

Chapter 14

'Desertification' – international conventions and private solutions in Sub-Saharan Africa

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1 INTRODUCTION

International policy and even scientific debate has been characterised by widespread confusion over the meaning of and, therefore, the causes of, drought, desertification, deforestation, degradation, and development. The respective roles of man and of climatic variation (which is largely uncontrollable by human action) have been at the heart of the misunderstandings. This paper briefly reviews the debates which led up to the Convention to Combat Desertification (CCD) in 1996, and the lack of official action which followed. It then examines the rainfall variations and trends with which farmers in Sub-Saharan Africa (SSA) have had to contend. A second challenge facing them has been population growth, relatively slow in rural areas, but rapid in urban areas, transforming local food markets. The success of farmers in keeping up with local demand is demonstrated by the record of per capita food imports, which appear more affected by a country's exchange rate policy than by its rainfall. The adaptations and innovation by which farmers in areas with low and erratic rainfall have met market needs and maintained their own livelihoods is illustrated by some case studies. It is concluded that the CCD misunderstood the needs and underestimated the abilities of African farmers. National and international policies need to be redirected to creating the environment which supports rather than frustrates African entrepreneurs, whether as small farmers, traders or businessmen and women.

2 THE CONVENTIONS

The great Sahel Drought which culminated in widespread famine in 1972-74 had a pivotal significance in the evolution of national and international dryland development policy. It was perceived at the time, in official circles, as a fivefold crisis:¹

- drought: technically viable indigenous systems of production quite suddenly came to be seen as maladaptive and necessitating new technical or management solutions.
- food scarcity: persistent dependency on food aid continued through the 1980s in the francophone Sahelian countries, casting doubt on the region's ability to feed itself.
- overstocking: the massive mortality among livestock holdings convinced some that the populations exceeded the levels supportable.
- degradation: the effects of drought were easily confused with 'desertification': 'overcultivation' (or 'soil mining'), 'overgrazing' (or pasture degradation),

¹ Mortimore (1998)

‘deforestation’ (or removal of woodland) and - it was assumed – ‘overpopulation’, as discussed later.

- ‘coping’: a disaster that affected the viability of the crop and livestock sectors was believed to be the underlying cause of increased poverty, asset losses and extensive out-migration.

What many saw as a collapse of livelihoods across the region led to calls for massive interventions by governments and donors to save the natural resources from further destruction. Earlier pessimistic assessments had been made of degradation in Africa,² but the 1972-4 droughts provoked a sandstorm of literature surrounding the United Nations Conference on Desertification in 1977. Human activities were blamed:

*“Desertification is the diminution or destruction of the biological potential of the land, and can lead ultimately to desert-like conditions..... Over-exploitation gives rise to degradation of vegetation, soil and water”*³

The Conference approved a Plan of Action to Combat Desertification (the PACD), which was co-ordinated by the Desertification Branch of the UNEP, as the basis for national plans. Although global in its scope, the sheer size of the African drylands ensured their prominence. About 36-43% of Africa (depending on the definition used), is dryland. Of this, the heart is the semi-arid zone, where crops and livestock are of equal importance. It contained in the 1970s about a third of the human and cattle populations of Africa, and about a quarter of its sheep and goats.⁴

Desertification was thus used to justify central policies, interventions in smallholders’ management of their natural resources and spending by aid donors and development agencies; on the grounds that “People are the producers of desertification”⁵. Time-hallowed associations between population growth, over-exploitation and degradation were repeated in the literature; and assessments continued to make extensive use of approximations and assumptions.⁶ The struggles of the Desertification Branch of UNEP to mobilise funds for the PACD, in the face of scepticism and controversies surrounding the history, definition and operation of the term ‘desertification’, the extent of the affected area and the institutional dynamic have been well documented.⁷ The criticisms resulted in a new definition of desertification for the Earth Summit in 1992:

*“Desertification means land degradation in arid, semi-arid and sub-humid areas resulting from various factors, including climatic variations and human activities.”*⁸

This became the basis of the United Nations Convention to Combat Desertification (CCD), which came into effect on 26 December, 1996. Although climatic variation was now admitted

² Dregne (1970)

³ UNEP (1977)

⁴ Mortimore (1998), p. 11

⁵ Mainguet (1994)

⁶ UNEP (1990); Dregne *et al.* (1991)

⁷ See: Warren and Agnew (1988), Thomas and Middleton (1994), Mortimore (1989; 1998), Morris (1995), and Swift (1996).

⁸ Stiles (1995)

as a contributing cause, the activities which followed its signing continued to advocate programmes and projects to reform farmers' and pastoralists' practices (though participation and institutional issues were elevated in the rhetoric). The focus of the Convention is the preparation of national plans for furtherance of the 'combat'.⁹ However, the Intergovernmental Negotiating Committee was soon complaining of difficulties in attracting the necessary finance,¹⁰ in spite of the fact that the CCD was ratified by the European Union, in 1997,¹¹ and by the US Senate in 2001.¹² The various national and international action plans put forward thus remain paper documents. Meanwhile, according to the October 2001 newsletter of the Convention to Combat Desertification, the 4th meeting to review implementation "did not enable well defined conclusions".¹³

More recently a *Global Drylands Partnership* has been set up to address drylands issues. It includes the Canadian International Development Development Agency, the UNDP's Office to combat desertification and drought (UNSO) and several major environmental NGOs. So far it has published on the Web four Challenge Papers, which "question many of the underlying assumptions (some of which are incorrect) that frequently inform programme designs and interventions in the drylands". However, while emphasising a variety of situations, they continue to perpetuate without documentation statements such as "the vicious circle of poverty and environmental degradation" (in *Poverty and the Drylands*) and the "population pressures, social changes ..., exploitative agricultural and grazing practices" etc which "degrade 20% of the world's drylands" (in *Vulnerability and adaptation to climate change in the drylands*). Accepting the 20% figure at face value suggests that 80% have met the challenges of rainfall variability and population growth relatively successfully, and the same paper acknowledges "the knowledge and initiative of the dryland people themselves", but says that "success stories are more the exception than the norm". The underlying message, though, remains continued deterioration, increasing poverty, and lack of knowledge, requiring interventions by governments and agencies.

There is still need, therefore, to define more carefully the nature of the challenge facing people in drylands SSA, to identify the responses that they have already made, and the policies which enable relatively successful adaptation, and which could help to alleviate the undoubted poverty from which many of their people suffer. The remedies are different if we are looking at ignorant degrading activities, or at partly success efforts to sustain livelihoods for more people in the face of unfavourable rainfall trends. The argument of this paper is that rainfall plays a more important part than is normally acknowledged, and that people have responded rationally to the challenge of periods of diminished rainfall which have coincided with a period of high population growth.

⁹ The military language used in the CCD has been a feature of the discussion of anti-desertification efforts since at least the 1950s (Morris, 1995).

¹⁰ UNEP (1997)

¹¹ European Commission (1997)

¹² It was included in a list of 34 treaties ratified without debate, which has since caused some controversy (www.sovereignty.net/p/land/treaties.shtml – eco-logic on-line)

¹³ The obsession with underfunding is not new: the main output of ICRISAT (the International Crops Research Institute for the Semi-Arid Tropics), which became the convening centre for the Desert Margins Initiative, "an integrated national, regional and international research program to combat land degradation in sub-Saharan Africa" has been restricted by shortage of funds to a report on workshops in nine SSA countries to review the state of current knowledge and to identify research priorities. (Fletcher, 1996)

3 DEFINITIONS

Warren and Khogali suggested restricting the term ‘dryland degradation’ to degradation ‘brought about mainly by inappropriate land use under delicate environmental conditions’, and using the term ‘dessication’ for natural drying out over decades.¹⁴ This assists clearer thinking, though there are practical difficulties in separating the effects of each out and measuring their impact.

Unsustainable cultivation techniques or grazing practices, or careless cutting of trees for fuel, etc. often occur in patches, rather than on a wide front. They may also be temporary, remedied to a greater or lesser extent after a few years when people recognise they have a problem. The indicators of desertification vary over time as well as space.¹⁵ Measurement after a series of dry seasons can mislead, since with the return of more humid weather, natural vegetation, crop yields and livestock numbers can recover – and there are periods of dry or humid conditions (see Figures 1 and 2). Sorting out the human and natural causes of what is measured is also difficult, since vegetation dies from lack of rain as well as ‘over-grazing’, leading to bare soil and erosion. Some soil phenomena are partly due to natural factors. The Loess Plateau in China has perplexed soil scientists for decades.¹⁶ The human element is clearer when water is badly managed, but the problems of irrigated drylands, more extensive in Asia than Africa, are not at the forefront of the desertification debates.

Thus, measurement presents a technical challenge, and it does not necessarily lead to clear identification of causes. Crop yields can fall because the cost of inputs has risen in relation to outputs, or because of reduced water availability to plants, (which affects their ability to take up nutrients), or because of the depletion of soil nutrients, or the deterioration of other valuable soil characteristics, or because of soil loss due to erosion. The required remedial measures will obviously differ.

There is the further problem of definition. Vegetation measurements usually relate to the natural vegetation. However, over time, in all countries, men have gradually cleared large areas in order to create farms. They may retain some, but not all, of the natural species as part of their farms. They also may introduce new species. Maize is now grown in countries far from its place of origin in the Americas, the Australian eucalyptus is everywhere, and the Indian neem provides shade in Nigerian towns. The question is whether such activities should be regarded as degradation, deforestation, or development. Should degradation be measured by the underlying productivity of the soil, in years of ‘normal’ rainfall, regardless of the type of biomass produced?

4 DESSICATION AND RAINFALL CHARACTERISTICS IN SSA

The reference to ‘normal’ rainfall brings us to the heart of the problem. In semi-arid Africa farmers cope with great variation in rainfall from year to year, sometimes apparently coupled with underlying cycles of more or less humid conditions about which we know very little. The few stations that have recorded measurements for as long as 80 years show this annual

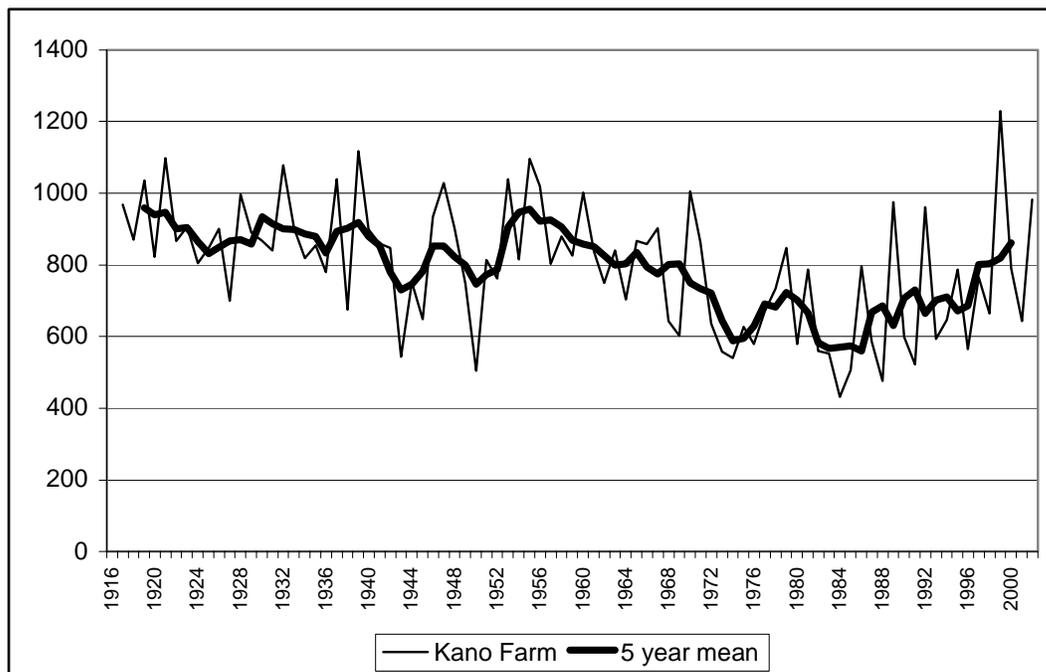
¹⁴ Warren and Khogali (1992)

¹⁵ Stiles (1995)

¹⁶ Tiffen (1998)

variability and conflicting evidence on trends and cycles¹⁷. Figure 1 gives the annual seasonal rainfall (May-October) and the five year seasonal running mean at Kano Farm, Nigeria, 1916-2001. The annual totals demonstrate the risks farmers have to take into account. The five year running mean shows that in this Sahelian region, the 1950s were a period of relatively high rainfall. This was followed by a decline, which was particularly steep from the mid 1960s to the mid 1970s, followed by a slight recovery, followed by another dip in the early 1980s. This pattern, which was fairly similar across the Sahel,¹⁸ led to fears of what we are terming 'dessication'. However, now that we can extend the Kano data to 2001, it looks as if there might have been a recovery since the late 1980s. Data from Maradi in Niger and Diourbel in Senegal shows the same upward direction in the 1990s, but less clearly, since we have not the figures for the last two years. The droughts of 1972 and 1984 had all the greater impact on livelihoods and ability to buy food because farmers had been unable to rebuild grain stores and livestock herds after immediately preceding poor seasons. Official concern about drought and desertification coincides with the rainfall decline.

Figure 1: Rainfall at Kano Farm, Nigeria, 1916-2001



The rainfall record in East Africa shows a different pattern. There was no long decline circa 1965-85, but some tendency towards a cyclical pattern which differs as between the two cropping seasons, October-December and March-May.¹⁹ Figure 2 gives the data for Makindu station, in Makueni District, Kenya, 1904-1997. Farmers in this area with good water conservation tactics can get some maize from 250-300 mm per season, provided the rain is

¹⁷ It would be desirable to be able to average data from several stations in a zone, since there can be considerable variations due to local storms.

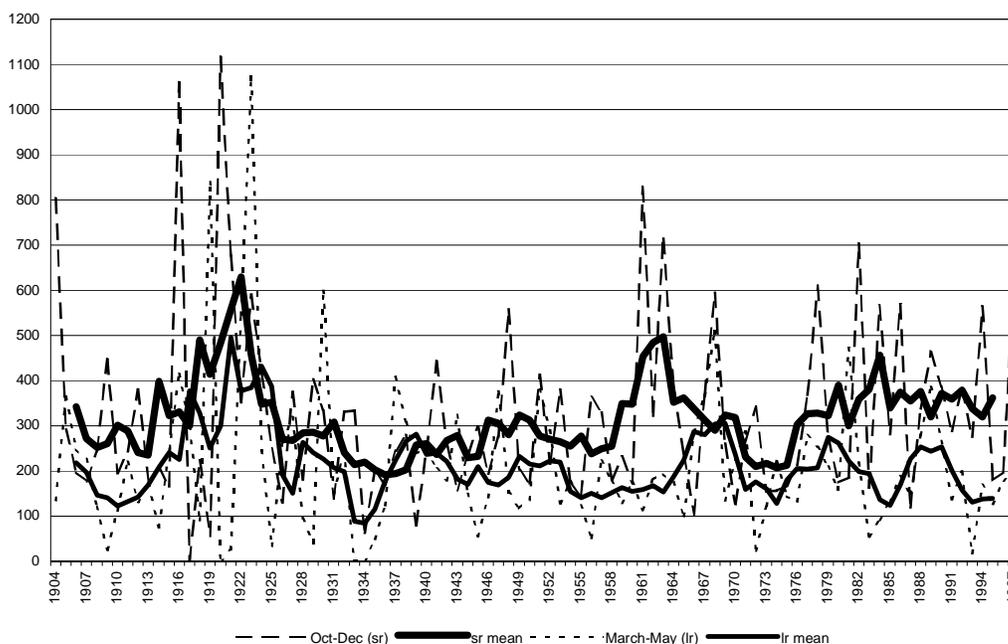
¹⁸ The slight recovery in the late 1970s was less marked in the two stations in the Diourbel, Senegal, for which we also collected data.

¹⁹ Tiffen, et al. (1994)

well distributed. Figure 2 shows that they do not always get this minimum. Sequences of several poor seasons may make them dependent on assistance, and from which they need time to recover.

Long-term rainfall data collected from a farm in the southern region of Zambia, owned by the same family since the 1920s, shows similar variability. Periods of higher and lower rainfall could be detected, but no clear downward trend. The extremely low rainfall resulting in the drought of 1992 had been matched in 1923-4. The 1991-2 rains came after a decade of lower rainfall, somewhat worse than the 1920s (Tiffen and Mulele, 1994)

Figure 2: Rainfall at Makindu, Makeni District, Kenya, 1904-1997



Rainfall accounts for a large proportion of variability of crop output, for some of the deaths and southward shifts of some natural species, for the lowering of groundwater levels and reduced availability of surface water. Lack of water and forage will lead to deaths of domestic livestock. Periods of poor rainfall make it more difficult for farmers to maintain good cultivation practices (death of oxen for ploughing and first weeding, lack of manure, lack of money to buy fertiliser, etc). In fact, what is amazing when we look at the record of crop and livestock production in these areas is how farmers have continued to cope with rainfall variability, to adapt to it, and to recover.

There is the question as to whether human actions have led to rainfall change. Some changes in climate may be caused by a rise in atmospheric concentrations of greenhouse gases, though the extent of this effect is contested [see the chapter by Balling in this volume]. Most concern has focussed on the burning of fossil fuels, though changes in land use and particularly deforestation may also be important – but even then the main concern is the tropical humid forests,²⁰ outside the area of interest to the CCD²¹. The likely effects on rainfall will differ

²⁰ Lambin *et al.* (2001)

regionally. A detailed study for FAO of the potential impact of global climate change on Nigeria under various scenarios found that temperature increases were likely, but would not necessarily affect crop productivity. The south of the country was expected to benefit from global change. In the semi-arid northern Nigeria the effects were more uncertain. There might be reduced growing periods and, “Higher technology levels under rainfed conditions cannot compensate for reductions in the length of the growing period if this occurs”. The report therefore called for climate monitoring and attentive preparedness, in view of the uncertainties.²² The uncertainties are well illustrated in the rainfall for Kano in Figure 1.

5 POPULATION GROWTH, URBANISATION AND DEGRADATION

The main driver of degradation, in the view of pessimists, is over-exploitation of resources due to population growth, and the associated growth in domestic livestock. Certainly, population growth in SSA has been very rapid. However, it started from a low base. In some areas, for several decades after 1960, rural growth could be accommodated by clearing new land for cultivation. Where people have moved to dryer zones they are exposed them to greater crop risks, for which they try to compensate by diversifying family income sources and using livestock as a buffer. In other areas, all nearby cultivable land was already occupied by the 1960s and in these rural population growth has been slower, as many young families have either migrated to towns, or, in some cases, found new farm land at a considerable distance. As a result, though average farm size has diminished on inheritance, it has not done so as fast as if there had been no out-migration. There has, however, been a remarkable spurt in urbanisation, so that those remaining on the farms have fed an increasing proportion off-farm. The change in rural and urban populations and the growth of the urban market for products the semi-arid areas can produce – grains, pulses, livestock, - is illustrated in Table 1. In northern Nigeria a tenth of the Kano area population in 1952 lived in towns of over 5,000 people; in 1991 nearly 30% were in towns of over 20,000. In Senegal, the urban drift is even more pronounced. It has been less in Niger, in the Department of Maradi, where population density is much lower, and where the option of starting a new farm in unclaimed bush was until recently still open, at least in its northern districts.

Table 1: Rural and urban population in three districts, and densities/km²

	Total	Urban*	% urban	Average density	Rural density
Nigeria: (Kano Province in 1952, Kano and Jigawa States, 1991)					
1952	3,396,350	335,707	14	79	77
1991	8,685,995	2,516,706	30	200	(Jigawa) 118 (Kano) 169
Niger (Departement de Maradi)					
1960 (estimate)	561,000	13,500	2	13	13
1977	949,747	44,459	5	23	22
1988	1,389,443	110,739	8	35	33

²¹ It is also possible to exaggerate the extent of land-cover change, particularly at the boundaries. A well-known study shows how what were regarded as ‘forest island’, supposed remnants of humid forest that would have previously extended further north into the savannah, were in fact deliberate encouragement of trees around villages, and the myth of a past forest a generation back had been steadily reported since the 1890s, but disproved by aerial photo analysis and anthropological enquiries (Fairhead and Leach, 1996).

²² Voortman *et al.*, (1999)

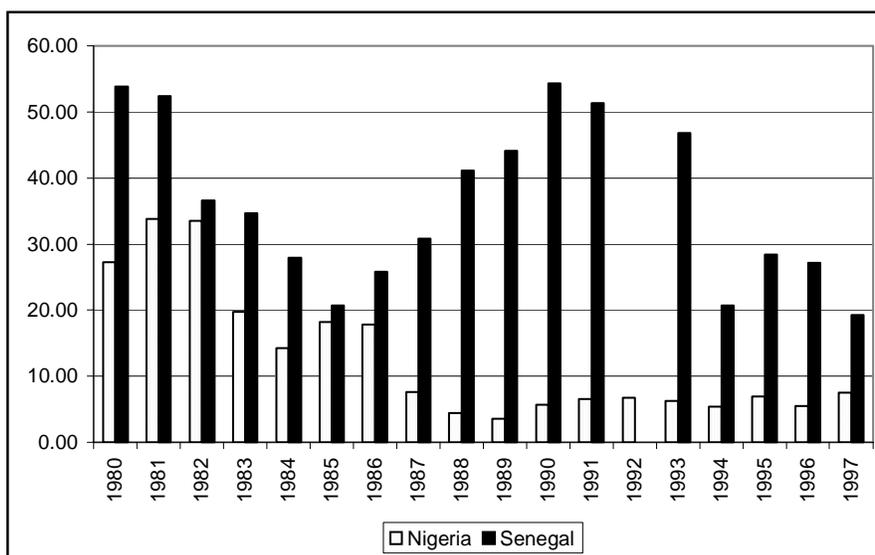
Senegal (Région de Diourbel)					
1960 (estimate)	261,000	n.a.	n.a.	60	n.a.
1976	423,038	117,761	28	97	70
1988	620,197	259,973	42	142	94

Source: Census data and analysis in Tiffen, (2001) and Barry *et al.*, (2000)

*Urban population in Nigeria and Niger defined as settlements over 5,000 in 1952 and 1960, and over 20,000 in later years. Urban population in Diourbel includes Touba Mosquée, a city without urban administrative status which has continued its rapid expansion since 1988.

If, as the proponents of desertification argue, farm productivity is going down, then food imports per capita must rise to fill the gap. They have not done so in Nigeria, where the Naira has been progressively devalued since the 1980s. In Senegal, various pricing policies have discouraged farm investments and favoured imported rice,²³ but food imports per head have fallen since the devaluation of the FCFA in January 1994. In both countries, Figure 2 suggests that food imports are more strongly related to a misaligned currency than to droughts (which should produce sudden rises in specific years) or degradation (which should show a steady upward trend in imports). In Nigeria, while the Kano area imports some southern foods such as yams, it continues to send south considerable amounts of northern maize, cowpeas and livestock.²⁴

Figure 4: Food imports per capita, in constant 1995 US \$, Nigeria and Senegal, 1980-97



Source: Constructed from World Bank Africa Database, 2000

²³ Faye *et al.* (2001)

²⁴ Ariyo *et al.* (2001).

6 EVIDENCE OF ADAPTIVENESS

The decline in food imports supports evidence of the adaptiveness of farmers found in many case studies. Despite rainfall variability and decline in average farm size, they have risen to the opportunities presented by market growth. This is illustrated by case-studies made by Drylands Research, in co-operation with teams of national researchers, but other studies have found similar results.

6.1 Makueni District, Kenya

Makueni District was scantily inhabited till 1948, when the colonial government moved people from what were then degraded hillsides in the north of Machakos District, caused, it was believed, by over-population and overexploitation.²⁵ Some 2000 families were resettled in Makueni²⁶, at a cost to government of £148 per family (which can probably be multiplied by 20 or 25 to get the present day equivalent). After 1960 the government lost control and thousands flowed into former uninhabited Crown land to establish new farms. The population rose from 190,631 in 1948 to 670,359 people in 1989. They too invested time and money, but their own. The initial house had an earth wall and grass thatch. An agricultural officer reckoned on 100 poles and 80 bundles of grass and 130 days labour per family for collection and construction.²⁷ By 1998 40% of the families we interviewed in a sample of four villages had replaced thatch with corrugated iron (which enables the roof to harvest rain water) and 13% had stone or brick walls.²⁸ Ox ploughs were in use by 40%; more had had these earlier, but had lost oxen to disease. In three of the four villages all farmers had fenced their holdings. All farmers had over the years constructed cut-off drains, *fanya ju*²⁹ terracing, or grass strips to conserve soil and water, to a good standard. Construction of the two former per farm took 93 to 245 man days, costing US\$230 – \$600 at the exchange rate in 1998, being highest in the longer established villages.³⁰ All farmers had planted fruit trees, varying from 3 to 200, which requires digging a large planting pit, buying in manure, and watering during establishment.³¹

It is clear that the creation of new farms requires considerable private investment, which does not appear in national accounts. The Kenya Government policy of recognising and registering private rights in both grazing and crop land has provided security, but deeds are not risked to take loans because of the vagaries of rainfall.³² Inter family transfers are much more important than loans in providing money for farm improvements, education, or consumption needs.³³ Makueni now has large areas of conserved farmland instead of dry bush. Should we term this change development or degradation?

²⁵ Tiffen *et al.* (1994)

²⁶ In 1992 the former Machakos District was divided to form the present Machakos District and Makueni District, the latter named after its first official settlement.

²⁷ Report by M.E.W. North, D.O. i/c Settlement areas, 4-5-1950, in Kenya National Archives.

²⁸ Gichuki (2000a)

²⁹ Meaning throwing upwards – leading to the formation of a bench terrace.

³⁰ Gichuki (2000b)

³¹ Gichuki (2000c)

³² Mbogoh (2000)

³³ Nelson (2000)

Given the uncertain rainfall, farmers regard it as extremely important to educate their children, so that some of them might be successful in the ever-more competitive and lucrative urban and non-farm labour markets. Primary schooling for both sexes is universal. Education costs parents, but educated children are expected to, and do, assist parents.³⁴ Farmers were asked to name the three most important investments they had made for their overall welfare in the last ten years, the top five being; terracing, planting trees, clearing bush (for cropping), house-building and education.³⁵

Makueni's grain production statistics are not very reliable³⁶ but show the expected great variation from year to year in the 1990s, but an average production of just over 200 kg per head of grains and pulses, with no evidence of any downward trend in production. There were years when families without a member in paid employment needed help to buy food, and appreciated limited aid from government.³⁷ Temporary school feeding programmes helped them keep their children at school. This poor District is generally in the top five for Kenya Primary School Leaving Certificate results.³⁸ In other years people have been able to sell grains. There are farms where insufficient manure is applied to replace nutrients,³⁹ but people blame the effects of livestock diseases on their holdings rather than droughts for this.⁴⁰ The veterinary service is one of many government departments with inadequate budgets, and conditions in the district have not been such as to attract private sector vets, though there are now more shops selling veterinary supplies. Makueni presents a complex story which belies any simple desertification explanation.⁴¹

6.2 Maradi Department, Niger

Maradi Department, like Makueni, still had land available for settlement in 1960. The adjustments farmers had to make to their farming practices as land became more scarce and fallowing impractical, took time. By 1999 there has been an increase in manuring, and in the use of artificial fertilisers when it was economic, particularly in the more crowded southern districts. Figure 5 shows the different trend in yields between a southern village in Madarounfa Arrondissement, where land has become scarce, and the drier Dakoro in the north, where production can still be expanded by taking in more land. Analysis of soils and farmer practices showed farmers knew how to recover fertility, but not all had access to sufficient manure, and chemical fertilisers at current prices had become less economic.⁴² Nevertheless, the crisis predicted after studies in the 1970s had not occurred. Departmental records show continued increases in production. Despite population growth, the District produces enough grain and pulses to meet its own needs and to sell to Nigeria, except in drought years. However, as in most places, wealth is unequally distributed, and while some farmers are able to invest, expand and prosper, others are reliant on various forms of non-

³⁴ Nzioka (2000)

³⁵ Nelson (2000)

³⁶ They suffer from the difficulty government officers have in getting out and about

³⁷ Mbogoh (2000)

³⁸ Gichuki *et al.* (2000)

³⁹ Mbuvi (2000)

⁴⁰ Fall (2000)

⁴¹ Gichuki *et al.* (2000)

⁴² Issaka (2001)

farm income to make a poor living.⁴³ Investment is a key to producing more, and is affected by the level of farm profits, which in turn depend partly on factors such as government management of the currency. The devaluation of the FCFA in 1994 has prompted an increase in investments, as shown in Table 3.

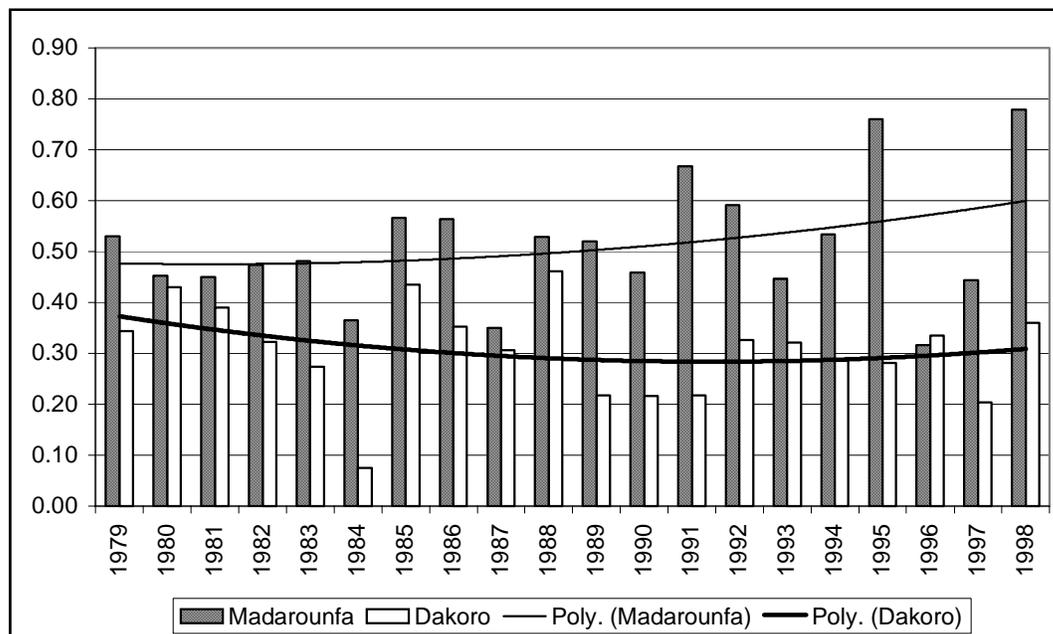
Table 3: Year of acquisition of new capital equipment

	Plough oxen	Ox cart	Heavy plough	Light plough	Bicycle*	Motor cycle**
To 1994	1	8	10	4	2	0
1995 onwards	18	9	2	34	6	4

Source: Hamadou, 2000a.

The source of capital is mainly livestock and crop sales. Internal family flows from the contributions of educated children are less important than in Kenya. Many fewer children are sent to school in Niger, partly because the education, in French from day 1 and geared to qualifying for secondary education, presents greater risks of failure and has less practical benefits than its Kenyan equivalent. Hence, the many young men who go to Nigeria for spells of work, or trade, or Koranic study, are unable to access the better paying jobs that demand literacy at least in Hausa, the lingua franca on both sides of the border. They go to save their families the cost of supporting them in the dry season, and hope to return with enough to marry.⁴⁴

Figure 5: Millet yields/ha in Madarounfa and Dakoro Arrondissements, 1979–98



Source: Mortimore *et al.*, (2001)

⁴³ Mortimore *et al.* (2001)

⁴⁴ Diarra Doka (2001)

6.3 The Kano area of Nigeria and Diourbel Department, Senegal

In Kano and in Diourbel, all cultivable land was already claimed by specific families by 1960. Here, as in most of West Africa, custom protected the rights of the cultivator to the fruits of his work and his investments in land, but owner-like rights did not, as in Kenya, extend to fenced grazing. As land became scarcer, so the rights of the farmer have extended to exclusive use of his crop residues, the weeds in his fallow land, and the wild trees on it that he protects⁴⁵.

In northern Nigeria there has been considerable investment in intensification, often greatest on the smallest farms.⁴⁶ As the meat market has grown with urbanisation, fattening of sheep, goats and cattle has become common. The animals are kept in pens for a great part of the year, and fed on nutritious groundnut hay and cowpeas, and the residues of maize, sorghum, millet etc. These may be produced on farm, or bought in.⁴⁷ Grass, weeds and tree brows are also collected. Fattening requires considerably more labour than herding, and feeding and watering has to continue during the busy cropping season, when animals have to be kept off crops. In an extensive Sahelian farming system, livestock in the farming season took only 20 units of labour compared with farming tasks that peaked at 280 units in a week. In an intensive system, livestock care took 30-70 units in some weeks, when crops were taking 80 to 160 units.⁴⁸

Many examples can be given of careful selection and crossing of local and research-bred varieties to adapt crops to lower rainfall and to particular niches.⁴⁹ Farmers in northern Nigeria have also invested strongly over the last 20 years in oxen and ploughs, and have switched on a large scale to maize, which has become more important in farming systems previously geared to millet and sorghum. They have also coped with the vagaries of the market, with prices at times strongly affected by inflation, or sudden devaluation, and changes of policy in regard to wheat imports, etc. However, while nominal prices for the main grains and pulses have been driven higher and higher by inflation, the real prices have mainly been on a downward trend since the 1970s, apart from sudden rises connected with severe drought years.⁵⁰ This does not suggest failure to meet rising urban demands, especially in view of the import record shown in Figure 2.

As regards tree cover, the evidence is that farmers husband resources rationally when wood becomes more scarce. The first stage is more careful clearing, to preserve useful species – known as *défrichment amélioré*, as observed in Maradi. The next is careful preservation of useful species, and use of coppicing and pruning to obtain fuel, now more or less universal in northern Nigeria.⁵¹ Finally comes planting species specifically for fuel, common in Kenya.⁵² We had a nice illustration of the differences in view of the causes of degradation in a

⁴⁵ The masculine pronoun is appropriate. Women generally acquire land through their husband, who under some customs is supposed to give them a portion of his land for their own use, not by inheritance from their father. In Niger and Nigeria they can, and sometimes do, buy land.

⁴⁶ Okike *et al.* (2001)

⁴⁷ Baba and Magaji (1998)

⁴⁸ Mortimore and Adams (1998)

⁴⁹ Mortimore and Adams (1999)

⁵⁰ Ariyo *et al.* (2001)

⁵¹ Cline-Cole *et al.* (1990)

⁵² Dewees (1991); Patel *et al.* (1995)

workshop in Senegal, discussing our findings there. There was a relative absence of middle-aged *faidherbia albida*, a tree useful for improving soil fertility.⁵³ The academics were inclined to blame poor extension advice, which at one time advocated deep ploughing and the removal of all trees. The farmers present insisted they had always valued and preserved this tree, but many young ones had died in the droughts of the 1970s and 1980s. They had always preferred the light plough, which is more manoeuvrable.

Farming in Diourbel, Senegal has been more subject to government intervention than in Nigeria. There was a government-fuelled investment boom in farm equipment and inputs in the 1960s and early 1970s, whereby farmers were compelled to join co-operatives, market through these at controlled prices, and credit was subsidised and expected to be used for all inputs. Groundnut prices were deliberately kept below world levels to cream off as much as possible for the state and its growing number of employees. The system eventually crashed as growing expenses and corruption in parastatals encountered falling world prices at the end of the 1970s.⁵⁴ Millet was not an attractive alternative crop, as decades of imported broken rice at low and sometimes subsidised prices made this the preferred food both of urban people and rural people with a millet deficit. However, since the 1980s farmers have responded to the growing urban market for meat by fattening sheep and cattle. Their chief investments are now directed towards livestock, not crops. Groundnuts remain important in their farming system, however, valued for their contribution to family food, fodder for livestock and cash from sales. Past studies have evaluated and condemned the farmers' practice of planting groundnuts ever more closely solely in relation to the value of seed produced, ignoring the important fodder, which is widely traded throughout Senegal.⁵⁵ Soil studies show that farmers know how to maintain fertility, and do so on fields close to their homes by manuring, but outer fields may lack sufficient inputs now that the groundnut-fertiliser price relationship is unattractive.⁵⁶ Indeed, at current prices, the livestock once so universally condemned for causing degradation are the key not only to raising soil fertility levels, but also income levels!

As in Kenya, farmers in Diourbel need to encourage their young to obtain non-farm jobs. As in Niger, they do not see the education system (basically similar in both countries) as the route to this. A large proportion of their investments goes on what are termed ceremonies – the gifts and expenditures which sustain both family and religious networks. The latter is particularly important in Senegal, where most farmers are now linked to the Mouride brotherhood, which amongst other achievements, finances a network of informal trading not only in Dakar but all over the world. There can be few tourists in Europe, the USA or South Africa who have not encountered a Senegalese hawk on the beach or pavement. Farmers at our workshop saw this as the best hope for their sons. Their investments have also created a new city in the region, the Mouride headquarters, Touba, as well as financing many quarters of Dakar.⁵⁷ The achievements of informal unrecorded urban investment in west Africa have been as neglected as farm investments. One estimate in the 1990s put them at \$300 billion.⁵⁸

⁵³ Sadio *et al.* (2000)

⁵⁴ Gaye (2000)

⁵⁵ See for example Kelly (1997)

⁵⁶ Gaye (2000), Badiane *et al.* (2000)

⁵⁷ Coulon (1999), Wilson Fall (2000)

⁵⁸ Snrech (1995)

7 CONCLUSION

Dessication has occurred, sometimes over spells of years, with temporary ill effects on vegetative cover, erosion, etc. Unfortunately, we do not well understand all the influences on rainfall trends. There may or may not now be an upturn in west Africa – there is insufficient evidence as yet. The impact of global warming on crop production will vary from place to place, in some cases being positive, in others negative. Hence, farmers may have to be even more adaptive in the future than at present.

Degradation of soils by mistreatment has not occurred as widely or as permanently as feared. In general, farmers know the remedies, but they are not always economic or feasible given the risks, which include animal disease as well as the price relationship between fertiliser and marketed crops. What is needed is actions that make investment in farms more attractive – maintaining a stable currency, at a reasonable exchange rate, maintaining and if possible developing the public infrastructures that give access to markets and which act on the farm-gate prices of both inputs and outputs, maintaining those government services where externalities mean private sector provision may be handicapped (for example, in animal health). Ensuring that government services are relevant and give value for money (which parents judge keenly in relation to schooling) will benefit not only farmers but also the growing numbers trying to earn a living in towns. There is a symbiosis between prosperous and growing towns providing employment, and prosperous agriculture. Farmers in northern Nigeria have recently experienced a fall in their goat sales as urban disruptions (both of the socio-political variety and those caused by failures of electricity, petrol supplies, telecommunications etc) reduce urban incomes.⁵⁹ Those goats provide manure as well as cash.

In general, the government services listed above do not coincide with the desertification agenda. Naturally, it helps farmers if they are given information on new technologies that are practical and economic. Research and dissemination are useful government provisions, but more fundamental is ensuring that economic policies give farmers the incentive, the security and the means to invest. It helps if they can also access written information. Bjorn Lomborg, the “skeptical environmentalist”, agrees with the pessimists that Sub-Saharan Africa trails the world in many economic and social indicators, for which he blames political and economic failures.⁶⁰ Some resource degradation can indeed be the result of human error, but where policies have been even moderately facilitating, case studies show African farmers can conserve and improve⁶¹. They need, not lectures, but encouragement.

REFERENCES

Ariyo, J.A., Voh, J.P., and Ahmed, B. (2001) 'Long-term change in food provisioning and marketing in the Kano Region', *Drylands Research Working Paper 34*. Drylands Research, Crewkerne, United Kingdom.

⁵⁹ Ariyo *et al.* (2001)

⁶⁰ Lomborg (2001), p. 66.

⁶¹ Other recent case studies in dryland Africa reaching similar conclusions concern Burkina Faso (Mazzucato and Niemeijer, 2001), and Cote d'Ivoire (Dumont, 1998), while (Reij *et al.*, 1996) gives examples of good soil conservation from many countries.

- Baba, K.M. and Magaji, M.D. (1998) 'Fadama crop residue production and utilisation in north-western Nigeria', in I. Hoffmann, ed. *Prospects of pastoralism in West Africa*: 247-262. Tropeninstitut, Giessen, Germany.
- Badiane, A.N., Kouma, M., and Sène, M. (2000) 'Région de Diourbel: Gestion des sols', *Drylands Research Working Paper 15*. Drylands Research, Crewkerne, United Kingdom.
- Barry, A., Ndiaye, S., Ndiaye, F., and Tiffen, M. (2000) 'Région de Diourbel: Les aspects démographiques', *Drylands Research Working Paper 13*. Drylands Research, Crewkerne, United Kingdom.
- CCD Secretariat (2001) 'Down to Earth: The newsletter of the convention to combat desertification'. Convention to Combat Desertification Secretariat, Bonn.
- Cline-Cole, R.A., Main, H.A.C., Mortimore, M., Nichol, J.E., and O'Reilly, F.D. (1990) *Wood fuel in Kano*. United Nations University Press, Tokyo.
- Coulon, C. (1999) 'The Grande Magal in Touba: a religious festival of the Mouride Brotherhood of Senegal', *African Affairs*, 98/391: 195-210.
- Deweese, P.A. (1991) 'The woodfuel crisis reconsidered: observations on the dynamics of abundance and scarcity', *World Development*, 17 1159-1172.
- Diarra Doka, M. (2001) 'Évolutions à long terme de l'organisation sociale et économique dans la région de Maradi', *Drylands Research Working Paper 26*. Drylands Research, Crewkerne, United Kingdom.
- Dregne, H.E. (1970) 'Arid lands in transition', *Publication 90*. American Association for the Advancement of Science, Washington, D.C.
- Dregne, H.E., Kassas, M., and Rosanov, B. (1991) 'A new assessment of the world status of desertification', *Desertification Control Bulletin*, 20 6-18.
- Dumont, M. (1998) *Trajectoire d'évolution des systèmes de production senoufo - Le cas de Dikodougou, Nord Cote d'Ivoire*. IDESSA; CNEARC,
- European Commission (1997) *Addressing diversification - A review of EC policies, programmes, financial instruments and projects*. Luxembourg: EC.
- Fairhead, J. and Leach, M. (1996) *Misreading the African landscape: society and ecology in a forest-savanna mosaic*. Cambridge University Press, Cambridge.
- Fall, A. (2000) 'Makueni District profile: Livestock management, 1990-1998', *Drylands Research Working Paper 8*. Drylands Research, Crewkerne, United Kingdom.
- Faye, A., Fall, A., Mortimore, M., Tiffen, M., and Nelson, J. (2001) 'Région de Diourbel: Synthesis', *Drylands Research Working Paper 23e*. Drylands Research, Crewkerne, United Kingdom.
- Fletcher, A. (1996) *Desert Margins Initiative. Consolidated report on national workshops*. ICRISSAT Sahelian Center, Niamey, Niger.

Gaye, M. (2000) 'Région de Diourbel: Politiques nationales affectant l'investissement chez les petits exploitants', *Drylands Research Working Paper 12*. Drylands Research, Crewkerne, United Kingdom.

Gichuki, F.N. (2000a) 'Makueni District profile: Farm development, 1946-1999', *Drylands Research Working Paper 1*. Drylands Research, Crewkerne, United Kingdom.

Gichuki, F.N. (2000b) 'Makueni District profile: Soil management and conservation, 1989-1998', *Drylands Research Working Paper 4*. Drylands Research, Crewkerne, United Kingdom.

Gichuki, F.N. (2000c) 'Makueni District profile: Tree management, 1989-1998', *Drylands Research Working Paper 5*. Drylands Research, Crewkerne, United Kingdom.

Gichuki, F.N., Mbogoh, S.G., Tiffen, M., and Mortimore, M. (2000) 'Makueni District profile: Synthesis', *Drylands Research Working Paper 11*. Drylands Research, Crewkerne, United Kingdom.

Issaka, M. (2001) 'Évolution à long terme de la fertilité de la sol dans la région de Maradi', *Drylands Research Working Paper 30*. Drylands Research, Crewkerne, United Kingdom.

Kelly, V. (1997) 'Are structural adjustment programs and sustainable soil fertility management incompatible? Evidence from the Senegalese Peanut Basin', in G. Renard et al., eds. *Soil Fertility Management in West African Land Use Systems*: ICRISAT, Niger.

Lambin, E.F., Turner B.L.II, Geist, H.J., and et al. (2001) 'The causes of land-use and land-cover change: moving beyond the myths', *Global Environmental Change*, 11 261-269.

Lomborg, B. (2001) *The skeptical environmentalist: Measuring the real state of the world*. Cambridge University Press, Cambridge.

Mainguet, M. (1994) *Desertification. Natural background and human mismanagment. 2nd ed.* Springer-Verlag, Berlin.

Mazzucato, V. and Niemeijer, D. (2001) 'Overestimating land degradation, underestimating farmers in the Sahel', *Issues Paper 101*. IIED Drylands Programme, London.

Mbogoh, S.G. (2000) 'Makueni District profile: Crop production and marketing, 1988-1999', *Drylands Research Working Paper 7*. Drylands Research, Crewkerne, United Kingdom.

Mbuvi, J.P. (2000) 'Makueni District profile: Soil fertility management', *Drylands Research Working Paper 6*. Drylands Research, Crewkerne.

Morris, J. (1995) *The political economy of land degradation: Pressure groups, foreign aid and the myth of man-made deserts*. Institute of Economic Affairs, London.

Mortimore, M. (1989) *Adapting to drought, farmers, famines and desertification in West Africa*. Cambridge University Press, Canbridge.

Mortimore, M. (1998) *Roots in the African dust: sustaining the Sub-Saharan drylands*. Cambridge University Press, Cambridge.

Mortimore, M. and Adams, W. (1999) *Working the Sahel: Environment and society in Northern Nigeria*. Routledge, London.

Mortimore, M. and Adams, W.M. (1998) 'Farming intensification and its implications for pastoralism in northern Nigeria', in I. Hoffmann, ed. 262-273. Tropeninstitut, Giessen, Germany.

Mortimore, M., Tiffen, M., Boubacar, Y., and Nelson, J. (2001) 'Department of Maradi: Synthesis', *Drylands Research Working Paper 39e*. Drylands Research, Crewkerne, United Kingdom.

Nelson, J. (2000) 'Makueni District profile: Income diversification and farm investment, 1989-1999', *Drylands Research Working Paper 10*. Drylands Research, Crewkerne, United Kingdom.

Nzioka, C. (2000) 'Makueni District profile: Human resource management, 1989-1998', *Drylands Research Working Paper 9*. Drylands Research, Crewkerne, United Kingdom.

Okike, I., Jabbar, M.A., Manyong, V., Smith, J.W., Alinwumi, J.A., and Ehui, S.K. (2001) 'Agricultural intensification and efficiency in the West African savannahs: Evidence from northern Nigeria', *Socio Economics and Policy Research Working Paper 33*. ILRI, Nairobi, Kenya.

Patel, S.H., Pinckney, T.C., and Jaeger, W.K. (1995) 'Smallholder wood production and population pressure in east Africa: Evidence of an environmental Kuznets curve?', *Land Economics*, 71/44: 516-530.

Reij, C., Scoones, I., and Toulmin, C. (1996) *Sustaining the soil, indigenous soil and water conservation in Africa*. London: Earthscan,

Sadio, S., Dione, M., and Ngom, S. (2000) 'Région de Diourbel: Gestion des ressources forestières et de l'arbre', *Drylands Research Working Paper 17*. Drylands Research, Crewkerne, United Kingdom.

Snrech, S. (1995) *Preparing for the future: A vision of West Africa in the year 2020: Summary Report of the West Africa Long Term Perspective Study*. Club du Sahel/ OCDE/OECD, Paris.

Stiles, D. (1995) 'An overview of desertification as dryland degradation', in D. Stiles, ed. *Social aspects of sustainable dryland management*: 3-20. John Wiley, Chichester.

Swift, J. (1996) 'Desertification: narratives, winners and losers', in M. Leach & R. Mearns, eds. *The lie of the land. Challenging received wisdom in African environmental change and policy*: 73-90. James Currey, Oxford.

Thomas, D.S.G. and Middleton, N. (1994) *Desertification: Exploding the myth*. John Wiley, Chichester.

Tiffen, M. (1998) 'Demographic growth and sustainable land use', in H.-P. Blume et al., eds. *Towards sustainable land use: Furthering co-operation between people and institutions*, 2: 1333-1347. Catena, Reiskirchen, Germany.

Tiffen, M. (2001) 'Profile of demographic change in the Kano-Maradi Region, 1960-2000', *Drylands Research Working Paper 24*. Drylands Research, Crewkerne, United Kingdom.

Tiffen, M., Mortimore, M., and Gichuki F. (1994) *More people less erosion: environmental recovery in Kenya*. John Wiley & Sons, Chichester, UK.

Tiffen, M. and Mulele, M.R. (1994) *The environmental impact of the 1991-2 drought on Zambia*. International Union for the Conservation of Nature, Gland, Switzerland and Lusaka, Zambia.

UNEP (1977) *Report of the United Nations Conference on Desertification, 29 August - 9 September 1977*. United Nations Environment Programme, Nairobi.

UNEP (1990) *World map of the status of human-induced soil degradation*. United Nations Environment Programme, Nairobi.

Voortman, R.L., Sonneveld, B.G.J.S., Langveld, J.W.A., Fischer, G., and van Velthuisen, H.T. (1999) *Climate change and global agricultural potential: A case study of Nigeria*. 99-06. *Staff Working Paper*. Stichting Onderzoek Wereldvoedselvoorziening van de Vrije Universiteit, Amsterdam.

Warren, A. and Agnew, C. (1988) *An assessment of desertification and land degradation in arid and semi-arid areas*. International Institute for Environment and Development, London.

Warren, A. and Khogali, M. (1992) *Assessment of desertification and drought in the Sudano-Sahelian region*. United Nations Sudano-Sahelian Office, New York.

Wilson Fall, W. (2000) 'Région de Diourbel: The family, local institutions and education', *Drylands Research Working Paper 20*. Drylands Research, Crewkerne, United Kingdom.