

Research Article

Anthropogenic and Institutional Determinants of Forest Resource Degradation in the Savanna Ecological Zone of Northern Ghana

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Abstract: This study has been conducted to assess the major factors that impede the sustainable exploitation and conservation of forest resource in the savanna ecological zone of Ghana. Semi-structured interviews were used to elicit information from the officials and forest guards of the Forestry Commissions (FC) in three government administrative districts in Northern Ghana, while structured questionnaires were used to obtain data from a sample of respondents who were identified by the officials of the Forestry Commissions as being the main categories of people involved in forest resource exploitation in the study area, i.e., firewood harvesters, charcoal burners, plant therapists and farmers. The Results showed that poverty, insatiable demand for agricultural land, unsustainable method of exploiting forest resource, weak enforcement of institutional and policy framework within the forestry departments and agencies were the main factors affecting forest resource conservation in the area. Other factors included the lack of public awareness and knowledge of issues relating to forestry and forestry laws, failure of existing development-oriented policies to address the issue of poverty, little coordination between the activities of the various institutions involved in forest resource conservation in the area. In addition, the lack of a sustainable energy policy and the inadequate promotion of intensive livestock production policy were seen to be other contributory factors militating against forest resource conservation in the region. Intervention strategies towards ensuring forest resource sustainable use and conservation in the region should therefore revolve around these factors.

Keywords: Forest degradation, forest-savanna, northern Ghana

INTRODUCTION

The forests in Ghana, which are part of the Guinea-Congoleaphy to geographical region, cover about 24.2% of the country's total land area of the country (FAO, 2010). Ecologically, the country is divided into a high forest zone to the southwest, accounting for about a third of the land area (about 7.5 million hectares), a savanna zone (14.7 million hectares) mostly in the north and a transition zone (1.1 million hectares) (ITTO, 2006). The Forest Services Division (FSD) of the Forestry Commission (FC) categorized the forest reserves under their jurisdiction into different management areas. Forests are categorized into reserved and unreserved forest. The reserved areas account for 1.77 million ha of forest lands, of which 1.634 million ha is under the management and control of the Forest Services Division (FSD), while the Wildlife Division (WD) manages 0.136 million ha (Koteyet *et al.*, 1998). The importance of Ghana's forest is seen in its unique contribution to the stability of the environment, economy and to the social values of the

people, especially the rural populace (Francois, 1995). Agriculture, including forestry, is the backbone of the Ghanaian economy. Forestry as a sub-sector accounts for 6% of the GDP, 11% of export earnings and employs a labour force of 100,000 people (FAO, 2010). Most of the rural population depends on the forests for their survival as forestry has played a significant role in the provision of food, clothing, shelter, furniture, potable water supply sources and bushmeat, thus providing livelihood for over 2.5 million people. The forests are also highly valued as sources of natural medicines, which are essential components of health treatment, which is commonly used in conjunction with mystical and ritual practices (NSBC, 2002; FAO, 2010). However, while the pursuit of economic and social exploitation of forest resources has contributed to development in both rural and urban communities in the country, the manner in which it has sometimes been done has led to decline in forest environmental quality (Francois, 1995). The damaging effects caused by persistent bushfires and grazing on plants coupled with over exploitation of plants by people in the form of fuel

wood and charcoal, timber and medicinal products as revenue resources adversely affect forest resource conservation in the region (FAO, 1998). It is indeed reported that over the last century Ghana lost over two-thirds of its forest estate, which at the beginning of the 20th century measured about 8.2 million hectares (NSBC, 2002). Only about 10.9 to 11.8% remains as intact forests. Deforestation in the country is estimated at 22, 000 km² per annum (Hawthorne and Musah, 1993; FAO, 1998). Protected areas are under increasing pressure from the demand for more fertile agricultural lands and forest products (Ntiamao-Baidu, 1995). Hence, the persistent exposure of Ghana's forest to human activities constitutes a serious threat to the country's productive systems as well as the livelihood and very survival of Ghanaians (Ntiamao-Baidu, 1995; Campbell *et al.*, 2000; FAO, 1998). It is indeed reported that at the current rate of deforestation there will be no intact forests left in the country within the next 100 years (Ntiamao-Baidu, 1995; FAO, 1998). This situation is particularly pronounced in the northern part of the country where pressure on land and savanna woodland resources is extreme (Blench, 1999). The drylandsavanna zone of the Northern region of Ghana occupies 40% of the country. It comprises sub-humid to semi-arid guinea and sudansavanna (Gyasi, 1995). While the northern savannas are home to about one third of wildlife species in Ghana, annual bushfires affect 50% of the savannas, destroying species of flora and fauna and reducing biodiversity. The Northern savanna zone is also under tremendous pressure from growing human and livestock populations, agricultural expansion, inappropriate farming practices, deforestation and introduction of new crop varieties that are replacing indigenous ones. There are over 60 forest reserves and two wildlife reserves in the northern savanna zone of the country. Unlike protected area systems in the high forest zone of the country, very little attention has been paid to the management of savanna forest and wildlife estates on sustainable basis (NSBC, 2002). Hence the savanna ecosystem of Northern Ghana continues to experience major biophysical environmental degradations closely associated with production pressures to meet the needs of the growing population (Nsiah-Gyabaah, 1996). In a region where inhabitants depend upon natural resources for their livelihoods, the degradation of the forest-savanna of Northern Ghana is a serious threat to the sustainability of their subsistence lifestyle (O'Higgin, 2007). The preservation and conservation of this forest ecosystem is therefore of paramount importance not just for the sake of production of commodities, but more so for maintaining its ecological balance and environmental reasons (Campbell *et al.*, 2000). Studies conducted in other countries

(Barraclough and Ghimire, 1996; Fairhead and Leach, 1995; Grundy *et al.*, 2000) indicate that the relationship between forest resource exploitation and communities' livelihoods sustenance and the associated implications for environmental degradation are influenced by social and economic factors as well as policy and institutional variables. Hence, the understanding of these factors is relevant for formulating sound policies and intervention strategies for forest resource sustainable utilisation and conservation and communities' livelihoods sustenance. It is in line with this perspective that the following research was carried out. The objective of this study was to determine what major factors impede the sustainable exploitation and conservation of forest resource in the savanna ecological zone of Ghana. Data from the study could provide useful insight for the development of sound forest resource management prescriptions and control measures for the forestry and natural resources advisory services and non governmental agencies involved in forest resource conservation.

MATERIALS AND METHODS

Study area: The study was conducted in three government administrative districts in the savanna ecological zone in Northern Ghana (8° N, to lat. 11° N and longitudes 2°57'W and 0°34'E). The districts include the Bolga District and the Bawku West District of the Upper East Region (UER) and the West Mamprusi District of the Northern Region (NR) (Fig. 1).

The climate in these areas is characterised generally as tropical continental, or savanna, with a single rainy season, from May to October, followed by a prolonged dry season (FAO, 1998). Average ambient temperatures are high year round (about 28°C) but the harmattan months of December and January are characterised by minimum temperatures that may fall to 13°C at night, while March and April may experience 40°C in the early afternoon. The savanna ecological zone is associated with a total annual rainfall of about 1000-1300mm/ annum. The rainy season is 140-190 days in duration, while the estimated reference evaporation is about 2000 mm/annum, creating a great seasonal deficit every dry season. The peak rainfall period is usually late August or early September. About 60% of the rainfall occurs within the three months (July to September).

Most of the geological formations in the area are overlain by a regolith comprising in situ chemically weathered material and, to a lesser extent, transported surface material. Typically, this weathered layer consists (from top to bottom) of a residual soil zone (usually sandy-clayey material possibly underlain by an indurated layer) and a saprolite zone (completely to slightly decomposed rock with decreasing clay content with depth) (Carrier *et al.*, 2008).

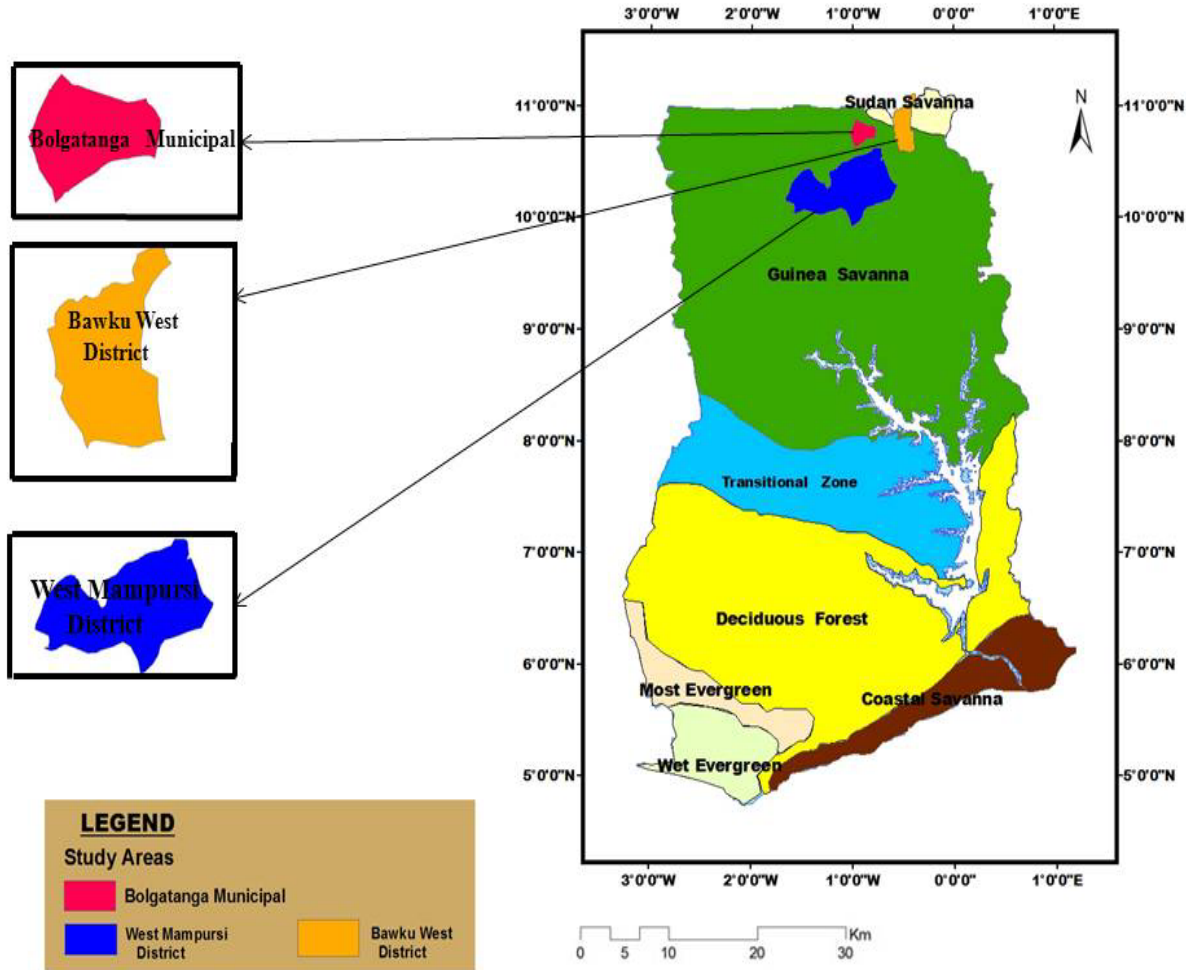


Fig. 1: Ecological zonation map of Ghana showing the location of study areas

The vegetation cover typical of the savanna ecological zone of Northern Ghana consists of mixed formations of fire resistant trees and shrubs. Moving northwards, within the savanna region, there is at first densely wooded and vigorous grassland (*Andropogon, spp.*) with fire resistant shrubs, often referred to as woodland savanna or Guinea savanna. Further north, in an increasingly arid environment, grass savanna or sudansavanna is formed, with trees and shrubs either absent or very sparse. The total reserved area of the Northern Ghana savanna is about 6,388 km² (FAO, 1998). It is estimated that 20,000 hectares per annum of the reserved area in Ghana is lost to agriculture, or through bush fires and other human activities such as bush burning, overgrazing, logging and mining (FAO, 1998). Hence, the persistent exposure of the forest savanna of Northern Ghana to human activities constitutes a serious threat to its environmental sustainability and communities' livelihoods (Francois, 1995;FAO, 1998;Campbell *et al.*, 2000).

The total population of northern Ghana is 4,228,116, representing 17.1% of the national

population. Of this total population, 49% are males and 51% are females (Ghana Statistical Service, 2012). The majority of the population (80%) in the area lives in rural areas. Social indicators are very low for these areas. Poverty is highly concentrated in rural areas and among small farmers, particularly in the savanna ecological zone (NSBC, 2002). As with the rest of the country, agriculture is the dominant economic activity in the area, involving crop and livestock production (Adams and Ohene-Yankyer, 2015).

Research approach and data collection: The research strategy used for this study was a mixed methods research strategy, as the study integrated both quantitative and qualitative research methods for the collection of data. A two-tier system of primary data collection was used to elicit information from the key stakeholders involved in forest resource use and management in the study areas. The first tier of this system consisted of the officials and forest guards of the Forestry Commissions (FC) of the three districts, while the second tier of this data collection approach

was made up of the main categories of people actively involved in forest resource exploitation in the study area. These categories of people were identified with the help of the Forestry Commissions (FC) and cross-checked using field investigations. The identified categories of people included firewood harvesters, charcoal burners, plant therapists and farmers. Data were collected using two main techniques: interviews and questionnaires. The interviews were conducted with the officials and forest guards of the Forestry Commissions (FC) of the three districts which constituted the study area. The interviews consisted of a semi-structured nature and conducted individually so as to allow respondents to freely express their views and opinions on topical issues relating to forest_savanna resource exploitation and associated implications for environmental sustainability. Specific information collected from the interviewees included the anthropogenic factors that degrade the forest_savanna of Northern Ghana, the existing forest management interventions and related challenges and suggestions for ways of ensuring forest resource conservation and sustainable utilisation in the area. The perceptions and attitudes of firewood harvesters, charcoal burners, plant therapists and farmers of the use of forest_savanna resource and how best anthropogenic factors can be brought under control so as to ensure sustainable conservation and utilisation of forest resource in the area were investigated using questionnaires. The specific issues covered in the questionnaires included the demographic profile and educational status of respondents, the reasons for choosing their respective activities, the type of forest site where the forest resource was exploited, the method and frequency of exploiting the forests, the time span over which the respondents were engaged in their respective activities and their perception of the trend in the availability of the forest products exploited over the years. The other aspects of the information garnered were related to the question of whether some periodic sensitization campaigns were carried out by the Forestry Commissions with the view to educating the local communities on the importance of protecting forest resource including the off_reserve forests and whether the locals were actively involved in the protection of the forest reserves. In addition, suggestions from respondents on the way forward for addressing challenges relating to human pressures on forest resource and ensuring forest_savanna sustainable conservation in the area were also collected.

Procedure used for sampling respondents: One hundred and twenty-nine respondents made up of the four categories of people, i.e., firewood harvesters (30), charcoal burners (33), plant therapists (20) and farmers

Table 1: Profile of respondents

Variable	Respondents %
Gender	
Male	58.90
Female	41.10
Marital status	
Married	94.57
Widow	5.430
District of residence	
Bawku West	25.58
Bolga	38.76
West Mamprusi	35.66
Age-group	
20-29	13.18
30-39	14.72
40-49	37.20
50-59	27.00
60+	7.900
Education	
Primary	8.500
No formal education	91.50

(46) were sampled across the three districts and formed the survey sample for the study. Within each district, two communities were randomly selected for the study. The distribution of the respondents amongst the three districts was based on the size of the population in these districts. The respective proportions of respondents allocated to the three districts are contained in Table 1. The group of farmers were selected randomly (simple), while the remaining three categories of respondents, i.e., the firewood harvesters, charcoal burners and plant therapists, were selected using a non probability sampling method (Bryman, 2008). The sample of firewood harvesters, charcoal burners and plant therapists, was drawn using the snowball sampling method as the universe of these three categories of respondents was unknown (Bryman, 2008). The following approach was adopted in selecting the respondents based on this sampling method: A key member of the district community, namely the assemblyman (elected personality of the community who represents the people of the locality at the District Assembly) was consulted to help identify at least one respondent of each category in the community. The identified respondent was then used to establish contact with other members of the sample in the community. As for the group of farmers, their sample was drawn randomly (simple) using households as sampling units. A list of households in each community was obtained from the local district assemblies.

RESULTS AND DISCUSSION

Profile of respondents: The study results revealed that the majority of respondents were males (58.9%) as against 41.1% females. The data also showed that of the total number of 129 respondents, 94.57% were married while 5.43% were widows (Table 1). Data on the age_group distribution of respondents showed that the respondents were predominantly in the age_groups of 40 to 49 and 40 to 59 years corresponding to 37.2 and 27.0% of the total sample of respondents respectively. The study results further revealed that the

Table 2: Respondents' perceptions of their activities and the way forward for addressing the challenges relating to impacts of human activities on forest resource conservation in the study area.

Variable	Respondents (%)
Reasons for choosing activities	
Poverty	46.51
Financial problems	36.43
Lack of agricultural land	17.05
Type of forest site where activities were carried out	
Forest reserve only	0.00
Forest reserve and off-reserve forest	18.6
Off-reserve forest only	81.4
Place in the forest where activities were carried out	
Activity is carried out deep in the reserve	18.06
Activity is carried out across the off-reserve forest	81.4
Method of exploiting trees in the forest	
Cutting down of tree from the base of the trunk	76.74
Cutting down of branches	3.880
Peeling out of bark	9.300
Removal of whole tree by digging out the roots	2.330
Burning of trees	7.750
Type of tree species exploited in the forest	
Specific species	15.22
All type of species indiscriminately	84.78
Life form of trees exploited in the forest	
Live trees only	32.60
Dead trees only	41.30
Both live and dead trees	26.10
Level of maturity of trees exploited in the forest	
Mature trees only	65.22
Both young and mature trees	34.78
Frequency at which activities were carried out in the forest	
Every day	31.00
Twice to three times a week	15.50
Two to three times a month	48.80
Every farming season	4.700
Time span over which respondents were engaged in the activities	
More than ten years	33.33
Five to ten years	43.41
Two to five years	23.26
Perception of the trend in the availability of forest resource over the years	
A gradual decrease has been observed	15.15
No decrease has been observed	84.85
Periodic sensitisation of respondents by the Forestry Commission to the dangers posed by respondents' activities on forest resource sustainable use and conservation and the need of protecting forests	
Yes	
No	100
Active involvement of respondents and locals of fringe communities in the protection of forest resource by the Forestry Commission	
Yes	
No	100
Periodic sensitisation of respondents by the Forestry Commission to the dangers posed by respondents' activities on forest resource sustainable use and conservation and the need of protecting forests	
Yes	
No	100
Active involvement of respondents and locals of fringe communities in the protection of forest resource by the Forestry Commission	
Yes	
No	100
Respondents' suggestions on the way forward for addressing the impacts of their activities on forest resource sustainable use and conservation	
Government should provide us with alternative income generating activities	53.49
Government should help us to develop our own plantations	21.71
Government should satisfy our need for agricultural land and intensive cattle rearing	15.50
Government should educate the locals on the importance of protecting forest resource	7.75
Government should enforce the forestry law against illegal activities in the reserves	1.55

overwhelming majority (91.5%) of respondents were illiterates as against 8.5% who had only primary education (Table 1).

Respondents' perception of their activities: The study findings revealed that the main reasons that prompted the respondents to choose forest resource exploitation as their source of livelihoods included poverty, financial problems and lack of agricultural land. Most of the respondents (46.51%) mentioned poverty as the reason for engaging in forest resource exploitation, as against 36.43 and 17.05 % who pointed out financial problems and lack of agricultural land respectively (Table 2). The study data also show that although the majority (81.31%) of respondents claimed they have been carrying out their activities in the off_reserve forests only, others (18.6%) did acknowledge that both the off_reserve forests and forest reserves were used as places for their activities. Information gathered also showed that the respondents used several methods for exploiting forest resource. These included the cutting down of trees from the base of the trunk (76.74%), the peeling out of the bark of trees (9.30%), the use of slash_and_burn method (7.75), the cutting down of tree branches (3.88%) and the removal of the whole tree by digging out the roots (2.33%). The data also showed that when the respondents used the forest reserves as place of exploitation, they carried out their activities deep in the reserves so as to ensure that their presence was not obtrusive. Data contained in Table 2 further show that the exploitation of forest resource affected both mature trees (65.22%) and young trees (34.78%) in either their live form (32.60%), or dead form (41.30%), or in both (26.1%). Besides, majority of respondents (84.78%) targeted all types of tree species when exploiting forest trees, while 15.22% selected specific tree species. It further appeared from the data that the frequency at which the forest was exploited varied among the respondents. The majority of respondents (48.8%) exploited the forest resource at the frequency of two to three times in a month, as against 31 and 15.5% who carried out their activities in the forests every day and twice to three times a week respectively. The rest (4.7%) carried out their activities in the forest every farming season. As regards the time span over which the respondents have been carrying out their activities, the results show that 43.41% of respondents were engaged in the exploitation of forest resource for five to ten years, as against 33.33 and 23.26% of respondents who were involved in the activity for more than ten years and two to five years respectively. With regard to the views of respondents about the trend in the availability of the forest resource they have been exploiting over the years, the respondents overwhelmingly stated that they did not notice any decrease in the availability of the resource since they have been practising their activities. With

regard to the question of whether the Forestry Commissions in the study area have been conducting periodic sensitization campaigns for the locals on the need for protecting forest resource and exploiting it in a sustainable way, the interviewees unanimously responded no. The same answer was obtained from the respondents when they were asked whether the Forestry Commissions actively involved them in the protection of the reserves in the area. As regards respondents_suggestionson the way forward for addressing the challenges relating to human pressures on forest resource and ensuring a sustainable conservation of forests in the area, majority of respondents (53.49%) suggested that the Government should provide them with alternative sources of livelihoods. Others (21.71%) recommended that the Government should help them to develop their own plantations. Further recommendations which requested some interventions from the Government included: addressing farmers' need for agricultural land and intensive cattle rearing(15.5%), educating the locals on the importance of protecting the forests (7.75%) and enforcing the forestry laws against illegal activities in the reserves (1.55%).

Perception and views of the Forestry Commission (FC) officials: Data garnered from the interviews conducted with the officials of the Forestry Commissions (FC) of the three districts showed that firewood harvesting, burning of charcoal, medicinal plants harvesting, crop farming and cattle rearing and bushfires were the most prevalent human activities that constitute a serious threat to the sustainable conservation of both the unprotected forests and forest reserves across the study area. The other anthropogenic factor which was said to be rearing its ugly head in the area was the issue of illegal gold mining popularly known as *_galamsey_*. The information gathered also revealed that the main drivers of these human activities were poverty, hunger and insatiable demand for agricultural land. The interviewees also pointed out that the forest_savanna zones of northern Ghana, including the reserves, were undergoing some form of degradation as a result of the above mentioned human pressures, most of which were blamed on the locals of the fringe communities. The interviewees bemoaned this human_induced deforestation and the fact that it constitutes a serious threat to forest resource conservation and plant biodiversity in the area. The respondents also indicated that the anthropogenic activities in the form of firewood harvesting, charcoal burns, medicinal plants harvesting and farming, were mostly meant for commercial purposes. The study findings also revealed that these anthropogenic activities were carried out throughout the whole year without respite. As to the management prescriptions put

in place for managing the forest reserves and curbing the unrelenting human pressure put on forest resource in the area, the respondents indicated that the Forestry Commissions (FC) were deploying strenuous efforts toward ensuring the protection of forest reserves despite the numerous challenges they faced. The study data further showed that the activities of the Forestry Commissions were focused on the implementation of the Forestry Policy, particularly the strengthening of institutional structure, the protection of forest reserves, the monitoring and control of forest production and the development of forest plantations. With regard to the challenges the respondents of the three district Forestry Commissions were faced with in the discharge of their duties, the following problems were mentioned: understaffing and poor logistics, lukewarm attitude of some traditional chiefs about supporting the Forestry Commissions in sensitising the locals on the importance of protecting the forest reserves, difficulty in getting some chiefs and their people actively involved in the protection mechanisms as the communities had little or no understanding of the need for protecting the forests. The challenges also included the difficulties in implementing successful forest plantation programmes as a result of lack of support of the labour force of the fringe communities as the Forestry Commissions reneged on their promise to remunerate them for the plantation work done owing to financial difficulties. This problem was coupled with the failure of the World Food Programme (WFP) to provide the locals with food in exchange for the plantation work done and the lack of the required logistics to enable the Forestry commissions to carry out the plantation programmes properly. As a result of these difficulties the various plantation programmes, namely the DAP (District Afforestation Programme), NFPP (National Forest Plantation Programme), HIPC-FPP (Highly Indebted Poor Countries - Forest Plantation Programme) and the NNFPPD (Non Natural Forest Plantation Development Programme) were generally not successful across the region. The challenges were further attributed to political interferences from some traditional chiefs and local government authorities in the strict application of the law by the Forestry Commissions against the locals of the fringe communities whenever they were caught logging, burning charcoal or farming deep in the forest reserves. The interferences consisted mainly of putting pressure on the Forestry commissions to release the offenders or stop prosecuting them. According to the interviewees this situation, in some instances, paved the way for threats made against the forestry commission staff's lives by some locals. Moreover, this situation contributed to thwarting the Forestry Commissions' staff in their daily efforts to protect the reserves and deter illegal activities therein by effectively prosecuting

the offenders. The interferences were further attributed to failure by the local government authorities to allocate appreciable responsibility to the Forestry Commissions in the area in some reforestation/afforestation programmes such as the SADA (Savanna Accelerated Development Authority; an agency for coordinating a comprehensive development agenda for the Northern Savannah Ecological Zone (NSEZ) in Ghana and transforming the NSEZ into a place of opportunity and free from poverty) afforestation programme in which the Forestry Commissions were only requested to provide their technical advice without being in effect involved in the practical aspect of the afforestation. This situation was further blamed on other governmental and non governmental agencies which are involved in community_based afforestation/reforestation programmes. With regard to the interviewees' perspective on the way forward for addressing the energy demand in rural and urban areas in the region so as to lessen the overreliance on firewood and charcoal and slow down the ongoing deforestation the following ideas were put forward by the respondents: the development of private plantations consisting of firewood and pole-producing trees and orchards in rural communities with the technical and logistical support of the Forestry Commissions and the local Governments and the promotion of the use of combustible gas by the Government. The promotion of solar energy by the Government was seen as a very interesting option by the respondents as they pointed out that the sun intensity is high throughout the year in the northern part of Ghana. The information gathered from the interviews also revealed that no immediate action was put in place to deal with the human-induced threat to plant biodiversity conservation in the area apart from the routine efforts toward ensuring the protection of the forest reserves. The interviewees also indicated that no forest_savannaex_situ plant biodiversity conservation programme was existent in the whole savanna ecological zone of northern Ghana. The respondents therefore suggested the establishment of botanical gardens and a seed conservation centre in the savanna ecological zone of the country as some measures that could have the potential of conserving plant biodiversity in the region. The interviewees also suggested the promotion of intensive livestock production policy in the region as the most effective way of preventing the locals from using the forest reserves to graze their cattle.

Discussion: The study revealed that anthropogenic activities were the main causes of forest degradation in the forest_savanna zone of Northern Ghana. These activities which were mainly in the form of firewood harvesting, charcoal burning, medicinal plants

harvesting, crop farming, livestock farming and bushfires affected the off_reserve forests and forest reserves indiscriminately. These findings substantiate the fact that the forest_savanna of northern Ghana plays important roles in servicing the socio_economics of the region (Nsiah - Gyabaah, 1996) and justify the huge human pressures placed on forest resource in the savanna ecological zone of the country. Many studies have demonstrated that these pressures constitute a serious threat to forest resource conservation and communities' livelihoods sustainability in the region (FAO, 1998; O'Higgin, 2007). These findings support the fact that, in Ghana, 20,000 hectares per annum of the reserved area is lost to agriculture, or through bush fires and other human activities (FAO, 1998). From the study results it appeared that the human_induced deforestation in the region is likely to be sustained and even aggravated in the long run as the people involved in forest resource exploitation indicated that they relied solely on forest resource for their livelihoods. This prospect is further justified by the fact that the respondents harvested the forest products in commercial quantities. Moreover, the methods used for harvesting the forest products and the frequency at which these products were exploited, coupled with the time span over which the respondents were engaged in forest resource exploitation were further illustrative of the huge pressures placed on forests in the region and the threat to their sustainable conservation. Data on the age distribution of respondents show that most of the respondents were in the age brackets of 40 to 49 years (37.2%) and 50 to 59 years (27.0%). The result further shows that majority of respondents were engaged in the exploitation of forest products for five to ten years (43.41%) and more than ten years (33.33%). These findings suggest that majority of them were involved in their activities when they were within the age_groups of 30 to 39 years or 40 to 49 years. In view of the life expectancy level in the country which is estimated at 62 years (WHO, 2015) these findings suggest that most of the respondents were likely to spend 13 to 22 years or 23 to 32 years in their activities. These facts are further indicative of the tremendous pressure that is put on forest resource in the region and support the prospect that the human_induced deforestation in the region is likely to become severe in the long run. The majority of respondents stated poverty (46.51%) and financial problems (36.43%) as the main reasons that prompted them to rely on forest resource exploitation for livelihoods. These reasons are in line with the fact that poverty in all its manifestations is pervasive in sub-Saharan Africa (Muntali, 2007). Indeed, the United Nations Environment Programme (UNEP, 2003) estimated that at least 313 million people earn less than US\$1 per day and that this number may increase by 9% by the year 2015, contrary to the United Nations Millennium Development Goals' proposition that the

proportion will be halved during the same period. In Ghana in particular about 60 percent of the total population is rural. Poverty is highly concentrated in rural areas and among small farmers, particularly in the savanna ecological zone. The incidence of poverty in the rural areas is high (36%) and accounts for 84% of total poverty in Ghana. Social indicators are also very low for these areas (NSBC, 2002). The study results could therefore be an indication of the fact that Ghana's limited financial resources means that no extensive programmes of social protection are in place in these areas (NSBC, 2002). Data gathered from the study further show that other human and institutional factors were playing in favour of the human_induced forest resource degradation in the area. These include the lack of a sustainable energy policy in the country, lack of awareness amongst the locals of fringe communities of issues relating to forest resource conservation and sustainable utilisation and the weak enforcement of institutional and policy framework within the Forestry departments and agencies. The other factors are the level of importance of traditional healthcare in the country and the failure of existing development oriented_policies to holistically address the issue of poverty head-on, particularly in rural communities.

With regard to energy, it is established that biomass energy is the primary energy source in a majority of rural sub-Saharan areas (Murphy, 2001; FAO, 2007). This situation explains why rural communities in the savanna ecological zone of Northern Ghana depend nearly entirely on firewood and charcoal as energy sources for cooking and heating (FAO, 1998; NSBC, 2002). Historically, fuel wood harvesting occurred on individual farmlands and was for household subsistence use only. However, fuel wood exploitation in forest reserves and protected areas has increased considerably over the last decades (NSBC, 2002). This situation is substantiated by the findings of the study which indicate that the exploitation of forest resource by the respondents was done in commercial quantities. It is indeed established that, if the present human pressure on forest resource continues unchecked, most reserves will be depleted of wood resources and most parts of Northern Ghana will easily become desert (FAO, 1998; NSBC, 2002). It is against this background that the following solutions were mooted by the officials of the Forestry Commissions as the way forward for addressing the energy demand while slowing down the current rate of deforestation in the region: the development of private plantations consisting of firewood trees and orchards in rural communities which was further suggested by some of the four categories of respondents engaged in forest resource exploitation, the promotion of solar energy and the promotion of the use of combustible gas in the region by the Government.

The lack of awareness amongst the locals of fringe communities of issues relating to the importance of forest resource conservation and sustainable utilisation and the lack or inadequate involvement of these communities in the conservation activities are also factors contributing to the degradation of forest resource in the region. The study revealed that it was difficult for the Forestry Commissions to sensitise the locals on the importance of protecting forest resources in the area and get them actively involved in the protection of the forest reserves and the reforestation programmes. These findings are an indication of the fact that inadequate or negligible involvement of local communities in forest resource management can lead to undesirable consequences. Ntiamoa_Baidu (1995) buttressed this fact by pointing out that people will support natural resource conservation projects if they can identify themselves and their needs with such projects. The same author further observed that more often than not conservation projects are planned to address threats to natural resource conservation; and management strategies do not address the needs of the people whose livelihoods are inter_linked with the natural resource.

The third factor which contributes to the exacerbation of human pressures on forests in the area is the exploitation of forest resource for therapeutic purposes. This fact is in line with the study results which showed that medicinal plants harvesting was one of the most prevalent human activities carried out in the forests. This finding emphasises the importance of traditional healthcare in the country, particularly in rural areas where healthcare is provided partially by traditional healers and traditional birth attendants who are dependent on a sustainable supply of medicinal plants (NSBC, 2002). It is estimated that approximately over 4 billion people or 80% of the world's population rely on traditional medicine, one way or the other, for health care (WHO, 2003). In Ghana, about 70 to 75% of the population rely on herbal medicine for their primary health care. Besides, herbal medicine is the first line of treatment for more than 60% of children with high fever resulting from malaria (WHO, 2003). According to the World Health Organisation (WHO, 2003), there is, on the average, one traditional medical practitioner for every 400 people, compared to one biomedical doctor to 12,000 people in Ghana. In some rural communities of the country, herbal medicine is the only form of health care that is available, affordable and accessible (Twumasi, 2005). It is further demonstrated (Ntiamoa_Baidu, 1995) that traditional systems of medicine continue to be widely practiced in Ghana on many accounts: population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases. These factors have led to increased emphasis on the use of

plant materials as a source of medicines for a wide variety of human ailments. The importance of traditional medicine in the country supports the findings in this study which indicate that a huge anthropogenic pressure was put on medicinal plants, plant biodiversity and forest resource in the area.

The lack of effective enforcement of institutional and policy framework for implementing sustainable forest_savanna management systems in collaboration with the local communities is another factor that impedes efforts towards ensuring forest resource sustainable utilisation and conservation in the region. This fact was corroborated by the inadequate working conditions under which the Forestry Commissions carried out their activities as the officials of the Forestry Commissions deplored the understaffing and poor logistics under which they were operating. The officials of the Forestry Commissions further bemoaned the interferences from some traditional chiefs and local government authorities in the strict application of the law against illegal activities in the reserves as these authorities put pressure on the Forestry commissions to release the offenders or stop prosecuting them. This situation illustrates the difficulty in effectively enforcing the law on forest resource conservation in the country. The Forestry Commissions further deplored the failure by some local governmental agencies, such as the SADA, to allocate them appreciable responsibility in afforestation/reforestation programmes. This problem was further blamed on some non governmental agencies involved in community_based afforestation/reforestation programmes. This situation is in line with findings from previous research (Ntiamoa_Baidu, 1995) which stated that there is very little coordination between the activities of the various institutions involved in natural resource conservation in the country. The study results also showed that the sample of respondents engaged in forest resource exploitation unanimously stated that they were neither involved in the protection of forest reserves nor sensitised on the importance of protecting the forests in the area. These observations are a clear indication that the lack of public awareness and knowledge of issues relating to forestry and forestry laws is a factor militating against natural resource conservation activities in the country (Ntiamoa_Baidu, 1995). These observations also imply that the communities living around the forest reserves have no or little knowledge of the aims, objectives and conservation activities going on in the reserves. Under such situations, it is difficult to expect any support or participation from such people (Ntiamoa_Baidu, 1995).

The last factor which was identified in this research as being an impediment to efforts towards ensuring forest resource sustainable utilisation and conservation in the area is the failure of existing development oriented policies to holistically address the issue of

poverty head-on, particularly in rural areas. The study showed that forest resource is of immense value for the respondents as it was their main source of livelihoods and hence their lifeline. This means that there is an urgent need to look at the social realities that determine the interaction between people and forest resource (Ntiamao_Baidu, 1995). The reasons that prompted respondents in their activities, namely poverty, financial problems and lack of agricultural land are further indicative of the failure of existing development oriented policies to effectively address the multi-faceted issue of poverty. Perman *et al.* (1999) argue that sustainability and irreversibility are important and related issues in thinking about policy in relation to the natural environment. They further argue that, if depletion of a resource stock is irreversible and there is no close substitute for the services that it provides, then clearly the rate at which the resource is depleted has major implications for sustainability. This argument is in line with the suggestions made by the majority of respondents in this study, who recommended that the Government should provide them with alternative income generating activities (53.49%), satisfy their need for agricultural land (15.50%) and help them to develop their own plantations (21.71%) as the way forward for addressing the impacts of their activities on forest resource sustainable use and conservation in the area. In the light of these observations and the study results, it appears that the greatest challenge to forest conservation in the region and the country as a whole is to be able to identify the factors and forces that compel people to exploit and destroy forest resource and evolve a system that integrates forest conservation with people's need. Hence, forest resource conservation cannot be viewed in isolation from the wider development and socio-economic problems of the country (Ntiamao_Baidu, 1995).

CONCLUSION

The study showed that the anthropogenic activities that affect forest resource sustainable use and conservation in the area were predominantly in the form of firewood harvesting, burning of charcoal, medicinal plants harvesting, livestock farming and bushfires. The other human activity which was said to be gaining ground in the area was illegal gold mining in forest areas including the reserves. Poverty, insatiable demand for agricultural land, unsustainable method of exploiting forest resource, weak enforcement of institutional and policy framework within the forestry departments and agencies were the main factors affecting forest resource conservation in the area. Other factors included the lack of public awareness and knowledge of issues relating to forestry and forestry laws, failure of existing development-oriented policies to address the issue of poverty, little coordination between the activities of the various institutions

involved in forest resource conservation in the area. In addition, the lack of a sustainable energy policy and the lack of promotion of intensive livestock production policy in the country were seen to be other contributory factors militating against forest resource conservation in the area.

In the light of these findings the following actions are suggested:

- The intensification of the protection of existing forest reserves in the savanna ecological zone. The management prescriptions and protection measures thereof should also be applied to off-reserve areas in order to ensure the best possible use of forest resource contained therein.
- The establishment of ex-situ savanna plant biodiversity conservation in the form of botanical gardens and seeds conservation centres in the savanna ecological zone should be seriously explored.
- The promotion and adequate subsidization of combustible gas by the government coupled with the development and promotion of environmentally friendly and sustainable sources of energy such as solar energy and wind energy.
- The development and promotion of private plantations in rural communities consisting of firewood trees and orchards.
- The promotion of intensive livestock production policy should be vigorously pursued.
- The provision of adequate human and material resources for the Forestry Commissions so as to promote a better management and protection of forests including the off-reserve areas.
- The promotion of collaboration between the various governmental and nongovernmental institutions involved in forest conservation activities should be strongly encouraged so as to ensure proper coordination of their conservation efforts.
- Arrangements should be made to ensure that regulations regarding illegal exploitation of forest reserves are strictly enforced. For example, the interventions of some traditional chiefs and local government authorities to get some offenders released without prosecution render the enforcement of the law ineffective. This situation further makes the locals of fringe communities less fearful of the law and the institution in charge of enforcing the forestry law, i.e., the Forestry Commissions.
- Communicating with the locals of fringe communities. To that effect, the people who live around the reserves and off-reserve areas should be sensitised on issues relating to forest resource conservation and sustainable utilisation. They should be given a clear explanation of the rationale, aims and activities planned in conservation projects in a way that they can understand (Ntiamao-Baidu, 1995). This approach arguably creates a climate of understanding more conducive to the kind of long-

term community mobilisation “implicit” in the concept “sustainable development” (Blewit, 2008).

- Integrating in conservation projects alternative sources of income generating activities for rural communities when access to forest resource exploitation by the locals is restricted.
- Employing some community members as community Forest Guards (CFGs) as a way of ensuring community participation in forest reserves conservation projects. The employment of CFGs could foster a sense of ownership of forest resources in the area and elicit more commitment than from government-employed forest officers (Attuquayefio and Gyampoh, 2010). The locals could also have more confidence in the CFGs since they will see them as one of their own (Ntiamao-Baidu *et al.*, 2000).
- Government authorities at local and national levels and nongovernmental organisations should evolve effective poverty alleviation schemes and promote the integration of forest resource conservation and rural development.

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