



# Role of tenure insecurity in deforestation in Ghana's high forest zone

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## ABSTRACT

Land tenure insecurity is one of the underlying causes of deforestation in Africa. However, how land tenure arrangements influence deforestation in Ghana's high forest zone is not well understood. Only a few studies have empirically examined the effects of land tenure on deforestation. This knowledge gap is addressed by examining the nexus between deforestation, land tenure arrangements and local rules in Ghanaian communities. Data were collected through interviews with 756 randomly selected households and analyzed using descriptive statistics and multinomial logistic regression techniques. Of the different tenure arrangements reported by 441 respondents, 42%, 25%, and 33% were customary freehold, sharecropping, and leasehold arrangements, respectively. Under arrangements such as sharecropping and leaseholdings, farmers who engaged in short-rotation farming systems were hesitant to undertake long-term investments, such as tree planting. In many cases from this study, the local tenure system contributes to deforestation because the rules governing land holdings create adverse effects. In dealing with this problem, policy reform is required that should target benefit sharing schemes, including future benefits from Payment for Environmental Services (PES), which until now has only benefited land owners.

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## 1. Introduction

Although Africa holds only 16% of the global forest area, from 2000 to 2005 it annually lost about 4 million hectares of forests (FAO, 2009). In Ghana, the tropical high forest zone (HFZ) is approximately 8.5 million hectares (GFC, 2002). It covers seven forest types (Hall and Swaine, 1981) and consists of reserve forests and outside reserve forests (off-reserves). The present study is focused on the off-reserves, which are 5.482 million hectares of the HFZ where timber is also produced (TBI-Ghana, 2009). Of these off-reserves, farmlands (i.e. food crops, cocoa farms, and newly cleared farms) cover 48%; fallow lands cover 26%; natural and secondary forests cover 15%; and grasslands and other lands comprise 11% (Hansen et al., 2009). Among these lands, a larger proportion of the timber trees are located on farmlands and fallow lands (Kotey et al., 1998). The concentration of the tree resources in these two places is attributed to the farming systems that require trees to replenish soil nutrients, provide shade and enable a microclimate for the growth of farm crops (Dumenu, 2010).

The farming systems in the off-reserves of Ghana consist mainly of two types, cocoa farming and food crops farming (Asare, 2010). Furthermore, there are two main methods used in cocoa farming, traditional shade grown and sun grown. Although it appears that the

sun-grown method is the only cause of deforestation in these off-reserves, the unsustainable farming practices must also be included because of the traditional farming methods (e.g., shifting cultivation and the slash and burn techniques) that are employed (Anyomi et al., 2011; Mann et al., 2010).

Logging, shifting cultivation, and land and tree tenure arrangements are among the important causes of deforestation in Ghana (Appiah et al., 2007). In Ghana, Adjei-Nsiah et al. (2006) suggested that land tenure arrangements are a priority cause of deforestation. Therefore, understanding land and tree tenure systems of local communities is critical to the success of PES<sup>1</sup> and REDD,<sup>2</sup> which are mitigation measures against deforestation. Saunders et al. (2008) argue that economic incentives generated from these schemes are only part of the solution, and other critical factors, such as land and tree tenure systems, would also need to be addressed as part of the solution to deforestation.

Appiah (2001) described the main land ownership systems in Ghana as a traditional customary system of communal ownership. Although it has been recognized that the land and tree tenure arrangements under this ownership system often lead to deforestation in the HFZ of Ghana (Hansen et al., 2009), how these arrangements influence deforestation in the HFZ is not well understood. With both the emerging science of REDD as a climate change mitigation effort and the need to sustain timber supplies from

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<sup>1</sup> Payment for Environmental Services.

<sup>2</sup> Reducing emission from deforestation and forest degradation.

both the farming lands and forest reserves in the HFZ of Ghana (TBI-Ghana, 2009), addressing the linkages between these tenure arrangements and the forest environment is crucial. Problematically, only a few studies have considered the effects of tenure arrangements on deforestation at the rural household level (Owubah et al., 2001; Afikorah-Danquah, 1997). However, these studies do not adequately address the relative effect of the tenure arrangements on farm level deforestation. The goal of this study is to determine how land and tree tenure arrangements impact forest availability, with a particular focus on providing information to support forest policy decisions that are aimed at minimizing the effect of deforestation. Specifically, this paper seeks to: 1) identify informal (not statutory or formal) rules governing holdings of farmlands that promote deforestation and 2) to determine the effects of different tenure arrangements on perceived environmental problems related to deforestation.

Based on the nature of the land and tree tenure arrangements in the off-reserves, the hypothesis of this study is that non-titled land owners in the rural farming communities in the HFZ of Ghana, who have insecure land-use rights, are more likely to engage in farming practices that lead to deforestation, compared to those that have secured land-use rights. The assumptions under this hypothesis are that: 1) non-titled land owners are unable to acquire land that would enable them to make long term investments on such lands and 2) non-titled land owners depend on short- to medium-term land tenure for their farming purposes.

## 2. Concepts

### 2.1. Land, tree tenure and tenancy arrangements in Ghana

Land tenure includes the various laws, rules and obligations that govern the holding and ownership rights and interest of land (Kassanga, 1998). Tenure systems are about ownership and user rights to a given resource for a given time span and under some conditions (FAO, 2002a). Important concepts of land tenure (e.g., ECA, 2009) include:

- ❖ 'Freehold': the absolute right to control, manage, use and dispose of a piece of land. This is the same as the allodial (absolute ownership) interest for land that a stool (person or group of persons having control over community and family lands in Southern Ghana), a clan, a family, an earth priest or a private person holds. This interest can be transferred from one owner to another (Dadson, 2006);
- ❖ 'Leasehold': land belonging to one entity and leased to another entity for a fixed period of time through contractual agreement;
- ❖ 'Statutory allocations': land allocated for the use of some legally constituted body;
- ❖ 'Customary freehold'<sup>3</sup>: the rights of a subject or member of a stool/skin (the equivalent of a stool in Northern Ghana) or family to free use of the land. When analyzing the holdings of such lands under customary law, members who acquire such customary freehold rights pay a token for the rights to use such lands (Larbi, 2009).

The customary land tenure system is comprised of stool, skin, clan, family and individual lands. About 78% of the total land area in Ghana belongs to these customary land owners<sup>4</sup> (Arko-Adjei et al., 2009). The remaining percentage of the land is divided into two categories: 20% of the land belongs to the state and 2% is held in a dual ownership system that is comprised of legal estates for government and customary authorities, respectively. The traditional land-owning authorities hold allodial title to land in trust for the community (Kasanga, 1996). Moreover, family lands are held in trust by the family

heads on behalf of the family members. Family and individually owned lands are passed on to the succeeding generations through inheritance, which is either matrilineal (i.e., property is passed from the mother's brother to sister's son) or patrilineal (i.e., property is passed from father to son).

Migrants, settlers, or tenant farmers, using outright purchase, gifts, rental and sharecropping, hold land for agricultural purposes. Sharecropping consists of two systems (Benneh, 1988) that are known locally as 'abunu' and 'abusa'. Under the 'abunu' tenancy, the proceeds from the harvest or the farm may be divided equally between the tenant and the landowner. In the case of the 'abusa', the ratio of the tenant farmer's acreage to that of the landowner is two to one. Land acquired as gift is land given to a migrant or settler farmer from a landowner. Nothing is paid in return for this type of tenure arrangement. Under the outright purchase agreement, the farmer acquires the land from a chief through the use and signing of formal documents (e.g., indentures) after payment (Benneh, 1988).

Beside land tenure, separate tree tenure rights (e.g., the right to own, inherit, plant, use and dispose of trees) exist in Ghana (Fortmann, 1985). During the colonial era, the Forest Service of Ghana was focused on reservation, while ownership rights to the tree resources remained with chieftaincy and were guided by customary law (Parren and Reitze de Graaf, 1995). However, by 1962 all rights over ancestral tree resources were taken from the traditional communities. Since then, trees in the reserves and naturally occurring trees outside the reserves are vested in the President in a trust for the landowners (Hansen et al., 2009).

## 3. Methods

### 3.1. Study areas

The sample for this study covers rural communities in 22 districts, spread across five administrative regions of Ghana that includes Western, Brong Ahafo, Eastern, Ashanti, and Central (Fig. 1). The relevant characteristics of these regions are indicated in Table 1. The Ashanti region has forest vegetation in the south and savannah in the northeast. This region has an average daily temperature of 27 °C. The Brong Ahafo region has two main types of vegetation, which are the moist semi-deciduous forest in the south and the guinea savannah woodland in the north. This region has a tropical climate with a mean daily temperature of 23.9 °C.

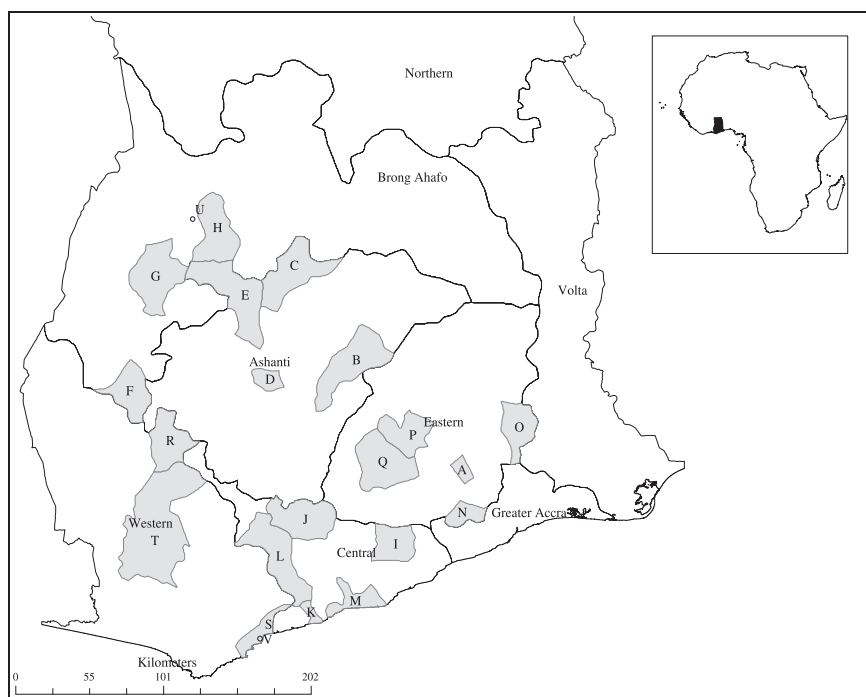
The Central Region lies within the dry equatorial zone and moist semi-equatorial zone, with a mean monthly temperature ranging from 24 °C to 30 °C. It has a coastal savannah vegetation type with grassland and few trees along the coast, and semi-deciduous forest in the inland areas. The Eastern Region lies within the wet semi-equatorial zone with temperatures ranging from 26 °C in August to 30 °C in March. The Western Region lies in the equatorial climatic zone, with temperatures ranging from 22 °C at nightfall to 34 °C during the day. Finally, the southwestern areas are rain forests, and the high tropical forest and semi-deciduous forest occupy the north.

### 3.2. Sampling and data collection

In 2005, the Institute of Statistical, Social and Economic Research (ISSER) in Ghana under the Land Tenure and Land Policy Research Project conducted a nationwide survey of households on issues of land use, including land tenure (ISSER, 2005). The sample for the survey was taken in the ten administrative regions of Ghana. In each of these regions, five districts were randomly selected and sixty household heads in one electoral area in each of these districts randomly selected and interviewed on land and land tenure issues using a pre-coded questionnaire. A total of 2690 individual household heads constituted this national sample.

<sup>3</sup> Members of communities owning the allodial title could acquire the customary freehold title or interest in land by exercising their inherent right to develop any vacant, virgin communal land (Ollenu, 1962).

<sup>4</sup> The first settlers of communities are usually the owners of the land.



**Fig. 1.** Map of Southern Ghana showing the study districts in the regions. Note: Districts in Ashanti (B = Asante Akim North, C = Ejura/Sekyedumase, D = Kumasi Metropolitan, and E = Offinso North); Brong Ahafo (F = Asunafo South, G = Sunyani, H = Techiman, and U = Wenchi); Central (I = Agona, J = Assin North, K = Cape Coast, L = Lower Denkyira, and M = Mfantseman); Eastern (A = New Juaben, N = Akwapim South, O = Asuogyaman, P = Atiwa, and Q = Kwabibirem); and Western (R = Bibiani/Anhwiaso/Bekwai, S = Shama Ahanta East, T = Wassa Amenfi West, and V = Shama).

The data for this study were taken from this survey using the portion that covered the households in five administrative regions located in the HFZ of Ghana. Beside the location of these regions in the HFZ, they were selected because, in comparison to the remaining two regions in the southern part of Ghana, the tenure arrangements identified for this study are intensively practiced in these areas. In addition to the demographic characteristics of the respondents, the specific questions used in this study were: i) if respondents have acquired lands for farming; ii) initial terms of the acquired lands; iii) general conditions governing holding of farmlands; iv) whether these terms and conditions affect farmers; and v) the environmental problems associated with small scale farming in the communities. The total sample size of the households that responded to these questions was 756, which is out of the 1395 households surveyed in the study regions from the random national sample.

### 3.3. Theoretical framework

In much of the deforestation literature, impoverishment, neo-classical, political and ecological approaches are used to explain the deforestation phenomenon (Wunder and Verbist, 2003). The neo-classical approach is adopted as the theoretical framework for this study since its features are most relevant in explaining impact of the

tenure system on deforestation. This approach is identified with open access property rights, the importance of large or small agents, and agents' reactions to incentives as some of the main factors responsible for deforestation.

Ill-defined property rights are seen as one of the factors responsible for deforestation. In this context, the neo-classical approach points to insecure land and tree tenure as one factor driving deforestation. Although without empirical results, the theoretical model of Sjaastad and Bromley (1997) does show that tenure insecurity leads to suboptimal incentives for investment; therefore, leading to deforestation in Sub-Saharan Africa. Insecure land and tree tenure has also been identified as a cause of deforestation (Hatcher, 2009; Southgate, 1994). While insecure tenure can lead to higher investment in tree planting, this only occurs when insecure landholders have the opportunity to increase tenure security through such an investment (Brasselle et al., 2002; Mekonnen, 2009). However, land and tree tenure security has been found to be an ambiguous factor vis-à-vis the determination of forest loss (Wunder and Verbist, 2003). Wunder and Verbist (2003) argue that secure tenure does not always support forest management. According to them, secure tenure has a more positive effect on tree planting and agro-forestry than on natural forest management. For Arnot et al. (2011), the disparity in the findings of studies about the impact of tenure insecurity on deforestation are due to differences in both the measurement of tenure security and in how investment is defined in relation to the activity of deforestation.

Following these studies, the theoretical model relating tenure security to deforestation in this study derives from the deforestation model of Alston et al. (2000), which explored the impact of institutional factors, such as security of ownership, on tropical deforestation. The hypothesis that is tested in this model (Eq. (1)) is that those institutional factors are important factors that explain deforestation.

$$F_t - F_{t-1} = f(q_{it}; Z_{it}) \quad (1)$$

**Table 1**  
Characteristics of the five regions (study sites) in Ghana.  
Source: Ghanadistricts.com (2006).

| Region      | Mean annual rainfall (mm) | Mean monthly/daily temperature (°C) | Population | Land area (sq. km) |
|-------------|---------------------------|-------------------------------------|------------|--------------------|
| Ashanti     | 1270                      | 27                                  | 3,612,950  | 24,389             |
| Brong Ahafo | 1000–1400                 | 23.9                                | 1,824,827  | 39,557             |
| Eastern     | 1750                      | 26–30                               | 2,106,696  | 19,323             |
| Central     | 1000–2000                 | 24–30                               | 1,593,823  | 9826               |
| Western     | 1600                      | 22–34                               | 1,924,577  | 23,921             |

where  $q_{it}$  is a vector of institutional factors;  $Z_{it}$  is a vector of other explanatory variables; and  $F_{it} - F_{it-1}$  is change in forest stock over a previous period (which, is defined as perceived environmental problems related to deforestation).

### 3.4. Model specification and data analysis

For this study, a multinomial logistic model (e.g., Chan, 2005) was specified to estimate the impact of tenure security on perceived deforestation. To specify this model, a generalized logit model was used. As indicated in So and Kuhfeld (1995), the choice set in this model is a function of the characteristics of the individual making the choice. For instance, an individual farmer in the HFZ of Ghana chooses among  $n$  alternatives in a choice set. The elements in the choice set are defined as: i) the intensive cultivation/reduction in fallow period (Angelsen, 1994), ii) the vegetation cover reduction/exposure of top soil/felling of trees, and iii) the non-availability of fertile land/farming closed to riverbanks. These were formulated using each of the respondents' answers to the question about the main environmental problems of small-scale farming (related to deforestation).

Let  $\Pi_{jn}$  denote the probability that an individual,  $j$ , chooses alternative  $n$ . Furthermore, let  $X_j$  represents the characteristics of farmer  $j$ . These characteristics are defined as: land tenure arrangements made between landowners and the land users, i.e., a) inheritance/gift/customary freehold, b) leasehold, and c) share cropping. Tree tenure is treated as a constant across these land tenure arrangements. Furthermore, it is assumed that farmers who hold secure land tenure are either more likely to invest in shade-grown cocoa with naturally occurring forest trees or in planting timber and other (fruit) trees on portions of their lands instead of growing only annual crops. Other characteristics of the individual farmers are: i) gender, ii) ethnicity, iii) residence status, and iv) distance of farmland from the resident (Angelsen, 1994).

The generalized logit model focuses on the individual as the unit of analysis and uses individual characteristics as explanatory variables and these variables are considered to be constant over the alternatives (So and Kuhfeld, 1995). The probability that farmer  $j$  chooses alternative  $n$  is

$$\Pi_{jn} = \frac{\exp(\beta'_n X_j)}{\sum_{i=1}^w \exp(\beta'_i X_j)} = \frac{1}{\sum_{i=1}^w \exp(\beta_i - \beta_n)' X_j)} \quad (2)$$

The coefficient,  $\beta_n$ , represents the effects of the  $X$  variables on the probability of choosing the  $n$ th alternative over the last alternative. Table 2 shows the measurement of the explanatory variables ( $X$ ) and the elements in the choice set ( $y$ ), which were used in estimating Eq. (2). As shown, all of them were categorical variables. In addition to the multivariate analysis, the data were analyzed using descriptive statistics, graphs and Chi-squared statistical techniques using the Statistical Package for Social Scientists (SPSS) software.

## 4. Results

### 4.1. Effects of tenure systems on deforestation

Table 3 shows the variables predicting the effect of tenure insecurity on deforestation. These variables were obtained from the multinomial logistic regression analysis of the responses provided by the households on the environmental problems associated with small-scale farming. The overall predictive effect of the model is significant ( $\chi^2 = 46.33$ ,  $p < 0.01$ ,  $df = 12$ ,  $n = 415$ ). This implies that the independent variables explain the variations of the elements in the choice set.

**Table 2**

Number of respondents and description of the variables used in the multinomial logistic regression analysis.

| Predictors (X)                           | Frequency and elements in choice set (y) as dependent variable |                                                               |                                                              |       |
|------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------|-------|
|                                          | Intensive cultivation/decrease in fallow periods               | Non-availability of fertile land/farming close to river banks | Vegetative cover reduction/exposure of top soil/tree felling | Total |
| <i>Gender:</i>                           |                                                                |                                                               |                                                              |       |
| Male = 1                                 | 227                                                            | 130                                                           | 153                                                          | 510   |
| Female = 2                               | 106                                                            | 41                                                            | 47                                                           | 194   |
| <i>Ethnicity:</i>                        |                                                                |                                                               |                                                              |       |
| Akan = 1                                 | 276                                                            | 125                                                           | 154                                                          | 555   |
| *Non-Akan = 2                            | 57                                                             | 46                                                            | 46                                                           | 149   |
| <i>Residence status:</i>                 |                                                                |                                                               |                                                              |       |
| Indigene = 1                             | 214                                                            | 113                                                           | 119                                                          | 446   |
| Migrant = 2                              | 117                                                            | 58                                                            | 81                                                           | 256   |
| <i>Distance:</i>                         |                                                                |                                                               |                                                              |       |
| 1 to 10 km = 1                           | 196                                                            | 96                                                            | 110                                                          | 402   |
| 11–150 km = 2                            | 1                                                              | 4                                                             | 13                                                           | 18    |
| <i>Land tenure:</i>                      |                                                                |                                                               |                                                              |       |
| Leasehold = 1                            | 71                                                             | 42                                                            | 34                                                           | 147   |
| Sharecropping = 2                        | 59                                                             | 24                                                            | 28                                                           | 111   |
| Inheritance/gift/customary free hold = 3 | 73                                                             | 45                                                            | 65                                                           | 183   |

\* Mole Dagbani, Ewe, Ga-Adangbe, Grunsi, Guans, Sissalas, tribes from Burkina Faso and Togo.

As shown in Table 3, farmers who acquire land on either a leasehold or share cropping basis are more likely to indicate that intensive cultivation is the main problem with small-scale farming or are more likely to engage in the short-rotation farming system, compared to those who acquired their lands on a gift, customary, or inheritance basis. This is significant at the odds ratio of 2.90,  $p = 0.001$  and the odds ratio of 2.34,  $p = 0.01$ , respectively. In addition, when analyzing the choice of the non-availability of fertile land, those who

**Table 3**

Estimation results of the multinomial logistic regression of the households' responses to environmental problems associated with small scale farming in the study sites.

| Dep. var. | Explanatory variables   | B     | s.e.<br>B | Sig. | Odds ratio (eB) | 95% *C.I. of odds ratio |             |
|-----------|-------------------------|-------|-----------|------|-----------------|-------------------------|-------------|
|           |                         |       |           |      |                 | Lower bound             | Upper bound |
| b         | Constant                | −4.13 | 1.18      | 0.00 |                 |                         |             |
|           | Leasehold               | 1.06  | 0.31      | 0.00 | 2.90            | 1.59                    | 5.28        |
|           | Sharecropping           | 0.85  | 0.31      | 0.01 | 2.34            | 1.27                    | 4.32        |
|           | 1–10 km                 | 3.44  | 1.06      | 0.00 | 31.16           | 3.89                    | 249.38      |
|           | Indigene                | 0.49  | 0.26      | 0.06 | 1.63            | 0.98                    | 2.72        |
|           | Indigenous tribe (Akan) | 0.57  | 0.33      | 0.08 | 1.76            | 0.93                    | 3.35        |
| c         | Male                    | −0.01 | 0.28      | 0.98 | 0.99            | 0.57                    | 1.73        |
|           | Constant                | −1.96 | 0.84      | 0.02 |                 |                         |             |
|           | Leasehold               | 0.88  | 0.34      | 0.01 | 2.40            | 1.23                    | 4.67        |
|           | Sharecropping           | 0.26  | 0.37      | 0.49 | 1.29            | 0.62                    | 2.68        |
|           | 1–10 km                 | 1.29  | 0.62      | 0.04 | 3.64            | 1.09                    | 12.18       |
|           | Indigene                | 0.60  | 0.30      | 0.05 | 1.81            | 1.00                    | 3.27        |
|           | Indigenous tribe (Akan) | −0.35 | 0.34      | 0.31 | 0.71            | 0.36                    | 1.38        |
|           | Male                    | 0.18  | 0.34      | 0.60 | 1.20            | 0.62                    | 2.33        |

a. The reference category: reduction of vegetative cover, exposure of topsoil, and tree felling.

b. Intensive cultivation/decrease in fallow periods.

c. Non-availability of fertile land/farming close to riverbanks.

s.e. = standard error.

\*C.I. is confidence interval.

hold land on a leasehold basis are more likely to indicate that it is the main environmental problem associated with small scale farming, compared to the farmers holding land on customary or an inheritance basis. This is also significant at  $p = 0.01$  and the odds ratio of 2.40.

Under the short-rotation farming system, farmers whose farms are closer to the village, in comparison to those whose farms are further away from home, are more likely to engage in this system. As shown in Table 3, this comparison is significant at  $p = 0.001$  and at the odds ratio = 31.16. Under the non-availability of fertile land, those whose farms are nearer to the village are more likely to indicate non-availability of fertile land as the environmental problem compared to those who have their farms further away. This comparison was found to be significant at  $p = 0.04$  and odds ratio = 3.64.

#### 4.2. Rules of farmland holdings

74% and 18% of the respondents have indicated that sharecropping and non-transferability of rented farmlands are the most important informal rules, respectively (Table 4). The next most important informal rules are the situation where farmers do not have the opportunity to plant specific crops (13%) and where they are directed to plant specific crops (10%) on their rented farmlands. These informal rules could discourage the planting of trees. On the other hand, informal rules such as the prevention of farming on certain days and an emphasis on the observation of taboos are rules that are likely to promote forest conservation. Prevention of bush burning is also important for forest conservation; however, is mentioned by only 1% of the respondents in the Western region.

Beside these rules, one adverse condition is the loss of land to the landowner when it is not cropped. Although, this was only reported in the Central and Brong Ahafo regions by 2% and 5% of respondent (results not indicated here), respectively, it does not seem to allow the holders to leave the land to regain its fertility due to the risk of loss to the land owner.

#### 4.3. Effects of rules on holding of farmlands

When analyzing the effect of the rules on holders of farmlands, insecurity of tenure is the most important effect, indicated by over 24% of respondents (Fig. 2). Other effects are that farmers are forced to practice intensive cultivation, they are unable to cultivate the type of crops desired and they must pay high tenancy fees. As indicated, over 10%, 6% and 3% of the respondents, respectively, indicated these as disincentives for them to plant trees on their acquired farmlands

(Fig. 2). These disincentives may be translated into negative effects on the forest in the form of deforestation.

#### 4.4. Confirmation of effects of rules on holding of farmlands

A further examination of the effect of the tenancy arrangements and rules on the farmers is indicated in Fig. 3. Farmers were asked to indicate whether these tenancy arrangements affect the use of their respective farmlands. The Chi-squared test for no effect using farmers' responses (yes or no) is significant at  $p = 0.04$ ,  $p = 0.02$  and  $p = 0.08$  for respondents in the Central, Western and Brong Ahafo Regions, respectively. This indicates that the tenancy arrangements affect the farmers. However, the results of the Chi-squared test were not significant for the respondents in the remaining two regions and for all respondents combined (Fig. 3). This may be due to unfamiliarity with some tenure arrangements by some respondents in the study area. However, in absolute number of the responses, respondents in all five regions indicated that these rules affect the use of their farmlands.

### 5. Discussion

#### 5.1. Role of tenure on deforestation

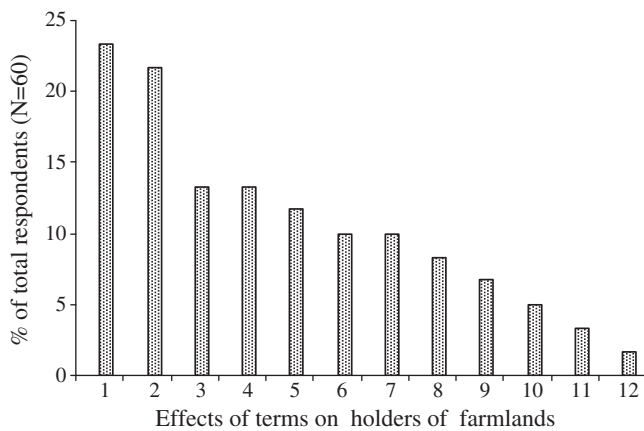
The findings of the present study suggest that leasehold and sharecrop land holding farming activities contribute to deforestation, which may be because of the insecurity of tenure, compared to the customary freehold land holdings. Possible reasons for this are Ghana's Concession Act, 1962 (Act 124), which forbids tree felling in the off-reserve and reserve forests for monetary gains (FAO, 2002b; Parren and Reitze de Graaf, 1995) and the marginal direct benefits that local communities derive from timber resources on their farmlands. For instance, in Ghana, stumpage fees from the timber trees are shared among the constitutional beneficiaries, which include the District Assembly, Administrator of the Stool Lands (the public agency that manages the stool lands accounts), and the Stool and the Traditional Council. However, through administrative arrangements, the Forestry Commission of Ghana deducts the largest proportion (Hansen et al., 2009) from this amount to meet its management cost of the forest before giving the remainder to these beneficiaries.

On the other hand, local communities, as original owners of the forests, receive nothing directly as their share. This development is against the background that local communities contribute to the growth of these trees through nurturing them on their farmlands. In the process, they experience destruction of their crops that results

**Table 4**  
Formal and informal rules for holding farmland in the five study regions.

| Rules to observe on borrowed farmlands         | Western<br>% total respondents<br>(N = 119) | Central<br>% total respondents<br>(N = 264) | Brong Ahafo<br>% total respondents<br>(N = 158) | Ashanti<br>% total respondents<br>(N = 129) | Eastern<br>% total respondents<br>(N = 63) | Total<br>% total respondents<br>(N = 733) |
|------------------------------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------------------|---------------------------------------------|--------------------------------------------|-------------------------------------------|
| Prohibited from farming on specific days       | 29                                          | 16.7                                        | 5.1                                             | 2.3                                         | 7.9                                        | 12.8                                      |
| Plant specific crops                           | 5.0                                         | 7.2                                         | 11.4                                            | 19.4                                        | 4.8                                        | 9.5                                       |
| Do not plant specific crops                    | 14.3                                        | 14.4                                        | 5.1                                             | 24                                          | 1.6                                        | 13.0                                      |
| Land not transferable                          | 36.9                                        | 0.2                                         | 0.04                                            | 0.1                                         | 0.24                                       | 18.3                                      |
| Land cannot be sold                            | –                                           | 0.4                                         | –                                               | –                                           | –                                          | 0.1                                       |
| Sharecropping                                  | 47.1                                        | 74.2                                        | 89.9                                            | 78.3                                        | 71.4                                       | 73.7                                      |
| Free/no rules                                  | 0.8                                         | 0.8                                         | 3.8                                             | 1.6                                         | 9.5                                        | 2.3                                       |
| Return land after harvest                      | 5.0                                         | 1.5                                         | 3.8                                             | 7.0                                         | –                                          | 3.4                                       |
| Do not sublease land                           | –                                           | 0.8                                         | 2.5                                             | 2.3                                         | 3.2                                        | 1.5                                       |
| No permanent structures on the land            | –                                           | 3.8                                         | 1.3                                             | –                                           | –                                          | 1.6                                       |
| Return land when land value increases          | –                                           | –                                           | 1.3                                             | –                                           | –                                          | 0.3                                       |
| Payment in kind                                | 11.8                                        | 1.1                                         | 1.9                                             | 28.7                                        | –                                          | 7.8                                       |
| Observe taboos in relation to land             | 4.2                                         | 1.9                                         | 0.6                                             | 0.8                                         | –                                          | 1.6                                       |
| Do not harvest tree crops on land <sup>a</sup> | –                                           | 0.8                                         | 0.6                                             | 4.7                                         | –                                          | 1.2                                       |
| Do not burn bush <sup>a</sup>                  | 0.8                                         | –                                           | –                                               | –                                           | –                                          | 0.1                                       |

<sup>a</sup> Both formal and informal rules.



**Fig. 2.** Effects on farmers of rules and conditions for holding borrowed farmlands. Note: 1 = insecurity of tenure, 2 = not afraid to use land for all crops, 3 = not much money is earned, 4 = flexible terms, 5 = able to plant long gestation plants, 6 = forced to practice intensive cultivation, 7 = more resources used to develop the land, 8 = able to do some work on the farm, 9 = unable to cultivate the kinds of crop desired, 10 = high yield, 11 = low yield, and 12 = extractive tenancy charges.

from the extraction of timber with little or no compensation paid (Richards and Asare, 1993). Consequently, they are not encouraged to conserve naturally occurring timber trees on their farms (Amanor, 1996). In addition to this, the incentives of individuals and even the land-owning communities to grow and tend trees in off-reserves are undermined by stumpage fees, which are politically determined far below the actual stumpage value (Hansen et al., 2009).

In Zhang and Owiredun's (2007) study, and in comparison to those with larger percentages of their land under outright purchase, households with a larger percentage of their land under leasehold are found to be less likely to engage in a plantation establishment. This indicates the role that tenure insecurity plays in deforestation; thus, confirming the findings of the present study. These findings are, however, not in isolation. Among Ecuadorian farmers, Pichon (1997) reports of less deforestation when households have more secure tenure and when there is less of a threat of encroachment on their land by outsiders.

Although the findings of Owusu et al. (2007) in the Brong Ahafo region of Ghana appear to differ from those of this study, their findings of shared croppers investing more in land improvement could be due to the larger acreages of their holdings. As revealed in their findings, for those with larger fixed-rent acreages, less investment in land improvement is made; thus, confirming the reasons for the effects of tenure insecurity on deforestation among these rented farmland holders.

What is significant about all of these findings is that it is possible for these farmers to invest in tree planting if they have secured holdings to their acquired lands. As the findings of Leach and Fairhead (2000) and Afikorah-Danquah (1997) show, landowner–farmers with secured tenure rights in Wenchi District of Ghana preserve and encourage a variety of forest tree species on their fields. According to Leach and Fairhead (2000), even in some localities where the shortening of the fallow period is felt due to the effect of population pressure, these landowner–farmers have responded through fallow enrichment and integration of a variety of more rapidly growing trees into their cropping system. In contrast, Leach and Fairhead (2000) find it rare for tenant farmers in the same localities to undertake such practices of tree conservation due to the insecure tenure of the land they acquire on short-term borrowing arrangements.

## 5.2. Traditional land tenure regimes and deforestation

The findings of insecurity of land tenure among share crop and leasehold holders may be due to the adverse effects of the tenancy arrangements and rules that farmers have to observe. As revealed in this

study, findings, including the experience of insecurity of tenure, involvement in the short-rotation farming system, and the inability to cultivate the desired crop, has a negative impact on forest conservation.

Possibly due to these adverse conditions in the off-reserve areas in the HFZ of Ghana, some borrowed farmland holders enter the state forest reserves to establish their farms illegally (GNA, 2009). Additionally because of the insecurity of land tenure, other farmers use chemicals to prepare their farmlands in the off-reserve areas. According to the GNA (2009), these chemicals indirectly destroy saplings of timber species regenerating on these farmlands, thereby retarding tree growth. The reasons why these share crop holders and leasehold farmland holders display this behavior may include the possibility of the need to meet the food and income requirements of their households and the need to satisfy the conditions imposed on them by the landowners. Therefore, issues concerning tree planting appear to be a secondary matter to them.

These revelations confirm the findings of the present study of the impact of the tenancy arrangements on tenant farmers. However, these findings are no exception. Similar findings have been observed in a study done by Gyasi (1997). In his study on strategies on sustainable farming among tenant farmers, he notes that from one third to one half of the food crops cultivated by the tenants that are given to the landowners results in overexploitation of the land. This is due to the attempts of the tenant farmer to minimize losses incurred under the tenancy arrangements. By doing so, farmers continue to intensify the work on the acquired lands in anticipation of greater harvest, therefore leading to overexploitation of the land. The finding of Afikorah-Danquah's (1997) study further confirms this land exploitation by migrant farmers. In the Wenchi district, he finds that by virtue of the fact that tenant farmers depend on short-term leaseholds involving high tenancy fees, they feel insecure and will engage in short-term exploitation of the land.

One other reason why these tenancy arrangements discourage the planting of trees among these tenant farmers is the perception that purposefully planted trees are a form of claim to land within the customary systems (Unruh, 2008). As a result, landowners issue restrictions to tenants on the type of plant they are allowed to grow on their allotments. Permissions have to be sought in case a tenant farmer decides to change the type of crops to grow on the acquired land. This is done to discourage the planting of trees with long gestation periods that may enable the tenant farmer to lay claim to the land (Leach and Fairhead, 2000).

These tenancy arrangements, particularly the high tenancy charges, have been of concern to tenant farmers in the cocoa-growing zone in the Western region of Ghana. Benneh's (1988) study in the Wassa Amenfi traditional area in the Western region, found tenant farmers who acquired lands through the outright purchase were not better off than the share croppers. Tenant farmers, according to Benneh (1988) are continuously forced to arbitrarily contribute to festivities (e.g., enstoolment, funeral celebrations, festivals, etc.) and land litigations that their landowners (sub chiefs) are engaged in. In certain instances, tenants contribute to land litigation with their landowners, to secure their land. In situations where the first landowner loses the case in the law court, tenant farmers are made to contribute to the litigation cost of their second (the winner) landowner. In essence, this constitutes double payment on the part of these tenant farmers. According to Benneh (1988), tenants consider these to be exorbitant demands on them that make it difficult for them to engage in sustainable forest management practices.

## 5.3. Implication for REDD and PES

PES is a new source of income for sustainable forest management. To render such income accessible, formal markets have emerged for greenhouse gases (carbon), water, and biodiversity (Forest Trend et al., 2008). Furthermore, in these markets, open trading in the international

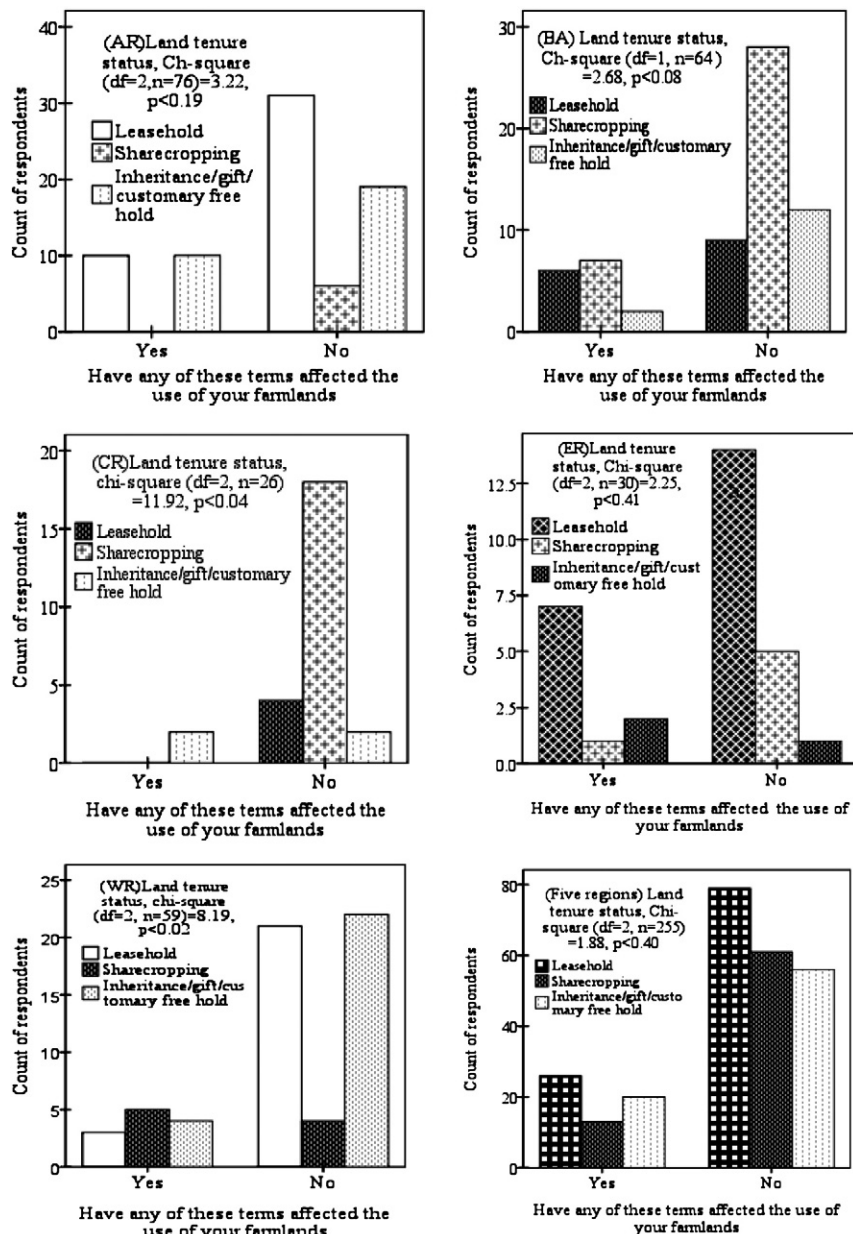


Fig. 3. Examination of the effects of the tenancy arrangements and rules on land users in the five regions (study sites) of Ghana. Note: AR = Ashanti, WR = Western, BA = Brong Ahafo, CR = Central, ER = Eastern, and Five region = respondents in all five regions combined.

carbon market for carbon dioxide emission reduction certificates have been established. This is the proposed REDD policy that attempts to provide compensation to developing countries that is equivalent to the amount of carbon emissions reduced if their national deforestation levels decrease below the baseline (Skutsch and Trines, 2008).

Economic analyses done on the prospects of REDD in Ghana show a potential benefit for the country (Osafo, 2005). However, there are many challenges (Unruh, 2008) that need to be addressed. One of these is the tree tenure insecurity in the HFZ of Ghana, with a particular focus on the trees on farmlands in the off-reserves. As such, policy and institutional arrangements are being considered to clarify landowners' and farmers' rights (Angelsen et al., 2009) vis-à-vis the Concessions Act, 1962, which gives the government management rights over all naturally growing trees. However, there is still the problem of the distributional mechanism and the weighting of REDD-plus payments at the farm level among the landowners and the land users. Staiss et al. (2009) reported on similar findings in Southern Ghana. They point out that the tenancy arrangements at the farm level

between farmers and landowners is one critical area for the sustenance of REDD. In particular, land users working on a leasehold and share crop basis receive nothing under the prevailing timber revenue sharing in the HFZ of Ghana. In addition, land users are faced with challenging tenancy arrangements for their rented farmlands, which make it difficult for them to engage in sustainable forest management practices as suggested in the findings of this study.

Above all, it is important to note that the low number of respondents who acquired lands for farming purposes could explain the seemingly large proportion of missing values in the estimation results of this study. Only this group of farmers provided information on the terms and conditions of lands they acquired and their experiences with the small-scale farming were used as the categorical dependent variable in the multinomial logistic modeling. Additionally, the seemingly low statistical significance of the results may be due to the inability to include field observations and to undertake direct measurements of deforestation during data collection, as done in similar studies (Codjoe and Bilsborrow, 2011).

## 6. Conclusion

This paper examines the effect of land tenure insecurity on deforestation at the farmland level in the off-reserves in the high forest zone (HFZ) of Ghana. The findings indicate that land lease holding farmers and share crop farmland holders are more likely to engage in a short-rotation farming system and in an intensive cultivation system that will lead to forest-cover loss compared to those who have more secure land use rights. The likely reasons for this were the Timber Concession Act, 1962 that granted timber rights of the naturally occurring trees to the central government, the lack of direct benefits from timber revenues, and the stumpage fees that are politically determined below the actual values.

These findings have implications for sustainable forest management, in general, and for the sustenance of the REDD and PES, which attempts to intervene and prevent the deforestation. Land owners, especially the stool chiefs, largely receive all the benefits (revenue) from trees that are suppose to encourage protection of the forest among communities' members; however, they are less likely to solely ensure the growth and protection of these trees. If benefits from these schemes should go solely to these land owners, which is the status quo, there is no guarantee that the trees will be grown and protected to sustain and ensure the achievement of the objective of these schemes. Another problem is the prevailing timber revenue sharing, with the central government getting the largest share. Application of this formula in the REDD payments is also unlikely to guarantee the conservation of trees in the off-reserves.

Therefore, it is recommended that the informal tenancy arrangements and rules (especially leasehold and sharecrop tenancy) should be reformed, formalized, enshrined in legislation and mainstreamed in the official forest management practices in the off-reserves. This should be done both in consultation with these farmers at the individual level and using the past understood lessons from the implementation of the Rent Stabilization Act (109) in Ghana (Benneh, 1988). In addition, the design of any benefit sharing scheme for forest resources should recognize the contribution of the farmers working on rented lands, especially the holders of sharecrop and lease hold farmlands; thus, these holders can also be rewarded and encouraged to use sustainable forest management practices.

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