

## **Community involvement in watershed management in Ghana**

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### **Abstract**

Ghana had some 8.2 million hectares of moist forest at the beginning of the last century, i.e., the 20<sup>th</sup> century. By 1989, the forest cover had been reduced to less than 2.1 million hectares and currently, only about 1.4 million hectares of the original forest exist. The deforestation is due mainly to increased human activities resulting in unsustainable levels of timber extraction, poor agricultural practices (i.e. shifting cultivation), surface mining, use of fire for illegal hunting and the cutting of trees for fuel wood and charcoal production. The effects of deforestation on the water resources of the country are enormous. Hitherto perennial rivers and streams have become ephemeral because of the seasonal drying up of these water sources as a result of the removal of the vegetation cover of the watersheds. Rainfall amounts in many parts of the country have been observed to be declining while temperatures have been increasing. Since the early 1990s the government has taken a serious view of the devastating effects of deforestation and has put in measures to arrest the situation. This paper looks at some of the corrective measures being implemented by the government. They include controlled timber extraction, ban on the activities of illegal chain-saw operators, afforestation and reforestation of catchments by communities and Non Governmental Organisations (NGOs) and the designation of some watersheds as protected areas.

### **INTRODUCTION**

By the dawn of the twentieth century, Ghana which was until 1957 (year of attainment of independence from Britain) known as the Gold Coast was covered by some 8.2 million hectares of moist tropical forest. This rich tropical forest became the basis for Ghana's cocoa industry which grew gradually and finally earned the country for many years the enviable record of the world's leading exporter of the commodity. The timber industry also had its genesis in the moist tropical forest. Initially the timber extraction was done on small scale as only rich varieties of tropical timber logs were exported to Europe and elsewhere.

The rate of timber extraction and deforestation increased after 1970 due not only to population pressures but also to foreign currency demands from the exportation of timber products. During this period more sawn-mills were set up in the forest basins to add value to the timber products for export. Many companies were also given licences to extract the timber and export the logs. This in many cases was done on non-sustainable basis with the result that by 1989, the forest cover of Ghana had been reduced to less than 2.1 million hectares. Currently, only about 1.4 million hectares of the original forest exist. Ghana has as a result of deforestation been losing on the average about 70 000 hectares of forest annually. The deforestation has resulted mainly from unsustainable levels of timber extraction, poor agricultural practices (i.e. shifting cultivation), surface mining activities, use of fire for illegal hunting and the cutting of trees for fuel wood and char-

coal production. The moist tropical forests are necessary since they act not only as water storage both overland and underground for human consumption, agricultural and industrial activities and for hydropower generation among others, but also play an important role in maintaining at micro level global biodiversity which is so vital for human existence. The impact of deforestation on the water resources of the country are therefore enormous. Rivers and streams which in the past never dried up have of late been experiencing seasonal drying up, rainfall amounts in many parts of the country have been observed to be declining while temperatures have been increasing.

The government has since the early 1990s taken a very serious view of the devastating effects of deforestation with the view to arresting and correcting the situation. The government's response was necessitated by many factors among which are:

- the inability of the government to police the forests;
- population pressures;
- pressure from International Organizations;
- genuine concerns of the bodies set up to protect the forest; and
- results from research and other sources show that the people are concerned and are reacting to negative and positive impacts.

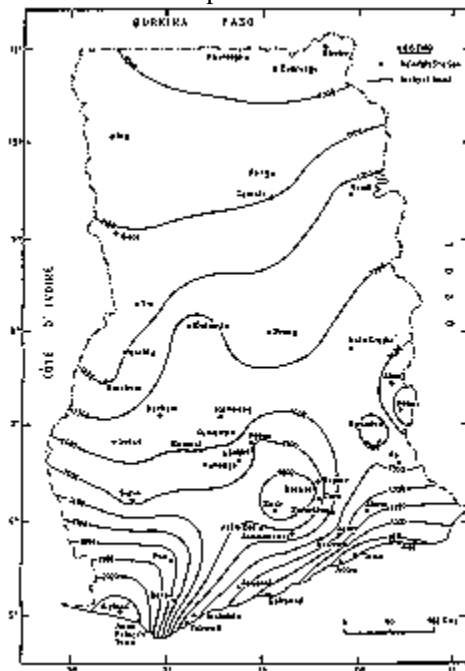
The corrective measures which are being implemented by the government form the basis of this paper. These measures include controlled timber extraction, ban on the activities of illegal chain-saw operators, afforestation and reafforestation of river catchments by communities and NGOs and the designation of some watersheds as protected areas.

## **CLIMATE**

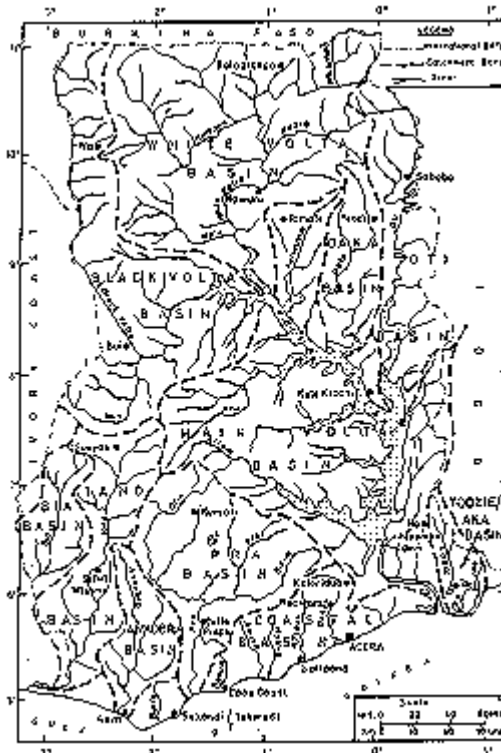
The climate of Ghana is influenced by three air masses namely, the South-West Monsoon, the North-East Trade Winds (Tropical Continental Air Mass) and the Equatorial Easterly. The warm but moist South-West Monsoon which originate from the Atlantic Ocean and the warm, dry and dusty Tropical Continental Air Mass (Harmattan) from the Sahara Desert approach the tropics from opposite sides of the equator and flow towards each other into a low pressure belt known as the Inter Tropical Convergence Zone (ITCZ) (Ojo, 1970). The slow and irregular north-south oscillations of the ITCZ gives rise to the regime of wet and dry seasons. The northern sections experience single rainfall regime in a year from April/May to October with a peak in September. However, more than half of the total annual rainfall is recorded in just four months (June to September). During the dry season (November to March) there is very little or no rainfall at all. The wet season in southern sections of Ghana is characterized by two main rainfall regimes, i.e. double maxima. The first rainy season occurs from March/April to mid-July with a peak in June, and the second from September to November with a peak in September/October. The months December through February can be considered dry.

The extreme south-western portion of Ghana is the wettest part of the country and receives more than 2000 mm of rainfall a year (Figure 1). Rainfall generally decreases towards the north and the south-eastern sections of the country. The driest part of the coun-

try is found in the south-east coastland plains where the mean annual rainfall is about 800 mm. Figure 2 shows the river basins of Ghana and in response to the rainfall pattern of the country, the South-Western Rivers System (Pra, Ankobra, Tano and Bia) are endowed with more perennial streams than the north and south-east.



**Figure 1. Mean Annual Rainfall, 1961-1990 (Values in Millimetres) (After Mote, 1998).**



**Figure 2. Map of Ghana showing Main River Basins.**

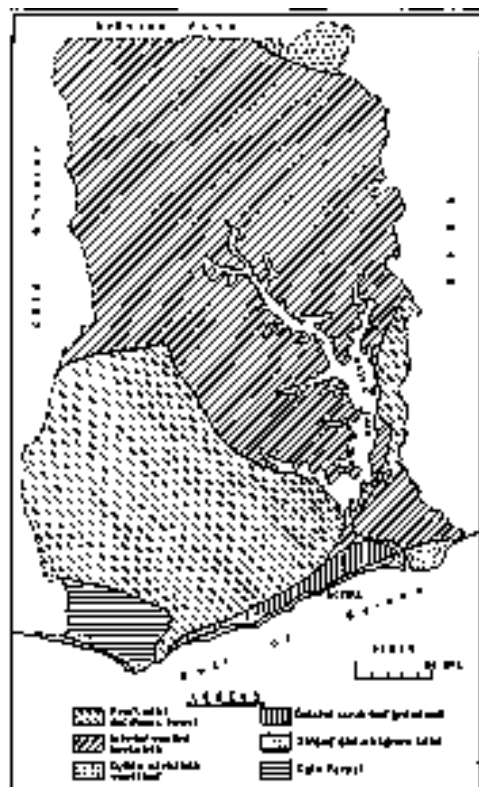
Mean monthly temperature over the country never falls below about 25°C and open water (pan) evaporation is generally high ranging from about 1200 mm per year in the south-west to more than 2600 mm in the north. Relative humidities are high along the coast, generally between 95% and 100% during the night and early morning. In the north they can be as low as between 20% and 30% or less when the area comes under the influence of the dry Tropical Continental Air Mass (Harmattan).

## VEGETATION

The vegetation of Ghana as it is the case throughout the world is determined by three main factors, namely, the climate, soil and human activities. The climate is the most important factor as it determines the major natural vegetation formations like wet or dry forest. The soils sometimes account for the principal modifications within the vegetation formations. Over the centuries, human activities such as the felling of trees, the clearing of land for farming, seasonal burning of grass and the grazing of livestock have caused great changes in the structure and composition of the original vegetation.

Figure 3 shows the various vegetation types of Ghana. These vegetation types are the rain forest, moist-semi deciduous forest, strand and mangrove zone, coastal scrub and grassland, interior wooded savannah and the Sudan wooded savannah. The rain forest lies in the south-western equatorial climate region where rainfall is heavy with an annual amount of more than 1900 mm. The moist semi-deciduous forest which contains most of the country's valuable timber trees lies in the wet semi-equatorial climatic region where the annual rainfall is between 1250 mm and 1750 mm.

The mangrove forests are found along the coastal lagoons where the soil is waterlogged and salty. The coastal scrub and grassland occur in the dry equatorial climatic zone and is the driest region of Ghana with an annual rainfall of between 740 mm and 890 mm. The interior wooded savannah occupies a greater part of the country while the Sudan wooded savannah is found in the extreme north east. These two vegetations fall between annual rainfalls of 900 mm and 1250 mm.



**Figure 3. Vegetation Types of Ghana (After Dickson *et al*, 1970).**

### **EFFECTS OF DEFORESTATION ON RAINFALL AND SURFACE WATER RUNOFF**

The effects of deforestation on rainfall and surface water runoff in two forest catchments in the south-western region of Ghana have been undertaken by Gyau-Boakye and Tum-

bulto (1998). The study was based on the observation that the rainfall regime in West Africa changed drastically after 1970. Earlier studies which confirmed this observation revealed that there has been a clear rainfall deficit trend since the 1970s in both the forest and savannah zones of West Africa (Aka *et al*, 1996; Paturel *et al*, 1997; Opoku-Ankomah *et al*, 1998). The study was based on the river Pra and Tano catchments which belong to the South-Western Rivers System. Runoff analyses were made at two discharge measuring stations of Twifo Praso (catchment area of 20 783 km<sup>2</sup>) on the Pra river and Sefwi Wiawso (catchment area of 8442 km<sup>2</sup> on the Tano River) (Figure 2). Daily discharges were available from 1951 to 1991 for Twifo Praso in the Pra basin and from 1957 to 1991 for Sefwi Wiawso in the Tano basin. Two synoptic stations of Kumasi and Sekondi/Takoradi within the South-Western Rivers System were selected for the study. Monthly rainfall totals from 1950 to 1991 for the two synoptic stations were used in the study.

The data was divided into two distinct periods, i.e. 1951-1970 and 1971-1991 on the basis of the work cited above (Aka *et al*, 1996; Paturel *et al*, 1997; Opoku-Ankomah *et al*, 1998). The study indicated that there are reductions in the mean annual discharges during the second period (1971-1991) of 43.7% and 44.1% respectively at Twifo Praso and Sefwi Wiawso. During the same period, there were reductions in the mean annual rainfall of 19.3% and 20.6% respectively for Kumasi and Sekondi/Takoradi. These reductions were found to be significant at the 95% level of confidence.

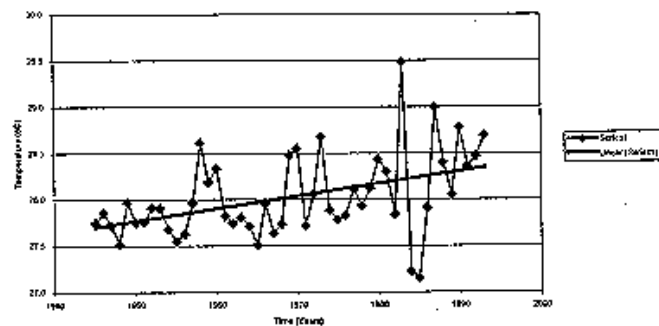
Similar studies were undertaken in the savannah zone of the country which is close to the sahel on the White Volta and Oti, both tributaries of River Volta (Gyau-Boakye *et al*, 2000). Nawuni, a discharge measuring station with a catchment area of about 96 957 km<sup>2</sup> was selected on the White Volta while Saboba (with a catchment area of about 54 890 km<sup>2</sup>) was selected on the Oti river (Figure 2). Monthly rainfall totals were obtained for the synoptic stations of Tamale, Yendi, Navrongo and Wa (Figure 1). The results showed that there were reductions in the mean annual runoff for the second period (1971-1991) of 23.1% and 32.5% respectively for Nawuni (White Volta) and Saboba (Oti). These reductions were significant at the 95% level of confidence. During this same period there were reductions in the mean annual rainfall of 1.5% at Tamale, 2.3% at Yendi, 7.2% at Navrongo and 11.3% at Wa. These reductions were significant at the 95% level of confidence only for Wa.

The reduction in rainfall which is a primary factor in the reduction of runoff could result from basically two sources. Firstly, this could result from local events or activities which severely degrade the environment. Secondary, it could result from global natural events like the climate variability in West Africa which has been linked to the Sahelian drought further north of West Africa. If the reductions in rainfall in Ghana were caused mainly by global natural events (i.e. linked to the Sahelian drought) then it is reasonable to assume that there should be much higher reductions towards the north, which is closer to the Sahel zone or at least similar reductions throughout the country. This is not so as shown by the reduction figures given above. The stations in the savannah located further north, on the contrary, showed lower rainfall reductions than the humid south-west. Even though both the humid and savannah zones of West Africa have been affected by the Sahelian drought of the 1970s and 1980s, the effect was not evenly spread (Servat *et al*, 1997;

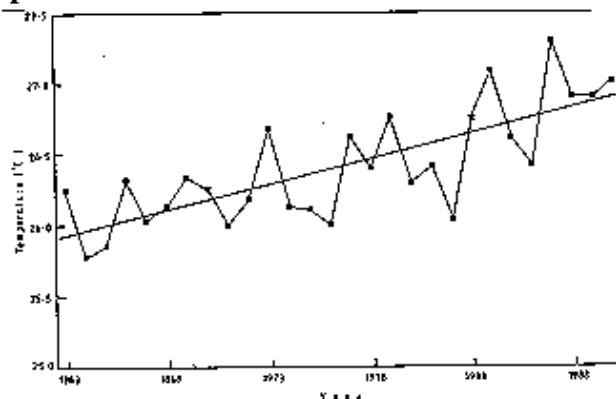
Paturel et al, 1997). Ghana was one of the least affected (Paturel et al, 1997). These observations led Gyau-Boakye and Tumbulto (1998) to conclude that the rainfall reductions in the south-west of the country is due mainly to local activities (i.e. deforestation, etc.) rather than the global climatic change linked to the Sahelian drought.

## EFFECTS OF RISING TEMPERATURES ON SURFACE WATER RESOURCES

The historical trend of temperatures for the forest zones and the savannah regions of Ghana have been studied. The plot of mean monthly temperature of the synoptic station of Tamale in the savannah region from 1945 to 1993 shows nearly a 1oC rise in temperature (Figure 4). A similar rise in temperature was observed in the South-Western Rivers System (Figure 5). The rise in temperature means that the capacity of the air for water vapour increases by about 5 or 6% per degree celsius (Rosenberg et al, 1990). There is therefore a corresponding increase in evaporation for this rise in temperature. This is particularly disturbing for most of the river systems in the savannah zone which feed the Volta river and consequently the Volta Lake. There is not enough vegetation to break the winds hence the rivers and particularly the Volta Lake (surface area of about 8500 km<sup>2</sup>) are subject to intense evaporation from the rising temperatures.



**Figure 4. Temperature Trend at Tamale in the Savannah Zone.**



**Figure 5. Temperature Trend in the Pra Basin within the South-Western Rivers System.**

## **WATERSHED MANAGEMENT IN GHANA**

Watershed management aims basically at maintaining certain density of vegetation cover with the view to achieving specific results, which in this case is the protection of water bodies. It is therefore essential to control the degradation of the environment, rehabilitate the forests where necessary, and to exploit timber from the remaining forests on a sustainable basis. This will then protect the watersheds, particularly the headwaters, and prevent the water bodies from drying up. The government has acted appropriately to achieve these objectives through the following measures:

### **Controlled timber extraction**

Since the early 1990s the Forestry Department has instituted what has become known as controlled timber extraction. What this means is that timber firms are allocated concessions of land to exploit. However, unlike the previous practice, the Forestry Department delineates a plot of the concession which can be exploited each year. The activities of the timber firms are now limited to a piece of land which is demarcated at the beginning of each year. Also at the beginning of each year the Forestry Department supplies the timber firms with fast growing and high yielding timber seedlings for reforestation of the already exploited pieces of the concession. Some of these reforestation programmes are supported by donor agencies and NGOs. The idea is to make timber extraction quite sustainable. At the end of the concession after several years it is hoped that the timber firms can start all over the same process.

All activities of chain-saw operators who do not have concessions but operate illegally in the forests especially during the night are now banned and the ban is enforced with the communities acting as watchdogs.

### **Afforestation and reforestation**

Most of the afforestation and reforestation programmes are targeted at the affected communities. The Forestry Department in conjunction with the District Assemblies demarcate areas within a district which need afforestation or reforestation. To ensure the success of the programme, seedlings are distributed free of charge to farmers and communities in addition to free technical advice. Some of the farmers are into agro-forestry while others especially those in the northern part of the country or the savannah regions are taught to grow the seedlings on a sustainable basis for fuel wood. These programmes are supported by either the government, donor agencies or NGOs. Currently there is a Swiss Lumber Company which has invested in the promotion, development and sustenance of agro-forestry in the South-Western Rivers System (Western Region). The Japanese International Cooperation Agency (JICA) is also assisting 6 communities in the moist semi deciduous forest in the Brong-Ahafo Region in the area of reforestation.

Mining companies are now obliged to undertake Environmental Impact Assessment (EIA) of their activities before the commencement of mining. The companies are obliged by law to restore the environment through afforestation to its original state at the end of their operations.

### **Designation of some watersheds as protected areas**

Community participation in watershed management traditionally dates back several years. Certain indigenous customary laws and regulations aimed at the proper use or conservation of the resources of watersheds have been in force for ages. These customs usually overseen by fetish priests and the traditional rulers have been respected by the communities. Some of these include protected grove yards on the headwaters of rivers and streams, the ban on entry into streams or water bodies at certain times of the week and for certain periods and the regulation concerning the washing, bathing and blocking of streams, etc. Another custom that has been employed in farming practices in the old traditions are the clearing and use of the low lands for farming leaving the hills protected by forest vegetation to ensure the water sources are protected. It is therefore apparent that in the past most headwaters of watersheds were no-go-areas for the inhabitants since through a combination of taboos and myths people were terrified to go to these areas let alone to farm there. With the introduction of education and foreign religion by the colonialists, cultural mixing, most of the taboos fell apart and the myths were broken. The result was the indiscriminate degradation of watersheds including headwaters. This has resulted in exposing some streams and rivers to the full force of the weather causing seasonal drying up of these sources. Some of these rivers serve as intake for water supply systems to some important urban communities, i.e. the Densu river serves both Koforidua and Nsawam; the Kakum serves Cape Coast and the Daka serves Yendi (Figure 2).

To protect some of these important rivers, the government has designated some headwaters and some parts of the watersheds as protected areas. Some of the protected areas have been established as 'forest reserves'. All human activities in these areas including mining are banned and the communities are supplied free seedlings and technical advice to undertake afforestation and reforestation programmes.

### **Education and legislation**

People and communities are gradually being made aware of the importance of the forest in the socio-economic development of the country. People and communities are being educated to exploit the timber on sustainable basis by planting seedlings annually during the wet season. They are also taught not to farm at headwaters or in certain parts of watersheds to protect rivers and promote biodiversity. People and communities are advised against farming on steep slopes not to expose these stretches of land to excessive erosion and degradation. Communities, including school children are educated on the importance of tree planting and are encouraged and led by government functionaries, annually, to plant trees. The education highlights on communal labour. To contain the problem of bush fires which is particularly acute in the savannah areas, rural communities are encouraged to form anti-bush fire volunteer corps. This group is trained on how to combat and contain small scale bush fires. Farmers are advised to seek clearance from the anti-bush fire volunteer corps before burning their plots of land for farming. Awards have also been instituted in the rural communities which are won annually by communities with the least or no destruction to the environment resulting from bush fires.

Bold, efficient and effective ways of managing the country's watersheds have been instituted by the government. These alone are not enough. What the government needs to do is to make sure these measures or regulations are strictly enforced. This is because Ghana



has in the past instituted some good laws and measures but these have not materialized due to lack of a good enforcing mechanism.

## CONCLUSION

Ghana has seen a lot of deforestation since the beginning of the twentieth century. Ghana saw her moist tropical forest dwindle from 8.2 million hectares at the dawn of the last century to 2.1 million hectares in 1989. The causes of the deforestation have been ascribed to increased human activities resulting in unsustainable levels of timber extraction, poor agricultural practices (i.e. shifting cultivation), surface mining activities, use of bush fire for illegal hunting and cutting of trees for fuel wood and charcoal production.

The effects of deforestation on rainfall and surface water resources and the rising temperatures on the surface waters have been discussed. These effects have had devastating impacts on the socio-economic development of the country particularly in areas of urban water supply. To arrest the situation the government has since the early 1990s instituted certain measures. These include controlled timber extraction, ban on the activities of illegal chain-saw operators, afforestation and reafforestation of watersheds by communities and NGOs and the designation of some watersheds as protected areas. These measures, laudable as they are, cannot in themselves make any significant impact unless the government makes sure that they are strictly enforced.

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