all the locust bean trees in the community. The common landholders, while having full tenure rights over their land, have no tenure rights over the locust bean trees on their land. So the issue here is that even when farmers/landowners have secure tenure over their land, the locust bean trees, whether grown wild or planted by themselves, would not belong to them. This is likely to affect the way farmers manage locust bean trees on their farmland.

Furthermore, due to different tenure regimes between shea and locust bean trees for most farmers, the management of these two species on their lands are likely to differ, with a subsequent impact on their current population and the viability of their future population. This proposition is analysed based on three specific research questions:

1. *What are the major distinctions between shea and locust bean trees in terms of their tenure?* By identifying the major distinctions between the tenure rights over shea and locust bean trees, we can identify whether the tenure regime is likely to provide particular incentives, and to which stakeholders in the community.
2. *What are the contributions of shea and locust bean trees to the households?* It is essential to ascertain and compare the contributions of these species to household income and to other nonmonetary benefits to assess the level of incentives available to the households to manage these trees on their farmlands. It is expected that farmers would be more favorable to protecting the species that provides relatively higher benefits to their households.
3. *What are the perceptions of various stakeholders towards shea and locust bean trees?* Understanding the perceptions of various stakeholders towards shea and locust bean trees should provide an insight into how they are managing these trees on their farmland, and how they might manage them in future.

Study Sites, Data Collection, and Analysis

Two adjoining communities—Cheyohi (9° 26', 0° 59') and Kpachi (9° 25', 0° 58')—in the Dagomba traditional area in Northern Ghana, next to a rapidly growing town of Nyankpala, were selected for this study (Figure 1). These two communities,

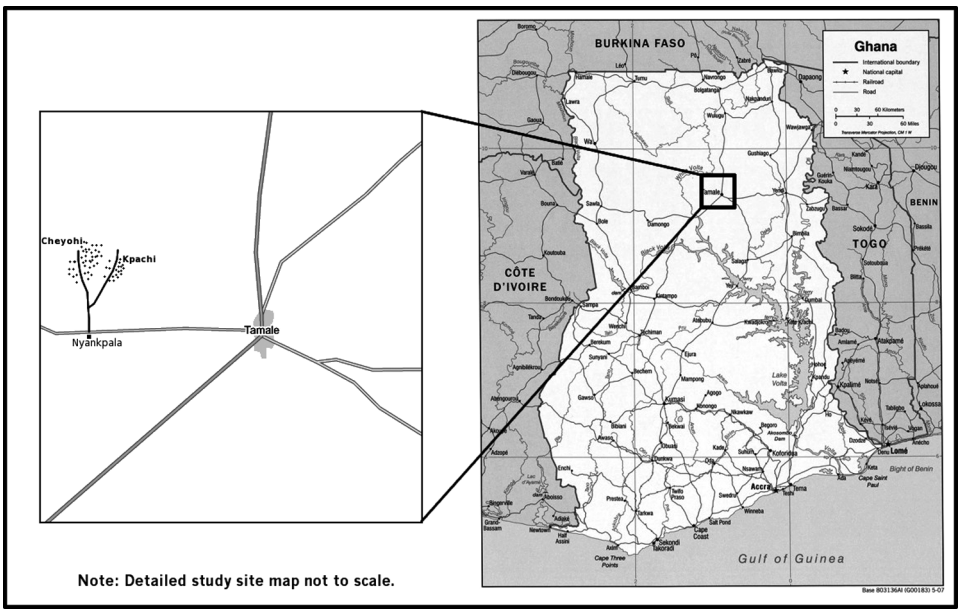

Figure 1. Map showing the location of the study site in relation to the Northern Region capital Tamale. The locations of the communities Cheyohi and Kpachi relative to the town centers of Nyankpala and Tamale are for illustration only and are not to exact scale.

homogeneous in ethnic composition with all households belonging to Dagomba group, were selected so as to have large enough population to draw the study sample from. Cheyohi had 102 households, while Kpachi had 29 households[4]—with total population of 1393 and 409, respectively. Each had a chief, tree chief, and other subchiefs and elders. A 70% random sampling was carried out in each community (including replacements) with a view to surveying 60% of the households in total, which resulted in a total sample of 80 households: 62 in Cheyohi and 18 in Kpachi.

The communities were at about 21 km from the regional capital Tamale. A regular local transport to Tamale from Nyankpala meant that they had relatively easy access to the markets and were aware of the commercial potential of both shea and locust bean trees. Furthermore, with these communities being next to Nyankpala, with an increasing land scarcity, research in these communities allowed an examination of tree tenures in context of resource scarcity and external pressures.

Primary data was collected, during October–November 2007, through key informant interviews and focus-group discussions (FGDs), household questionnaire survey, and a census of shea and locust bean trees. Initial visits to the study sites were made to gain familiarity with the study area, local stakeholders, and key issues. Key informant interviews and FGDs concentrated on gathering community-level and stakeholder-specific information. The structured household questionnaire survey sought to gather detailed information on socioeconomic characteristics of the households, respondents' views on land and tree tenures, and perceptions of the effects of trees on the crops. In addition, the questionnaire on shea and locust bean trees included a series of hypothetical questions about the respondents' willingness to plant these trees under certain incentives, such as the availability of improved varieties of seedlings and stronger tenure rights. The objective was to elucidate which of the factors provided the greater incentive to plant and preserve these trees.

The initial versions of the survey questionnaires were pretested and then revised based on the feedback from pretesting to prepare the final version (Glewwe 2005a; 2005b). From each household, the household head (or the member responsible for providing for the household) and the head woman were interviewed. The household-level information related to income, expenditure, and agricultural production was collected for the 12-month period leading up to the survey using a recall method. "Off-farm income" included incomes from trading, employment, wage labor, and collection and sale of nontimber forest products (NTFPs).[5] The information was recalled by the main respondents, with the help of relevant member of the household when necessary.

Finally, a census of shea and locust bean trees was carried out on the farmlands of all the households surveyed. The census was restricted to the farmlands that were within these communities, as some households had additional farmlands in other communities. An exhaustive count of mature (fruiting and old nonfruiting) and young (taller than 1 m, yet-to-fruit) trees of both species was carried out for all the households surveyed. The author carried out the census with a local field assistant, and a member from the household surveyed who was aware of the plot boundaries on all sides.

The collected data was entered and analysed in SPSS 16.0 (SPSS, Inc. 2008). This study focuses on two main stakeholder groups—common farming households and the households of chiefs/subchiefs—and explores differences in their access to resources, their interests, and their management and utilization of shea and locust bean trees (Grimble et al. 1995). The article relies on the qualitative data analysis

methods (cross tabulation, ordering, and ranking), which were used to analyze local institutional arrangements with regard to land and trees, respondents' perceptions of the impact of trees on crops, and their attitudes towards trees on their farmlands. Furthermore, descriptive statistical analysis and correlation were used to explore quantitative data and the relationship between two or more variables of interest (Swinton and Labarta 2003).

Results

Landholding, and Access and Use Rights over Shea and Locust Bean Trees

All surveyed households had access to at least one plot of nonirrigated land used to grow staple crops, such as maize, yam, millet, and beans; all but one household claimed ownership over the land it was farming (Table 1). It is important to note that "ownership" in this study means the ownership as the respondent saw it, and not necessarily with legal documents. Indeed, despite not having formal entitlement papers, all the respondents who said they had gained access to land through inheritance said they had the rights to use their land as collateral for loans, or even to sell it. The system of land tenure was that of a typical Dagomba community, with the chief claiming overall "ownership" of the land; however, as Abudulai (1986) explains, this was more of a "trusteeship" than ownership in a proprietary sense, as the local chief had no absolute rights to dispose of the land that was being held and used by a common household. This meant the respondents who claimed "ownership" over their land indeed had stronger proprietary rights than the local chief.[6]

The total area of farmed plots held by the households varied from 0.61 ha to about 6.88 ha, with an average of 2.47 ha. In terms of distribution, 5% of the respondent households held less than 1 ha of farmed plots, 75% held 1–3 ha, and the remaining 20% held more than 3 ha of farmed plots. The households of chiefs and subchiefs held 2.71 ha of farmed plots on average compared to 2.39 ha held by the

Table 1. Land holding and tenure information for households surveyed

Landholding and tenure characteristics		Irrigated land Plot I	Non-irrigated land Plot I	Non-irrigated land Plot II
Households with plots		59 (73.8%)	80 (100%)	76 (95%)
Average landholding (ha)		0.93	1.01	0.49
Ownership	Yes (w/papers)	1 (1.7%)	1 (1.2%)	1 (1.3%)
	Yes (w/o papers)	57 (96.6%)	78 (97.5%)	74 (97.4%)
	No	1 (1.7%)	1 (1.2%)	1 (1.3%)
Rights to sell or use as collateral	Both	58 (98.3%)	79 (98.8%)	75 (98.7%)
	No rights	1 (1.7%)	1 (1.2%)	1 (1.3%)
Use obtained through	Inherited	58 (98.3%)	79 (98.8%)	75 (98.7%)
	Rented	1 (1.7%)	1 (1.2%)	1 (1.3%)
Years under continuous farming	1–10 years	11 (18.7%)	10 (12.5%)	23 (30.3%)
	More than 10 years	47 (81.3%)	70 (87.5%)	53 (69.7%)

nonchief households, with no significant difference between the two groups ($t = 0.986$, $p = .327$, $df = 78$). Of the households surveyed, only 17 (21%) had left fallow plots, with the area ranging from 0.40 ha to about 8.09 ha with an average of 1.49 ha.

All respondents said they "owned" the shea trees on their lands and that their household had full access and harvest rights, including rights to exclude others (Table 2). Only one household allowed other households in the community the secondary harvest rights to shea nuts on fallow lands. Secondary harvest rights amounted to the permission to collect shea fruits and nuts on the land after members of the landholding household (i.e., with primary rights) had completed the first round of collection. Only 19 respondents—all from the households of chiefs and subchiefs—said they had ownership of locust bean trees on their lands including full access and harvest rights. It is important to note at this point that although the *Dohannaa* was the overall chief for the locust bean trees within the community, the chief and subchiefs had full tenure rights over locust bean trees on their land. All together, 19 of the 80 households surveyed had greater tenure rights over locust bean trees by virtue of their status as the households of the chief, tree chief, or a subchief. The remaining respondents reported that the locust bean trees on their land belonged to the tree chief, including full access and harvest rights (Table 2).

Although all respondents said they could plant both tree species on their land, only 19, all from the households of chiefs and subchiefs, had unrestricted rights to plant locust bean trees; 60 said they could plant locust bean trees on their land but could not claim ownership over those trees. One respondent could only plant locust bean trees if his household did not claim ownership over the land where they were planted. In contrast, everyone reported having unrestricted rights to plant shea trees on their land. Yet, despite possessing the rights to plant trees, only one household had planted either of the two trees.

All the respondents said they would plant shea trees on their farmlands if "improved varieties were available," whereas only those from the households of chiefs and subchiefs would plant locust bean trees under the same incentive.

Table 2. Tenure information for shea and locust bean trees

		Holders of the rights				
Level of rights	Trees	Household head	HH members (inc head)	Chief	Land owner	Other villagers
Ownership	Shea	80 (100%)				
	Locust bean	19 (23.8%)		61 (76.2%)		
Access and harvest rights—1st priority	Shea		80 (100%)			
	Locust bean		19 (23.8%)	61 (76.2%)		
Access and harvest rights—other	Shea		78 (97.5%)			1 (1.2%)
	Locust bean		19 (23.8%)		60 (75%)	1 (1.2%)

However, everyone said they would plant both the trees if they had "unrestricted access/use rights" or "full ownership" over the trees planted. While 86% of respondents indicated that the availability of improved varieties would be the most important factor in their decision to plant shea trees, the same would be true for only 24% of the respondents in case of locust bean trees. For three out of four respondents, having full ownership over the planted trees would be the most important factor in their decision to plant locust bean trees.

Common tree management practices on farmlands included pruning or cutting of the branches, removal of unwanted trees and seedlings, and transplanting of the seedlings or saplings. All the respondents said they had unrestricted rights to cut branches from shea trees. However, only 25% had equivalent rights for locust bean trees on their land, while 60.5% could only cut dry branches and 14.5% could cut those only with chief's permission. While all the respondents said they had the right to cut shea trees on their land, only those from the households of chiefs and subchiefs had the rights to cut locust bean trees.

Contribution of Shea and Locust Bean to the Households

The total off-farm income of the households surveyed ranged from zero to GH¢4539, with an average of GH¢607.30 (~US$613.30).[7] Shea contributed GH¢10.40 to GH¢230 to the household income, which translated to about 1.2–100% of the total off-farm income for those households.[8] It is important to note that the income from shea and locust bean reported here only includes actual cash income from these trees and does not include household consumption of the products collected. Thus the total benefits to the households from shea and locust bean is likely to be higher than that reflected by the cash income. The bottom 10% of the households received less than 4%, whereas the top 10% of the households received more than 31% of their total off-farm income from shea (Table 3). There was no significant difference in the incomes from shea between chief and nonchief households; hence, the results reported in Table 3 show the contribution of shea to all the households surveyed. Female respondents reported total annual cash income between GH¢20 to GH¢550, with a substantial portion coming from the sale of shea nuts and/or butter.

Table 3. Contribution of shea and locust bean to the household income

	Income from shea ($N = 76$)		Income from locust bean ($N = 3$)	
Percentiles (% of valid respondents)	As % of total off-farm income of the household	As % of total income of women in the household	As % of total off-farm income of the household	As % of total income of women in the household
10	3.41	13.70		
25	5.66	21.35	0.20	1.09
50	11.51	28.60	1.00	1.64
75	21.85	42.20	2.07	3.53
90	30.56	66.50		
Average	17.06	35.10	1.09	2.09

In contrast, only three households/women, all from chief households, were involved in selling locust bean, which contributed less than 2% of the total off-farm household income and less than 3.5% of the women's total cash income (Table 3).

In addition to cash income, fruits from both these trees were part of the diet for most households during the fruiting season. Shea trees provided fodder for 70% of the households surveyed, while 24% used both shea and locust bean trees. Shea trees were also the main source of firewood for about two-thirds of the households. Barks and roots of both trees were used as medicine by most households, while just over one-third of the households sourced building materials from shea trees.

Trees on Farmland: Current Densities and Respondents' Perceptions

The number of mature shea trees per hectare of farmland ranged from 1 to about 99, with an average of about 27 trees per hectare. The number of mature locust bean trees ranged from zero to about 14 trees per hectare with an average of about 3 trees per hectare. The density of young shea trees ranged from 0 to about 12 trees per hectare, while young locust bean ranged from 0 to about 4 trees per hectare—with an average of 2 trees per hectare for shea and less than 1 per hectare for locust bean. Pearson correlation showed a weak but significant negative correlation between the mature shea tree densities and plot sizes ($r = -0.349$, $p < .001$, $n = 80$). Although mature locust bean tree densities and young shea and locust bean tree densities were also negatively correlated with plot sizes, these correlations were very weak and statistically insignificant.

The respondents were also asked about their views on current population of these trees within their farmlands compared to 5 years ago,[9] in order to discover how they perceived changes in these parklands: 97% and 86% of the respondents, respectively, thought the number of fruiting shea and locust bean trees had increased compared to 5 years ago. However, only half of the respondents thought the number of nonfruiting young shea trees and seedlings had increased, with 40% saying they had decreased. A gloomier picture emerged for young locust bean trees and seedlings, with 4%, 31%, 58%, and 7% of the respondents saying that the number had increased, decreased, remained about the same, and "don't know/can't tell," respectively.

In general, both male and female respondents had similar responses regarding threats to shea trees on their farmland—fire and cutting branches being the top two threats for both. Male respondents thought that felling trees for firewood was the third major threat, whereas female respondents thought it was the deliberate killing of trees by the farmers to clear land for intensive farming (Table 4). In contrast, a significant majority of respondents, both male and female, said they "don't care" or "don't know" about the threats to locust bean trees (Table 4). The remaining responses were dispersed among the threats such as fire, cutting branches or tree felling.

Every farmer responding to the question about the effects of trees on crops said shea trees negatively affected maize yield, while 58% perceived a negative effect of locust bean trees on maize yield, with 40% saying locust bean trees had no effect on maize. The yam yield was also thought to be negatively affected by shea trees by 38 of the 48 farmers responding to the question. In contrast, only 5 farmers thought locust bean trees negatively affected yam yield, with 40 responding that locust bean had no effect. Thirty farmers (out of 32 responses) believed shea trees had a negative effect on groundnut yield, while 17 farmers (out of 30 responses)

Table 4. Perceived threats to shea and locust bean trees on the land

	Threats to shea trees			Threats to locust bean trees		
Respondents	1st	2nd	3rd	1st‡	2nd‡	3rd‡
Male ($N = 80$)	Fire	Cutting branches	Felling trees (for firewood, etc.)	Don't care OR Don't Know	—	—
	73%	69%	66%	65%	—	—
Female ($N = 76$)	Fire	Cutting branches	Deliberate killing (i.e., induced burning, cutting roots, etc.)	Don't care OR Don't know	—	—
	82%	70%	75%	71%	—	—

‡The minority of the respondents who *did not* say "don't care" or "don't know" in response to the question about threats to locust bean trees had similar responses about their perceived threats to these trees as they had for shea trees.

believed the same of locust bean trees. Overall, more farmers believed shea had negative effects on the crops than locust bean trees. None of the respondents believed that these trees had positive effects on any of the crops.

Discussion

Shea contributed significantly to the total off-farm household income, primarily through women's cash income. The fact that every woman surveyed earned some income from shea during the 12 months prior to the survey shows its importance to the women and subsequently to their households in these rural communities. In addition, shea trees provided a variety of products for household consumption, highlighting the benefits from shea to the households and especially to women, as other studies have shown in Northern Ghana (Chalfin 2004) and across West Africa (Teklehaimanot 2004; Elias and Carney 2007). Furthermore, recognition by men (who held rights over land and trees therein) about the importance of shea to their households meant that they had the incentives to protect and better manage these trees on their farmlands, often making trade-offs with their crops. For example, farmers planted crops like pepper and millet on farms with higher densities of shea trees, and maize on those with very few trees. Moreover, despite reporting lower yields for almost all crops under these trees, an issue commonly reported for these agroforestry parklands in the region (Kater et al. 1992; Kessler 1992; Boffa et al. 2000), most farmers were very protective of the shea trees on their farmlands, indicating the strength of the incentives these trees provided. In contrast, the income from locust bean was almost nonexistent, which is not surprising as most households had restricted rights to the access and use of these trees, even on their own farmlands. The few women who were involved in trading locust bean were the wives of chiefs or subchiefs; however, the overall contribution of locust bean to their cash

income was still negligible. Nevertheless, most chief households had access to locust bean seeds for household consumption, which was not always the case for nonchief households. Although both trees provided a multitude of products to the households, shea provided larger benefits to a wider proportion of the households, thereby providing higher incentives to a wider population compared to locust bean.

Despite the distinction in tenure systems, the strength of rights over the land and trees usually complemented each other. This, however, was not the case for locust bean trees, which belonged to the tree chiefs regardless of the tenure rights over the lands on which they stood, a system similar to that of many other groups in the region (Boffa 1999; Schreckenberg 1999). The fact that common households had no rights over locust bean trees on their farmlands, while having to tolerate potential negative impacts of these trees on their crops, generated a huge disincentive. Furthermore, if the chief decided to harvest all the locust beans and not leave any for the landholders, the latter had no right to complain. It was this lack of ownership and the subsequent lack of incentives that prompted most respondents to declare that they would not plant locust bean trees even if improved varieties were available. The frustrations of these respondents at having to tolerate locust bean trees on their farmland also shows in the frequencies of "don't care" and "don't know" responses when asked about major threats to these trees, which is in stark contrast to their eloquent explanation of the threats to shea trees. The disincentives inherent in the tenure system for locust bean trees are likely to discourage farmers from taking care of this species. Indeed, the low number of locust bean trees left on the farmlands, especially young ones, illustrates this neglect.

Although all respondents said they would plant both tree species on their farmland if they had unrestricted access/use rights or full tenure rights over the planted trees, by ranking "access to improved varieties" as the most important factor in deciding whether to plant shea trees, they showed that they were secure about their existing tenure rights over shea trees. In contrast, it was only the households with rights to locust bean trees who said access to improved varieties would be the most important factor in their decision to plant locust bean trees. For nonchief households, possessing full tenure rights over the trees planted was the most important factor. Thus, under the present tenure system for locust bean trees, it is unlikely that these farmers would voluntarily plant or protect these trees—supporting the argument that rules of tenure indeed impact on the "preservation, protection and planting of trees" (Bruce and Fortmann 1988).

These tenure issues should also be considered in the context of land availability in these communities. These communities were increasingly facing a shortage of fertile farmland, and had to use chemical fertilizers to maintain soil fertility. Most households had continually cultivated the same plots of land for more than 10 years, highlighting the land scarcity in a region where farm-fallow rotation is the traditional way of farming (Schreckenberg 1999; Augusseau et al. 2006). Furthermore, some respondents had additional farmlands in other communities, while very few had left the land fallow, reflecting the degree of land scarcity. In the face of this land scarcity, it was clear that most of the respondents wanted greater rights over the trees on their land so that they could make decisions, when necessary, on whether to leave or to cut certain trees based on the level of benefits they accrued (or the costs they incurred). However, it is also clear from the density of shea trees on these farmlands, especially from the fact that the tree densities were higher on smaller landholdings as shown by the significant negative correlation between shea tree densities and plot sizes, that

having full tenure rights did not necessarily lead to the clearing of shea trees for intensive farming.

The historical densities of mature shea and locust bean trees reported for Ghana and West Africa have shown a relatively high value for shea compared to locust bean trees (Hall et al. 1996; 1997). In the communities studied, although the density of mature shea trees was little different from those reported for the West African parklands (Hall et al. 1996), the worrying aspect was the density of young shea trees: 38% of the households had no young shea trees and only 7% of the households had more than five young shea trees on their farmland. These findings indicate a serious deficiency in the level of regeneration of shea trees, most likely related to the scarcity of land leading to more intensive farming and lack of fallows (Schreckenberg 1999; Lovett and Haq 2000). However, the plight of shea trees looks much better when compared with locust bean trees: 14% of the households had no mature locust bean trees, and only half had more than 2 trees per hectare of their farmland, a density comparable to those reported for Northern Ghana (Hall et al. 1997). Furthermore, 87% of the households had no young locust bean trees on their farmlands, and only 5% had more than 2 young locust bean trees per hectare. With an average of 0.20 young locust bean trees per hectare of farmland in these communities, the seriousness of the problem in regeneration of this tree species cannot be exaggerated.

Conclusions

Given the pressure on land from food production demands, it is very unlikely that the densities of shea and locust bean trees will improve in the future, a trend common to the region (Schreckenberg 1999; Lovett and Haq 2000; Augusseau et al. 2006). However, as argued in this article, the pressure on land is not the sole factor affecting the densities of these trees in these communities. The absence of strong incentives to care for the locust bean trees seems to be compounding the problem, especially in their regeneration, as it is much easier to get rid of young trees or seedlings than a big tree. Many farmers did acknowledge that they cared little about locust bean trees on their farmland because the trees did not belong to them. In contrast, shea trees provided a significant contribution to the household income, in addition to the products such as fuelwood for local energy needs, thus providing enough incentives to protect these trees. Indeed, the current densities for shea trees in the area studied seem reasonable in the context of greater West African shea densities on the farmlands (Hall et al. 1996). Although the level of regeneration seems lower compared to the mature tree densities, the responses that farmers would be willing to plant shea trees if they had access to improved varieties of seedlings indicates that they do care about having shea trees in their farms. Furthermore, the realization in most households and among most men (farmers) that these trees provide valuable cash income to their women, which in turn is helping them run their household better, should be a stronger incentive to protect these trees.

Finally, there could also be an element of complacency (or lack of realization) in caring for young shea trees, given healthy mature shea densities on the farmland. This complacency could be avoided through extension support, training in agroforestry, and helping farmers understand the need for a healthy population of young trees to replace old and dying ones. As for locust bean trees, the findings here make it clear that mere training and extension support might not be enough. An increased market for locust bean seeds and *dawadawa*—similar to that for shea nuts and

butter—could certainly provide strong incentives for preservation of these trees. However, and more importantly, there needs to be a major shift in tenure (and subsequently the incentive structure) with regard to locust bean trees in order to encourage farmers to plant, protect, care for and manage locust bean trees in the way they seem to have done for shea trees. Failure to do so could rob these parklands of not just one of the most important indigenous trees, but also of the potential for off-farm income generation in these communities, especially for women.

Notes

1. A term usually associated with "rights," tenure systems in the context of this study mean the rules/institutional arrangements whereby an individual or a household or a group of individuals/households is given some form of rights (among the bundle of rights usually associated with the resource; Schlager and Ostrom 1992) to access, use, control, or appropriate benefits in some form or other from that resource.
2. "Customary tenure" should be understood in this article as a system of tenure, often undocumented, based on the local-level practices (Whitehead and Tsikata 2003) and understanding between the individuals, households, and lineages. A complex and controversial issue, customary tenure in Africa has been variously defined, understood, and debated (see, for example, Chanock 1991; Mamdani 1996; Woodman 2001; among many others).
3. Dagomba is one of the major ethnic groups in Northern Ghana, and the area governed by Dagomba is termed Dagomba land (or interchangeably, Dagbon or Dagomba traditional area).
4. The primary unit of survey for this research, a household, is defined as a person or a group of persons living together who eat from the same kitchen and share the housekeeping arrangements (United Nations 1997).
5. NTFPs, following the FAO definition, are defined as products of "biological origin other than wood, derived from forests, other wooded land and trees outside forests" (FAO Forestry 1999, 63).
6. The scope of this study limits a detailed analysis of the system of land tenure, and local governance structure in relation to land in Dagomba traditional area; however, specific characteristics of land tenure that are relevant to the discussion, especially in relation to tree tenure, are explored in the text as required. For an excellent overview of the land tenure among the Dagomba in Northern Ghana see Abudulai (1986).
7. The end of the year 2007 exchange rate between US$ and GH¢ used in this article was GH¢1 = US$1.0099. Thus, the amount in GH¢ can be taken as being equivalent to the amount in US$.
8. Only 76 households (out of 80 surveyed) were involved in the collection, processing, and trade of shea nuts. The remaining four households did not have adult female member and were not involved in shea nuts collection and trade.
9. The selection of a 5-year period to gauge their perceived changes was a compromise, based on the feedback from pretesting of the questionnaires, between the respondents' ability to recall (shorter period), and the potential changes in tree densities in these farmlands over time (longer period) due to population pressure, land scarcity, and pressure for tree resources, such as fuelwood.

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