

# **Forestry policy as a tool for biodiversity conservation in the Ashanti Region of Ghana:**

## **Does equity matter?**

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### **Abstract**

This paper assesses the equity effect of forestry policy as a means of influencing biodiversity conservation among forest communities in Ghana. It employs a quantitative approach, with primary data collected through a two-stage probability sampling procedure from forest districts in Ghana. A sample of 158 households provided complete responses to questionnaire which were analyzed to ascertain the extent of equity associated with forestry policy implemented in Ghana. The analysis focuses on whether through forestry policy there had been any significant transfer of forest benefits from richer to poorer households, which could provide incentive for forest conservation. The Lorenz curve and Gini-index was constructed to assess the extent of forestry income distribution among households. Also, Chi-square test of independence was used to verify the extent of association between forestry policy and the resulting forestry policy induced equity levels. The study finds that inequity exists in forest communities with respect to the distribution of forestry policy benefits. A Gini-index of 0.37 meant that on the average, the poorest of two forest community households earned about 63 percent of the forest community mean income, which is less than US\$1.00 per day. The null hypothesis that forestry policy is independent of the resulting inequity was rejected at the 5% level, suggesting a significant association between forestry policy and inequity. We conclude that the equity effect of forestry policy in Ghana has been negative and would constitute a major challenge to the realization of biodiversity conservation and ecosystem service provision.

**Keywords:** *Biodiversity conservation, equity, forest communities, forestry policy, Ghana.*

**JEL CODES:** Q23, Q28, Q57.

### **1. Background**

Tropical rainforests are estimated to account for more than half of the plant and animal species on earth, with some estimates ranging up to 90 percent, although they only cover about seven percent of global land area (Gockowski and Sonwa, 2008). Around the world, an estimated 27,000 species are lost each year due to the destruction of rainforests (Wilson, 2002). The single most important factor in species extinction is the destruction of habitat that occurs with forest conversion. In addition to biodiversity losses, deforestation due to land-use change is estimated to account for 17% of annual global greenhouse gas emissions (Nabuurs et al., 2007).

Identified more than 30 years ago as a global priority ecosystem for biodiversity conservation (Myers, *et al.*, 1988) the Guinean moist forests of West Africa are home to more than a quarter of Africa's mammals, including more than 20 species of primates. However, rapid land-use

change is threatening to consume the few remaining intact remnants of this ecosystem, which are home to an estimated 1,900 endemic plant and animal species (Conservation International, 2007). Once covering an estimated 600,000 km<sup>2</sup>, only 10 to 15 percent of these forests remain. The current global search for solutions to tropical deforestation, supported by colossal monetary budgets, is a demonstration of the need for appropriate policies towards sustainable allocation of tropical forest resources for biodiversity conservation, ecosystem service provision and economic development.

The past two decades have seen the formulation of forestry policies more than ever before, locally and internationally (Mayers and Bass, 1999). For instance, forestry policy in Ghana has provided for forest conservation, protection of water bodies, the provision of favourable conditions for cultivation of agricultural crops, and the promotion of public education and research since 1948 (Ghana Forestry Commission, 1994). In spite of these policies and interventions, the destruction of the country's natural forests continue at an alarming rate of 2% per annum (Boon *et al.*, 2009). The Ministry of Lands and Natural Resources (MLNR) of Ghana has conceded that the implementation of the 1994 forestry and wildlife policy with all the associated reforms from 1994 to 2010 could not halt the deforestation and degradation of the forest resource base (MLNR, 2012).

## **2. The problem**

The fact that the value of the standing forest as wildlife habitat or as a key element in the local ecosystem is an external cost can lead to inefficient decisions that threaten biodiversity conservation and ecosystem service provision. Failure to recognize all of the social values of the standing forest provides an incentive not only to harvest an inefficiently large amount of timber in working forests but also to harvest timber even when preservation is the efficient alternative (Tietenberg and Lewis, 2012).

Community interference has been perceived as one of the major hindrances to forestry policy in Ghana. The Ghana Environmental Protection Agency (EPA) has asserted that the immediate self-interest of individuals, communities, agencies and firms defeat the purpose of forestry policy. They revealed that when it was in the short term interest of users to destroy the forest endowment, it was very difficult for policy to prevail (EPA, 1991).

Since the average rural forest dweller in Ghana is poor and sees his use of the forest as a means of immediate source of survival, it stands to reason that current forestry policy through its provisions may be trying to persuade and educate groups of people who misuse the forest out of necessity, since they have no other immediate means of livelihood. The importance of this issue cannot be underestimated particularly when about 70% of Ghana's population depends on forest resources for livelihood and cultural purposes (MLNR, 2011).

On the other hand, forest dwellers advance the argument that they are not accorded a fair share of the forests they live in, by the state (Amanor, 2005). This perceived inequity could be an important root cause of community interference with forestry policy implementation. The incentives for forest conservation in Ghana could lie in achieving equity in allocating forest benefits to forest communities.

This paper therefore assesses the equity effect of implemented forestry policy in the Ashanti Region of Ghana as a way of ascertaining whether forest communities would avail themselves

for forest conservation to ensure biodiversity conservation and ecosystem service provision. The following section provides a formal justification for the study. This is followed by the theoretical framework and then methodology. The analysis follows, beginning with a presentation of the socio-economic characteristics of respondents to questionnaire on forestry policy benefits in sampled areas. It then proceeds to carry out equity analysis to assess the equity effect of implemented forestry policy in the region and finally concludes with some recommendations.

### **3. Justification for the study**

The evaluation of the equity effect of forestry policy in Ghana would help to ascertain the extent to which the distribution of benefits through forestry policy can enhance human welfare. It is essential to explain the potential of forestry policy to generate a workable scale of local benefits both in terms of livelihood contribution and as an incentive for communities to make long-term investments and commitments in forest management for biodiversity conservation and ecosystem service provision. This potential is to a large extent dependent on the relative strengths of benefits that households and other economic units encounter in the forestry sector through implemented policy. Byron and Arnold (1999) hold that rural development and poverty reduction could be achieved normally through some supposedly minor forestry products for several millions of deprived people. This means the answer to who benefits from forestry must never be overlooked, being one basic goal not only of sustainable economic development but also biodiversity conservation and ecosystem service provision.

Ghana has two predominant ecological zones: the high forest zone mainly in the south-western part constituting a third of the country (about 35 percent of the country) and the savannah zone occupying the rest of the country. The forests are classified as on-reserved and off-reserved and there are 282 Protected Areas covering a total area of 23,729 km<sup>2</sup> with 216 of them located within the high forest zone. Forest and wildlife conservation areas constitute about 16.2 percent of the total land area. Two types of Protected Areas exist - Production reserves exploited for timber (75 per cent) and Protected forests (25 per cent) established for conservation purposes (MLNR, 2011).

The biological diversity of the high forest ecological zone is considerable and accounts for most of the biological diversity of the country. For example, out of 3,725 higher plants known to be in Ghana, about 2,300 are found in the high forest zone, including 730 tree species. Similarly, 185 of the 222 mammals of Ghana and about 200 of the 494 resident birds in Ghana are present in the high forest zone. Amphibians, reptiles and fishes have not yet been systematically surveyed in the forest zone but it is assumed that this zone harbours most of the diversity of these groups (National Biodiversity Strategy for Ghana, 2002).

From the discussion above, evidence abounds to the effect that any effort particularly through scientific research to identify appropriate instruments and incentive mechanisms for biodiversity conservation in Ghana through forestry policy would enhance holistic human welfare both locally and internationally.

## **4. Theoretical framework**

The distribution of impacts of forestry policy can be assessed in three main ways. The first is to trace the distribution of costs and benefits with the assumption that they can be quantified and valued. The second way is to use weights to represent costs and benefits accruing to specific groups of people for the fear that market prices may be suboptimal in determining distributional inequities in the forestry sector. Finally, entitlements (use and access rights) of particular groups of people can be assessed based on certain legal requirements or standards which must necessarily be met (Bann, 1999).

A rights-based or entitlements approach to forestry policy impact assessment begins from allocated entitlements; for instance, the requirement that indigenous populations retain their traditional access rights to particular forest areas. Entitlements thus define the boundaries or parameters of the analysis. These rights or limits are for the forestry sector in Ghana, derived from the forestry policies implemented over the past 100 years.

### **4.1 Forestry Policy and Equity**

#### *4.1.1 Forestry policy*

The term “*forestry policy*” is used in many different contexts, from a general statement of the overall aim, goals or general objective of forest resource management for a country, to a fairly detailed prescription of a course of action with specific objectives for a rather narrowly defined field (Fraser 2002; Shahbaz *et al.*, 2007).

Thus, any combination of well thought out plans or actions for the management of forests qualifies to be called forestry policy. Therefore in this paper, forestry policy is considered the set of all implemented public decisions, plans, actions and inactions with state approval for the management of forests in Ghana, at any point in time. This implies forestry policy is cumulative, since in Ghana the practice has been to add new lines of action to existing ones, particularly when existing ones seem to be failing. This means, for Ghana, forestry policy is an aggregation of the 1908, 1948 and 1994 forestry policies as well as all the other implemented official decisions meant to direct or guide forestry activities in Ghana since the beginning of the 20<sup>th</sup> century. The approach of this paper is not to evaluate any specific forest policy for equity but to evaluate the equity effect of the cumulative forestry policies. Such an approach is holistic and has the capacity to capture leakages from unevaluated policies.

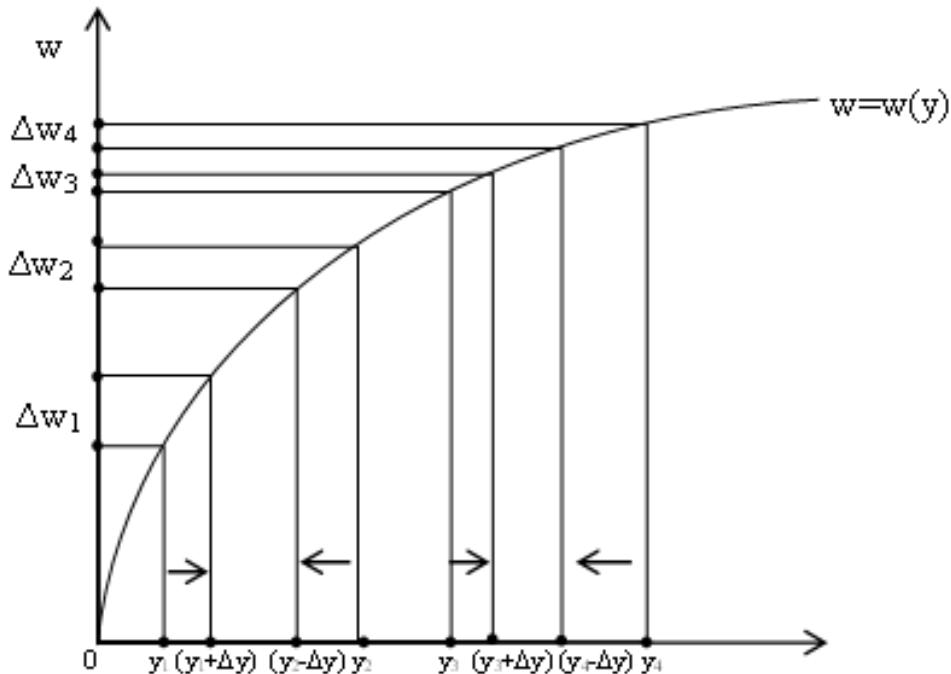
#### **4.2 Measuring forestry policy induced Equity**

The uses of utilitarian preferences imply neutrality to inequality, where only mean incomes are considered important. On the other hand, Rawlsian preferences lend themselves to infinite inequality aversion, bringing into focus incomes of the poorest. However, Lorenz curves rank income distributions, showing that the characteristics of preferences of decision makers are embedded in Economic Welfare Functions (EWF). An income-seeking decision maker who is inequality averse, regards transfers from poorer to richer persons as unacceptable, while transfers from richer to poorer people are desirable, all things being equal.

Generally, with the government as the sole decision-maker, it would favour a reduction of inequality for the benefit of the poorer people than to increase inequality to favour the rich. This means all things equal; government would apply the diminishing transfers’ principle of the Economic Welfare Function (EWF) as explained by Bellu and Liberati (2005).

This principle suggests that the increase in the economic welfare generated by a transfer of a given amount of forestry benefit (income) from a richer to a poorer person, both of whom are in the lower part of income distribution, increases the economic welfare more than a transfer of the same amount of benefit from a richer to a poorer individual, both of whom are in the upper part of income distribution. The Economic Welfare Function,  $w=w(y)$  where  $w$  = welfare and  $y$  = income:

- i) Increases with income and argues that all things equal, income increases  $\Delta y$  at the income levels  $y_1$  and  $y_3$ , will lead to positive changes of welfare  $\Delta w_1$  and  $\Delta w_3$ , respectively as shown in Figure 1.



**Figure 1: The principle of diminishing transfers**

Source: Bellu and Liberati (2005)

- ii) Reflects inequality-aversion which is the principle of transfers by arguing that all things being equal, an income increase  $\Delta y$  at income level  $y_3$  generates a lower welfare increase  $\Delta w_3$  than the welfare increase  $\Delta w_1$  generated by the income increase  $\Delta y$  at the income level  $y_1$ , showing that,  $(\Delta w_3 < \Delta w_1)$

Therefore, the welfare change decreases as forestry benefits (income) increases, implying,

$$(\Delta w_3 - \Delta w_1) < 0$$

- iii) Confirms the principle of diminishing transfers that for small transfers of income  $\Delta y$ , the gain in welfare, due to a transfer of income from richer to poorer people in the lower part of the distribution, say from  $y_2$  to  $y_1$  (as indicated by the arrows), is greater than the gain in welfare due to a transfer of income from richer to poorer people in the upper part of the distribution, say from  $y_4$  to  $y_3$ . From Figure 1 this can be stated as:

$$\frac{(\Delta w_1 - \Delta w_2)}{(\text{Recipient} - \text{Donor})} > \frac{(\Delta w_3 - \Delta w_4)}{(\text{Recipient} - \text{Donor})}$$

Re-arranging the inequality shows that  $(\Delta w_4 - \Delta w_3) > (\Delta w_2 - \Delta w_1) > 0$ .

Thus an increase in the economic welfare obtained by a transfer of a given amount of benefit (income) from a richer to poorer person, both in the lower part of income distribution, more than offsets the loss of welfare generated by the transfer of the same amount of benefit (income) from a poorer to a richer person, both in the upper part of income distribution.

Therefore this paper ascertained whether through forestry policy there had been any significant transfer of forest benefits (income) from the richer to the poorer, both of whom were in the lower income range, in the Ashanti Region as one criterion that drives forest conservation for ecosystem service provision and economic development.

## 5. Methodology

### 5.1 Data source

The main source of primary data was sampled forestry districts in the Ashanti region of Ghana. Household heads from sampled households responded to questionnaire. These heads of households were considered as the most qualified and resourced to provide complete situational information about their respective households. The responses formed the basic primary data set for empirical analysis.

### 5.2 The study area

The selection of the region was based on its distinctive forestry characteristics. The Ashanti Region hosts the highest number of timber firms in Ghana. In addition, the largest single wood market in Ghana has for several years existed in the region. Also, a little over 20% of Ghana's forest reserves are found in the Ashanti Region. This is the highest number of forest reserves found in any one particular region. Naturally, the region is the most prominent in forestry activities in Ghana.

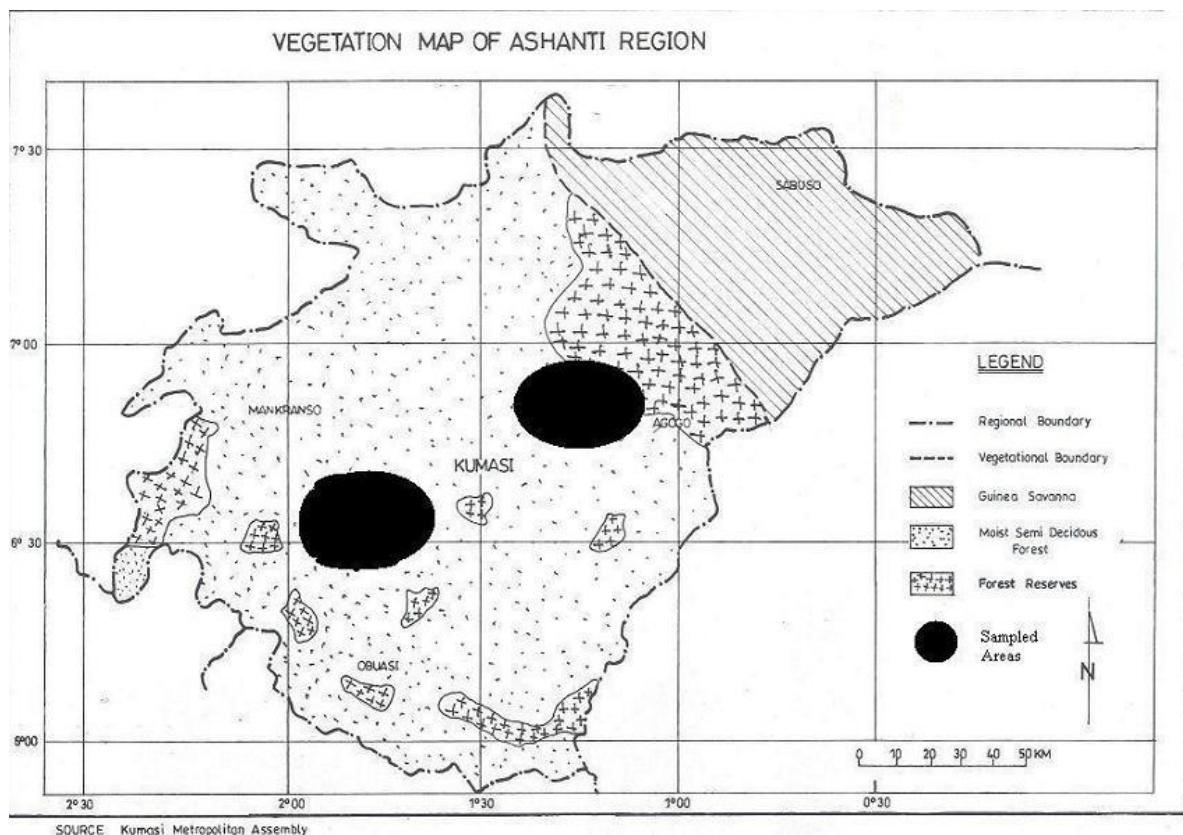
#### 5.2.1 Location and Physical features

The Ashanti Region is located centrally in the middle belt of Ghana between longitudes  $0.15^{\circ}\text{W}$  and  $2.25^{\circ}\text{W}$ , and latitudes  $5.50^{\circ}\text{N}$  and  $7.46^{\circ}\text{N}$ . It occupies a total land area of 24,539 square kilometres representing 10.2 per cent of the total land area of Ghana, being the third largest region after Northern (70,384 sq. km) and Brong Ahafo (39,557 sq. km) regions. It has a population density of 196.0 persons per square kilometre, the third after Greater Accra and Central Regions. More than half of the region lies within the wet, semi-equatorial forest zone. The forest vegetation of parts of the region, particularly the north-eastern part, has been reduced to savanna mainly because of the degrading effects of bushfires and human activities. The region is enriched geographically with lakes, scarps, forest reserves, waterfalls, national parks, birds and wildlife sanctuaries. The Lake Bosomtwe, the largest natural lake in the country, and Rivers Offin, Prah, Afram and Owabi serve as the natural drainage systems for the region. Several other smaller rivers and streams serve as sources of drinking water for residents of some localities in the region (GSS, 2013).

### **5.3 Choice of sample**

Sampling was used to obtain primary data through questionnaire administered through face-to-face contacts with household heads in the Ashanti Region. A simple random sample of 2 forest districts was selected from among the seven forestry districts of the Ashanti Region for the administration of questionnaire. This comes to about 30% of the forestry districts in the region.

The sample selection procedure involved a choice from a bowl of seven folded pieces of paper each bearing the name of one forestry district. The selection was done one at a time without replacement. The sampled districts were the Kumawu forest district and the Nkawie forest district. Figure 2 shows a map of the Ashanti Region indicating the sampled areas. The survey covered forest communities within the two forest districts. These two forest districts together had 99 settlements out of which 19 were sampled following a random sampling selection procedure of selecting from a well-mixed set of folded papers bearing the numbers 1 to 99, one at a time without replacement. This provided a sample of about 20% of the number of settlements. The communities thus sampled were Kumawu, Dadease, Bodomase, Asakyerewa, Akrokyere, Bodwoase, Oyoko, Wonoo, Akotosu, Nkawie, NkawiePanin, NkawieKuma, Nkawie-Toase, Toase, Ankobea, Nkawie New Site, Zongo, and Nkubem.



**Figure 2: Vegetation Map of Ashanti Region showing Sampled Areas**

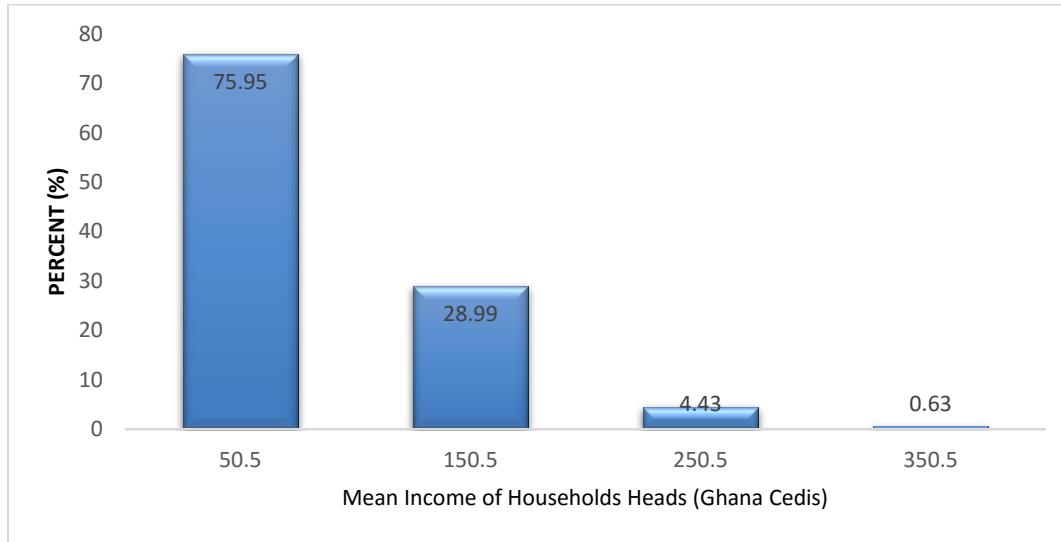
A sample size of 200 household heads was selected, first based on the total population of 7564 households in the communities. In addition, a precision level of +/-10% where the confidence

level is 95% and  $P = 0.5$  was selected. Then, making room for a 50% non-response rate, the published table of sample sizes of Israel (2009) was used to obtain the sample size of 200 household heads. The household heads selected from the communities responded to questionnaires, based on their availability, according to the systematic sampling procedure where after a first house the fourth house in a row was next to be contacted. In all, 158 household heads provided complete responses for the analysis.

## 6. Analysis

### 6.1 Socioeconomic characteristics of forest communities

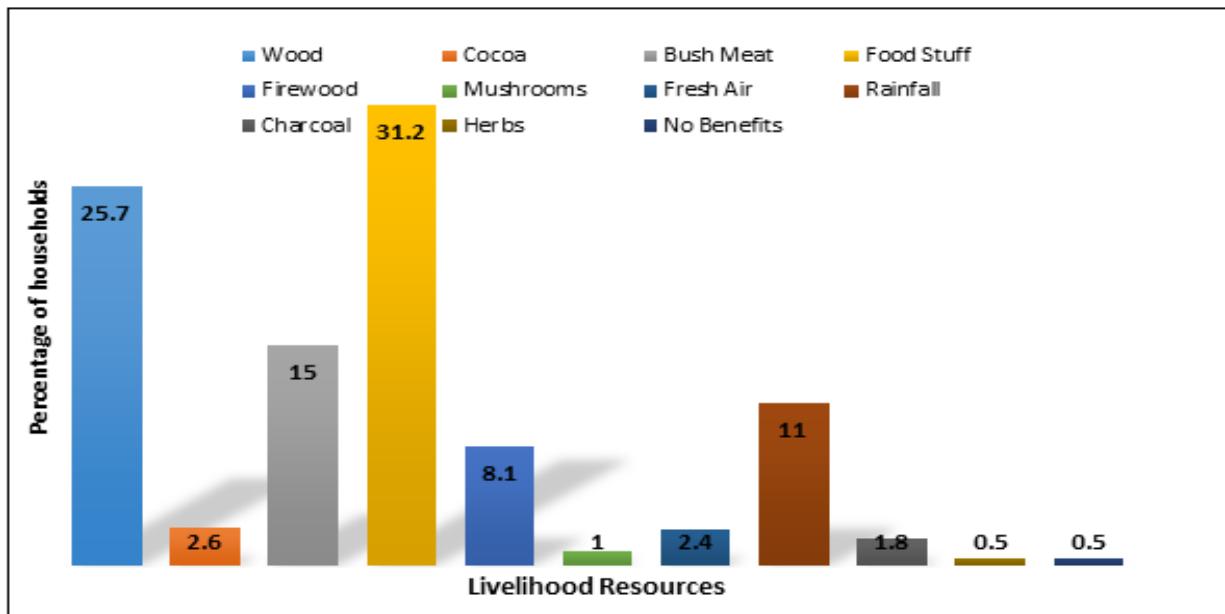
Of the 158 respondents, 62.7% were male and 37.3% female. The income distribution among the respondents showed that 75.9% had a monthly income less than 95.5 Ghana cedis, 19.0% had average monthly income of 150.5 Ghana cedis, 4.4% had average monthly income of 250.5 Ghana cedis and the remaining 0.6% had an average monthly income of 350.5 Ghana cedis. The modal income was 95.5 Ghana cedis, showing that over 75% of households had monthly incomes less than US\$2.00 per day (US\$1.00 = 1.6 Ghana cedis). Thus the forested communities generally had low incomes. Figure 3 shows a bar graph of the income distribution.



**Figure 3: Income distribution of household heads in forestry communities**

### 6.2 Forests as source of subsistence

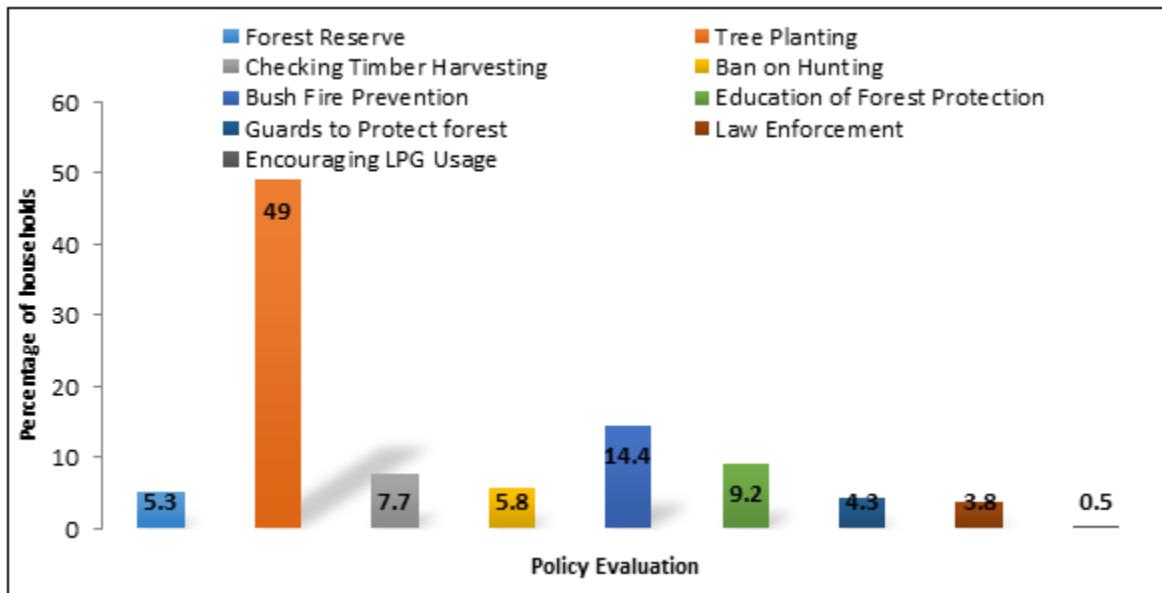
Figure 4 shows the items households subsisted on from their forests. The most common source of subsistence was foodstuffs (31.2%) which they obtained through the forest. The next most important was wood (25.8%), followed by bush meat (15%) and rainfall (raw water) (11%)and firewood (8.1%). Each of the remaining uses was below 3% with 0.5% indicating they had no benefits from the forests.



**Figure 4: Items households subsisted on from forests (in percentage contribution to livelihood)**

Source: Author's fieldwork, 2010

Figure 5 shows how well-acquainted households were with the implementation of forestry policy on the ground. The most frequent activity they reported as practical implementation of forestry policy was tree planting (49%), followed by bushfire prevention (14.4%) and education on forest protection (9.2%). The regulation of timber harvesting (7.7%) and forest reservation (5.3%) also featured prominently among the activities they recognized as the implementation of forestry policy in their communities.



**Figure 5: Forestry community knowledge of forestry policy implementation**

### **6.3 Forest community benefits from forests**

Table 1 presents a summary of the results from the survey on forestry benefits. From the total sample, 98.7% of households got regular sustenance from forests. This is an indication that the livelihoods of the communities depended almost entirely on forests and forest practices, signifying that policies on forests would be important determinants of the level of welfare of the people. Over 79% of the households had subsisted on forests over the past 9 years. More than 85% of these households had experienced some shortage in the availability of forest products which they had access to previously, while about 15% of households seemed not to have experienced any shortages.

**Table 1: Sources of forest benefits for forest communities**

Sources of Benefits	Yes	%	No.	%
Regular source of sustenance from forests (V)	156	98.7	2	1.3
Length of time benefits have been enjoyed (Lb)	<2yrs	5	3.2	
	3yrs	10	6.3	
	6yrs	18	11.4	
	9yrs	125	79.1	
Running out of some forest goods (Deg)	135	85.4	23	14.6
Education on sustainable forest use (U <sub>ed</sub> )	112	70.9	46	29.1
Education on government forestry policy (P <sub>ed</sub> )	140	88.6	18	11.4
Knowledge of government policy implementation on the ground (A <sub>ed</sub> )	134	84.8	24	15.2
Knowledge of the payment of forest royalties to district (B <sub>ed</sub> )	86	51.9	76	48.1
Knowledge of the use of royalties (Inf)	77	48.7	81	51.3
The household benefiting from royalties (B)	77	48.7	81	51.3

Source: Author's fieldwork, 2010.

In terms of households receiving education through the forestry commission or district assembly on the sustainable used of forests, about 71% of the households testified to having been given some education while 29% had not received any such education. This shows a clear case of policy implementation going on in the region.

Over 84% of households knew of government forest policy being practically implemented within their areas. While education on government policies had been very forthcoming, the same could not be said about education on benefits that accrued to the households. About 52% of households knew that royalties were being received by district authorities and stools, while the other 48% were ignorant of this fact. Also, about 49% of households knew what the royalties were used for, while over 51% did not know. In all, about 49% of households acknowledged they benefited

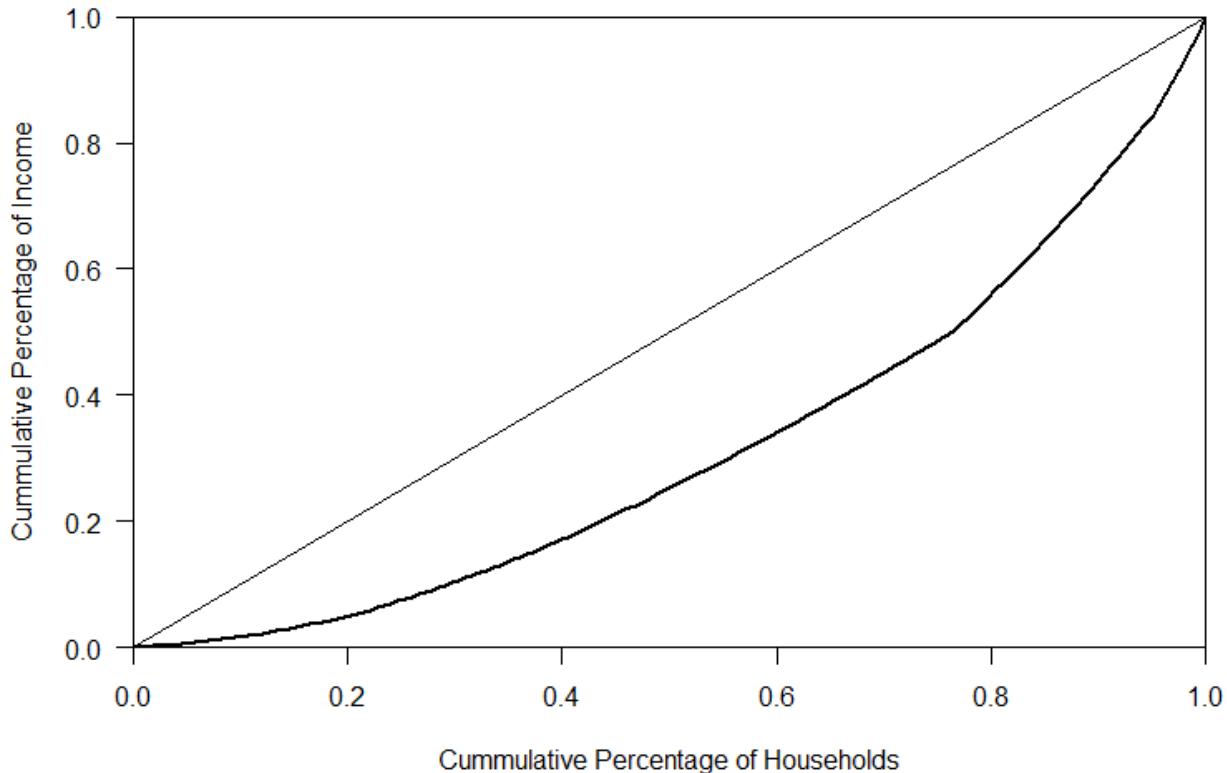
from royalties in direct or indirect ways; the majority (over 51%) indicated they did not benefit from royalties.

Thus, while in terms of passing on government policy and regulations to households there was high performance, with over 81% of households made aware of what their responsibilities were, the same had not been the case for providing knowledge on the rights of forest communities. On the average, while about 49.7% of households had enough knowledge about benefits, over 50% of households had no knowledge of benefits they could obtain through forestry policy. Therefore, there is inequity in the management of knowledge on forest benefits against the forest communities.

#### ***6.4 Income Distribution***

The incomes of household heads were assessed to ascertain the distribution of income within households through a construction of the Lorenz curve for the communities sampled. Figure 6 shows the resulting Lorenz curve. The horizontal axis represents individuals (in percentage terms over the population) ordered from the one with the lowest income to the one with the highest income (in a left to right direction). The vertical axis represents the percentage of incomes of household heads in the forest communities. When the income accumulation curve, or Lorenz curve, coincides with the diagonal, it means that income is equally spread among the households. Reading it from bottom left to right, it would mean that the 20% of the poorest people accumulate 20% of the overall income; and likewise for any other percentage. However, the Lorenz curve in Figure 6 rests below the diagonal. It indicates that the 20% poorest part of society earns less than 20% of what the communities earn. In general, curves further away from the diagonal reflect society with income distributed less equally.

The Gini-index is a quantity calculated from a particular Lorenz curve. It is defined as an integral that summarizes how much the Lorenz curve in question deviates from perfect equitability (Farris, 2010). The Gini-index for the sampled households is 0.37, derived from the Lorenz curve. Based on the value of the Gini-index, the interpretation is that the lower of two of the forest households' incomes, chosen at random, is about 63% of the mean; on the average, the poorer of two families earns only about 63% of the forest community mean income.



**Figure 6: Lorenz curve for forest communities in Ashanti Region**

Source: Author's construction

The curve provides evidence of inequality in the incomes of the households. However, unequal incomes per se do not explain the contribution of forestry policy to this inequality. This necessitated the use of the chi-square test of independence to ascertain the extent to which forestry policy had contributed to inequality. The chi-square test procedure is presented in the following section.

### 7. Factors influencing forestry income distribution

To test the hypothesis on the distribution of forestry policy benefits in the Ashanti Region in terms of equity, a chi-square test of independence was performed. The test was in relation to the distribution of forestry policy benefits in the Ashanti Region based on the sex of respondents. If the distribution of benefits was skewed towards the underprivileged in terms of sex, then, the distribution mechanism (forestry policy) was equitable; otherwise it was inequitable.

Based on the requirement that the expected frequency count for each cell in the chi-square contingency table should be at least 5 for credible results, none of the direct tests on incomes was feasible with respect to the variables for equity assessment in Table 1. This explains the use of only sex instead of sex and income. For each of the tests in the following section, the expected frequency count requirement for the chi-square test of independence was satisfied. Thus for each test of hypothesis, the chi-square test of independence was used to determine whether there was a significant relationship between a forestry policy benefit and the sex of household head in the Ashanti Region of Ghana at 5% significance level. Each forestry policy benefit obtained based

on sex was a necessary condition for equity. If this condition was not met, then there could not be equitable distribution of the benefits of forestry policy. If this condition was met, then it had to be more favorable for women than men, since women were generally less privileged than men in Ghanaian society (GSS, 2014). The test results for the chi-square test of independence are presented and discussed in the following section.

### **7.1 Presentation and discussion of Chi-Square Test results**

Table 2 shows the results of the chi-square test of independence between the variables and the sex of household heads in the forest communities.

**Table 2: Results of Chi-square test of independence**

Variable	Ped	Aed	Bed	Inf	B
Chi-square statistic	1.391	0.000	1.420	1.525	0.821
P-value	0.238	0.986	0.233	0.217	0.365

#### **(i) Education on forestry policy and sex of household head**

Hypothesis:

$H_0$ : Education on forestry policy and sex of household head are independent.

$H_1$ : Education on forestry policy and sex of household head are not independent.

The probability of the chi-square test statistic (chi-square = 1.391) was  $p = 0.238$  and greater than the alpha level of significance 0.05. The null hypothesis that differences in education on forestry policy are independent of differences in sex is not rejected. The research hypothesis that differences in education on forestry policy are related to differences in sex is not supported by this analysis. Since education on forestry policy is required for equity in handling forestry issues, this means the right to education on forest resources and policy should favor women more than men. This is because women have generally been less privileged than men in Ghanaian societies. The test result therefore shows that there is inequity in education on forestry policy in the Ashanti region.

#### **(ii) Knowledge of forestry policy implementation and sex of household head.**

Hypothesis:

$H_0$ : Knowledge of forestry policy implementation in one's community and sex of household head are independent.

$H_1$ : Knowledge of forestry policy implementation in one's community and sex of household head are not independent.

The probability of the chi-square test statistic (chi-square = 0.000) was  $p = 0.986$  and greater than the alpha level of significance 0.05. The null hypothesis that differences in knowledge of policy implementation on the ground are independent of differences in sex is not rejected. The research hypothesis that differences in knowledge of forestry policy implementation on the ground are related to differences in sex is not supported by this analysis. Since knowledge of forestry policy implementation on the ground is required for equity in handling forestry issues, this means the right to knowledge of forestry policy implementation in one's community should favor women more than men. This is because women are generally less privileged than men in

Ghanaian societies (GSS, 2014). The test result therefore shows that there is inequity in the provision of knowledge on forestry policy implementation on the ground in the Ashanti region.

**(iii) Knowledge of payment of forest royalties to one's District Assembly and sex of household head**

Hypothesis:

$H_0$ : Knowledge of payment of forest royalties to one's District Assembly and sex of household head are independent.

$H_1$ : Knowledge of payment of forest royalties to one's District Assembly and sex of household head are not independent.

The probability of the chi-square test statistic (chi-square = 1.420) was  $p = 0.233$  and greater than the alpha level of significance 0.05. The null hypothesis that differences in knowledge of the payment of forest royalties to one's District Assembly are independent of differences in sex is not rejected. The research hypothesis that differences in knowledge of the payment of forest royalties to one's District Assembly are related to differences in sex is not supported by this analysis. Since the knowledge of the payment of forest royalties to one's District Assembly is essential for equity in forest resource decisions, it should favor women more than men. This is because women are less privileged than men in Ghanaian societies. The test result therefore shows that there is inequity in knowledge of the payment of forest royalties to one's District Assembly in the Ashanti region.

**(iv) Knowledge of the use of forest royalties and sex of household head.**

Hypothesis:

$H_0$ : Knowledge of the use of forest royalties is independent of sex of household head.

$H_1$ : Knowledge of the use of forest royalties is not independent of sex of household head.

The probability of the chi-square test statistic (chi-square = 1.525) was  $p = 0.217$  and greater than the alpha level of significance 0.05. The null hypothesis that differences in knowledge of the use of forest royalties are independent of differences in sex of household head is not rejected. The research hypothesis that differences in knowledge of the use of forest royalties is related to differences in sex of household head is not supported by this analysis. Since the knowledge of the use of forest royalties is directly related to equity in the administration of forest royalty funds, it should have favoured women more than men, since women are less privileged than men in Ghanaian societies. The test result therefore shows that there is inequity in knowledge of the use of forest royalties in the Ashanti region.

**(v) A household benefiting from forest royalties and sex of household head.**

Hypothesis:

$H_0$ : A household benefiting from forest royalties is independent of sex of household head.

$H_1$ : A household benefiting from forest royalties is not independent of sex of household head.

The probability of the chi-square test statistic (chi-square = 0.821) was  $p = 0.365$  and greater than the alpha level of significance 0.05. The null hypothesis that differences in the household benefiting from forest royalties are independent of differences in sex of household head is not rejected. The research hypothesis that differences in the household benefiting from forest

royalties are related to differences in sex of household head is not supported by this analysis. Since the issue of household benefiting from forest royalties is an equity issue, it must favor women more than men. The test result therefore shows that there is inequity in households benefiting from forest royalties in the Ashanti Region.

## **8. Conclusion**

Following the assertion by forestry communities in Ghana that they do not receive a fair share of forest resource benefits due to state control and the effects this could have on the conservation of forest resources, with implications for biodiversity conservation and ecosystem service provision, this paper evaluated forestry policy in Ghana's Ashanti Region based on the equity criterion. It assessed the equity effect of forestry policy as a means of influencing biodiversity conservation among forest communities in Ghana. It employed a quantitative approach, with primary data collected through a two-stage probability sampling procedure from forest districts in Ghana. A sample of 158 households provided complete responses to questionnaire which were analyzed to ascertain the extent of equity associated with forestry policy implemented in Ghana.

The analysis focused on whether through forestry policy there had been any significant transfer of forest benefits from richer to poorer households, which could provide incentive for forest conservation. The Lorenz curve and Gini-index was constructed to assess the extent of forestry income distribution among households. The tests of hypotheses reveal the presence of inequity in the allocation of rights of households with respect to education on forestry policy and forestry policy implementation as well as the sharing of forestry policy benefits. These findings are confirmed by Lambini and Nguyen (2013), who found that about 93% of forest communities do not obtain benefits realized from forests in Ghana.

Therefore, there exists inequity in the distribution of forestry policy benefits in the Ashanti Region of Ghana. This inequity could be largely responsible for deforestation and forest degradation in the Ashanti Region of Ghana, and therefore a contributor to the loss of biodiversity and ecosystem service functions of Ghana's forests. This result is consequently applicable to the entire country because conditions are very homogeneous in all the forest districts of Ghana. Thus, forestry policy in Ghana has not only been welfare reducing but also a source of biodiversity loss and ecosystem service loss by inequitably distributing forestry policy benefits. To conserve forests for biodiversity preservation and ecosystem service functions, the government of Ghana would need to address inequity in the distribution of forestry policy benefits by giving due consideration to the views of forestry communities, not just by consultation.

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