Drought in the Sahel: the debit side of development?

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Readers will remember, two to three years ago, pictures from the Sahel published in newspapers and seen on television, of cattle dying of thirst and nomads receiving food brought from overseas to keep them alive. For two years good rains have fallen in the Sahel and when I flew over it last September the aircraft had to avoid storm clouds; green grass and standing water were clearly visible where previously there had been bare sand.

Great relief is felt all over the world that the drought is over. The Fulani are again able to drive their cattle north to make use of the Sahel pastures at calving time, and millet is again being planted in the drainage areas of the Sahel; but many people are apprehensive that the famine will recur and that the cycle of seven fat years will again be succeeded by seven lean years. "Sahel" means border in Arabic and it represents the border land between the arid Sahara and the wetter country of West Africa. It is marginal land in every sense of the word.

Famines have occurred previously in the Sahel and the Tuareg record names such as "forget your wife" or "the sale of children" to indicate earlier periods of privation, but none of these periods lasted for more than three years and they were all localized to particular areas, whereas "La Sécheresse" not only lasted for about six years but covered the whole zone to the south of the Sahara. Clearly this drought was different from any which had occurred within living memory.

THE WEST AFRICAN CATTLE TRADE

I have been trying to assess the circumstances that led up to the drought, and my analysis has been published (Ormerod 1976). My present purpose is to give a résumé of my results and to discuss aspects of them which seem to have a particular significance to medicine and to the giving of aid. My argument centres on West Africa, because the best data are available from there, but my conclusions can be applied to the whole Sahelian zone stretching eastwards into Sudan, Ethiopia, and Eritrea and to some extent they apply also to the dry areas of Southern Africa.

I ascribe the severity of the latest drought primarily to economic development of the area and to the demand that has been created by the growth of coastal towns. Many are familiar with Lagos and its traffic problems worse than those of Europe and America, but other coastal towns also show remarkable and rapid changes in their standard of living. Abidjan, for instance, is said to be the second most expensive city in the world where "tournedos" comparable with those of the best Paris restaurants can be obtained. Although statistics are unreliable it would not be unreasonable to state that the meat trade to these coastal towns has doubled each decade since the beginning of the century. The vast majority of the cattle supplying this meat trade have been bred in the Sahel.

Most people who have travelled in West Africa are familiar with the sight of herds of humped Zebu cattle trekking south. These cattle have usually been bought by Hausa traders, but it is still the nomad Fulani who take them on their trek of perhaps over a thousand miles. Shortly before the drought the pattern of trade began to change; abattoirs with freezing plants were set up in the north and more cattle began to travel by lorry, but more important has been the attitude of the Fulani to their cattle and its sale as a cash crop.

TRANSFER OF TECHNOLOGY

At a recent discussion meeting on resource development in semi-arid lands, held at the Royal Society, various techniques developed in the dry lands of USA and Australia were suggested as a means of increasing the production of cattle in Africa: thus, rapid destocking when the rains fail is a commonsense measure that the Fulani have always carried out; movement of stock to areas of sudden rainfall is again commonly practised by the Fulani but, as was pointed out at the meeting, it has a danger of concentrating stock in a limited area. Finally, the complementary use of contiguous dry and moist areas was suggested as a means of maintaining stability; in practice the Fulani have used this technique to their great advantage. It has enabled them by seasonal "transhumance" from the dry northern to the moister southern grazing areas to build up and maintain very large herds and this, I believe, has determined the course of events more than any other factor.

SOCIAL ORGANIZATION OF THE FULANI

European technologists frequently underestimate the skill, adaptability, and intelligence of indigenous people; the Fulani should not be underestimated in this way. In the early nineteenth century, as a result

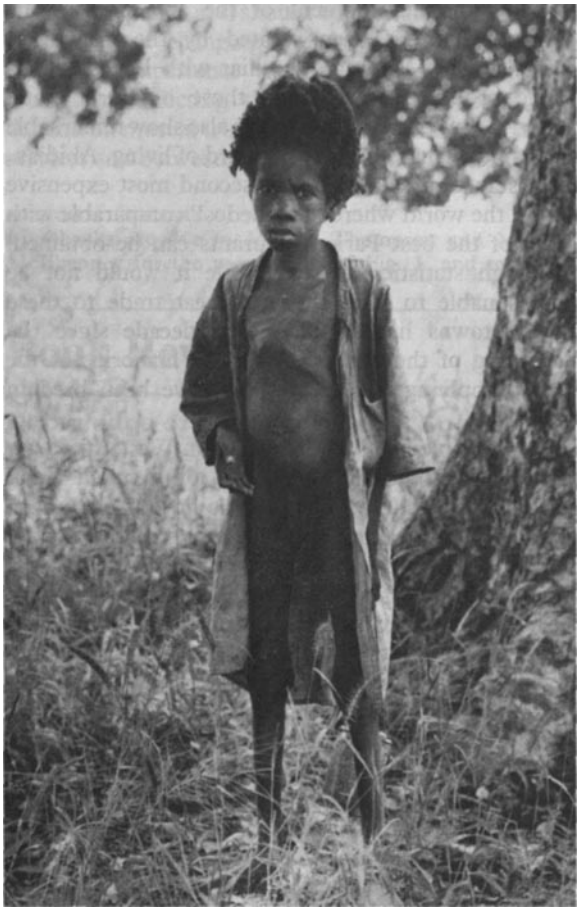

Fig. 1. A survivor from the Sahel drought-stricken area. (Courtesy of WHO, Geneva).

of a "Jihad", they imposed their rule on the Hausa, the dominant settled tribe living south of the Sahel, and the result today is that the Hausa aristocracy is Fulani in origin and the Fulani slave caste is Hausa in origin. By means of these two links the Fulani have integrated themselves closely with modern society and yet have preserved what they regard as the traditional values of nomadism; yet these values are being eroded and in this process the old slave caste (the Dillalai) is playing an important if enigmatic role.

It is wrong to regard the Dillalai as slaves; they are independent of the Fulani but undertake tasks which the Fulani will, by tradition, not carry out themselves. The most important of these tasks is to act as butchers and to negotiate sales of cattle with Hausa traders. Fully nomadic Fulani are by tradition reluctant to sell their cattle, which are bred for milking; some still maintain this attitude but most have yielded to the pressure of Hausa traders and the Dillalai intermediaries and now breed cattle on a commercial basis. This has developed, until the drought intervened, on an ever-increasing scale.

IMPORTANCE OF CONCENTRATED RAINS AND OF DRY PASTURES

It is not generally realized how much rain falls in the Sahel. Sokoto at its southern margin has an average of 689 mm per annum; London has 594 mm but whereas London's rainfall occurs evenly throughout the year, almost all the rain at Sokoto falls in July, August, and September. The northern margin of the Sahel is usually taken as the 250 mm per annum isohyet; at this density the rainfall is even more concentrated. Not only is it concentrated on a monthly basis but it tends to be concentrated in individual storms which can do great damage; this damage is particularly marked on pastures which have been overgrazed or on ground which has been tilled for planting crops. The only protection against this damage caused by heavy rainfall is vegetation that covers the soil and binds together the particles with its roots.

Traditionally the Fulani have trekked their cattle northwards in July to make use of the two to three-month period of rainfall in the Sahel so that they can drop their calves there. The great advantage of the Sahel as a breeding ground is that the pastures are virtually free from ticks and helminthic parasites which cannot survive on the arid and deserted land during the rest of the year. This system of seasonal grazing worked admirably until commercial pressures caused the population of cattle to increase.

SOCIAL EFFECTS OF ECONOMIC GROWTH – OVERGRAZING

When the population of cattle began to increase other changes also began to occur. There are a number of other tribal groups inhabiting the Sahel; many are sedentary, based on the Niger valley and the Lake Chad basin, some are semi-nomadic and others, like the Tuareg, purely nomadic, but only the Fulani carry out seasonal transhumance and are thus able directly to increase their stock. Cattle in the Sahel represent investment capital and the change that has come about can be regarded as the Fulani "playing the market". The effect of playing the market has been an increase in the circulation of "small change": these are sheep and goats which are used as exchange in local trading. The main item of local trade is millet. Each of these factors involves a significant increase in land use. As the situation has developed, the human population has increased and many groups, including

the Fulani, have tended to go over to the more usual type of cash economy. Cash crops such as cotton and groundnuts have been introduced, there is an increased sowing of millet and the result has been that some of the more stable pastures have been closed to grazing during the rains.

Most of the agricultural activity has to take place during the two to three rainy months, at a time when damage to the soil from exposure to rainfall is most likely. Only in close proximity to the Niger and to Lake Chad and its rivers does tradition allow graziers to succeed arable farmers in orderly succession, to the benefit of both and even in these areas commercial pressure has tended to cause a breakdown of the system. Intensive commercial grazing of the Sahel has also caused destruction of trees as well as grass and this has freed the sandy soil and made it more liable to wind erosion during the long dry season.

The Fulani and their Zebu cattle exploit the flush of grass in the Sahel and when this is finished they retreat south to the wetter regions or to the inland delta of the Niger west of Timbuktu. The Tuareg and their smaller, more drought-resistant cattle have to retreat north where, if they are lucky, smaller unexploited flushes of grass may be found. In the Sahel itself once the rains are over, virtually all the ground cover of vegetation will have been removed and will remain absent until the next cycle of rains: in view of the size of the Sahel (1.5 million km^2), this in itself can be considered sufficient cause for a major ecological disaster.

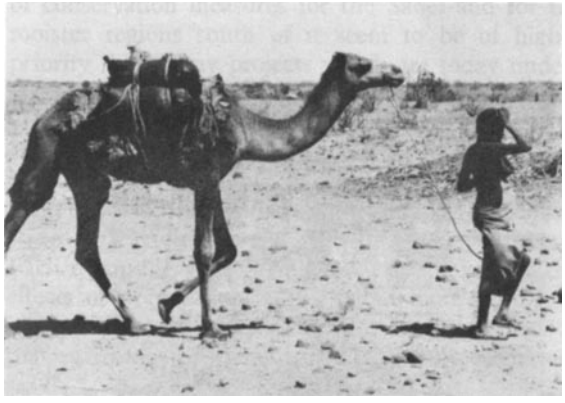

Fig. 2. This woman is returning to her home in Ethiopia after loading precious water on her camel. (Courtesy of the League of Red Cross Societies, Geneva).

RELATIONSHIP BETWEEN OVERGRAZING AND CLIMATE

The extent of this seasonal removal of ground cover can be recorded by satellite photography and its significance appreciated. One of the results of this denudation is that the desert sand reflects a higher proportion of the sun's radiation than would the ungrazed vegetation and this energy returned to the atmosphere is now considered to have a significant effect in changing the climate. A group of climatologists at the Massachusetts Institute of Technology and the Goddard Space Research Centre in the USA have studied the effect of this increase in reflectivity or "albedo" by means of a mathematical model and their results indicate that the increased albedo caused by overgrazing in the Sahel can account for a 70% decrease in the rainfall not only in the Sahel itself but in the whole region. Many will maintain a position of scepticism about these theoretical results and affirm that they tell us little that we did not know already, namely that the Sahel was grossly over exploited and that a major drought occurred. The connection between overgrazing and soil degradation has long been recognized but the weather cycle itself has, until very recently, been regarded as an inevitable sequence of good rains and bad rains, the control of which was entirely beyond the scope of man. The importance of the albedo theory of climatic change lies in its indication that recurrent droughts may, to a considerable extent, be a direct effect of man's operations on the surface of the planet and not independent of them.

Hitherto, the expectation that years of good rainfall would inexorably be followed by years of drought may have encouraged maximum economic development during the good years: consideration must now be given to the possibility that the bad years may, at least in part, be a consequence of excessive exploitation of the land during the good years. This change in concept strengthens the case in favour of conservation measures and the reasonable limitation of exploitation.

It is possible only dimly to foresee what conservation measures will be possible in the Sahel although it is clear that the most important of these measures will be the limitation of grazing. Those concerned with cattle will be most unwilling to take this step. Meat is of such importance in the personal lives of people in the coastal towns, and cattle of such economic and political significance to the Sahelian states that limitation does not seem to be a practical possibility, nor is it likely to become practicable at least until another cycle of drought has occurred. Today every effort is being made to rebuild the herds that were destroyed by the drought and to reintroduce agriculture to the Sahel: exploitation rather than con-

Fig. 3. A victim of severe malnutrition during the drought in Ethiopia is brought in from the desert on a stretcher to a Red Cross relief centre. (Courtesy of the League of Red Cross Societies, Geneva.)

servation continues to be the universal policy. West Africa as much as any other part of the world is attached to the juggernaut of short-term economic advance regardless of possible prejudice to the future.

MEDICAL ASPECTS OF OVERGRAZING

What is the medical relevance of this discussion which has, up to now, been political, economic, agricultural, and climatological? As in the nineteenth century, when missionaries acted as the spearheads for political penetration, so in the twentieth medical and veterinary scientists have pioneered economic advance in Africa and the present situation could not have arisen without their intervention.

Malnutrition, ever present in Africa, led nutritionists to teach that protein, particularly animal protein, was the most valuable source of nutriment. Today the pendulum of opinion has tended to swing away from this view: animal protein may indeed be valuable to those who can afford it and it is certainly very attractive to them, but in West Africa, as in other parts of the world, meat generally goes to the rich townspeople; poor country people continue to subsist on cereals. Meat on a world basis must be regarded as a luxury rather than a necessity; in many areas herds have to be fed with quantities of corn of far greater nutritional value; in other areas meat competes for land which could more economically be used for cereals. The idea that stock and cereals complement each other in systems of mixed farming is only relevant under certain ecological conditions such as are found in Europe and the few parts of the world with similar climate and soil structure.

Disease control has been of particular importance in the economic development of the Sahel because epidemics of yaws, smallpox, cerebrospinal fever, and measles in the past prevented a rise in the human population. The first two of these diseases have been eradicated and the other two controlled. More spectacular has been the effect of controlling cattle diseases. Rinderpest and pleuropneumonia (epizoötics equivalent in their killing power to the great epidemics of man, such as smallpox and plague) have been abolished; there are no important diseases in the Sahel to limit the growth of cattle populations, but although drought and starvation within the Sahel remain as the only internal limiting factors there is another important limiting factor acting from outside.

IMPORTANCE OF TSETSE AND TRYPANOSOMIASIS IN LIMITING OVERGRAZING

The Fulani avoid drought and starvation in the Sahel by trekking their cattle south and in doing this they come into country infested with tsetse fly where they run the risk of their cattle becoming infected with trypanosomiasis. The Fulani are well aware of this risk and, since the best grazing today is to be found in areas occupied by tsetse fly, the skill with which they manage their herds depends on their assessment on the one hand of the risk of their cattle dying of trypanosomiasis and on the other of their deterioration from drought and starvation. During the past 20 years much has been done both in providing prophylactic drugs and in controlling tsetse to increase the areas available for cattle but, even so, trypanosomiasis, apart from drought and starvation, remains the only real means of controlling the numbers of cattle that graze the Sahel.

TSETSE ERADICATION IS NOT NECESSARILY THE BEST WAY TO CONTROL SLEEPING SICKNESS

The technology is now available for complete eradication of tsetse south of the Sahel and given the finance and the assistance of foreign governments and international organizations, eradication could be achieved in the foreseeable future. The Sahelian drought has given to this operation a sense of urgency so that greater efforts and funds have now gone into this work but few have considered what would be the consequences of success. One of the arguments frequently used in favour of complete eradication of tsetse is that this insect also acts as vector for the human disease sleeping sickness. Although sleeping sickness is also caused by a trypanosome its epidemiology is very different from the animal disease.

In areas where cattle are of economic importance, both diseases tend to be dealt with together by tsetse eradication and this is not always to the advantage of the human population; where cattle are not so important, more limited control measures can be carried out which are at least as effective and can be better adapted to the agricultural needs of the people. The most appropriate methods of controlling sleeping sickness are so different from those used to control cattle trypanosomiasis that I cannot accept the commonly held view that the existence of sleeping sickness constitutes an additional reason for tsetse eradication.

POTENTIAL DANGERS OF AN UNLIMITED MEAT TRADE

Some people say that there is so much land available that is now occupied by tsetse (about 7 million km^2) that a far greater population of cattle could be grazed in Africa if tsetse were eradicated, and this is undoubtedly true. This view ignores, however, the fact that much of the land in question already shows signs of degradation. The conditions of the Sahel are not exceptional as many people believe; drought is only one factor in its degradation; the others are a combination of poor soil, concentrated rainfall, overgrazing, and overcultivation. Similar combinations are either already present or, in the face of exploitation, could rapidly arise over most of West Africa. The main protection afforded to the soil in many of these areas is the existence of tsetse. I believe that insufficient consideration has been given to the likely demand for meat that might become apparent should production of cattle be extended in West Africa. Meat from cattle reared on savannahs could be sold cheaply on the world market since it would be competing mainly with corn-fed beef, but the real expense of meat production in Africa by existing methods would only become apparent when an area, possibly much greater than the Sahel, became degraded to an equivalent extent.

TSETSE INFECTION IS ONLY A TEMPORARY BRAKE ON EXPLOITATION

Clearly tsetse eradication cannot be postponed indefinitely and the existence of tsetse can only be regarded as a temporary brake on ruthless exploitation of the land. However, it seems foolish to allow this brake to be removed before conservation measures have been devised or even considered. The planning of conservation measures for the Sahel and for the moister regions south of it seem to be of higher priority than many projects which are today undertaken and accepted as aid, yet a large-scale planning project involving conservation of the Sahel cannot be entertained partly because there is no political agreement as to what should be the priorities of such a plan, but also because there is no scientific agreement as to why environmental degradation is occurring. Each discipline gives a different explanation for the effects of degradation and different (and frequently incompatible) remedies. The only real agreement is that environmental degradation is actually occurring.

IMPORTANCE OF ECOLOGICAL PLANNING

African countries expect to have at least a share of world economic development comparable with that achieved by Europe and North America and the finding of oil and other minerals must have raised many hopes of economic advance in the post-colonial period. The term "developing countries" presupposes that they will in time achieve comparable standards and become "developed", but the impoverishment of the Sahel must make everyone consider the possibility that there might also be a debit side to development as well as a credit. We are beginning to appreciate that tropical ecosystems may be even more fragile than those in temperate zones. When we cut down our primeval forest in Britain it was replaced by a relatively stable ecosystem of agricultural land. We tend therefore to expect that the same will happen elsewhere and are surprised when it does not. Even in Britain we are beginning to realize that far more care and forethought is necessary when large-scale changes are made to the countryside and this seems to apply with even greater force to Africa.

Ecological planning is often regarded as a proper preoccupation only for rich countries, while poor countries should concentrate on improving their economic standard. The degradation of the Sahel should show the dangers of this view and impress on African opinion that ecological planning and conservation are essential not only if further degradation is to be avoided, but also if economic development itself is not to be jeopardized.

REFERENCE

Ormerod, W. (1976). *Science*, **191**, 815.