

**POPULATION GROWTH AND ECOLOGICAL DEGRADATION
IN NORTHERN GHANA: MYTHS AND REALITIES**

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Abstract

As people struggle to improve their well-being it is the environment which both provides materials whilst at the same time constraining the effort. This interconnection between human aspiration and ecological integrity is a rather complex one incorporating links between population numbers and per capita resource demand, pattern of culture, organisation, technology and the physical environment. Each ecological complex of concern is located within a wider politico-economic environment. The paper argues that popular perceptions concerning the links between population growth and ecological degradation in Northern Ghana can be misleading if examined outside this complex nexus. It is argued that ecological degradation processes in Northern Ghana are as socially, economically and politically determined as they are physical and not resulting from mere growth in population even if population is an important factor given the underlying institutional failures which do not allow for adaptive responses by encouraging a shift to more intensive systems. Since the current unfolding ecological crisis in Northern Ghana is essentially human-induced, it can equally be solved through human action at the local, district, regional, national and global levels of intervention, co-operation and support.

Introduction

As people struggle to improve their well-being it is the environment which both provide materials whilst at the same time constraining the effort. This interconnection between human aspiration and ecological integrity is the underlying theme of sustainable development. "Accumulating evidence from ecology, agronomy and hydrology indicates that sustained over-use of biological systems can set in motion changes that are self-reinforcing. Each stage of deterioration hastens the onset of the next" (Brown & Wolf, 1987, p. 22). Every land area has a carrying capacity beyond which it cannot be utilized without causing damage, deterioration and decreased productivity. This ecological rule which has long been overlooked is suddenly dawning on humanity at the global, continental, national and regional levels.

Whereas the rich industrial North accounts for a mere 23% of the world's population, this population earns 85% of the world's income. "The strains of this level of economic activity are felt in the loss of forests and species, the pollution of rivers, lakes and oceans, the accumula-

tion of greenhouse gases and the depletion of life-preserving ozone." (Human Development Report, 1992, p. 16). It is therefore an undeniable fact that it is the rich minority of the world's population rather than the poor majority who threaten the wider ecological integrity of humanity's existence. For example, as one expert puts it:

From the point of view of a simple population head-count, China, India, Indonesia and Brazil might be regarded as jeopardising the future of the Earth's resources, but using a resource demand index this risk is more fairly placed at the door of the USA, Japan, Germany, the UK, Canada and Russia. In the case of Indonesia the USA exceeds its resource demand by a factor of 50. It is not difficult to see where the population control effort should be applied! Sweden as a country with a mere 8.6 million people exceeds the resource demand of Bangladesh (116.4 million) by some 15 times (Chadwick, 1994, p. 7).

But the poor 77% of the world's people, like those in Northern Ghana are also known to threaten the ecological integrity of their limited life spaces out of sheer necessity rather than through greed. These are the 'dead end societies' for whom it is argued there is little prospect for substantially improving the lives of more than a few people given the global configuration of power relations (Adams, 1991). Given this neo-Malthusian environmentalist vision of our societies, it is not surprising that issues of environmental degradation have often been articulated narrowly in terms of the growing numbers of the poor and hence narrow solutions in terms of population control (Wilmoth & Ball, 1992; Hardin, 1977). It is also fast becoming a convenient ploy for some governments in Africa. Whilst relishing the roll back of the developmental role of the state and substituting in its place the crude barbarism of unmitigated market forces, they would retreat into arguments about peasant sexual proclivities being the cause of the developmental impasse and degradation rather than the failures of governance. But clearly ecological degradation is a more complex process as we seek to demonstrate in this paper.

The object of this paper on population growth and ecological degradation in Northern Ghana is therefore not aimed at playing to the gallery by re-stating the popular perceptions which others hold concerning the future of our people and our societies. It is rather an attempt to demonstrate that ecological degradation processes in Northern Ghana are as socially and politically determined as they are physical and not resulting from mere growth in population even if population is an important element. This arises from a concern to map out a visible and sustainable development strategy that satisfies the current aspirations of our people for development whilst maintaining the opportunities for future generations for development.

More specifically, the paper presents an ecological model of the complex relationships between population and the environment as an organising framework. It then discusses the processes of agro-ecological change under demographic pressure. This is followed by an analysis of agro-ecology regimes that have evolved under the impact of population growth. Consequent upon this, the paper then analyses the impact of market forces and the role of the state in the ecological degradation process and draws some conclusions on strategies for sustainable development.

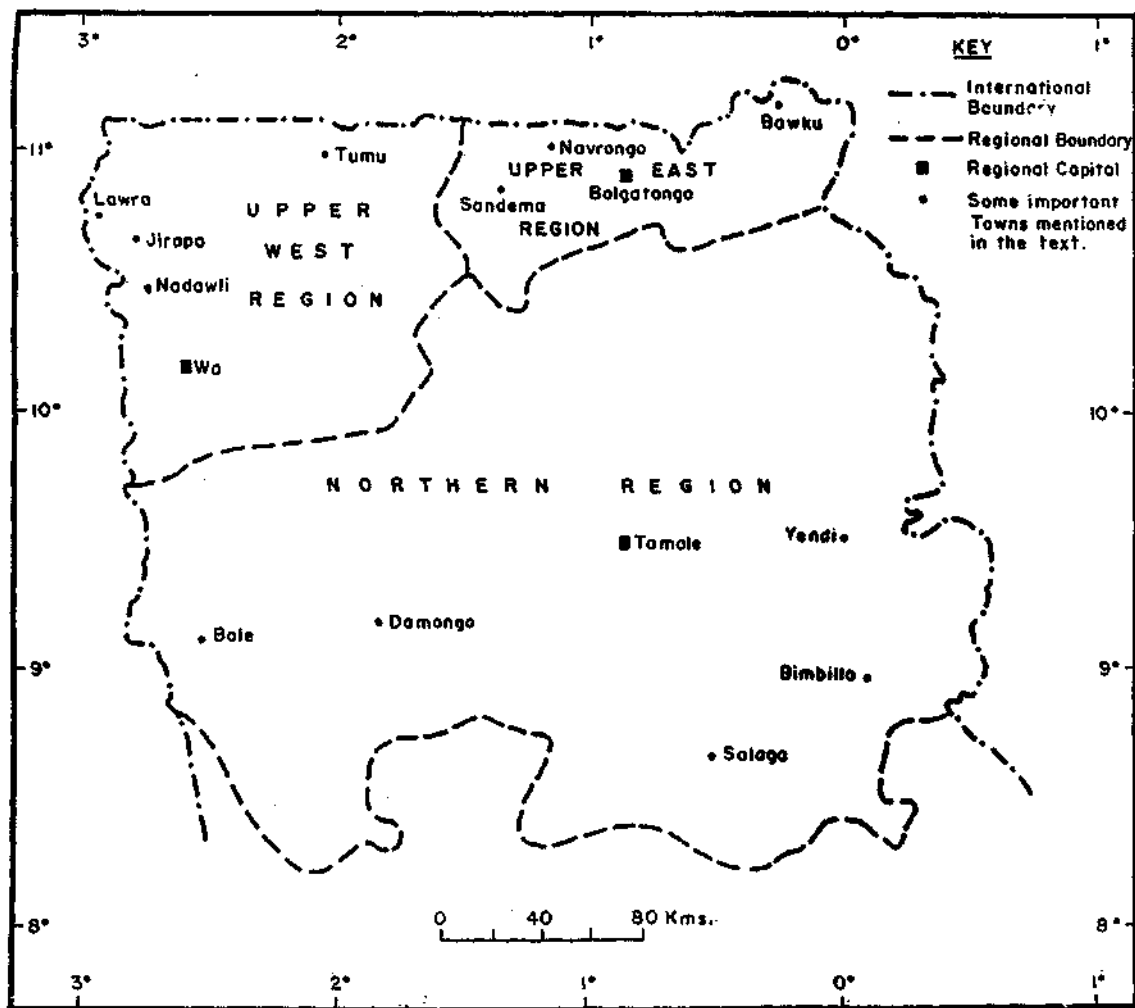
Northern Ghana which is the focus of this paper, comprises the Upper West, Upper East and Northern Regions of Ghana (Fig. 1). It has a land area of 98,000 km² which is about 41% of the total land area of Ghana. By contrast its share of the total population is under 20%. It lies within the rather fragile Guinea Savannah agro-ecological zone except in the extreme north-eastern corner where the Sudan Savannah takes over as the dominant bio-climatic type. Rainfall which is the major climatic element has a strong influence on animal and plant life and since it comes seasonally and variably from year to year it gives rise to a cycle of agricultural activity. These uncertain climatic conditions get worse towards the extreme northern frontier with Sahelian Burkina Faso.

The economic base of the area hinges on smallholder agriculture with over 80% of the population depending on it for their livelihood. The lack of modern industry in Northern Ghana is glaring: the region contributed a mere 1.3 percent of the total number of establishments, 0.3 percent of total value added and another mere 0.7 percent of total number of persons employed in industries employing 30 or more persons. This together with its low level of urbanisation, 8.5, 10.8 and 24.7% for Upper West, Upper East and Northern Regions respectively simply emphasises its rurality (Songsore, 1992a, p. 158). There were in 1988 only 45 bank offices, which amounted to a mere 8.6 per cent of the country's bank offices. The ratio of inhabitants to banking outlets reaches a high of over 1:58,000 with areas of 5,300 km². This very low bank density seems to be one reason why the entire North accounts for only 3.9 percent of all formal sector credit and 2.8 percent of all formal sector deposits (Songsore, 1992b, p. 86 - 87).

In terms of human development indicators, although the northern savannah regions account for a mere 20% of the national population they contain about 60% of the poorest tenth of the national population (ROG/UNICEF, 1990, p. 205). The health and nutrition conditions of its people are among the worst. The regions for example had the worst doctor/population ratios and also bed/population ratios. Similarly as a result of colonial educational policies, Northern Ghana has both the highest levels of illiteracy and lowest levels of school enrolment. Whilst all regions other than those of the northern sector had over 70% of 6-year olds in school in 1984/85 the percentage of 6-year olds in school was 30.95, 36.23 and 37.95 for the Northern, Upper East and Upper West Regions respectively.

And yet in terms of investment flows, these three regions are the most deprived. For example, in the area of education, the actual capital expenditure in 1990 was only 11.6 percent for the three regions despite having 20 percent of the population out of the total capital expenditure for the country for the year (World Bank, 1992, p. 13). This brief profile of the social and economic conditions sets the stage for an analysis of conceptual interactions between population and environment.

Fig.1 REGIONAL ADMINISTRATIVE AREAS OF NORTHERN GHANA



The Ecological Complex Model of Population - Environment Relationship

Subscribers of the neo-Malthusian orthodoxy of population put a great emphasis on population growth as an independent variable accounting for generalised land degradation. The evidence from human ecology indicates that population growth is just one of those variables whose influence on the integrity of the environment depends on the existing socio-political conditions of the society as shown by Fig. 2 sketching out the ecological complex model with its system of interactions.

According to this scheme, the ecological complex of a region or any territorial unit consists of environment, population, technology, organisation and culture: **Population** refers to number of people, density, age-sex composition and occupational structure and above all the quality of the human resource base; **environment** consists of natural environment and its resource base on the one hand, and on the other hand, the man-made physical environment; **technology** refers to the material means and knowledge available to utilise the natural resources and overcome the environmental challenges; **organisation** consists of the social, political, and economic structures that exist to organise the system of material reproduction on a sustained basis; and **patterns of culture** which refers to the ideational sphere i.e. beliefs, values, norms, ideology, customs and practices (Van Raaij, 1974, p. 13).

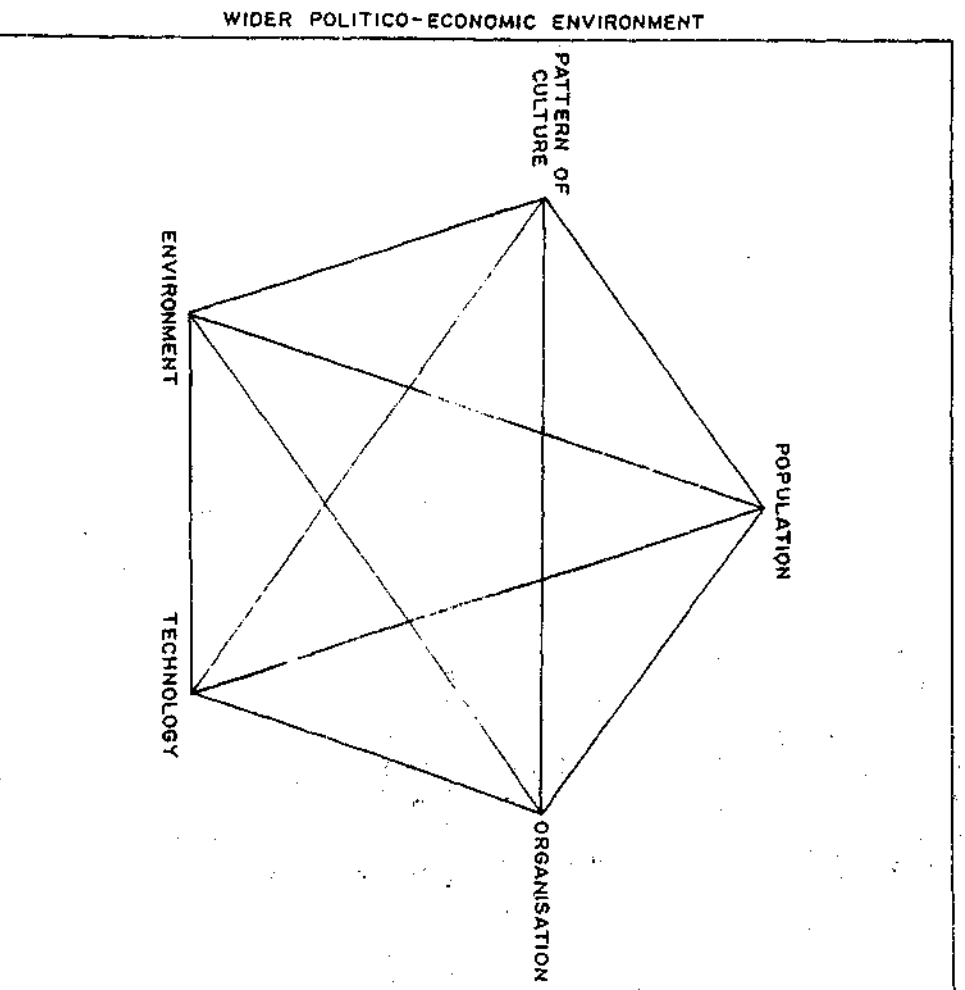
Since this model is applicable to different territorial scales and levels (i.e. local, district, regional and national) it is important to locate this scheme within the wider politico-economic environment which provides an important structuring force limiting the potential or capacity for action at lower levels. In our case the outer layer consists of the country and at a higher level the international political-economy.

The various components are interrelated in such a way that a change in anyone of them is likely to induce adjustments in the operation of the other systems. Population growth, its demographic structure does not function autonomously but influences, and is influenced by the other variables.

Processes of Agro-Ecological Change under Demographic Pressure in Northern Ghana

The relationship between demographic pressure and ecological degradation is not really a straightforward one. In an expanding regional economy that is technologically innovative and industrialising the structural shifts of labour into non-farm production and the revolution of agricultural technology may indeed lead to increased food output with less labour and reduced area under agricultural production. This experience which most industrialised societies have gone through has for a variety of reasons failed to materialise in Ghana. There are some scholars such as Boserup (1965) who indeed argued that population growth has provided the impetus for a change from simpler and more wasteful systems of farming to more intensive, technologically advanced systems. The Machakos experience in Kenya has demonstrated that rapid

Fig. 2 THE ECOLOGICAL COMPLEX : COMPONENTS AND INTERRELATIONSHIPS



Source: Adapted from van Raaij, 1974, p.14

population growth is compatible with sustainable environmental management under appropriate conditions. (Mortimore and Tiffen, 1994).

The evidence for Northern Ghana provides an entirely different scenario of economic neglect, poverty, mounting rural densities in isolated pockets in what generally is an under-populated area. Given that the land area of Northern Ghana cannot be increased the effects of mounting rural densities due to natural increase and immigration on ecological degradation do have some partial appeal especially given the predominant technology in use.

The average annual population growth rates of 2.3% and 2.5% for the Upper West and Upper East Regions are well below the national average of 3.0. The Northern Region however has the fastest population growth rate in Ghana. The high growth rate within Northern Region is partly on account of the low density and high prospects for agriculture thereby attracting migrants from other regions and outside Ghana.

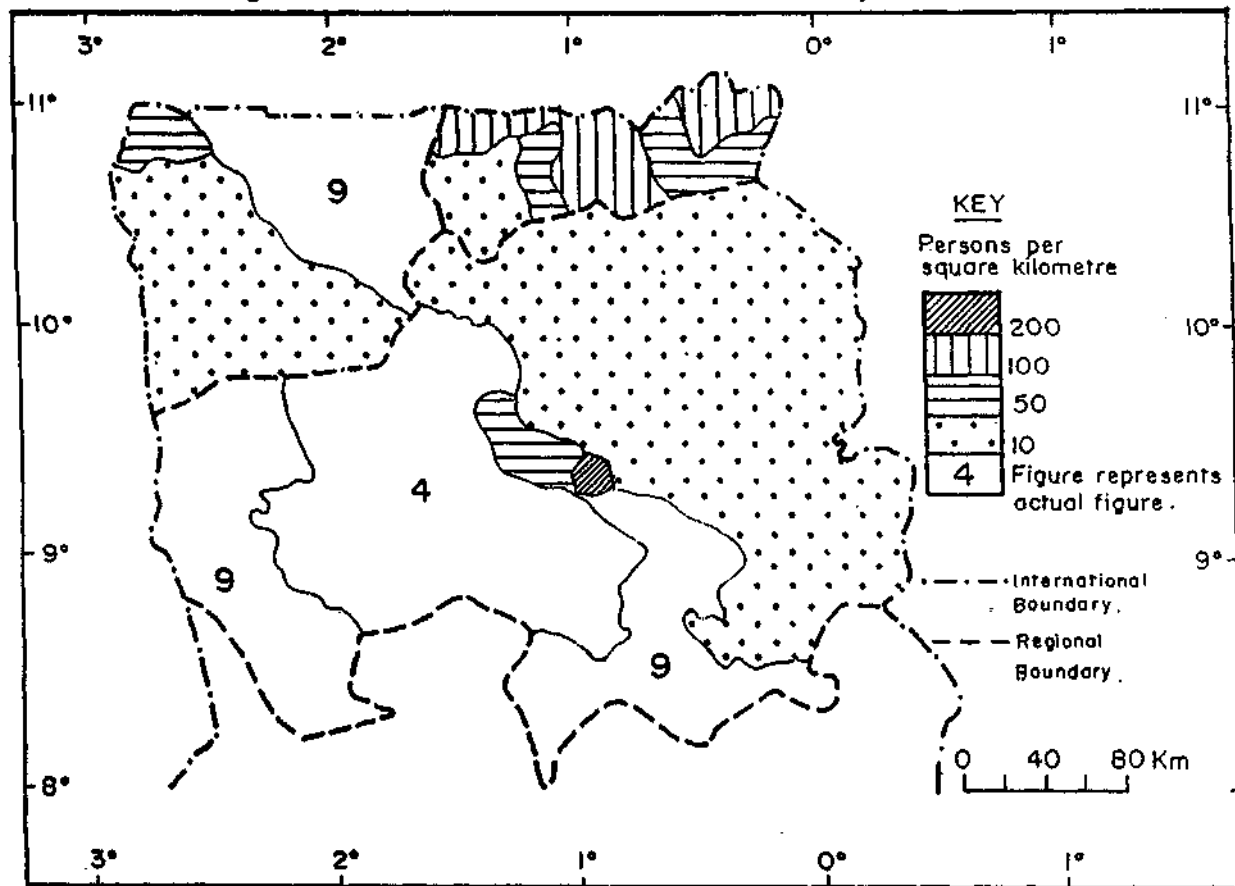
Whereas the Upper West and Upper East Regions have been experiencing decline of their relative share of the total national population between 1960 and 1984, Northern Region increased its share of the national population. Except for the Upper East Region the average population densities are among the lowest in Ghana (17 persons/sq. km. in Northern Region and 24 persons/sq. km. in Upper West). The population density of 87 persons/sq. km. in Upper East is well above the national average of 57. This is also the region in Northern Ghana where ecological degradation seems to be most acute. For more detailed population density patterns see Fig. 3 (Benneh and Agyepong, 1990)

Thus whereas the population of Northern Ghana remained stationary or even declined in the period immediately preceding the establishment of colonial rule, it has since been witnessing some gradual increase. This early stability in population was largely due to the prevalence of epidemic diseases and the activities of slave raiders such as Samori, Babatu, Amrahi and Asante (Songsore and Denkabe 1995). This led to the depopulation of the entire Middle Belt which extends from the Tumu gap down to Brong-Ahafo. The other reason for below average growth rates in the two Upper Regions are found in the high levels of infant and child mortality rates and negative net migration from the regions. By contrast, whereas infant and child mortality rates are equally high for Northern Region it is a net receiver of migrants.

Perhaps, the most important aspect of the demographic process which threatens the ecological integrity of some agro-ecological zones within the region is the extreme unevenness in the distribution of this largely rural population. The atmosphere of insecurity in the pre-colonial period led to the crowding of the population into watersheds and the abandonment of fertile river valleys to tsetse infestation (Hilton, 1966, pp. 27 - 29).

The processes of ecological degradation consists of all the processes that lead to the deterioration of the quality and productivity rating of the land. This often results in:

Fig.3 POPULATION DENSITY, 1984.



Source: Dickson and Benneh, (1988).

- 1) the reduction of biodiversity, including the stock of plant and animals species;
- 2) the decrease in the natural vegetation cover resulting in increased soil exposure and evapotranspiration;
- 3) the growing impoverishment of the soil in terms of organic matter, soil depth, structure etc. through accelerated erosion, leaching, desiccation through loss of moisture holding capacity, and the formation of hard pans of lateritic concretions; and
- 4) finally the siltation of ponds including dams by the deposition of the eroded material (The Dept of Geography & Resource Development, Nov. 1992, p.103).

Although this could be induced by the natural cycles of climatic change within the geologic time scale, the greatest culprit has been the inappropriate land management by humankind itself and since we are close to the Sudano-Sahelian Zone, it could all lead to desertification often due to drastic reduction in rainfall with the consequent human tragedy of famine and dislocation of the entire society.

Rose Innes (1964) has described the anthropogenic processes of ecological degradation in the Northern and Upper Regions as consisting of a cycle of events including the following:

- 1) clearing of agricultural land using simple tools, fire and more recently tractors and clearing machinery;
- 2) grazing of ruminants-cattle, goats and sheep;
- 3) bush burning as a generalised practice which has had widespread effects on both the cover and composition of vegetation in the region (The Department of Geography and Resource Development, November 1992, p. 136; see also Korem, 1985).

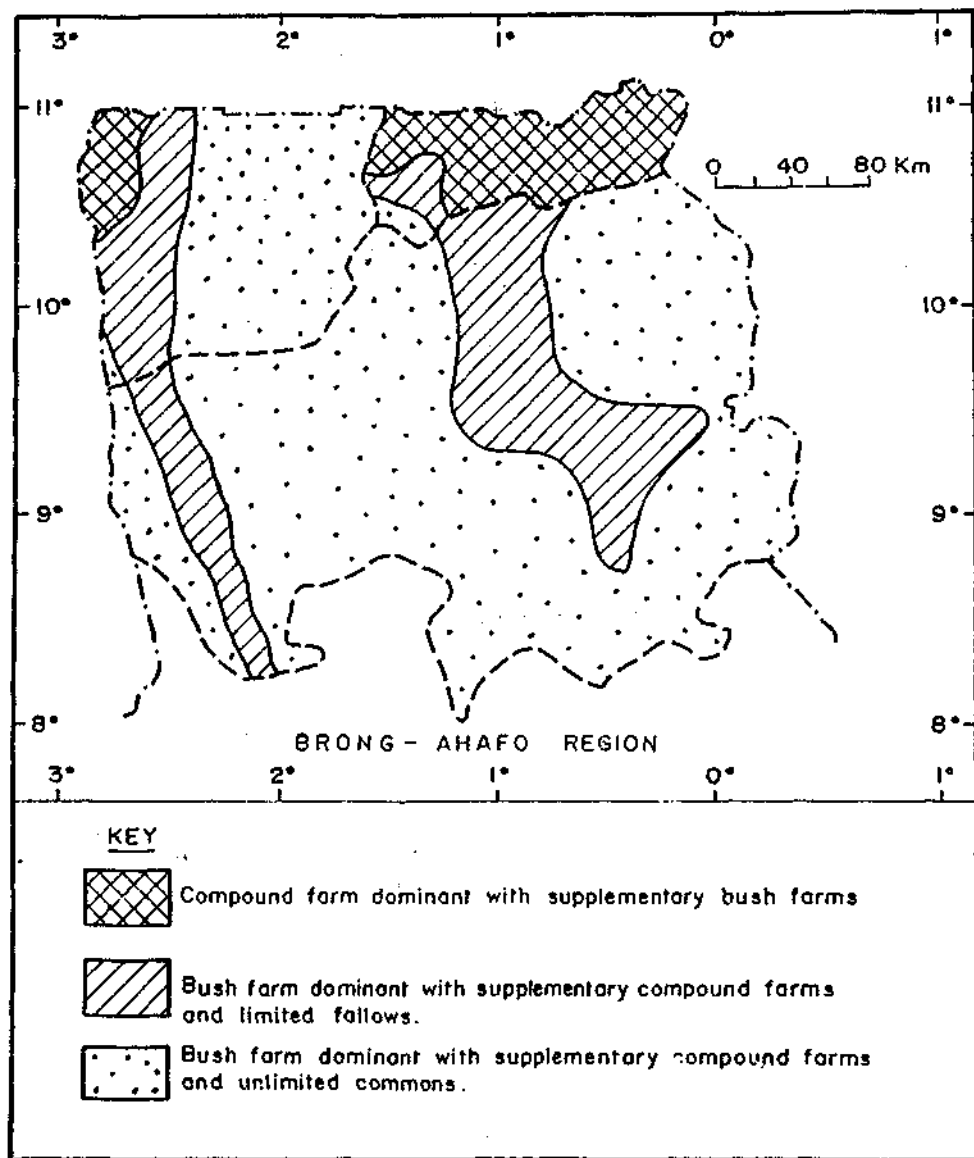
The intensified cycle of these events consequent on population growth and an increase in the ruminant population has meant the shortening of the fallow period limiting the regenerative capacity of soils, flora and fauna and an expansion into frontier zones.

Existing Agro-Ecological Regimes in Northern Ghana

These processes sketched in the preceding section have led to the emergence of the following agro-ecological zones at different stages of degradation (Fig. 4). These include schematically the following:

- 1) Bush Farm Dominant with Supplementary Compound Farms and Unlimited Commons;

Fig.4 AGRO-ECOLOGICAL REGIMES IN NORTHERN GHANA



Source: Personal Construct

- 2) Bush Farm Dominant with Supplementary Compound Farms and Limited Fallows;
- 3) Compound Farm Dominant with Supplementary Bush Farms and Privatisation of Economic Trees in the Limited Fallows (Songsore, 1996; Songsore, 1992c)

These are the cumulative result of agro-ecological adaptations in response to the growing pressures on resources given the limits to the technology of production in use.

Bush Farm Dominant with Supplementary Compound Farms and Unlimited Commons

This land management regime occurs in the resource frontier areas. In the Upper West it lies on the eastern parts of Wa and Nadawli Districts and almost the whole of Tumu District including the so-called "overseas territories". Here average densities are below 10 persons per sq. km. It is the predominant land management regime in Northern Region outside the perimeters of large settlements such as Tamale. In the Upper East except for Builsa District, it has become a relic land use. The system of land colonisation often starts with the creation of new settlements (consisting of a few households), the initial farms tend to be close to the settlements. But as the settlement attracts new migrants and as the ruminant population increases the following land uses develop:

- a) Small compound farms may persist around the settlement;
- b) this is followed by a belt of disused formerly cultivated areas which are reserved fallows for the browsing of domestic animals such as goats and sheep and for tethering of these animals during the wet season when the compound farms are under crop;
- c) beyond (b) is a belt of bush farms interspersed with long fallow;
- d) at the outer limits of the village may still exist unallocated commons with near virgin or primeval conditions (fire climax vegetation formations) (Songsore, 1992c, p. 7).

Although the ecological integrity of this regime is still largely intact because of the existence of long fallow periods allowing for natural regenerative processes to restore ecological balance, these are areas where there is an urgent need for planned intervention to prevent the practice of soil mining and extensive cultivation in the quest for quick profit. Areas under this regime can be the future granary of the region and the country if managed in a sustainable manner. This zone accounts for between 50 to 70 per cent of the land area of Northern Ghana.

Bush Farm Dominant with Supplementary Compound Farms and Limited Fallows

Once population densities rise anywhere to between 10 to 50 persons per square kilometre the

above system tends to give way to the land use system characterised by Bush Farm Dominant with Supplementary Compound Farms and Limited Fallows. The two field system of agricultural land-use persists but with the following difference:

- * the disappearance of communal land tenure and its substitution with family ownership as no unallocated village commons exist except for fetish groves,
- * the decline in woody species and fodder resources in fallow areas as the fallow period progressively falls to below 5 years which does not allow for the full regeneration of woody species and as a result of pressure on wood resources for woodfuel and for crafts and building,
- * the gradual dominance of economic trees such as sheanut and dawadawa trees which are protected by slash and burn agriculture and fuelwood foraging as other woody species progressively disappear,
- * the degradation and virtual disappearance of wildlife resources due to the disappearance of their habitats and through unsustainable hunting,
- * the degradation of soils consequent on the shortened fallow threatening village food security, and
- * the substitution of hardier crops for more preferred staple food crops.

This is the next most dominant agro-ecological regime in terms of land area, covering between 20 to 30 percent of the total land area of Northern Ghana. For the Upper West it covers the remaining parts of Wa, Nadawli, Jirapa-Lambussie Districts, and small residual parts of Lawra District. In the case of the Upper East Region it occurs in cells along river valleys which until recently were taken over by onchocerciasis and trypanosomiasis although it is dominant in the Builsa District. In Northern Region it occurs along the more densely settled transportation axis running from Tamale to Bolgatanga.

This agro-ecological zone is characterised by rapid natural resource depletion but whose ecological integrity could easily be restored if action is taken now. Once the system of field shifting under the bush fallow practice is further limited there is the transition to a different land use system characterised by more intensive land management and privatisation of farming lands and trees as discussed below.

***Compound Farm Dominant with Supplementary Bush Farms
and Privatisation of Economic Trees in the Limited Fallows***

As population densities mount to between 50 to 1,000, persons per square kilometre the dominant land management regime is characterised by the predominance of compound farms with

residual or supplementary bush farms. Indeed for some land hungry families all that may be left is a small patch of compound farm. Not only is there miniaturisation of land through subdivision but the further privatisation of land, economic and other trees and the complete disappearance of the village commons in fallows.

Within this zone, the bush farms where they exist are so impoverished that there is a progressive shift to intensifying production on compound farms. "Unlike for the earlier land management regime, there emerges a conscious application of animal droppings, household wastes and the inclusion of leguminous crops such as groundnuts and bambaranuts in a deliberate crop rotation. Small patches of exhausted soils are left from year to year for tethering domestic animals during the farming season" (Songsore, 1992c, p. 8).

In the Upper West Region this system is common in the present Lawra District and cells are developing around the settlements of Jirapa, Nadawli and Sankana-Takpo. This system is common in the Upper East Region where it is the dominant type of land use in Navrongo, Bolgatanga and Bawku Districts. Overall it covers between 10 to 20% of the total land area of Northern Ghana. This agro-ecological zone is affected by moderate to severe degradation characterised by the loss of vegetation cover, soil erosion, the development of duricrust or lateritic hard pans and the emergence of sudano-sahelian conditions as the first phase in the desertification process. There is the need to restore the ecological integrity of these areas through the encouragement of more intensive agricultural practices, land reclamation through agroforestry development together with labour movements to the new resource frontiers.

Reserved Areas

It is important to acknowledge the existence of forest and game reserves and to a lesser extent the fetish groves. The most prominent one is the Mole Game Reserve. These are sanctuaries of bio-diversity that have been affected only by fire. They promise to become vital in any programme of restoring the ecological integrity of degraded areas.

As we have argued, the cycle of agro-ecological transition begins with the opening up of resource frontiers. This is followed by a second phase of effective production. The third phase is marked by spaces that are left behind after the more dynamic phase of production has resulted in exhaustion. At this point they begin to 'export' or rather expel their excess population into new resource frontiers in a process of predatory migration of peasants arising from agricultural mining of the soil (Thomson, 1977, mimeo, p. 37).

But the territorial location of production vis-a-vis ecosystem potential and stability and the eco-technological gap in the adjustment of production within specific environmental niches and the needs of our region are as much the result of internal processes such as demographic expansion as they are the result of the logic of capital accumulation acting on the region from outside.

Commodification, Rural-Urban Terms of Trade and the Role of the State in Ecological Degradation

In most of Northern Ghana we find agricultural mining going on also because the socio-economic system the farmers are trapped in leads to diverse forms of social exploitation which in its turn is transferred to the natural environment. Besides, the economic motive of profit has in the post-independence period led to large scale exploitation of the ecosystem without the interest in putting anything back. In this context, I will touch briefly on large scale mechanised farming and rural-urban terms of trade.

Technology of Production and the Ecological Crisis

In the past, traditional technologies of agriculture such as bush fallowing, shifting cultivation and pastoration have all been based on technologies which adapt the agricultural system to the environment by allowing ecological recuperation through time. Under low population densities and low pressure for the cultivation of industrial raw materials and food for the urban markets, these systems worked well as they relied on natural regenerative processes to recuperate the soils and maintain ecological balance. With rapid population growth, urbanisation and the need to produce raw materials for industries and the world market, the limits of the traditional farming systems have become all the more glaring. Physical constraints to production include reliance on rainfed agriculture and the problem of drought together with low soil fertility and the problems of pests. The biological constraints relate to the prevalence of genetically unimproved crops and breeds of livestock whilst physical technological constraints relate to the use of the hoe and the dibble stick leading to the drudgery of farm work (Songsore, 1990, Okigbo, 1989).

Lacking faith in an evolutionary approach based on the development of improved appropriate technique that builds on indigenous knowledge, there has been the rush to the widespread application of western technologies which are generally unsuited to tropical agriculture. A case in point has been the widespread misuse of tractors on tropical soils which only encourages erosion, laterization and desertification because of the large scale clearance of trees, deep ploughing and compaction by heavy machinery. This has resulted from the quick fix solutions that were sought for an agricultural revolution under the state farm model and the predatory use of land by large-scale capitalist farming of rice, maize and other industrial crops such as cotton. This is practised as a form of shifting cultivation because of the ready availability of land rather than as a combination with inputs of matter and energy (i.e. nutrients) in a form of stable, sustainable and permanent cultivation.

The ecological scars arising from the inappropriate use of tractors is most visible around Tamale and along the Tamale-Bolgatanga road and in the Fumbissi Valley. Mechanised farming as applied in the temperate zone adapts environment to agriculture by the general practice of stable agriculture. Under the system there is an input of nutrients to balance extraction through cropping and grazing cycles so as to reduce the period of time required to complete the produc-

tion, extraction and recovery cycles.

Reproductive Squeeze, Poverty and Environmental Degradation

There are yet other ways in which the problem of ecological degradation do not begin and end with the land-using peasants themselves. One that ought to be mentioned here is the rural-urban terms of trade and the privatisation of input delivery under the ongoing structural adjustment programme. Although there is a secular tendency for terms of trade of rural producers to decline relative to manufactured goods from urban centres, this secular trend has been exacerbated by policies being pursued under structural adjustment. For example, although available studies indicate that rural-urban terms of trade have shifted in favour of cocoa producers since 1986 as a result of producer price increases, the same cannot be said to food producers in Northern Ghana whose major staples that enter interregional trade receive very little price support and attention from government since they are not among priority crops. The evidence in table 1 is very instructive as the terms of trade has been turned against the food producers in relation to non-food consumer items in the industrial centres of Southern Ghana and cocoa producers also in the south (Songsore, 1992a).

Table 1

RELATIVE PRICES OF FOOD : GHANA 1977-87 (1977 = 100)

	1977	1980	1981	1982	1983	1984	1985	1986	1987
Terms of Trade									
Food/Non-food									
Consumer Items	100	96	91	112	138	86	60	57	55
Relative Prices									
of food/Cocoa									
Production	100	131	92	125	184	136	64	51	41

Source: Songsore, 1992a, p. 164.

The overall effect of agricultural input policies under structural adjustment however goes beyond affordability of inputs. For example, privatisation of input delivery has led to a shrinkage in coverage away from remote rural communities, thereby further limiting access to these improved methods. This by itself is also bound to affect output negatively (Jebuni & Seini, 1992). More importantly peasants are likely to transfer their growing poverty and inability to access improved inputs into soil mining.

Rising Urban Demand For Biomass Fuels

Most urban households in the large towns such as Tamale, Bolgatanga, Wa, Navrongo, Bawku, Yendi, etc. rely on wood-fuel and charcoal as their principal sources of domestic energy and also for commercial activities such as pito brewing and manufacture of foodstuffs for sale in the informal economy of the towns. Commercial production of biomass fuels for urban markets is one of the hidden causes of environmental degradation because of the lack of access of urban households to such clean energy sources such as LPG and electricity.

Although the overall focus has been on rural landscapes it is important to note that because of the weakness of municipal institutions for the sustainable management of our new towns, they are rapidly becoming areas of accumulated waste and poor sanitation posing health risks to the inhabitants.

Given the complex historical, political, economic and demographic basis to the environmental crisis spanning from the micro level of the household, community, to the meso level of the district, region and the macro level of the state it may nevertheless be important, to add the international sphere. Many African governments have lost control of their economies to international financial institutions as a result of growing debts often resulting as much from inappropriate domestic policies as from an unjust international economic order. Consequently they are incapable of addressing the developmental aspirations of their people and the requirements of sustainable development.

Towards Environmentally Sustainable Development

It is obvious that the current unfolding ecological crisis in Northern Ghana is essentially man-induced, it can equally be solved through human action at the local, district, regional, national and global levels of intervention, co-operation and support.

Since we started by positing human numbers as the problem which is only partly so, the solution could also begin by investing in human development, through their education, health provision and their economic empowerment. The demographic transition occurred in the West because their governments invested in their people which in turn influenced life-styles and also a transition to a high life expectancy and low birth rates. The trained and skilled population was also able to overcome the narrow limits of environmental constraints through technological innovation. Environmental education should be actively promoted at school. There should also be a population redistribution strategy which seeks a more rational balance between people and land. These should be pursued with equal vigour as current family planning programmes.

There is also the need to promote the adoption of environmentally sound technologies such as minimum tillage, non-till systems and alley-cropping. This should be actively researched into by the new University for Development Studies at Tamale. At the community and regional

levels, effective planning and supervision of the use of village lands which implies lasting social contracts with regard to land ownership and the different uses to which land can be put is vital. At the national and international levels, there is an equal need for a major modification in the terms of economic exchange between town and country at the national level and between poor Third World countries such as Ghana and their international partners.

At the very least, District Assemblies, NGOs and traditional authorities should be committed to the following minimum set of actions:

- 1) compulsory education for all children of school going age with the institution of scholarship schemes run by district assemblies;
- 2) land capability surveys which seek to recommend agro-pastoral practices consistent with the effective management of different types of soils;
- 3) anti-desertification and deforestation measures such as the creation of woodlots, and the introduction of improved stoves and biogas systems along with improving kerosene and LPG supply to urban households;
- 4) developing more improved pasture lands to prevent overgrazing;
- 5) in the absence of effective implementation of bye-laws aimed at eliminating bush burning, recommending early bush burning instead of late burning to minimise the destructive impact of the vegetation; and
- 6) wildlife management programme and the enforcement of existing forestry reserve policies (Songsore & Denkabe, 1995, pp. 124 - 125). These could be handled by environmental management committees at district, ward and community levels.

For this to stand any chance of success the close co-operation and active partnership shown between the people, the Catholic Diocese NGO and the different layers of the state apparatus working in hand with progressive international organisations such as the Konrad Adenauer Foundation is the *sine qua non* for the achievement of sustainable development in Northern Ghana.

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