WILDFIRES AS DOMINANT FORCE DRIVING FARMING SYSTEMS IN THE FOREST TRANSITION ZONE OF GHANA

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ABSTRACT

Wildfires have become very influential in the ecology and socio-economic aspects of the rural landscape in the transition zone of Ghana. Eight farming communities around four forest reserves with short fire-return intervals were studied to determine major changes in farming systems that can be attributed to wildfires. Results show that recurrent annual wildfires and other related factors have caused major changes in the farming systems of the study areas. Based on farmer perceptions, significant changes were found in the type of vegetation available for conversion into farms, site productivity, crops grown, labour input, and crop yields. Thick secondary forests with long rotations and high site productivity are no longer available for cultivation. They have been replaced with light grass and Chromolaena odorata fallow with short rotations and low site productivity. Other important changes are a dramatic shift from the growth of perennials (e.g. Cocoa) to annuals (e.g. maize), high labour requirements for land clearance, low crop yields, and a reduced interest in the cultivation of cocoa which used to be the backbone of the local economy. Farmers perceived these changes to be negative factors, implying that bush fires may be undermining agriculture beyond the physical destruction of farms and farm produce.

Keywords: Forest transition zone, farming system, wildfires, change

INTRODUCTION

Fire is viewed by fire ecologists as neither innately destructive nor constructive and is said to cause changes. These changes, depending on their compatibility with one's objective or use of the resources could be desirable or undesirable (National Wildfire Co-coordinating Group, 1989). Fire has been used by humans for more than 1.5 million years (Goldammer, 1991) and its use is common and widespread throughout the tropics (FAO, 1999). In Africa, fire has a dominant role in the domestic setting due to the limited availability of electricity and gas facilities in homes. Fire is also widely used in agriculture for many purposes notable among which is the removal of debris during land preparation. It is viewed as an inseparable feature of the agricultural landscape of most tropical countries, especially in areas where land is abundant, but labour and capital are in short supply (Moreira *et al.,* 2000, Simmon *et al.*, 2004). In Ghana burning is embedded in the cultural values and traditional farming systems of the people (Nsiah-Gyabaah, 1996,) to such an extent that in most communities farming without fire is considered impractical.

In recent times fire has become a major threat to the forest resources and the development of agriculture in Ghana (Nsiah-Gyabaah, 1996). The extent and use of anthropogenic fires have become

prevalent and are considered to be a major threat to forests in Ghana (Kalame *et al.,* 2009). Even though forests in the northern-most parts of the forest zone are known to have a long association with fires, the fires shaped the forest vegetation in terms of structure and species composition but did not eliminate the forest (Hall and Swaine, 1981). However the fire events that have occurred since 1983 following an extended drought triggered by the El Nino-Southern Oscillation (ENSO) event in 1982/83 have had greater impact on forest vegetation and have destroyed many forest reserves (Hawthorne and Abu-Juam, 1995). Similar ENSO event of 1997-1998 that caused wildfires severely damaged 8,000km^2 of forest in Indonesia, 600km^2 in Mexico, and 10,000km^2 of primary forest in Roraima, a state in the Brazilian Amazon (Simmon *et al*., 2004). Presently wildfire is considered the most serious threat to the long-term productivity, genetic wealth and the general health of the semi-deciduous forest in Ghana having significantly altered the composition and structure of more than 30% of the forest (Hawthorne, 1994).

According to Cochrane (2003) burning of even tropical evergreen rainforest alters the forest composition and structure. Fuel build up that result from over harvesting by loggers and saw millers increases fire susceptibility of tropical forest and further aggravates the threat of wildfires (Blate, 2005). Recently, the range of forests damaged by fire has expanded southwards and a number of forest reserves in Ghana which used to have tall, dense and rich tree species diversity have now become grasslands of *Panicum maximum*. Grasses invade burned forests, slow regeneration and increase flammability (Cochrane, 2003). These observations suggest that recent fires may have a similar impact on related land uses especially crop cultivation. The Food and Agriculture Organisation (FAO) assessment during the 1982-1983 dry season in Ghana showed that about 35% (154, 000 metric tonnes) of standing crops and stored cereal were destroyed by bush fire (Ampadu-Agyei, 1988). According to Appiah *et al.*, (2010) forest households loose an average of about US$231 in terms of agriculture and forest produce to fire annually but the impact of fires on agriculture may extend beyond simple stock damage.

According to Amanor (1996) a farming system is a land use decision-making unit consisting of a farm household that produces different crops and livestock for commercial purposes or home consumption according to well-defined practices in response to the physical, biological and socioeconomic environments. In Ghana, the seven vegetation types within the high forest zone, each with their distinct plant associations and corresponding rainfall and soil conditions, are known to influence agricultural practices (Hall and Swaine, 1981; Amanor, 1996).

Over the last two decades since wildfires became a major problem in Ghana, they have affected the physical environment expressed as changes in local climate, soil productivity, vegetation and biodiversity and it stands to reason that fires may have impacted on farming systems as well. Ironically, the way in which fire is used in agriculture affects the fire regimes of the rural landscape and vice versa implying wildfires are likely to drive changes in agriculture. However, there is very little empirical evidence on how wildfires are affecting farming systems in Ghana.

Our objective was to assess the interface between agriculture and wildfires to identify changes in natural capital and other related factors for farming such as vegetation, soil productivity and crop production attributable to wildfires based on farmer perceptions in the forest transition zone in Ghana.

MATERIALS AND METHODS

Study Site, People and Land Use

The survey was conducted in eight randomly selected communities around four forest reserves (Table 1) with history of fires located in the Dry and Moist Semi-Deciduous forest zones of Ghana (Hall and Swaine, 1981). These sites were selected for their relatively short fire-return interval (time between successive fires) and variation in ecology. The forest reserves are Pamu Berekum, Tain Tributaries Block II, Afram Headwaters and Worobong South Forest Reserve (Figure 1).

Table 1: Selected communities and their location

Name of Forest Reserve	District	Community
Pamu-Berekum	Dormaa Ahenkro	Twumkrom, Taforo
Tain Tributaries Block II	Sunyani	Twumasikurom, Amanfoso
Worobong South	Begoro	Feyiase, Ahomahomasu
Afram Headwaters	Offinso	Anyinasu, Asuboi

The Pamu Berekum Forest Reserve lies mostly in the Moist Semi-deciduous Forest North-West subtype (MSNW) with an annual rainfall of between 1,200 – 1,500 mm. The total area is about 189,069-km^2. Reports of forest fires in this forest subtype accounts for 14% of all fire reports in the forest zone with the earliest report dating back to 1937 (Orgle, 1994). This area lies on basement complex rocks, which in most locations have deep, fertile soils.

The surveyed communities; Twumkrom and Taforo communities are located on (Latitude 2^o 49'12"W and longitude 7^o 19' 12"N) and (Latitude 2^o 48'36"W and longitude 7^o 19' 12"N) respectively. These communities are part of communities bordering the Pamu Berekum Forest Reserve. Twumkrom and Taforo have a population of 890 and 509 respectively. Twumkrom was a major cocoa producing area in the 1970s but wildfires destroyed many of the cocoa plantations. Most of the cocoa farmers migrated to the Western Region of Ghana which houses some of the most biodiverse forests in the country. Major food crops cultivated are plantain, maize and cassava with yam and pepper being minor crops.

Tain Tributaries Block II Forest Reserve is located in the Fire-zone subtype of the Dry Semi-deciduous forest type which has a long history of forest fires. The Fire Zone subtype accounts for 31% of reported fires in the forest zone (Orgle, 1994). Prior to the severe drought of 1983, this forest type was occasionally encroached upon by ground fires (Hall and Swaine, 1981) presumably in years of severe drought but since 1983, fires have recurred in years of less severe drought. The incidence and effects of these fires have been quite dramatic, reducing forest productivity substantially. Twumasikrom and Amanfoso located around Tain II Forest Reserve are typical farming communities with population of about 200 people and 170 people, respectively. Major

food crops in cultivation are maize, cassava and plantain.

Afram Headwaters Forest Reserve straddles the Dry Semi-deciduous forest inner and fire zone subtypes (DSIZ-DSFZ). It covers an area of 201 km^2. Trees in this forest display a less deciduous phenology than the DSFZ producing less fire-promoting leaf litter during the dry season. Forestry Department records show that forests of this subtype had a fairly dense understorey of trees until the early 1980s. Seventy-five percent of all reported fire incidences in this forest reserve came from the period 1979 –1992. There was only one report of fire before 1969 (Orgle, 1994).

Asuboi and Anyinasu with populations of 600 and 3,000 respectively are located at the opposite ends of the Afram Headwaters Forest Reserve. Asuboi shares a boundary with the reserve and part of the village has now moved beyond the boundary into the reserve. Both communities were major cocoa producing areas but lost most of their farms during the 1983 wildfires. Most of these cocoa farms have not been replanted for fear of destruction by wildfire.

In Anyinasu, bushfires occur annually, burning most fallow lands and most farmers do not have to re-burn their slash, which is an advantage to them. The annual occurrence of wildfires together with tree stumping practices associated with mechanized cultivation has encouraged the growth of grasses in the area, especially elephant grass (*Panicum maximum)*.

Worobong South Forest Reserve (109.45km^2) is located on the Kwahu Scarp where fire has reduced a large proportion of forest cover to grassland. The Moist Semi-deciduous forest Southeast sub-type (MSSE), where the Worobong South Forest Reserve is located did not experience fire until 1969 (Orgle, 1994). This forest which was originally tall and dense has now become grassland of mainly *Panicum maximum* with a large portion of scattered fire-damaged relict canopy trees. Annual rainfall varies between1500-1800mm. This Subtype accounts for 14% of forest fire reports in the forest zone (Orgle, 1994). Feyiase and Ahomahomasu communities located at the periphery of Worobong South Forest Reserve are within the Begoro district of the Eastern Region of Ghana. The population of these two communities is about 700 and 1000 people respectively. The major crops grown are maize, cassava, plantain, yam, pepper and tomatoes.

Data Collection

A total of fifteen respondents were selected randomly in each community. The target group was farmers who have been in farming for ten years and above. The longest period of farming observed was fifty years. Before the selection of the respondents all households in each community with a farmer who had farmed for ten years and above were identified and numbered with the help of opinion leaders and elders in the community. The grand total of respondents for the four districts was one hundred and twenty (120).

Primary data were collected through interviews, informal discussions and field observations. A pre-tested structured questionnaire was used to interview respondents. The questionnaire focused on issues such as vegetation types that are cleared for farming in the various communities, preferred and actual crops grown by farmers, fire effects on soil fertility and productivity and labour inputs to farming. Informal discussions were also held with opinion leaders and chiefs to gather information on the general farming practices and general socio-economic activities in each community. Direct observations were made on farms to gain a firsthand experience of farming systems in the study areas. Secondary data were collected through desk studies from the district assemblies and Ghana Statistical Services offices for

demographic and environmental information on the fringe communities around each forest reserve.

Data were analysed using the computer software, Statistical Package for Social Sciences (SPSS version 11). This analysis provided the frequencies of the various responses, allowed for the analysis of multiple responses and the cross-tabulation of two variables. Chi Square tests were used to determine whether the differences in changes in farming systems between the period before 1983 and after 1983 were significant. A preliminary analysis showed no clear patterns in changes in farming systems between sites. As a result data for all the four sites were pooled together for the analysis.

RESULTS

Changes in Farming Systems Due to Prevalence of Wildfires

The results focused on five aspects of biophysical and socio-economic change likely to impact on farming systems: 1) vegetation cover type, 2) labour inputs, 3) soil productivity and crop production, 4) fallow management and 5) farm sizes.

Empirical Evidence of Changes in Vegetation Cover Type Cleared for Farms

The study compared the changes in the vegetation on farm lands cleared by farmers during land preparation of the study settlements before and after 1983 (1983-2001). It found that there has been a shift from clearing thick woody vegetation like primary and secondary forest to herbaceous dominated vegetation with majority of respondents (73.9%) clearing a mixture of *Chromolaena odorata* and grass (Table 2).

Changes in Labour Inputs

The estimated man-days involved in clearing an acre (0.4ha) of land and the time required for the cleared slash to dry before burning have significantly changed (Table 3). More respondents held the view that it took fewer man-days to clear an acre of land in the period before 1983 (Table 3).

It was established that whilst before 1983 it took between three to four weeks for the cleared slash to dry well enough for effective burning, it now requires just one to two weeks (Table 4).

Table 2: Vegetation cleared by farmers before 1983 and between 1983 and 2001 in the fire-prone forest belt of Ghana. Total sample size: 119

Vegetation type	Percentage of Respondents		
	Before 1983	1983-2001	X^2Value
Grassland	0.8	10.9	92.0
Chromolaena bush	10.9	11.8	69.6
Mixture of *Chromolaena* and grass	0	73.9	71.6
Primary forest	53.8	2.5	53.0
Secondary forest	34.5	0.8	62.0

Critical value at (d.f.=1) is 6.63. P=0.01

Changes in Type of Crops Cultivated

One major change in the farming system is the choice of crops cultivated by farmers. Farmers have a reduced interest in growing certain crops such as cocoa whilst some crops which were not grown by most farmers in the past notably cassava and maize, are now cultivated by a majority of farmers (Figure 1). Notwithstanding, the influence of the marketplace on farmers choice of crops and the fire-related causes appear to be a strong determinant of what farmers decide to grow (Table 5).

Table 3: Man-days required for clearing an acre (0.4ha) of land in the past and at present in the fire-prone forest belt of Ghana. Total sample size: 117

Estimated man days	Percentage of Respondents Before 1983	After 1983	X^2Values
1-2	81.2	73.5	34.6
3-4	8.5	12.0	72.5
5-6	7.7	6.0	85.5
Over 7	2.6	8.5	91.1

The critical value at significant level 1% (p=0.01) for degrees of freedom (d.f. =1) is 6.63

Table 4: Duration for drying cleared vegetation in eight farming communities in the fire-prone forest belt of Ghana. Total sample population size: 117

Duration for drying cleared vegetation	Percentage of Respondents Past (Before 1983)	Present (After 1983
One week	9.5	31.6
Two weeks	19.0	24.8
Three weeks	12.9	18.8
Four weeks	50.9	23.9
Above 1 month	7.8	0.8

Table 5: Farmers' perception of factors influencing the cultivation of new crops in the fire prone forest belt of Ghana. Total sample population size: 116.

Factors	Percentage of Respondents
High market value	38.7
Ability to re-sprout after fire	12.9
Change in consumption pattern	8.0
Change in vegetation and soil fertility	28.2
Destruction of cocoa by fire	3.7
Short gestation period	5.5
Crops do well in degraded land	3.1

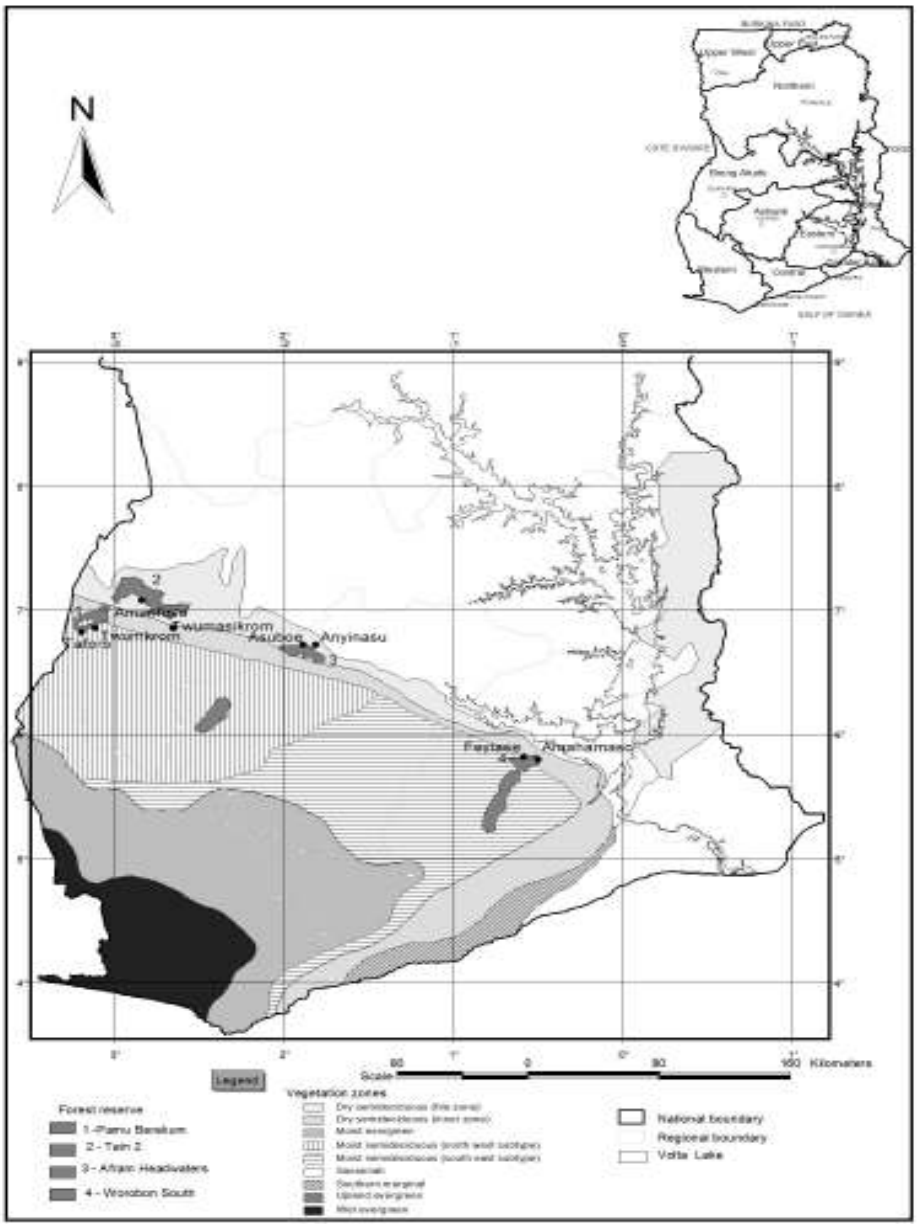

Figure 1: Map of Ghana showing the four forest reserves (Pamu Berekum, Tain Tributaries Block II, Afram Headwaters and Worobong South Forest Reserves) and the surveyed communities.

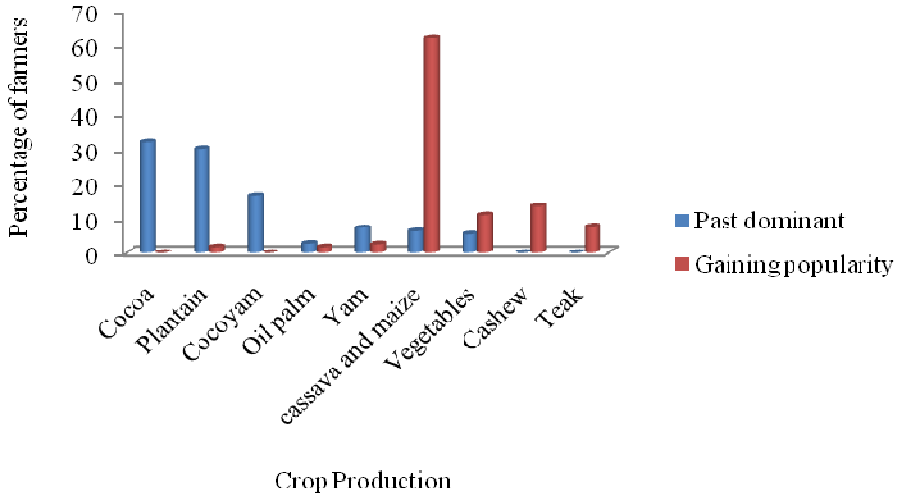

Figure 2: Crop production trend before and after 1983 in the fire prone forest belt of Ghana

Changes in Crop Yield

The incidence of wildfire has directly affected yield of some crops, partly because of the direct influence of fire on vegetation cover, soil fertility, and the indirect effect on labour requirements for land clearance and farm maintenance associated with the change in vegetation. The majority (84.7%) of the respondents indicated a decrease in yield and 15.3% an increase in yield. The major crops whose yields have been affected by fire were plantain, cocoa and cocoyam, while respondents could not give the exact changes in yield, they indicated that in the past plantain for instance could be harvested for a period of about ten years before the crop became unproductive whereas in recent times plantain remains productive for only two to three years.

The factors causing the changes in yield of crops were ranked by respondents and they identified wildfires as the major factor causing the decline in yield in recent times. Wildfire was followed by: the more aggressive growth of *Chromolaena* and grass, changes in rainfall pattern, increased labour inputs and reduced soil fertility.

Changes in Farm Sizes

A comparison of the sizes of farms before and after 1983 shows a decline in the number of large farms and an increase in the number of small farms (Table 6). There were fewer farmers cultivating farm sizes from 1-8 acres in the past (65.5%) than at present (78.4%). However more farmers were cultivating larger farm sizes from, 9-13 acres in the past (34%) than at present (21.5%). According to the farmers these large farms were cocoa plantations that were destroyed in the 1983 fires and other fire events that followed.

Fire Incidence on Farms and Fallow Lands and Impacts on Soil Fertility

The study indicated that about 80% (Table 7) of respondents have experienced fires one to three times on their farms and or fallow lands since fire became a threat in the study area. According to the farmers, the destruction of fallow lands contributed to the reduction of fallow period. This is because once the fallow has been burnt it serves as an incentive for the farmer to cultivate since the cost of labour to plant the burnt farm would have been reduced. Farmers had the perception that continuous (regular) burning has negative impacts on the soils. They cited reduction of soil fertility and microbial activities and invasion of new weeds as some of the reasons for this perception (Table 8). However, some felt continuous (regular) burning has no impact (10.2%) whilst others claimed that it improves soil fertility (2.4%).

Table 6**:** Changes in farm size attributable to bush fires in the fire-prone forest belt of Ghana. Total sample population size: 88

Sizes of farm in acres	Percentage of Respondents	
	Before 1983	After 1983
1-4	44.8	50
5-8	20.7	28.4
9-12	19.5	12.5
13-16	14.9	9.0

Table 7: Incidence of bush fire on farms in eight farming communities in the fire prone forest belt of Ghana since 1983. Total sample population size: 83

No. of incidence of fire on farms and fallow lands	Percentage of respondents
Once	23.0
2 times	31.0
3 times	26.4
4-5 times	8.0
6 times and above	11.5

Table 8: Farmers' knowledge of negative impacts of burning on the soil in the fire-prone forest belt of Ghana: Total sample population size: 120

Impact of burning on soil	Percentage of respondents
Reduction of soil fertility and microbial activities	70.9
Invasion of new weeds	11.0
Reduced yields	4.7
Soil compaction	0.8

DISCUSSION

Invasion of Non Native and Savanna Weed

Significant changes have occurred in the natural capital for farming in the studied area as a result of wildfires and other related factors. According to most farmers (73.9 %), these changes include a vegetation change from secondary forest to grassland and C*hromolaena odorata*. Fires in disturbed and evergreen tropical rain forest ecosystems, can cause remarkable changes in the composition, vegetation structure, and successional pathway of these forests (Kauffman and Uhl, 1991, Cochrane, 2003). The magnitude of the change depends on the severity of the fire, size of the fire, disturbance history, and the fire-return interval of the site and climate (Simmon *et al*., 2004). Farmers's perception that there has been a change in vegetation, which is one of the major natural capitals for farming, is in line with earlier observations that indicated both a 30% change in the structure and composition of semi-deciduous forest (Hawthorne, 1994) and a loss of 50% vegetation cover (Ampadu-Agyei, 1988) following the 1983 wildfires. Generally, a forest fallow has been found to be more efficient than a grass fallow in promoting soil fertility due to the role trees play in soil stability, creation of favourable environment for microbial activities and nutrient cycling (Sanginga, 1992). Consequently a change from a tree dominated environment to one with fewer or no trees will have a negative influence on soil stability and fertility in the long term. In the short term *Chromolaena odorata* fallow may be useful; however there is a problem in terms of increased competition with crops (Slaat, 1995; Honu and Dang, 2000).

Fire Effects on Soil Fertility

A reduction in soil fertility and microbial activities following the recurrent incidence of wildfire or burning over the years, as indicated by a majority (70.9%) of farmers, is supported by research that points out that most micro-organisms are killed and some fare poorly following a wildfire or after burning (Chandler *et al.*, 1983). The reduction in soil fertility resulting from prolonged burning could also be due to the severity of the burning in these areas. This is because almost 100% of the nitrogen found in plant and litter material could be lost at fire temperatures above 500^{o}C (White *et al*., 1973). Ketterings *et al* (2002) report of reduction in the strength with which phosphorus released to soil after a field burn are retained to soil particles over time. In addition rainfall incidence within the first four months after a wildfire may result in a rapid and widespread export of nutrients (Ferreira *et al.,* 2005). Most fires within the transition zone burn uncontrollably due to the low capacity on the part of local fire volunteers to suppress large and/or very intense fires. Changes in soil fertility are also likely to result from shorter fire return intervals on fallow lands which have been the case since 1983.

Fire Effects on Labour Inputs, Farm Size and Crop Yield

Labour in farming is one of the socio-economic issues poor small holder farmers are confronted with. Lower labour requirements make farming less difficult and the farmer may be able to cultivate more area if land is available to him or her. Labour requirements for land clearance have become a problem for most farmers in the study area, especially in areas where the vegetation is dominated by grass. This situation has come as a result of the fact that effective weeding of grass requires a hoe- based technology and more intensive tilling of the grass root structures and seed in the soil (Amanor, 1996). Intensive tillage of the grass root structures is required for the proper growth of crops like maize, cassava and vegetables. The process is time consuming and increases the workload for farmers and accounts

for the present increase in man-days (Table 3) for land clearance.

These research results show that large acreages of land which were in the past permanent plantations of cocoa have been lost mostly to wildfires. Many of these areas have become fragments of small acreage of food crop producing areas. A similar observation was made by Amanor (1994). This may be attributed to a complex interaction of factors namely, old age of farmers, changes in use rights, land fragmentation, wildfires and unfavourable conditions of weather prevailing in these areas contributed by changes in vegetation. In the past small size farms did not pose any problem to food security because the rich virgin soils at the time yielded abundant returns for a minimum physical outlay (La Anyane, 1963). In general, the current increase in food crop production in some farming communities have been achieved primarily through the use of more land, labour and the application of improved seeds and fertiliser (MOFA, 2001).

The increased incidence of bushfire has directly affected the yield of some crops, partly because of the direct influence of fire on vegetation cover, soil fertility, and the indirect effect on labour requirements for land clearance and farm maintenance associated with the change in vegetation. Depressed crop yields recorded by farmers (84.7%) in the face of reduced soil fertility, increased labour inputs and the high cost of farm inputs puts the farming system in crisis especially in the study area and for other farmers located on the edge of the forest zone boundary.

It is important to note that though other factors might have contributed to changes in farming systems, one is able to isolate the influence of fire due to physical evidence and reasons given by farmers as being responsible for crop production trends (Table 5). In addition, the migration of farmers from the surveyed communities and other communities within the transition zone of the Western Region of Ghana for cocoa cultivation is a clear indication of the consequences of vegetation change as well as the direct destruction of cocoa farms by fire. The migration of farmers to the Western Region for cocoa cultivation is in itself a threat to maintaining the biodiversity of forests in the south western part of Ghana (which forms part of the Upper Guinea biodiversity hotspot, one of the world's 25 most important biodiversity hotspots).

Farmer Response to Changes in Vegetation and Soil Degradation

In response to changes in the natural capital for farming (vegetation and soil fertility) and other factors, farmers are shifting from the cultivation of perennial crops (cocoa and plantain) to annual crops such as maize, cassava and vegetables. As a result, maize and cassava have become leading food crops in contrast to the traditional crops of cocoa, plantain and cocoyam that dominated the study area in the past. This observation confirms the results reported by Amanor (1996) that cocoa has ceased to be the dominant crop in the Dry Semi deciduous Forest Zone because of increasing desiccation and bushfires.

The shift to the cultivation of short rotation crops has allowed farmers to stay in business and make income but possibly at the expense of the environment. The growth of annual crops by an increased number of farmers poses a threat to the environment since farming system and fire use practices are closely correlated (Walker, 2000) The need to burn annually to enable the cultivation of annuals such as maize increases the fire risk and poses a challenge to fire management, especially since slash takes a shorter time to dry and influences farmers decision to burn cleared slash before the rains set in. In addition, the intensive cultivation of maize in these areas with no or short fallow intervals facilitates the removal

of trees consequently precipitating land degradation. This change calls for the development of alternatives to the use of fire through on farm research. Frequent annual or bi-annual burning associated with the growth of annual crops eliminates woody vegetation, aids the invasion of grassy species and enhances the spread of wildfires and thus facilitates the process of environmental degradation (Amanor, 1996). Fires prevent woody fallows from re-establishing, thereby reducing the extent to which the fertility of the soil is restored (Wills, 1962) and adversely affecting the sustainability of agriculture. The declining interest in the cultivation of cocoa by farmers due to direct destruction of farms by wildfires and the subsequent change towards a reduced tree environment may reduce the contribution of cocoa to the Gross Domestic Product of the Nation, which stood at 8.1% in 2005/2006 (Breisinger *et al.,* 2007). The need to curb the incidence of fire with its associated effects on the farming system of Ghana is paramount since about 67% of the population of Ghana is rural and depends on agriculture for survival.

CONCLUSIONS

There is empirical evidence from interaction with farmers that there have been significant changes in farming systems driven by fire. A major factor that has affected the farming system is the change in vegetation in the transition zone due to recurrent wildfires. The invasion of exotic weeds and savannah species in the studied area has resulted in increased labour inputs for clearing and weeding, reduced soil fertility and depressed crop yields. There has been a dramatic shift from the growth of perennial crops by farmers to the growth of annual crops which in itself encourages the incidence and spread of wildfires. There appears to be a synergy between the present farming practices and wildfire. The growth of annual crops does not encourage investment in fire prevention and control and since many farmers cultivate maize, the risk of fire incidence is increasing with its subsequent negative effects on farming systems. This development threatens sustainable farming. Fire management training should form an integral part of agricultural policies in Ghana in the absence of viable alternatives to slash and burn.

LIMITATION OF STUDY

One of the limitations of the study is that some of the responses during the interviews depended heavily on the experiences and recollection ability of individual farmers. Especially with responses associated with changes in crop yield. Consequently this aspect of the study has to be replicated in more farming communities in the transition zone before more definite conclusions can be made.

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