

# Food Security and Environmental Degradation in Northern Nigeria: Demographic Perspectives

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## Introduction

Malthusian controversy still storms about the causes of environmental change and food insecurity in the densely settled zones of Hausaland in Northern Nigeria. On a recent visit to Kano, the former President of the World Bank, Robert McNamara, said:

You can see the environment degrading before your eyes as a result of intensive cultivation and expansion of population.<sup>1</sup>

Similar concerns have been voiced by the Minister of Health:

... the rapid rate of the population growth has forced reduction in the size of farm holdings, led to misuse of land, depleted the supplies of fuelwood, increased the cost of food ...<sup>2</sup>

By contrast, in a recent work detailing the results of some 25 years of research in the KCSZ<sup>3</sup> (Kano Close Settled Zone), Mortimore [1989a:208-211] argues that fears of desertification are baseless, and that population pressure cannot be singled out as a cause of degradation. Equally, Williams [1990:19] has recently argued that the

neo-Malthusian approach ignores historical experience and abstracts from variations in social structures, and in demographic patterns.

This debate is briefly examined in what follows, and the position of the anti-Malthusianists provisionally accepted. The main argument of this article is, however, that at least on the basis of present data, such a debate cannot be resolved. It is not possible to say categorically how important population pressure is for environmental change and food security, relative to other factors, at a macro level. Furthermore, in its current form, the Malthusian debate does not address certain related important questions.

To answer the question of how it is that both fertility and population growth continue to be high in areas of savannah zone Nigeria which are so densely populated involves looking at both the causes and consequences of fertility patterns. However, to begin to understand

demographic motivation and behaviour, it is necessary to examine these causes and effects at the level of individuals and households, rather than at district or state level.<sup>4</sup>

The next section sketches an outline of the debate over population pressure as a cause of degradation and food insecurity in Hausaland, and the reasons for its inconclusiveness. It is argued that more attention should be paid to what Malthus actually said, and that this points to the importance of understanding the existing demographic regime in Northern Nigeria.

Two factors are important in this context: first, the proximate determinants of fertility, and potential sources of responsiveness to economic conditions; and, second, the consequences of demographic behaviour, especially for different economic strata. Existing studies suggest that fertility determinants are rather unresponsive to economic conditions, and that economic and kinship relations act to support the maintenance of high fertility, even where land is scarce for some.

In a final section, the controversy over policy — namely that of population or family planning policy — associated with the neo-Malthusian debates is considered. Again, it is argued that individual level perceptions have been ignored at the cost of realism.

## Population Pressure in Hausaland: Disaster or Delusion?

Northern Nigeria contains the largest densely settled zones in West Africa. Data from the most recent reliable census of 1953 show large, closely settled areas around the cities of Sokoto, Katsina, Zaria, and above all, Kano (see Figure 1). Even in the 1960s, the Kano Close Settled Zone, defined as an area with settlement at more than 350 persons per square mile, and an average of 500 p.s.m., was at points 80 miles across [Mortimore 1967].

In the intervening years, densely settled areas have spread, and towns mushroomed, giving rise to what is

<sup>4</sup> At this point a couple of disclaimers must be made. The aim is to provide an approach, not a set of research results. The analysis is based entirely on secondary sources. Secondly, the discussion of the effects of fertility experience on food security and environmental management relies on sources dealing only with agriculturalists. The situation of Fulani agro-pastoralists in and around the densely settled zones may well be very different.

<sup>1</sup> The Guardian (Nigeria) 20.6.90 p 16, cited in Mustapha [1990b p 3].

<sup>2</sup> Kuti, cited in Mustapha [1990b p 5].

<sup>3</sup> See below.

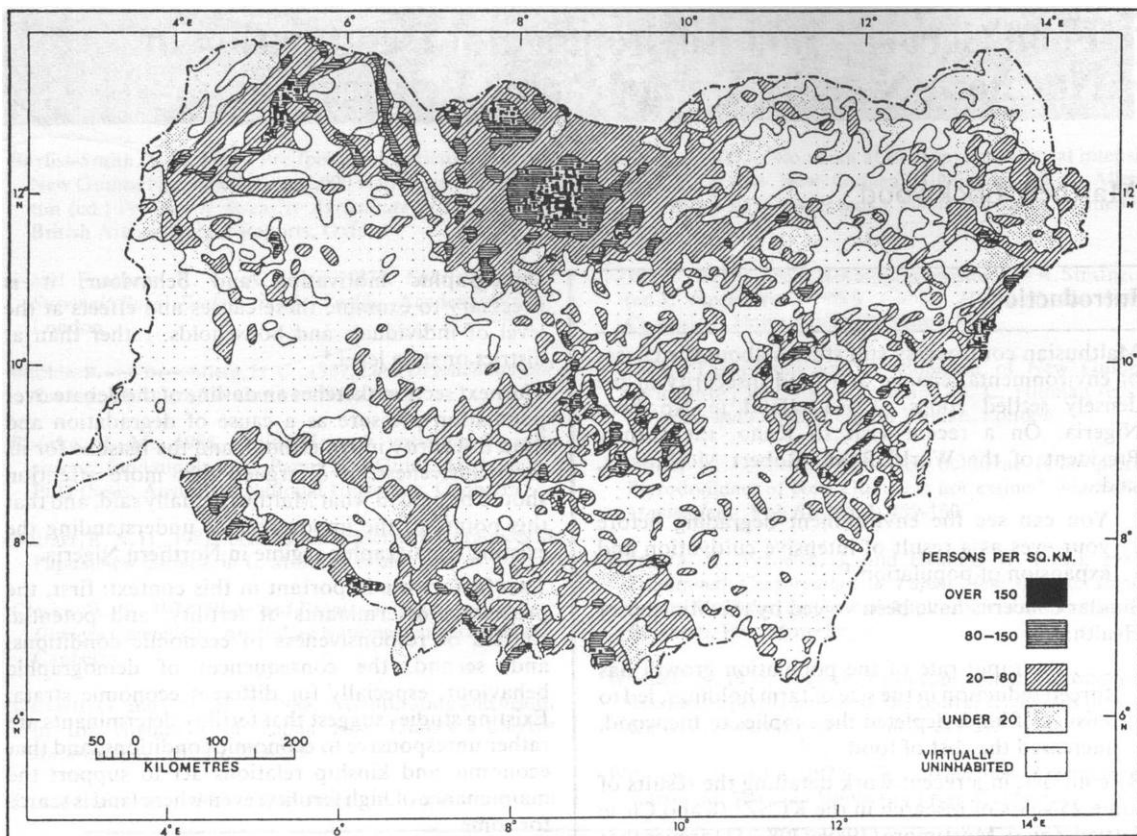


Figure 1 Density of the rural population in northern Nigeria based on R. Mansell Prothero and D. H. Birch (1958), *Northern Region, Nigeria*, 1:1,000,000. *Population Density*, London: Directorate of Overseas Surveys

now a largely unbroken zone of intensely farmed parkland between Katsina in the north, Zaria in the south, and beyond Wudil to the east of Kano [Mortimore 1989b]. Linguistically and culturally, this area falls within Hausaland, and dense settlement has become the archetype of rural Muslim Hausa society [Hill 1977].<sup>5</sup>

These densely populated rural areas fall largely within the Dry Zone of Nigeria, and experienced two major droughts in 1973-4 and 1984. Since the 1950s the trend in rainfall has been downwards. Furthermore, the region has been identified as at moderate to high risk of desertification by UNEP [Mortimore 1989a].

Finally, food insecurity is pervasive in the region, not only in the crisis periods of drought, but also in the form of chronic staple shortfalls for poorer farmers

[Mortimore 1989a:86-8; Hill 1977:118; Watts 1983, 1987].

What, then, is the role of population growth in environmental degradation and food insecurity in Hausaland? The evidence for the Malthusian case is a combination of trends in the close settled zones. First, high fertility supports a rapid population growth rate. Estimates of the crude birth rate for various parts of Northern Nigeria, between 1952 and 1982, range between 43 and 55 per 1,000; those of the total fertility rate between 4.0 and 6.75 [Osuntogun 1988; Udjo 1985]. The resulting crude rate of natural increase is put at 1.5-3.3 per cent p.a. [Udjo 1985], which implies a doubling of the population every 22-45 years.

As densities are already very high in certain areas, average per capita land holdings have become smaller, and diverging devolution of inheritance under Islamic law leads to subdivision and fragmentation. Table 1 gives some figures for densities and average holdings from a number of studies.

<sup>5</sup> Some areas of Hausaland are not densely populated, and Maguzawa, non-Muslim Hausa, tend to live in such areas. However, the very existence of a special phrase, 'deep rural', coined by Murray Last, to describe such communities, shows the contrast with the close settled zones.

Table 1

## Population density and land holdings in Hausaland

Source	Area	Date	Density	Average holdings (acres)
Mortimore (1989)	N.E. Kano	1975-86	Low	14.6
Norman (1967)	Zaria	1966-7	81	11.9
Hill (1972)	N.W. Kano	1967	250	6.7
Norman (1967)	Zaria	1966-7	396	9.8
Mortimore (1970)	KCSZ	1964	439	6.5
Mustapha (1990)	S. Kano	1986-8	2-400	4.5
Ross (1987)	KCSZ	1974-6	520	5.2
Mortimore (1970)	KCSZ	1964	609	3.3-3.7
Norman (1967)	Zaria	1966-7	709	5.5
Hill (1977)	KCSZ	1971-2	c. 1,500	2.9

Note: Density is people per sq. mile: usually district averages

The environmental impact of these pressures is seen in the shifts in land use and vegetation as areas become more densely populated. Traditional farming techniques included both extensive and intensive elements, with concentric rings of, first permanently manured farmland and *fadama*<sup>6</sup>, then grass fallowed upland farms, then bush fallow, and finally forest and grazing lands [e.g. Grove 1961:121-125]. In the densely settled areas, forest and bush fallow has all but disappeared [Goddard et al 1975; Mortimore 1967:677-682; Grove 1961]. It is argued that as a result of this overcrowding, pastoralists are displaced, fuelwood demands lead to deforestation, and soil fertility is exhausted.

A final outcome is upward pressure on food prices, as the demands of a growing population outstrip falling yields and access to land. Prices in Kano State of two staples — millet and guinea corn — increased almost ten-fold between 1970 and 1986, while that of cow-peas rose by a factor of about twenty [Mortimore 1989a:91].

Ranged against this perspective are a number of arguments put forward by two main groups. One is a set of researchers showing that rural Hausa farmers have responded to high densities through labour intensive techniques for raising yields and managing tree resources; and through a wide range of off-farm activities, giving a crucial non-agricultural source of income. They argue that environmental change and food insecurity are affected not so much by population pressure as by factors such as drought and the oil boom.

A key factor is that techniques for conserving soil fertility have long been practised in Hausaland. The most notable are the application of organic manure, and the dry season cultivation of *fadama*. These are now complemented with inorganic fertilizers and the growth of irrigated agriculture [Kimmage 1989]. The prevalence of these labour intensive techniques is strongly associated with population densities and land holding sizes [Goddard et al 1975; Mortimore 1967; Grove 1961]. They are also efficacious: yields of staple grains have been shown to be highly responsive to manuring [e.g. Watts 1987:177].

A second point is that non-agricultural activities have also been an essential part of rural Hausa economy, providing a source of income independent of farming, and indeed supported by high densities and the proximity of urban centres [Mortimore 1989a:210; Mortimore 1967; Goddard et al 1975; Hill 1977]. These activities include trading, crafts, migrant labour and a wide range of services. For women, who are now very often secluded, trading and craft making provide the sole sources of income.

The corollary of these factors is that neither environmental degradation nor food insecurity can be simply read off from high population densities. Mortimore argues that there is little evidence for degradation or desertification in Kano State [1989a]. His study of tree densities in the KCSZ from 1965-1980 showed no downward trend [ibid:163], and this is supported by research showing that tree densities on farmed parkland to the west of Kano actually increased by 23 per cent between 1972 and 1981 [Mustapha 1990b:3]. Equally, there is no evidence that the elimination of bush fallow and woodland has any effect on soil fertility. A much more serious threat is

<sup>6</sup> *Fadama* is low-lying seasonally flooded marshland, usually adjoining streams or rivers. It is used for dry season cultivation.

posed by desiccation from meteorological drought, and the effects of crop changes over time [Mortimore 1989a:200-213].

Detailed studies of Hausa rural economy also throw doubt on assertion of simple relationships between population pressure, land shortage and food insecurity through production shortfalls. For most farmers in the close settled zones, holdings have long been inadequate to allow self-sufficiency in grain. But wage labour and non-farm activities play a key role in maintaining incomes. Hill [1977:165-6] argued that, even in the anomalous case of Dorayi (c.1,500 p.s.m.), right next to Kano City, the poorest farmers were not necessarily worse off than their counterparts in less crowded Batagarawa.

Indeed, it seems that the categorisation of the Hausa as 'subsistence farmers' is plainly incorrect. Hill's work near Katsina shows that localised wholesale and retail grain trading was a central part of food provisioning, even for a village not particularly near a large town [Hill 1972:124-128]. Further, the absence of a wider range of food stuffs makes rural Hausa farmers highly dependent specifically on **grain** markets [ibid:137].

Finally, environmental change and food insecurity are more affected by exogenous factors than by population pressure. Drought is a good example, affecting soil fertility, livestock holdings, food prices and wages [Mortimore 1989a]. The oil boom is another, with consequences for wages and land concentration [Mustapha 1990:226; Lubeck 1978:39].

A second set of anti-Malthusian views is identifiable as taking a political economy viewpoint, arguing that environmental degradation, food insecurity and rapid population growth are the outcome of the commoditisation of agriculture, and are strongly differentiated by economic position.

It is argued that crop choice, land concentration and the viability of farming groups in rural Hausaland have been fundamentally determined by a process of commoditisation of agriculture, and the polarisation of farming classes [Shenton and Lennihan 1981]. This has led to greater food insecurity [Watts 1983], environmental degradation [Watts 1987],<sup>7</sup> and an upsurge in population growth as a response to increased labour demand [Williams 1990].

Most importantly, the political economy viewpoint suggests that all the factors supposed to be associated with population pressure (agricultural intensification, land shortage, increased wage labour, decline in **gandu**<sup>8</sup> farming groups) are experienced differently by different classes or strata of farmers. Thus, poor

farmers are less likely to buy land, and more likely to sell it; are less likely to use capital intensive techniques of farming, and to use manure or fertiliser; are more likely to perform wage labour; are more likely to be dependent on non-farm activities, but make less from them; and less likely to retain sons-in-**gandu** [Mustapha 1990; Hill 1972, 1977; Shenton and Lennihan 1981; Mortimore 1989a, 1967; Lennihan 1987; Longhurst 1984]. A corollary is that food insecurity is also differentiated by stratum or class [Watts 1987:196-204]. Poorer households obtain lower yields, produce less grain, and buy at less advantageous terms of trade than richer households.

Which of these two positions is correct? Is environmental degradation and food insecurity due to population pressure; or are they due to the commercialisation of agriculture? If both are involved, what is their relative importance? What degrees of environmental change and food insecurity actually exist in either case?

The evidence for a current Malthusian disaster in Hausaland is weak, while the rural economy is adaptive to various kinds of pressure, of which population growth is only one. However, ascribing an empirical relative level of importance to the population factor is difficult, if not impossible, at least on currently available data.

There are three reasons for this. First, all the available studies of economic and environmental change are micro-studies, and have been carried out over a period of at least 30 years. It is possible to piece together a kind of picture from this, but Hausaland contains a large population, a variety of climatic zones, and undergoes continuous processes of change. Without large scale systematic research, it is not possible to be sure of what applies to most of Hausaland, and what does not. This is true even of basic data, such as population patterns. This may change if the next census (due this year) is reliable, but other variables still face the problem.

The process of change brings us to the second point, which is that dynamics may be non-linear, especially for environmental variables. The apparent stability of farmed parkland in Hausaland contrasts with rapid changes in newly settled areas, and this distinction may be particularly important for desertification processes [Nelson 1988]. However, even if population growth has or has not been significant up until now, it does not mean that this will necessarily be the case in the future.

Thirdly, there is the intractable issue of separating population pressure as a causal factor of change from a wide range of other environmental, economic and social influences. Simply relating density to various differences in comparative micro-studies is open to problems of ecological fallacy.

<sup>7</sup> See Franke and Chasin [1980] for the nearby Sahel.

<sup>8</sup> The **gandu** is a farming, and sometimes consumption group, usually consisting of a father and sons. For a detailed discussion see Hill [1972 Ch. 3] and Wallace [1978].

These points lead to the conclusion that, when considering further micro-studies on the significance of population factors in rural Hausaland, another addition to this debate will probably not lead to further clarification of the issues. Another approach might be more useful. In the remainder of this paper, such an approach is developed. To do this, we must go back to Malthus.

### What Does 'Population Pressure' Mean?

The epithet 'Malthusian' is usually attached to those who see famine (and now environmental disaster) as an inevitable, if long term, outcome of rapid population growth. This view is indeed based on part of what Malthus wrote. However, most demographers now agree that Malthus was wrong, or rather rhetorical, about the long term dynamics of population growth, agricultural growth and starvation [e.g. Watkins and van de Walle 1983; Wrigley 1986].<sup>9</sup>

By contrast, much more credence is given to his analysis of short run demographic-economic dynamics [e.g. Tuzelmann 1986; Wrigley 1978, 1986; Smith 1981]. In the Malthusian system, population growth was largely regulated by age at marriage. Earlier marriage led to higher population growth, a consequent fall in agricultural wages, and destitution for the rural population. This in turn led to delayed marriage and a damping of population growth. Any factor, such as the Poor Law system, which amounted to a destabilising intervention in this system of feedback would lead to economic disaster, with only the immoral 'vice' of marital fertility control (i.e. contraception) as an alternative, one which Malthus was thoroughly opposed to.

The irony is not only in Malthus' opposition to contraception when compared with the neo-Malthusian promotion of it, but also in the fact that Malthus had based his analysis on an essentially correct grasp of the mechanism of fertility change in early modern England. By contrast, both neo-Malthusianists and anti-Malthusianists tend to adopt rather idealised notions of demographic behaviour in contemporary Hausaland. Thus in the 'isolation paradox' of the World Bank, it is assumed that farmers' fertility is determined through an economic decision making process, in which, because of unperceived externalities, they miscalculate the costs and benefits of children [World Bank 1984]. Likewise, Mortimore [1989a:209] follows Caldwell's approach to fertility as determined by the net flow of labour and other services from children to parents. Similar considerations dominate the political economy approach to fertility adopted by Williams [1990].<sup>10</sup>

Malthus' immediate argument, then, was based firstly on an understanding of how fertility was determined and changed, and secondly on an understanding of the consequences for the rural economy, and for individuals and households within it. However, it is well known that the demographic system which Malthus identified is far from universal [Lestaheghe 1980].

Thus his arguments cannot be applied directly; it is necessary to identify the factors determining fertility in each case. But it is still relevant to ask how responsive these determinants are to economic and environmental conditions, as they were in the case of marriage in early modern England. Cain and McNicoll [1988] have suggested that the degree of such responsiveness is a key factor in determining whether agrarian systems can sustain economic and environmental viability. The next section therefore examines the evidence on the proximate determinants of fertility in Northern Nigeria, to try to assess the responsiveness of the demographic system.

Second, consequences of the resulting fertility and marriage patterns for individual households, and especially households of different economic strata are discussed. This suggests giving a different meaning to the phrase 'population pressure'. Although the aggregate effect of high fertility may be high growth and density within a locality, each person's individual demographic history will have effects specific to him or her. The consequences of 'population pressure' therefore cannot be understood without looking at individual and household effects.

Finally, policy implications are considered, principally from a demographic perspective. Is population control through family planning currently a suitable and a viable policy to ensure environmental and food security in Hausaland? If not, what conditions would be necessary for it to be so? Central to this issue are people's own perceptions of reproduction and of their ability and right to control it.

### The Proximate Determinants of Fertility

The proximate determinants of fertility constitute a framework for understanding the bio-social routes through which fertility is determined. Their characteristic is that if one of them changes, then *ceteris paribus* fertility must change [Bongaarts and Potter 1983]. Any social or economic factors affecting fertility must act through them. A principal question here is whether the important proximate determinants are responsive to economic conditions, and in particular to crises of food security or environmental sustainability.

On the basis of existing research it is difficult to provide a detailed answer. Only a few preliminary points can be made. First, an idea of the structure of

<sup>9</sup> The work of Esther Boserup [1965] is obviously central to this critique.

<sup>10</sup> See Lockwood [1989] for a detailed discussion of the structures of these arguments and their problems.

the proximate determinants in areas of Northern Nigeria can be obtained from two sources. These suggest, in line with much of sub-Saharan Africa, that fertility is depressed through long birth intervals, but also that the role of infertility is key. It is not clear how these factors might be related to increasing densities, and economic and environmental pressures, if at all. Neither is it clear whether marriage and household formation might arise as a new locus of fertility control.

The only demographic study made to date in Northern Nigeria which gives direct indices for the proximate determinants is Udjo's 1985 survey near Maiduguri in Borno State. All three survey sites are far from the close settled zones of the North West, but they do cover varying conditions of density and commercialisation. The main findings were that, overall, marriage and contraception factors had negligible effects on fertility; birth spacing factors (breastfeeding and post-partum abstinence) were important; but the most striking factor was pathological sterility [Udjo 1988:290].

Infertility appears to be a particularly strong influence on fertility in the North East, and to be less prevalent in Hausaland. However, there is evidence that it is still a dominant factor. As Osuntogun notes [1988:248], Northern Nigerian populations generally have

... early and universal marriage, high conjugal mobility, desire for large family size, high infant and child mortality, negligible use of modern contraception, very low literacy and [a] low level of urbanisation.

While these factors should in theory lead to high fertility, in fact fertility in the North is low, relative to African populations in general and to the rest of Nigeria in particular. This is shown in Table 2 giving indices of contraceptive practice, marriage and fertility for different regions of Nigeria.

Lower fertility in the North is partly explained by longer average periods of full breastfeeding and sexual abstinence, but these have only a small effect. The main factor is infertility, which is shown in relatively high proportions of women with no children or one child in Northern populations [Osuntogun 1988: Table 8.2B].

The importance of sterility implies that fertility rates may increase with better facilities for treating and controlling gonorrhoea. Osuntogun [1988:116-7] suggests that, while total fertility rates in the North before 1970 were not above 5, they have risen to about 6 in the 1980s. The shift in this particular proximate determinant, however, is unrelated to conditions of food security and environmental degradation.

Changes in post-partum behaviour are generally argued to be less responsive as a fertility control to changes in economic conditions than marriage [Lesthaeghe 1989:31]. The mean reported durations of breast feeding and sexual abstinence in northern Nigeria show some variation [Nigerian Fertility Survey, Vol. I 1984; Udjo 1985:281]. However, whether such differences can be interpreted as a response to economic and environmental conditions remains an unanswered question.

The proximate determinants most conducive to response to economic factors, including scarcity of land, are marriage and contraception. Both are marginal in Northern Nigeria. As seen in Table 2, women marry very young, divorce is high, but so is remarriage. Contraceptive use is very low. There is little evidence that high density has disturbed this pattern. Hill's [1977] example of the 'big houses' near Kano City, under extreme conditions of density, show how even when independent household formation is not possible, marriage is facilitated by the extension of existing compounds.

As noted, the prevalence of contraceptive knowledge

Table 2

Contraceptive knowledge and use, age at marriage and children ever born, Nigeria

Region	% of women			
	Have heard of any method of family planning	Have used any method	Female mean age at marriage	Mean CEB 20+
N.E.	14.8	3.2	15.4	4.94
N.W.	17.6	6.4	14.8	4.33
S.E.	54.4	28.5	18.8	6.80
S.W.	49.0	22.4	20.1	5.82

Source: Osuntogun [1988:282]

and use is low in Northern Nigeria. As late as 1983, there was 'no family planning office or publicly available information on either planning or birth control' in metropolitan Kano [Callaway 1987:28]. As for education, a known co-factor in the adoption of contraception, survey data from the early 1980s shows that few women receive non-religious schooling [Osuntogun 1988: Table 3.16].

These, then, are the factors directly responsible for fertility and marriage patterns in Hausaland. We now turn to the individual and household level consequences of these patterns for environmental management and food security.

## The Proximate Consequences of Fertility

This section does not attempt an exhaustive treatment of how demographic events and structures may influence household environmental management and food security. Rather, it is suggestive, taking what are likely to be the more important issues, on the basis of existing studies. It is primarily intended to be a framework for further research.

It is also selective in a different sense, being largely (although not exclusively) concerned with relationships between fathers and sons. The economic consequences for women of different fertility and marriage histories is touched upon at times, but obviously deserves a more thorough treatment. The only mitigating factor here is that women participate much less in farming than men in rural Muslim Hausaland, and, therefore, are not so involved in issues of environmental management and food production (although they are the organisers of food trading).

The issues raised arise at three different stages of the lifecycle. They are: (i) the care and feeding of young children; (ii) the labour of sons-in-**gandu**, and its significance for food production and environmental management; and (iii) inheritance, the subdivision of land holdings and future economic viability.

(i) We have seen that overall fertility in Northern Nigeria, including Hausaland, is high, although not as high as in Southern Nigeria. However, this overall average figure is affected by sterility, so that the population is divided into two rather distinct groups: women with primary or secondary sterility, and 0, 1 or 2 children, and fecund women with a larger average (around 7) completed parity. There is thus some variation in the number of children ever born, and in the burden of raising those children. In particular, some families face a stage of household formation where they have a number of young, dependent children. However, there are several aspects of Hausa residential and labour organisation which act to smooth out these effects.

The first point is that, as Hill [1972:24] notes for Batagarawa, relatively few women live in a house

without any other adult women. This is partly due to polygyny, and it is clear that the 'staging' of marriages smooths out the burdens of child rearing associated with the early years of any particular marriage. However, as Hill shows, this is not entirely an effect of polygyny. It is also because a house (**gida**) will often contain more than one section, each with a married man and dependents [e.g. Hill 1972:17-19, 35].

A second point is that the institution of **gandu**, whereby, typically, sons work for their father in farming and obtain food and sometimes other benefits in return [see Hill 1972; Wallace 1978], has the consequence that young men are helped in the period of highest dependency ratios. Of two specific groups of poor men noted by Hill [1972:168-9] in her classic study of inequality, one is that of young married men without a paternal **gandu** to work in.

At this point we can introduce the dimension of differential experience. As noted above, we know that poorer farmers are less likely to sustain working **gandaye**. It is also the case that poorer farmers have fewer wives [e.g. Hill 1972: 37, 61]. Both these factors imply that poorer farmers may experience the period of maximum dependency more strongly.

(ii) This is also the case for the consequences of having adult children. Again, the number of adult children, and specifically sons, will vary according to the factor of sterility. However, household formation is also a social process, and the number of sons any one male farmer will have depends also on the number of his wives. Again, richer farmers have more wives than poorer farmers, and consequently more sons [Hill 1972:81-2]. Of course, sons are not the exclusive source of labour for farmers in Hausaland — wage labour is long established. But those with the least family labour (poorer farmers), and so, if not constrained by lack of land, in most need of wage labour, can least afford it. As a result they end up 'too poor to farm' — unable to embark on farming operations which provide the best returns [Hill 1972:191].

Sons are, however, necessary for the formation of paternal **gandu**, even if simply having sons is not a sufficient condition. The second group of poor farmers identified by Hill in her 1972 study was that of older men without **gandaye**.

These patterns have consequences for both food security and environmental management. Food security is discussed below. Many techniques of environmental management in African dryland agriculture are not only capital, but also labour intensive. These include soil improvement through manuring, ridging and rotation; intercropping; well-fed irrigation; and tree planting and tending [Watts 1987; Mortimore 1967; Grove 1961; Goodard et al 1975].

(iii) A third aspect of the consequences of fertility patterns is inheritance. This has been a focus of concern over high fertility in land scarce areas for the World Bank [1984]. It is argued that systems of inheritance (such as Islam), which do not preserve family estates through generations lead to extreme levels of subdivision and fragmentation. And there is evidence for the KCSZ that this occurs. Mortimore [1967:683] observed significant trends in both subdivision and fragmentation in registered land in an area of 448 acres between 1932 and 1964. Ross [1987] argues that such patterns are ameliorated by complex systems of land borrowing which mean that access to land circulates more widely, but it is clear that more farmers still end up with tiny holdings [see e.g. Hill 1977:122].

This would imply that having more children (sons and daughters since both inherit under Islamic law), would aggravate problems of subdivision. However, again the issue of differentiation is relevant. For we know that, while richer farmers have more children than poorer farmers, they also buy land — manured farmland — from poorer farmers [Mustapha 1990; Hill 1972]. The result is that those with more children

(richer farmers) also have more land, both in total, per head and per working man [Hill 1972: 62, 82].

The result of all these factors is the prediction, strikingly supported by at least three studies, that food security, measured by production or consumption, is not negatively affected by large household size; but rather that both will be differentiated by economic position. Table 3 shows selected aspects of household structure and food security from studies in Niger State, rural Kano and rural Zaria.

Richer households have more people, and more dependants, but meet more of their grain needs, than poorer households. In Longhurst's 1984 study, the nutritional status of children was not significantly positively related to economic position, and part of the reason may be the fact that richer households have more children. However, the most significant demographic variable for infants' status is birth order, rather than family size or dependency ratios, which may well be a maternal depletion effect. As for children aged 2-5 years, their nutritional status was significantly and **positively** related to the dependency ratio which Longhurst argues is again due to the fact that better off households have higher ratios.

Table 3

Household structure and food security by economic position (3 studies)

Group	Household size	Estimated % of calorie needs met by farm grain production	Total calories available p.c. after sales and purchases
Yelwa (Niger)			
I (rich)	11.2	70	2106
II	6.9	63	2005
III	6.9	60	2128
IV (poor)	3.9	46	1891
Kano			
I (rich)	9.3	146	3557
II	5.8	88	2031
III (poor)	3.7	34	1035
Group	Family size (consumer units)	Dependency Ratio	% Energy intake needs met
Dayi, Zaria			
I (rich)	7.89	1.63	100
II	4.77	1.31	83
III (poor)	3.43	1.33	86

Sources: Watts [1987 Tables 9.4 and 9.5 pp 199-200]; Longhurst [1984 Tables 2.8 and 3.8, pp 30 and 53]



Thus, it would seem from this kind of evidence that fertility in Hausaland is determined by proximate factors which are relatively unresponsive to economic conditions, and in particular land shortage. Ages at marriage are very low, as are contraceptive take up rates. Furthermore, the structure of residential and labour groups is such that the burdens of child rearing are minimised and the benefits of having sons maximised, especially for richer farmers. Indeed, those who stand least to lose and most to gain from having lots of children (rich farmers), are able to do so, mainly through having more wives. While this means slightly lower total marital fertility rates, it also means that attaining success in the close settled zones, including environmental management and food security, is associated with large families.

### Policy, People and Perceptions

However, this not should be taken as an argument that fertility in Hausaland is the result of economic decision making. As argued above, this is not a realistic approach. Fertility levels are set in an immediate sense by the proximate determinants. Unless some sort of 'marriage valve' comes into operation, the only way in which fertility may respond to economic or environmental pressures is through (i) the perception that population growth is responsible for these pressures; (ii) the adoption of contraception to control fertility. While the second issue is of prime policy interest to the neo-Malthusianist position, the first, or rather the closely related issue of general indigenous perceptions of environmental change, is of increasing interest to policy makers in the environmental field.

An example of the problems involved can be found in material from a recent oral history project in four Sahelian countries, run by the NGO 'SOS Sahel' in order to understand local perceptions and knowledge about environmental change [Barker and Cross 1990]. It shows the pitfalls in seeing an immediate link between aggregate population movements and environmental change on the one hand and fertility response on the other, for the reason that people in rural Sahelian communities themselves do not see such a link.

A common theme in the interviews was an association made between perceived environmental degradation (e.g. loss of trees), and population growth in a locality. But when it comes to discussions of what can be done about such degradation, notions of controlling fertility (or more generally population growth) are conspicuous by their absence. Population control is not on the indigenous 'policy agenda', at least in the form understood by many agencies and governments. Fertility control does not fall within the 'calculus of conscious choice' [Coale 1973; see also Trussel et al 1989].

### Conclusions

Most approaches to the population variable in discussions of food security and the environment focus on the aggregate effects of population growth or density. Whether Malthusian or Boserupian, they also usually treat the motivations for fertility behaviour in terms of its individual economic rationality or irrationality.

In this paper, a different view has been developed, in which the relationship between population, food security and the environment is shown to be more complex. The causes and consequences of fertility behaviour have been separated out, and examined at converse levels of scale. It has been argued that fertility levels have been maintained and may be rising in Hausaland, partly because their determination is not directly related to conditions of density, and any related economic and environmental factors, such as the overall availability of farmland, food security or environmental crisis.

It has also been argued that the social and economic organisation of labour, food supply and marketing, and environmental management are such that high fertility is less likely to heighten food insecurity and environmental degradation. This happens within a differentiated society, where richer farmers have more wives and children, but are able to bear the costs and obtain the benefits more easily than poorer farmers.

The system is thus demographically unresponsive, but economically and socially absorptive of demographic pressure. This sustains a generally pro-natalist society, in which perceptions of fertility behaviour are likely to change only if non-linear dynamics cause a rapid and large-scale crisis, or if education affects attitudes toward individual fertility control.

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