DEFORESTATION IN A GHANAIAN RURAL COMMUNITY

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Abstract: The case study examines the processes of deforestation in a Ghanaian rural community. The paper discusses the interrelated socio-economic, political, ecological and historical factors that account for the problem of deforestation. It is argued that knowledge of such micro-level processes of tree cutting in rural communities today may perhaps help provide some understanding or insights into the problem of deforestation and guide the search for its general solutions.

Résumé: Cette étude de cas examine le processus de déboisement dans une communauté rurale du Ghana. Elle discute les facteurs socio-économiques, politiques, écologiques et historiques—ainsi que leurs interactions—qui expliquent le problème de déboisement.

Introduction

The importance of the tropical rainforests cannot be overemphasized. They turn carbon dioxide (a greenhouse gas) back into oxygen, thereby cooling the atmosphere. They prevent flooding by supplying enough plant life to soak up heavy rain, and the roots of forest trees hold the soil in one spot. Forest plants are also invaluable for their medicinal and pharmacological uses (Burley and Styles 1976; Longman 1974). Consequently, deforestation has become one of the major environmental problems confronting humankind today (Caufield 1986; Adams and Solomon 1985).

A disproportional amount of the blame for deforestation has been heaped on the poor rural farmers of developing countries. But it is important to stress that deforestation is rooted in interrelated socio-economic, political and historical developments with both external and internal linkages that began with colonialism and the development of cash crop export economies in most developing countries (Ellis 1987). To the extent that many traditional communities in Africa, Asia and Latin America managed their forests well before the advent of colonialists, one can safely argue that the wanton de-

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struction of the forest is a relatively modern phenomenon (Brokensha et al. 1980). In Australia, the forest survived the Aborigines. It is in the last two hundred years that white settlers have cleared two-thirds of *native* forests. In India and in most of East and West Africa, local people conserved their trees over generations until the British started exploiting them for commercial purposes.[1]

The introduction of cash cropping on a massive scale in colonial West Africa, and particularly in the modern Sahel, resulted in the gradual degradation of the forest environment (Franke and Chasin 1980; Grainger 1982; Timberlake 1985). These external forces are still at work today, this time through the activities of largely multinational corporations. The situation has been worsened by the corruption and incompetence of some state governments of the developing world. National development policy goals fail to protect the poor and their environments from any undue *external* encroachments. The current trends in deforestation can partly be attributed to the expansion of industry geared to exports as developing nations boost their resource industries such as logging and mining. As industrial development and projects proceed, the need for more dams to supply power also increases.

In South and Central America, people are turning the forests into pasture on a large scale to supply a major export market for beef (Maguire and Brown 1986; Sinclair 1986). This large-scale, capital-intensive agriculture for the production of cash (export) crops, dominated by multinational corporations and governments, has been a fundamental cause of the destruction of the Amazon forest. The motivations for forest exploitation are the production of beef cattle, hardwood and pulp for export, as well as the construction of large-scale hydro-electric dams for power supply, as in Brazil. The creation of the dams has resulted in the total flooding of thousands of acres of former forest land.[2] A serious problem associated with the clearing and flooding of the forest (as a policy of national economic development) for the poor rural farmers is soil erosion. The use of heavy technology strips the land of its ability to nourish other plants and the local soils are left open to serious erosion.[3] As the debt crisis worsens for these countries, governments continue to use all available national assets, including forest resources. Unfortunately, the hard-earned foreign currency is barely enough to service the interest on these debts and to pay for the overpriced manufactured products that they must import from the industrialized countries.

A similar situation exists in parts of Africa. It has been estimated that the continent loses about 2.7 million hectares of forest every year (Timberlake 1985; FAO 1967). Since the 1950s, the Sahel has lost nearly 50 percent of its forests. Among the major reasons for tree cutting in the Sudan-Sahel region are the logging of timber for export, clearing the land for agricultural

purposes, grazing land for livestock, and the provision of fuelwood and other basic household necessities. Nearly 90 percent of the Sahelian population utilizes wood as fuel to satisfy energy requirements and for cooking purposes (Timberlake 1985; Weber 1981; Foley et al. 1984). Other basic household uses for forest trees include constructing house poles, handles for hoes, ploughs and fibre for ropes. Given the differing cultures and micro-ecological variations in the forest regions of the developing world, perhaps micro-level examinations of the processes and the mechanisms involved in tree cutting may help to guide any general and concerted efforts at finding solutions to the problem of deforestation.

The Study Community

This case study was conducted as part of a major research project in Ghana, during which the author examined the adaptive responses of the people of Ayirebi to seasonal food supply cycles, as well as to the general crisis in the national economy in the 1980s. Ayirebi is a food farming community of about 5805 people[4] who are predominantly Twi-speaking belonging to the matrilineal Akan sub-group known as the Akyem. It is located in southeastern Ghana, about 45 km from the nearest urban centre, Akyem Oda, and nearly 180 km north of the Ghanaian capital, Accra. The town covers an area of approximately one and three-quarter square kilometres. The community lacks electricity and a piped water supply. The common source of fuel and power is firewood in addition to kerosene that is used for lamps and lanterns. The water supply comes from local streams, wells and rainfall. The Ayirebi district is basically a moist, semi-deciduous forest zone consisting of moderately-grouped lofty trees (about 60 m in average height) with a matted undergrowth (Manoukian 1964; Hall and Swaine 1981). Within this forest region, trees occupy either the lower or the upper storey. Those in the lower storey are usually evergreen, while the taller members of the same species in the higher storey may be deciduous. The latter group of trees exhibit their deciduous characteristics during the long dry season from November to March. Scholars have commented on the sheer mass or variety of the vegetal and animal resources available in this forest region (Irvine 1961; Wills 1962). It is important to point out, however, that such prolonged human activities as felling trees for timber, clearing land and burning trees for agricultural purposes, and the introduction of new plants have caused great changes in the structure and composition of the climate-climax vegetation of the region. The result is that less than 30 percent of the primary forest remains, and most of what is left is actually secondary forest. This secondary vegetation consists of climbers, shrubs and soft woody plants. The areas of true forest are to be found in the forest reserves where cultiva-

tion and indiscriminate extraction of timber are forbidden by the national government (Boateng 1959).

The two major soil types in the Ayirebi district are forest ochrosols and forest oxysols (Ahn 1970). Forest ochrosols are predominant and have developed from highly-weathered parent materials under reduced amounts of rainfall. Unlike the forest oxysols which are highly leached, yellowish, very acidic and nutrient-poor, the forest ochrosols are less leached, reddish, slightly acid to neutral and better supplied with nutrients (Hall and Swaine 1981). Generally, these local soils are light and sandy, and thus easily cultivated. However, they are poor and rapidly lose their rich organic matter (leaves, animal matter) and are liable to damage by rains unless they are efficiently manured, cultivated, drained, and mulched.

Nearly 90 percent of the town's adult population depend directly on farming for their livelihood, producing both subsistence and cash crops. As food farmers, they produce such staple crops as plantains, manioc, maize, cocoyams, rice, and green leafy vegetables (tomatoes, pepper, okra, onions, garden eggs or eggplant), as well as citrus fruits and tree crops such as cocoa, kola nut and oil palm. Unlike other food crops, the production of vegetables has been on a much smaller scale, intended for household and local consumption. Other economic activities engaged in by the people include hunting and gathering of wild forest resources, raising of livestock, and the production of arts and crafts. The traditional subsistence economy is articulated with the national market economy through the sale of food crops and wage labour in the major Ghanaian urban centres of Akyem Oda, Akyem Swedru, Koforidua and Accra, as well as through the production of cash crops (kola nuts, oil palm and cocoa).

There are four major identifiable climatological and ecological periods in this community (Dei in press). There is a main dry season between January and March when the farming season begins with preparation of the farm fields (i.e., cutting trees, burning and tilling of farm land). The mean monthly rainfall during this time is less than 100 mm. It is followed by the main rainy season from April to June when farming activities continue with the sowing of seeds and crop planting. The heaviest rains fall in June. The period between July and September marks the pre-harvest, lean season devoted to weeding farm fields and attending to crops. There are two brief intermediate climatic seasons during this period. July and August bring low rainfall and moderate dry conditions, while September and October mark the beginning of the second rains. The main harvest season, October to December, witnesses the beginning of the dry conditions that continue and intensify through March. The intense dry period is locally referred to as the *harmattan*[5] period. Until the late 1970s (Dei 1988) annual rainfall in Ayirebi averaged over 1650 mm.[6] The most characteristic feature about the

climate of this region (as in Ghana generally) is humidity. The average relative humidity for the Ayirebi zone is between 85 and 90 percent. Temperature variation is slight. The mean monthly maximum temperature in the hottest months (February-March) ranges from thirty-one to thirty-three degrees Celsius, while the mean monthly minimum in the coldest months (December-January and August) ranges from nineteen to twenty-two degrees Celsius (Hall and Swaine 1981).

With regard to the traditional structures of food production, ideally the individual household, made up of a man, wife, children, and one or two members of a spouse's kinfolk, constitute the basic production unit. This group could form either the sole production unit occupying a house or compound, or part of a large group occupying a compound. In the latter instance, the compound would be subdivided into a number of separate (and independent) production units. It was also possible for a large group, organized around a segment of the matrilineage (an elder woman and her sister or daughters; or a man and his sister's children), to be the sole production unit within the compound or dwelling (Dei 1986; Hill 1975).

Members of the household share farming activities, working together on the farmland acquired either through the matrilineage and/or the custodian of the stool (i.e., village chief or sub-chief) or through the individual's personal effort (i.e., outright purchase) (Dei 1987). During periods of major economic importance (e.g., preparation of the land for farming, or harvesting of farm produce) when agricultural work intensifies, households may request the assistance of available extended family labour. Other "external" sources of labour available to the household production unit include seasonal migrants from the northern parts of the country and casual wage labour provided by the town youth. There is also the formation of such partnerships as *nnoboa*, collective self-help groups of age-mates helping each other in farming activities (Arhin 1983). The adult males perform the task of clearing the forest and preparing the land for farming. Women, the young and the elderly in the households do the planting and harvesting of crops, occasionally receiving some assistance from the adult males. The principal methods of farming are shifting cultivation on bush farms, and intensive cultivation in the gardens and farm plots closer to the homesteads.

Contemporary Adaptation and the Forest Vegetation

Farming activities in Ayirebi are largely devoted to the production of food crops for household consumption as well as the local market and the wider Ghanaian market. Historically, the cultivation of non-food cash crops such as cocoa has been relatively unsuccessful in the community. Among the factors accounting for this development are ecological problems (drought,

bushfires, soil erosion), diseases (such as swollen shoot), the problem of agricultural labour, and the failure of successive Ghanaian governments to provide adequate incentives to cocoa farmers (Senyah 1984). Moreover, because of the declining revenues of Ghanaian cocoa farmers, individual attempts have been made by the few cocoa producers of Ayirebi to devote the land to the cultivation of foodstuffs for both domestic and commercial purposes (Atsu 1984).[7] Cocoa production in the past was a major reason for extensive tree cutting in the forest zones of southern Ghana.

Ayirebi farmers, using a wide variety of farm methods and other food procurement systems, have successfully adapted to short and long term environmental problems as well as socio-economic forces in southeastern Ghana (Dei 1988, 1990). The resourcefulness and creativity of the farmers is worth emphasizing (Gadgil 1985, 1987). Cultural appraisal of natural resources (i.e., the ethno-ecological or practical knowledge of soils, topography, climate) has allowed the farmers to overcome the difficulties posed by the environment (e.g., humidity, poor soils, weeds, lack of rainfall, pests) on the one hand and to exploit the fullest potential of the environment on the other (Richards 1985; Brokensha et al. 1980; Osunade 1988). Farming methods are well adapted to the social and geographical environments in the region. The farmers do, however, have special problems to contend with relating to soil fertility. Specifically, these include the presence of light soils, relatively low in plant nutrients, that quickly lose their fertility through leaching and rapid oxidation, and the fact that torrential rains tend to carry essential minerals down to the subsoil, out of reach of the growing plants. The two basic elements in the local farming system, the protection of the ground surface and a long fallow period (and to some extent the use of manures), have been designed to deal with these problems (Jones 1961; Brokensha et al. 1980; Glaeser 1984; Richards 1986).

The partial clearing of the natural cover on proposed plots, whereby some forest trees are left standing, serves to provide shade and protection to the soil and to assist re-forestation. As farm plots in the community generally tend to be small and isolated fields, they are easily recaptured by natural vegetation. Farming is characterized by mixed and sequential cropping (Ruthenberg 1980; Dei 1990a). The goal is to maintain constant vegetative cover over the soil so as to reduce the damage of rain and sun. Also by allowing for a long fallow period, the bush is helped to produce its own fertilizer in the form of dead leaves, grass, plant roots, branches and other organic material which decompose (decay) in and on the soil. These materials increase the soil's organic matter, which in turn has a net effect on soil fertility.

Under the traditional system of bush fallow, a plot of land is cropped for at most two years and then allowed to return to bush for a period ranging

from three to ten years (depending on the amount of farmland available to the farmer), after which it is cultivated again. Since the early 1960s the growing subsistence needs of an increasing population, and the requirements of external markets have called for the gradual expansion of the local food economy. With regard to spatial organization of land use, Ayirebi farmers are moving from the lands of permanent cultivation and intensive fallow systems into the fields of bush and extensive shifting cultivation. When idle or virgin lands are not put into cultivation, fallow periods are being shortened. As the length of the fallow period becomes insufficient for the forest vegetation to regenerate itself, local farmers have had to rely on constant manuring to sustain the fertility of their fields of permanent tillage or intensive cultivation. On such fields, certain local farmers are now attempting to replace the nutrients removed by cultivated plants by incorporating crop residues into the soil, using manure, fertilizer, and compost of animal and occasionally human excreta or refuse.

An equally important feature of the farming system, and particularly of bush fallow, is the use of fire for clearing vegetation. Among the criticisms of bush burning is that nitrogen and sulphur in the fallow litter are lost in the burning process, and that the practice builds up fire-tolerant, low-productive species and causes soil erosion (Wilde 1966). Burning also exposes the soil to the detrimental effects of the sun and torrential rains until the first crop forms an effective protective cover. After the burning, the farm plot is still uneven, with tree stumps, roots and termite mounds. As the farmers till the land, they disturb, loosen and move small amounts of surface soil before the actual seed planting takes place (Spencer 1966). They also clear any unwanted tree stumps or other weeds that may appear to cause unnecessary harm to a germinating food plant. The danger of soil erosion can be profound when the soil structure is greatly disturbed by either the use of plough or the extensive uprooting of tree stumps.

Most of the cultivated food crops are annuals, and farm plots have to be prepared afresh every year using the traditional farm implements of *sekan* (machete), *aso* (hoe), *abonua* (steel axe), *akuma* (pick-axe or mattock) and *soso* (digging stick or long blade) to cut the forest and/or clear the vegetation. Traditionally, most of these implements have been obtained from local blacksmiths known as *tumfuo* (Ahrin 1983). A survey of food farm plots owned by sampled Ayirebi populations showed an average farming household to have between two and three separate farms. The study also showed household differentiation in the size of farm plots. For example, of the total of 412 research sample households, representing one-quarter of all Ayirebi households in 1982-83, 124 (i.e., 30%) households each had between 0-3 hectares of food farm plots; 140 households (i.e., 34%) had 3-6 hectares; 86 households (i.e., 20.9%) had 6-9 hectares; 41 households (i.e., 10%) had

9-12 hectares; and 21 households (i.e., 5.1%) had over 12 hectares (Dei 1987).[8] Apart from individual household farm plots, the research period witnessed the establishment of a number of communal and co-operative farms. This was one of the local measures to combat the effects of the drought and bush fires on the local food economy (see Dei 1988). Much of the forest vegetation had to be cleared for these relatively large-sized farms with an average size of about 3 hectares. In one study of the communal rice farm plot cultivated by the women in one section of the community (Zongo ward), at least 12 large and tall trees had to be cut using a bulldozer and a chain-saw rented from a private co-operative firm in Akyem Oda.

There is a gradual encroachment on the small amount of virgin forest left in the Ayirebi-Akyem Oda district. The encroachment cannot, however, be attributed solely to agricultural purposes. The noted trend towards deforestation in the recent decade has become an important issue of concern for the local leadership. In March 1982, the Ayirebi chief instructed the Town Development Committee (TDC) and the Committee for the Defence of the Revolution (CDR) to keep track of major tree-cutting activities in the community.[9] Other factors accounting for tree cutting in Ayirebi include logging for timber, cutting trees for firewood both to satisfy basic household requirements including arts and crafts, and for construction of a road. The latter is a project initiated by the Ghanaian government in the late 1970s and now under joint management with a major private road construction firm. It is aimed at transforming the existing dirt road into a bituminized trunk road linking Akyem Oda, Ayirebi and Nkawkaw, another major urban centre.

Table 1 presents data regarding tree-cutting in Ayirebi between September 1982 and August 1983. Corresponding data for the fall of 1989 show that in September, 6 trees were cut, 11 were cut in October, 15 in November and 12 in December.The data refers to large trees with an average height of about 60 metres felled by chain saw, axe or bulldozer. These were cases reported by the Town Development Committee as well as those which came to this researcher's attention during the study period. Appendix 1 contains a listing of some of the trees found in the Ayirebi community. The most common woods are *papaonua* (*Afzelia bella*), *odwen* (*Baphia nitida*), *mfia* (Rattan, *Calamus deeratus*), *onyina* (Kapot, *Ceiba petandra*), *odum* (*Chlorophora excelsa*), *sapele* (*Entandrophragma cylindericum*), *fruntum* (*Funtumia elastica*), *anyanyanfrowa* (*Mallotus oppositifolius*), *odwuma* (*Musanga smithii*), *ofram* (*Terminalia superba*), *sofo* (gum tree, *Sterculia tragacantha*), *wawabima* (*Sterculia rhinopetala*) and *wawa* (*Triplochiton scleroxylon*) (see also Irvine, 1961).

Table 2 gives a breakdown regarding those responsible for the tree-cutting data presented in Table 1. The data show that 41.7 percent (63 out of 151 trees) of the cuttings in the Ayirebi forest in 1982-83 were attributable

Table 1
Tree Cutting in Ayirebi, 1982-83

Month	No. of Trees Cut
September 1982	7
October 1982	12
November 1982	25
December 1982	11
January 1983	13
February 1983	23
March 1983	21
April 1983	9
May 1983	6
June 1983	3
July 1983	12
August 1983	9
Total	151
Mean	12.6

Table 2
Responsibility for Tree Cutting in Ayirebi, 1982-83

Agent(s)	No. of Trees Cut	% of Total (151)
Local farmers and farming activities	40	26.5
Road construction firm	27	17.9
State and private-owned logging firm	36	23.8
Town returnees from Nigeria	19	12.6
Other – includes individual sale and purchase of trees	29	19.2
Total	151	100

to the activities of state and private firms (i.e., as a result of logging and road construction activities). The breakdown of the data with regard to the 44 trees cut in the fall of 1989 also shows that local farmers and farming activities were responsible for cutting down 18 trees (40.9%), that logging firms cut down 17 (38.6%) and that individual sale or purchase of trees (for woodcarving, charcoal and firewood) accounted for the remaining 9 (20.5%). In 1989, the private road construction firm had suspended its activities. In Table 3 data are presented in terms of the ownership or type of the land on which these trees were cut. The data shows that the majority, 70.9 percent (i.e., 107 of 151), of the trees cut came from communal lands (i.e.,

lineage and the stool land entrusted to the local chief and elders). This is supported by the data for 1989 which shows that 20 (45.5%) were on lineage land, 12 (27.3%) were on stool land, 9 (20.4%) were on land acquired by outright purchase, and 3 (6.8%) were on rental land, including tenancies, leases and mortgaged lands (see Dei 1987 and forthcoming). The forest environment of Ayirebi and its surrounding communities has supplied a steady amount of timber for the four privately owned saw mills at Akyem Oda. The logging company pays royalties for its trees to the landowners. These owners are usually the local chief as custodian of stool land, lineage heads as caretakers of lineage lands, individual landowners in the community, and absentee landlords. The payment for a tree ranged from ₵150 to ₵250 in 1982-83 to between ₵1000 and ₵1500 in 1989[10] depending on its size. The timber is processed into sawn timber, plywood and paper, primarily for export and also for the wider Ghanaian market.[11]

Table 3
Type or Ownership of Land Regarding Tree Cutting in Ayirebi, 1982-83

Type/Ownership	No. of Trees Cut	% of Total (151)
Lineage	72	47.7
Stool	35	23.2
Outright purchase	29	19.2
Rent (includes tenancy, lease and mortgaged lands)	15	9.9
Total	151	100

Plantation agriculture in the form of state cocoa and oil palm plantations exists in the Akyem Oda district. Only a handful (less than 100) Ayirebi residents have gained employment as agricultural workers with these state farms. In 1983 and in 1989, there was talk of the government acquiring a portion of land in the Ayirebi zone in future years to expand its farms. Should this happen, the necessity to clear vegetation will lead to a further loss of trees. The history of state farms in Ghana reveals a great deal of mismanagement and corruption which have led to the farms suffering huge losses. At the same time these farms have not benefitted the rural poor majority in any substantial way (Atsu 1984). The state oil palm plantation in the Akyem Oda district has, however, encouraged some Ayirebi farmers to embark upon the cultivation of this cash crop in the 1980s. In 1982 and 1983 a total of 25 Ayirebi residents were noted to have cleared a combined area of about 16 hectares for the planting of oil palm trees. Among a sample of 450 farming households in 1989, 22 (4.9%) had established oil palm

fields with an average size of one hectare. Like cocoa farming which was gradually re-emerging in the town in 1989, the land for such cash tree-cropping was obtained by outright purchase and through the lineage. Unlike food-farming, tree-cropping tends to exacerbate the problem of deforestation since all trees have to be cut from the land (see also Dei forthcoming).

In early 1983, 298 Ayirebi citizens (representing 7 percent of the town's population) returned to the community as a result of the Nigerian government's deportation of nearly 1.2 million Ghanaian illegal residents. The returnees brought 10 chain-saws as part of the booty acquired while in Nigeria. These machines assisted in the farming activities insofar as their owners used them to clear the vegetation on the new lands acquired, which had been granted to them by the wider community in order to assist in their resettlement and rehabilitation efforts. The chain-saws were also available on a for-hire basis to local farmers and were utilized by the absentee landlords in particular to bring additional lands under cultivation. The fee for cutting a tree ranged from ₵60 to ₵150 in addition to the cost of fuel. In 1989, only 3 of the chain-saws used by the community were functioning.

The sale of trees to local artisans (e.g., woodcarvers, carpenters, trappers and other craftsmen and women), as well as to traders or sellers of burnt charcoal and wood as firewood is another feature of the local economy. There was a marked resurgence in arts and crafts, particularly among the male population, during the study period. The surrounding forest environment provided enough raw materials that could be exploited to produce a wide variety of handicrafts sold on the local and external markets. Appendix 1 provides a list of the varied uses of forest plants in the community other than for food and medicinal purposes. It shows how the local people utilized the raw materials available in their immediate environment (Dei in press). The observed local handicrafts included blacksmithing, basket-weaving, straw-work and barkcloth-making, woodcarving, mud-brick and tile-making. These were viable economic opportunities that enabled the practitioners who usually worked part-time to supplement their household cash income. The importance of blacksmiths in the community has increased in the past decade because of the absence from the local market of ready imports of such farm implements as machetes, knives, and axes. Local blacksmiths are relied upon to produce these implements. They accept old farm implements back from the local farmers and reforge them for recycling (Posnansky 1980). Their work, like tin-smithing, is heavily dependent upon the use of wood and burnt charcoal. In 1982-83 hoes and machetes that were being recycled in the community sold for ₵30 and ₵25 respectively. Woodcarving, like blacksmithing and tin-smithing, tends to be a specialized activity. Among the products of woodcarvers are mortars and household furniture (stools, chairs and tables). A medium-size wooden mor-

tar sells for ₵75, while a child's stool or chair cost ₵5 and a table, ₵20. Information obtained from some local artisans reveal that the average estimates of the yearly income derived solely from these part-time economic activities in 1982 are ₵1000 for the basket weaver; ₵3000 for a blacksmith, a tin-smith or bricklayer; and ₵2500 for the woodcarver (Dei 1986). Corresponding figures for 1989 are basket weaver, ₵6 000; blacksmith, tin-smith or bricklayer, ₵13 000; and woodcarver, ₵11 000.

Table 4
A Householder's Search for Firewood

Female Householder	Age	Household size	Time of Travel (approx. hr.)	Total Distance of Travel (approx. km)
1	42	5	3	1.5
2	15	8	2.5	5
3	10	3	2.5	4
4	65	6	4	5
5	43	5	4	5
6	64	6	2.5	1.5
7	71	8	4	5
8	12	2	4.5	4.5
9	12	5	3	3
10	21	3	5	3.5
Total	355	51	35	38
Mean	35.5	5.1	3.5	3.8

The selling of wood and burnt charcoal is an important source of income to Ayirebi women in particular. During the research period, there was a count of 24 and 5 Bedford trucks in 1982-83 and 1989 respectively, coming to the town to cart firewood and charcoal for sale in the Ghanaian urban centres and towns. Some Ayirebi residents act as brokers and women between the tree cutters and the wood and charcoal dealers in the cities and towns. As these activities intensify together with the other noted reasons for tree cutting, fewer trees will remain to provide the poor rural farmers with their only energy source, firewood. Today, energy shortage is a problem faced by many rural peoples of West Africa (Weber 1981; Morgan and Moss 1984). In Ayirebi, the problem, though not yet acute, is reflected in the data in Table 4. A detailed study of the total distance and time of travel (to and from) in search of a day's firewood was conducted among 10 females selected from 10 Ayirebi households. The data show that an extensive distance and amount of travel time is required to satisfy the firewood needs of the average household. Household heads were unanimous in point-

ing out that in the past a day's firewood could be obtained within a few minutes walk (less than 1 km) from the house or compound. Today, as firewood becomes scarce, most landowners are vehemently protesting (some even laying charges before the local polity) about the activities of firewood collectors on their farms.

Discussion

The knowledge of local processes and dynamics of sustainable forestry is essential if forest resource conservation is to become an integral part of a wider sustainable development agenda in the developing world. It is important that we gain an understanding of the strategies of forest resource exploitation and utilization before changes are introduced to improve upon the contemporary adaptation of local communities (Vayda, Colfer and Brotoksumo 1985). These communities cannot be expected to put an end to the use of firewood as the major source of household energy supply unless suitable and affordable alternatives are readily available. Similarly, if the tree-cutting activities of local artisans are to be halted, there ought to be the development of other income-generating sources for the tree cutters. The state and the wider international community must also regard trees as producers of food, shelter, fodder and firewood rather than as money-spinning cash crops.[12] What is needed is sustainable forestry, the development of community forestry projects which help people meet their needs directly without devastating the environment (Sachs 1978; Winterbottom and Hazelwood 1987; WCED 1987; FAO 1981; Carpenter 1984).

In the face of contemporary economic and ecological pressures (Dei 1986, 1988) the Ayirebi community is searching for alternative techniques and strategies to promote the judicious use of the remaining forest lands. There is an increased awareness in the community of the deleterious effects of tree cutting. The local polity and the various town committees and bodies (e.g., church and women's groups) have intensified education efforts on the judicious use of the local forest and the consequences of tree cutting. A local ban on the indiscriminate cutting of major trees and setting of bush fires in order to hunt game (Dei 1989) was in effect in mid-July 1983. Those who violated the ban were liable to a ₵500 fine and community service. Official government assistance for local educational efforts has been slow in reaching the people. While the government's appeal to all Ghanaian residents to join in a tree-planting exercise had caught the interest of some local residents as far back as 1984, the community still awaits the nursery tree stocks that were to be raised by the Ghana Forest Commission, and the information about what to plant, where and when. Among the more recent local initiatives of 1988-89 is the decision by the Town Development Com-

mittee (TDC) and the local Committee for the Defence of the Revolution (CDR) to study an idea for the development of a community forest reserve and woodlot project from land to be provided by the local polity. There are also some discussions about regulating commercial felling of trees and farming in the community forest reserves and about requiring that logging firms adopt tree planting as part of their activities in the area.

There is evidence that in some rural communities of the developing world (e.g., India), the indigenous peoples are capitalizing on their traditions of sustainable forestry. Trees are used to meet the basic needs of the poor by working within ecological constraints (Twose 1984; Winterbottom and Hazelwood 1987; WCED 1987). The reallocation or redistribution of land to the poor so that they can plant and manage their own trees once more is a positive sign. However, tree planting involves more than the mere planting of trees. Its success in terms of fostering sustainable development would depend on the consideration of some crucial factors. These include planting the right tree species (i.e., ecologically adaptable species) by the right people (i.e., women and others so identified as the pivot of the domestic farming economy) during the right period (i.e., the beginning of the cropping season), and in the right places (i.e., on the intensively cultivated plots which have suffered the most from repeated tree cutting) (Skutch 1983).

While the rural communities of the developing world take local initiatives to redress the problems of deforestation, it is important that the governments and citizens of the industrial world, as well as development and aid agencies, make concerted efforts to become part of the solution to the problem. Such steps as using fewer trees by recycling paper and other waste and opposing development projects that are not socially and environmentally sound are but a few of the contributions that the industrial world can make. At the global level there is informed consent on what the ultimate devastation of the rainforest will mean. It is predicted that there will be floods of unprecedented severity with large losses of human life and property as well as plant and animal resources. Specific grim assessments include droughts, starvation and destructive climatic change. The *greenhouse* warming effect resulting from the addition of carbon dioxide into the atmosphere is a matter of increasing concern to the industrialized world today. The lesson here is that the industrial community cannot escape the consequences or effects of events in small and distant rural communities of the developing world.

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Appendix 1
Household Uses of Ayirebi Forest Plants

Scientific Name	Local Name	Comment
A. Fibre and Fibre-Working		
Plants used as fibre:		
Baphia nitida	odwen	rope-making and binding material
Bombax buonopozense	akonkodie	root bark used as wads for guns; also floss for pillows
Calamus deeratus	mfia	rope-making and building material
Canthium hispidium	ogyapam	used in making baskets
Carapa procera	kwakuobese	serves as chewstick
Carpolobia lutea	ofewa	”
Ceiba pentandra	onyina	produces floss for pillows
Chlorophora excelsa	odum	fibre
Cocus nucifera	kube	root fibre used in the making of mats and brooms
Cola gigantea	watapuo	bast fibre
Craterispermum caudatum	duade	serves as chewsticks
Dialium guineënsis	asenaa	”
Diospyros heudelotii	omenewabene	”

Elaeis guineënsis	abe	used as fibre for snares and in making brushes and brooms
Funtumia africana	okae	produces floss for pillows
Funtumia elastica	fruntum	”
Garcinia kola	tweapia	roots used as chewstick
Glyphaea brevis	foto	used for rope making and chewsticks
Grewia mollis	kyapotoro	fibre used as sponge for washing
Griffonia simplicfolia	kegya	used as chewsticks
Hymenostegia afzelli	takorowa	”
Landolphia owariensis	abontere	”
Mallotus oppositifolius	anyanyanfrowa	”
Monodora tenuifolia	motokuradua	binding material
Napoleona vogelii	obua	used as chewsticks.
Raphia hookeri	adobe	making brooms, hats, mats and ropes
Rothmannia longiflora	samankube	used as chewsticks
Sphenocentrum jollyanum	kraman-kote	”
Sterculia tragacantha	sofo	bast fibre

B. General House Construction Purposes

For use in house construction
(e.g., house post, fences, hut poles, and roofing purposes):

Afzelia bella	papaonua	used as planks for house construction, and for some household furniture
Albizia adianthifolia	pampena	used as rafters
Albizia zygia	okoro	general purpose in house construction
Baphia nitida	odwen	for the construction of house posts, fences and rafters
Baphia pubescens	odwenkobiri	general household construction work
Bersama abyssinica	esonodua	constructing house posts
Blighia sapida	akye	for working household furniture
Blighia unijugatus	akyebiri	general building purposes
Bombax buonopozense	akonkodie	bark used for thatch roofing
Calpocalyx brevibraeteatus	atrotre	used as wooden planks
Canthium hispidium	ogyapam	used in woodworking or carving

Carapa procera	kwakuobese	bark used as thatch for roofing; stem as house posts and for carving objects, as well as for making boxes and coffins
Ceiba pentandra	onyina	bark used as thatch for roofing; stem as house posts and for carving objects, as well as for making boxes and coffins
Celtis zenkeri	esafufuo/esakoko	for general wooden construction, as well as posts for farm sheds
Chlorophora excelsa	odum	bark can be used as thatch for roofing; stem is timber for heavy construction work, as well as simple household furniture
Cocos nucifera	kube	rachis used as rafters and house posts; leaves also used for thatch roofing
Cola gigantea	watapuo	wood for house construction
Cola lateritia	watapuobene	wood for house construction as well as leaves for thatch roofing
Cola nitida	bese	wood for house construction and for carving objects
Cola verticillata	bese	”
Copaifera salikounda	entedua	used as veneers
Daniella ogea	ehyedua	for general interior house construction purposes
Dialium guineënsis	asenaa	posts for farm sheds
Diospyros canaliculata	otwabere	wood for building purposes
Diospyros kamerunensis	omenewa	used in the construction of house posts
Diospyros piscatoria	benkyi	used in household construction
Drypetes chevalieri	katrika	”
Drypetes gilgiana	adwea/katrikanini	”
Entandrophragma cylindericum	sapele	planks may be used for roofing purposes
Elaesis guineënsis	abe	rachis used for hut poles
Entandrophragma angolense	edinam	serves as veneers, windows

Funtumia africana	okae	for making doors and carving objects
Funtumia elastica	fruntum	used for carving objects
Hannoa klaineana	fotie	used as planks for the making of doors
Hunteria umbellata	kanwene-akoa	used in construction of house posts
Khaya ivorensis	dubini	used as veneers and in other household furniture work
Lannea welwitschii	kumanini	timber for construction purposes
Mallotus oppositifolius	anyanyanfrowa	used to erect yam poles
Monodora myristica	wedeaba	timber for general construction purposes
Monodora tenuifolia	motokuradua	"
Musanga smithii	odwuma	planks for house construction (doorway) and household furniture
Octoknema borealis	wisuboni	for the construction of house posts
Oxyanthus speciousus	korantema	used to erect poles
Pachypodanthium staudtii	kumadwie	for erecting house poles; bark may be used for hut walls
Raphia hookeri	adobe	provide hut poles; also when split can be used as house screens and rafters. Rachis can be used as roof beams or thatch
Sterculia oblonga	ohaa	planks for house construction and household furniture
Sterculia rhinopetala	wawabima	timber used as roof beams and also in household furniture work
Sterculia tragacantha	sofo	hut poles and for carving objects (e.g., shoots)
Terminalia superba	ofram	used in the construction of fence poles (i.e., pilings) as well as house posts
Tetrapleura tetraptera	prekese	for constructing hut poles and frames
Trichilia prieuriana	kakadikuro	timber used in house construction work

Vitex rivularis	otwentorowa	''
Xylopia staudtii	duanan	primarily used as poles; bark can also be used as partitions and in household furniture work (e.g., chairs).
Xylopia villosa	obaafufuo	''

C. Other Specific Uses in The Local Domestic Economy

(i.) Used in the making of farm implements:

Baphia nitida	odwen	for making such implements as knives and axe handles
Dialium guineënse	asenaa	used for making hoes and axe-handles
Diospyros kamerunensis	amenewa	''
Hunteria umbellata	kanwene-akoa	general tool handles
Khaya ivorensis	dubini	''
Monodora myristica	wedeaba	axe-handles
Monodora tenuifolia	motokuradua	used in making axe and hoe handles
Napoleona vogelii	obua	general tool handles
Newbouldia laevis	sesemasa	knife-handles
Rothmannia whitfieldii	sabode	hoe-handles
Strombosia glaucescens	afena	axe-handles
Xylopia villosa	obaafufuo	''

(ii.) Hunting and trapping implements:

Aulacocalyx jasminiflora	ntwenson	used in setting traps
Baphia nitida	odwen	''
Carapa procera	kwakuobese	used in making gun stocks
Cola nitida	bese	''
Glyphaea brevis	foto	used in setting traps
Klaineodoxia gabonensis	kroma	''
Microdesmis puberula	ofema	''

(iii.) Cooking implements
(e.g., spoons,bowls, ladles, mortars, pestles, and mallets):

Baphia nitida	odwen	used in making mortars and pestles
Bombax buonopozense	akonkodie	used in making such domestic utensils as ladles
Celtis zenkeri	esafufuo/esakoko	used to make pestles
Chlorophora excelsa	odum	used in the making of mortars

Cocos nucifera	kube	shells used as cups for drinking palm wine, water, etc.
Funtumia africana	okae	for making ladles
Griffonia simplicifolia	kegya	fruits can be used for making spoons
Rinorea oblongifolia	mpawutuntum	"
Triplochiton scleroxylon	wawa	used to make large plates on which foodstuffs such as tomatoes, peppers and fish are sold on the market
(iv.) Miscellaneous:		
Albizia adianthifolia	pampena	produces gum
Albizia zygia	okoro	gum/resin
Baphia nitida	odwen	dye, and also leaves can be used as foodwrappers
Blighia sapida	akye	can be used as fish poison
Blighia unijugatus	akyebiri	"
Bombax buonopozense	akonkodie	gum/resin
Carapa procera	kwakuobese	produces red dye, also gum/resin
Carpobolia lutea	ofewa	can be used as a walking stick, gum
Ceiba pentandra	onyina	gum
Cola gigantea	watapuo	gum, also leaves as foodwrappers
Cola nitida	bese	black dye
Daniella ogea	ehyedua	gum
Dracaena arborea	ntomme	used to protect young yam shoots
Elaeis guineënsis	abe	kernal oil used to make soap and pomade
Griffonia simplicifolia	kegya	used as black colouring material
Monodora myristica	wedeaba	can be used as walking stick
Monodora tenuifolia	motokuradua	"
Raphia hookeri	adobee	used to make pomade
Tetrapleura tetraptera	prekese	gum/resin
Rinorea oblongifolia	mpawutuntum	used as walking stick
Sterculia tragacantha	sofo	leaves as food-wrappers; also produces gum

See also Irvine (1961) and Hall and Swaine (1981).

Notes

1. The reader is referred to an article entitled "Rainforests: A Race Against Time" which appeared in the *Third World Centre Newsletter*, Windsor, Ontario, No. 42, April-May, 1988, p. 4 for similar observations.
2. The editorial comment in *The Toronto Star*, December 4, 1988, p. C4, reports that under the auspices of the World Bank, Brazil plans to build 136 dams in the next 22 years to flood about 26 000 sq. km of forest land.
3. Figures from the Rainforest Action Network in San Francisco reveal that the area subject to flooding in India has doubled since 1950, and that 6 billion tonnes of soil are washed away each year. The point to be made here is that the roots of a healthy forest hold the soil which in turn hold the water in the wet seasons, allowing it to run evenly into rivers as the weather dries. With the trees gone, the water washes quickly off the land flooding down rivers and carrying with it the thin layer of top soil.
4. This figure is made up of 2783 males and 3022 females and is based on the national population census data obtained from the Ghana Government Statistician for 1982.
5. "Harmattan" is a term used since medieval times to refer to the dry, parching land wind that blows along the coast of Upper Guinea during the months of November through March, raising a red dust-cloud that fogs the air.
6. Ghana Meteorological Services, Annual Rainfall Report, Headquarters, Accra.
7. Hill (1963) has detailed the crucial role played by a group of migrants from Akuapem, Ga and Shai in the hills above Accra in creating the Ghanaian cocoa industry. Starting in 1892, they migrated eastward to the present state of Akyem Abuakwa where they bought large tracts of uncultivated land from absentee landlords. These migrants occupied an area further to the southeast of Ghana than the Ayirebi town is located, and their settlements post-date the known early history and evolution of the Ayirebi community. The early settlers of Ayirebi were food producers. In later years, when the successful cocoa enterprise of the Akuapem migrants became generally known, cocoa growing became a feature in the Ayirebi economy. However, the cocoa farmers of Ayirebi (unlike those migrants of Akuapem) primarily relied on lineage and stool lands, as well as family labour, and combined their cocoa farming activities with food production (see also Wilks 1977).
8. The more recent 1989 study also reported similar findings. Of the 450 research sample households, 152 (33%) households each had between 0 and 3 hectares of farm plots; 144 households (32%), 3-6 hectares; 90 households (20%), 6-9 hectares; 34 households (7.5%), 9-12 hectares; and 30 (6.7%), over 12 hectares.
9. The members of the Town Development Committee (TDC) are selected by the local chief in consultation with his elders. Membership of the Committee for the Defence of the Revolution (CDR) is open to all town residents. This latter body was formerly called the People's Defence Committee (PDC). It is a more recent political action group, the idea of which was introduced nationwide by the ruling Provisional National Defence Council (PNDC) government since 1982.
10. In 1982-83 when this study was conducted, the exchange rate of the local currency, cedi (₵), was ₵2.45 to $1.00 Cdn. By the time of the second study in 1989, the rate was ₵240 to $1.00 Cdn.
11. Prior to the 1980s, two of the sawmills were jointly owned by the state and private firms. Today, the private logging companies are encroaching on the forest reserves in the Akyem Oda-Ofoase district—which includes Ayirebi and its surrounding villages. In fact, in the fall of 1989, this researcher observed at least two timber trucks almost daily transporting timber through the Ayirebi town. The drivers would not admit to the source of their timber load although the majority of Ayirebi residents agree that the timber is mostly from the forest reserves. In a forthcoming monograph, this author

hopes to explore the effects of the activities of the logging companies, particularly their gradual encroachment on the forest reserves in the Akyem Oda-Ofoase district.

12. See also *Third World Resource Centre Newsletter*, No. 42, April-May 1988, p. 6.

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