GRAZING IN THE SAHEL

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Crazing in the Sahel

This author is seeking responses from a wide range of experts in various fields in order to gather information to assess the impact and value of a credible and reliable long-range climate forecast for the Sahel in West Africa. Taking into consideration information like that presented in the background paper which follows, the reader of this paper is being asked to suggest what might have been done in the Sahel if perfect climate information about the 1972/73 crop year had been available to decision-makers as early as October 1972. For this study a perfect long-range climate forecast would consist of monthly precipitation and temperature averages expressed as higher or lower than long term averages. Readers should assume that there are no restrictions or limitations on the policies that they would implement in their attempt to lessen the impact of the drought that would have been forecasted for 1973.

By re-enacting the 1972/73 crop year in the Sahel, existing information on the climate, crop yields, precipitation, and population (both human and livestock) for that year can be used. General information and information about the preceding drought years will be used to supplement the data that does exist for 1972/73.

The objective of this approach is to determine how much flexibility decision-makers in the Sahel might have, given perfect information about their climate one year in advance. Although this type of information is not now available, an assessment of the impact of a perfect forecast can be useful in determining the impact and value of a less-than-perfect, but relatively more feasible, long-range climate forecast for the Sahel.
I had 100 cattle, but, because of the drought, I lost 50. Next time, I will have 200.

...A Fulani Herder, 1973

The Sahel: Rainfall

The Sahel is a climatically defined zone in the sub-Saharan part of West Africa, which receives 250 to 600 mm of annual average rainfall. It is bordered on the north by subdesert (100 to 250 mm) and to the south by the Sudan (600 to 900 mm).¹

Annual Mean Isohyets (mm of precipitation)

The amount of precipitation, as well as where and when it falls, affects the type of soil and the type of vegetation found in the region. On these factors, Michael Hordowitz has written that:
The rainfall may be evenly distributed throughout the four months of the rainy season, or may be concentrated in a few intense periods. Contiguous areas often experience much difference. In 1968 and 1969 [for example] early rains led the grass to germinate, and the immature seedlings were subsequently burned by the sun.

The 500 mm isohyet (line of equal precipitation) has been generally accepted as a boundary north of which only irrigated crops can grow.

**The Sahel: Livestock**

This region is mainly useful for the grazing of livestock, especially cattle. In 1973 it was estimated that three-fourths of the cattle and two-thirds of the sheep and goats were to be found north of the 600 mm isohyet, the southern edge of a zone of transition between the sedentary cultivators and the nomadic populations.

There has been much interest shown in the development of a livestock industry in the Sahel. It was noted in an International Bank for Reconstruction and Development (IBRD) report, as well as in reports of other development agencies, that:

The market prospects for livestock products are very favorable due to significant price increases during the last years, resulting from worldwide inflation, rapid urbanization in West Africa, and the opening up of new markets (namely in Arabic countries).

In spite of such optimism, however, the report also noted that the development of such industries would not occur rapidly and that:

The drought of the past six years has demonstrated that the Sahel does not constitute a rich resource capable of being quickly developed to support a major livestock industry with the capacity of radically improving the economic condition of the six Sahelian states.
In any event, livestock raising does hold out some hope to the inhabitants and the governments for an improvement in their standards of living.

**Pastoralism**

The availability, distribution, and timing of rainfall in this region has also had a major impact on the types of social systems that developed in the Sahel. Pastoralism takes on many forms in Africa, based on migratory patterns, degree of dependence on livestock, social structure, geographic location, and other similar factors. Several of the indigenous socio-political systems in the Sahel-Sudan region have placed a major emphasis on livestock for their livelihood as well as for their survival. Some pastoral groups keep livestock by tradition and not necessarily for subsistence. They supplement their diet by importing grain from adjacent regions. D. J. Stenning wrote that:

> The Wodaabe [for example] maximize cattle production by avoiding cultivation altogether. The increased size of their herds allow them enough of a surplus in milk, butter, cheese, and occasionally in meat, to trade with the farmers for surplus millet.

Others, however, are even more dependent on their livestock for subsistence. They depend on their livestock for food, fuel, fertilizer, barter, and transportation. There are cultural as well as economic reasons which encourage the herders to maintain as large a herd as possible. On the one hand, wealth and power are often measured in terms of the number of cattle that a herder possesses. On the other hand, in terms of survival it has been calculated by L. H. Brown that five head of cattle are required to support one individual. He suggests that many of the problems in the Sahel are related only indirectly to the large herd sizes but are directly related to the large human population which now lives
in this ecologically fragile zone. Brown has written that:

While overgrazing and erosion in pastoral areas is usually attributed to 'prestige' overstocking, it is shown here that there is a basic minimum number of animals required to support a human family. Where rising human population becomes too great to permit each family to maintain this necessary minimum herd, damage to the environment through overstocking becomes inevitable.  

In light of the belief that about five cattle are required to support one herder and that pastoralists have three basic economic objectives—milk production as cash income, large herds as insurance, and maximal individual gain from communal land—it appears to be almost impossible to effectively reduce herd sizes below the threshold at which the pastoral group subsists. On this Randall Baker has written that:

To expect people under these circumstances to destock is itself irrational unless an alternative form of security which they can comprehend as being acceptable for their traditional survival strategy is offered them.  

It has been suggested that rationalization of herd composition could lead to a reduction in herd size. For example, economic criticism of nomadic herding practices has generally been based on the management and the composition of the herd and on nomadic marketing practices. With respect to management, the cattle tend to be kept until they are either old or sickly. In addition they are grazed in such a way that most of the weight gained during the wet season is lost during the dry season, mainly because of the distances herds must travel in order to find suitable forage.  

With respect to herd composition it has been suggested that there are too many bulls and steers, while there should be a higher proportion of cows and calves in order to make the herd economically more productive.
All researchers note that there should be a higher offtake i.e., a culling of the herds. However, there does not exist at the present time an adequate system for marketing the surplus livestock which would be culled. Khalifa and Simpson have suggested that in pastoral societies there may exist a perverse supply (an inverse supply/price) relationship. They wrote that:

The usual argument is that in such non-market oriented communities, the money needs of the people are so limited that any rise in the price of their products inevitably leads to a curtailment in supply. . . . 14

It should be remembered that aside from the economic functions that the herds serve, they fulfill other important functions as well. Baker noted that:

To sell the extra animals would mean that the money earned would have to fulfill all the roles of the marketed beast which, in most pastoral societies, it patently does not. . . . 15

Most governments in the region have sought to sedentarize their nomadic populations for reasons relating to political control, economic development, or taxation. One author, Talal Asad, in writing of nomads elsewhere, has suggested that "Administrative arguments for settling nomads are often clearer than the economic ones." 16 Many observers of the current situation in the Sahel agree that there is an important function that nomadism (and transhumance) can fulfill with respect to using widely scattered and otherwise unusable resources. Commenting on this point, J. A. Pino wrote that:

"No better use than extensive stock-raising could be found for almost all of the Sahara-Sahelian zone, where irrigation is impossible, and a good part of the Sudano-Sahelian zone. Indeed, if not used for stock-raising, these lands are bound to be under-utilized or not utilized at all." 17 (italics mine)
External Interventions

It has been shown that in pre-colonial times the traditional herding practices of the nomads were extremely rational, given their ecological setting. For example, Lovejoy and Baier noted that:

The Tuareg trade network and commercial infrastructure not only formed a link between the economies of desert and savanna but also provided a safety valve for the desert during droughts, particularly those lasting more than several years.

Also,

The desert [Central Sudan] played a unique role in the development of the savanna here, where integration enabled the desert sector to survive periods of crippling drought and to prosper in times of favorable weather.¹⁸

Although it is now widely acknowledged that pastoralism was a rational response to the dangers inherent in living in an ecologically fragile zone, especially in pre-colonial times, that may no longer be the case.¹⁹

Outside interventions such as colonial boundary maintenance, the introduction of cash crops, piecemeal application of available technology, irrigation schemes, human and livestock population growth, and deterioration of the rangelands, all coupled with periodic extended droughts, served to sharply reduce the high degree of self-sufficiency previously manifested by the nomadic populations. The critical nature of the external factor aspect of the problem was noted by an author who wrote that:

The change to commercial agriculture is generally unfavorable to pastoralists. The disappearance of fallow with the extension of cultivation drives the cattle to a distance (even those of the cultivators to the detriment of their fields).²⁰

These outside interventions, among others, have had a major impact on the viability of the desert-edge sector and on the way of life of the
nomads. Factors external to the nomads, such as restriction of herd movements, veterinary medicines, indiscriminate well-drilling, and pressures to settle, had established new ground rules by which the nomads have had to live.

The Process of Deterioration

Ecological deterioration in the Sahel has been linked in several ways to livestock herds. The intrusion of modern medicines and of medical services into the pre-colonial nomadic system, however intermittent, has served to keep larger numbers of livestock and humans alive. To some, this has been cited as a counterproductive aspect of modern medicine. In times perceived to be normal, that is, during periods of above-average rainfall, herdsmen were in a symbiotic relationship with cultivators. The nomads, who would sometimes also herd the cattle of the cultivators, would be allowed to graze their cattle in the fields following the harvest and, in return, cattle manure would be used to fertilize the fields for the next crop year. In normal times the region in which the pastoralists lived was being taken from them as the cultivators pushed further north into more marginal areas in order to put more land into the cultivation of cash crops. Some of the marginal land that had been cleared for cultivation was later abandoned because of low crop yields, and was left open to wind erosion and desiccation. Nomadic populations became sandwiched, on increasingly marginal land on the southern edge of the Sahara, between the desert to the north and the cultivators (as well as the tsetse fly) to the south. During extremely favorable periods of weather, the pastoralists inhabited this marginal region with relatively large herds. However, with the onset of a series of dry years (drought) beginning at the
end of the rainy season in 1967, the nomadic populations found themselves occupying very marginal rangelands of which the carrying capacity of the land was extremely overtaxed by the large number of livestock. The end result was that the nomads who had been pushed into these marginal areas along with the sedentary farmers who sought to open up new, yet marginal, lands to cultivation found themselves to be victims of a natural disaster when in fact there was a return to normal rainfall conditions in the Sahel. Explaining this situation, one author noted that:

The result is that after a series of good years the distribution of human populations and the cattle numbers are not such as can be maintained in less favorable years. 22

As L. D. Stamp and others have suggested, "The carrying capacity of the land in men and animals is that of the poorest years, not that of the average years." 23 The following chart of previous rainfall extremes shows that the situation in the Sahel has always been a precarious one, climatologically speaking.

Chart A
Previous Extremes of Rainfall*

<table>
<thead>
<tr>
<th>Runs of years of particularly high rainfall in ZONE 2 (Sahel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>1929-1931</td>
</tr>
<tr>
<td>1952-1955</td>
</tr>
<tr>
<td>1957-1962</td>
</tr>
</tbody>
</table>
Runs of years of particularly low rainfall in ZONE 2

<table>
<thead>
<tr>
<th>Years</th>
<th>Rainfall as % of 1931-60 mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912-1915</td>
<td>85  55  78  94</td>
</tr>
<tr>
<td>1940-1944</td>
<td>80  82  76  101  73</td>
</tr>
<tr>
<td>1947-1949</td>
<td>83  93  64</td>
</tr>
<tr>
<td>1968-1973</td>
<td>72  98  97  74  69  65</td>
</tr>
</tbody>
</table>

*National Academy of Sciences, Arid Lands of Sub-Saharan Africa: Appendices (Washington D.C., 1975), p.155. Zone 2 rainfall stations were as follows: Niamey and Zinder (Niger), Sokoto, Kano and Maiduguri (Nigeria).

Coupled with this climatic variability, human activities with respect to animal husbandry and to agricultural practices have been suspected of having had a deleterious affect on the soil in the region. According to a recent FAO report, the present situation in the Sahel has been:

... due to the buildup over the years before the drought, of high human (and animal) populations relative to the carrying capacity of the land. This trend has been magnified by even greater population increases outside the range area, leading to an expansion of cultivation and hence, a reduction of available grazing area. 24

The recent reduction in available grazing area due to drought coincided with the time when expanded herds were in need of greater availability of forage and water. Other reports similar to that issued by the FAO have affirmed the view that the periodic droughts which have plagued the region have only tended to exacerbate a situation in which ecological deterioration was already well in progress. As one example, a U.S. AID official wrote that existing data on the Malian herds suggested that the stocking rate in relation to the carrying capacity had been exceeded
before the onset of the drought in 1968. As another example, Rene Dumont wrote in 1962 that:

... the areas near the wells have been overgrazed and vegetation much reduced. The points of water supply were set up before a map of the pasture-lands was drawn up, which would have established them on a more intelligent basis.

On the problem of water and forage availability and usage, J. A. Pino has written that even during periods of favorable rainfall in the grasslands of developing countries:

Water utilization [was] for the most part haphazard, and stock either had to travel too far for water or animals [were] concentrated near water to an extent that available forage [was] seriously reduced.

1972-73

Normally the need for green forage forced the herders to move their herds in a southerly direction and toward the rivers. Such movements would ordinarily take place between the end of one rainy season and the beginning of the next. In 1972 there was another major shortfall of precipitation throughout the region, as indicated by the following list of percentages of normal rainfall in the Sahel for that year:

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senegal</td>
<td>59%</td>
</tr>
<tr>
<td>Mali</td>
<td>72%</td>
</tr>
<tr>
<td>Niger</td>
<td>66%</td>
</tr>
<tr>
<td>Upper Volta</td>
<td>86%</td>
</tr>
<tr>
<td>Chad</td>
<td>77%</td>
</tr>
<tr>
<td>Mauritania</td>
<td>45%</td>
</tr>
</tbody>
</table>

During this rainy season, the northerly movement of the herds in general did not take place and, as a result of the poor rains, the movement toward the south began as early as October in Mali. The herds were allowed to linger in the southern part of the Sahel and in the northern part of the Sudan, resulting in a high concentration of livestock, all in competition for a necessary but dwindling resource—forage. This led
to extreme overgrazing of the vegetative cover around well sites and to a lowering of water tables. The cumulative impact of the shortfall of precipitation tended to reduce drastically the soil moisture needed to sustain annual grasses. When these grasses died before maturity, grazing pressures increased on the remaining forage. Deterioration of the range-land was apparently on a downward spiral of drought→less-than-perfect→drought and so on.

The impact of five years of drought on livestock in the region was a major one. Of the estimated 23 million cattle in the Sahel, approximately 20 to 30 percent migrated out of the area and of those that remained, 25 percent died. As of April 1973, existing livestock estimates were as follows:

- cattle......50% of normal
- goats.......80%
- camels.......95% of normal
- horses/mules...85%

These figures are estimates and are not necessarily the result of scientific investigation. Also, as with the rainfall data, there are large regional variations in the figures for livestock data. For example, the Biltine District in Chad reported that 80 percent had died by May 1973, while the Sixth Region in Mali reported that about 40 percent of its cattle had perished in the drought. By November 1973 it was reported:

Although the figures are not yet known with any certainty, the losses are estimated at one-third of the camel population, 20% of the cattle in Niger, 50% of the cattle in Mauritania and between 25 and 30% of the cattle in the other four countries with, no doubt, wide regional disparities.

Cattle, herded to the south in search of water and forage together, sometimes occupied land abandoned by a group of nomads which moved south in search of better grazing areas. In other cases, livestock was moved
into areas which, although normally infested by the tsetse fly, had become temporarily safe for cattle because the tsetse had also moved south in search of a moister climate. In still other cases some cattle had been moved out of the region and sold in anticipation of the impending disaster. One French report noted:

One of the worst aspects of the drought was the necessity to sell off at miserable prices, females, often gestating cows, whose average carcass weight fell from 130 down to 80 kilograms from March to July [1973].

The report, commenting further, noted that:

... The forced sale of a female constitutes a "loss" on the same order as death or necessary slaughter from the point of view of the dynamics and economics of the herd.

Some authors have suggested that the recent drought was no worse than others that have occurred in this century during 1910-14 and 1941-42. The greater impact of the current drought was apparently the result of poor land management practices and overpopulation. A five year accumulation of drought conditions led to the exhaustion of individually stored grain reserves. This was an important fact in that during normal times the pastoralists would undergo famine-like conditions by the end of the dry season every year.

Comments

Following the relatively favorable rains of 1974 and 1975, it appears that the recent drought situation is under control. This view has been fostered in part by the fact that with drought related deaths and migrations, a reduction in human and livestock populations has brought those remaining in the area into a better ecological balance with the land's
carrying capacity. Yet, even if we are witnessing an end to the recent
drought, basic problems of population growth and ecological deterioration
in the Sahel still remain, as does the lingering impact of the drought on
the inhabitants and the governments of the Sahel. H. N. Le Houérou in
his summary of ten recent international meetings on arid lands and range-
land problems noted unanimous recognition that continued rangeland mis-
use was resulting in such problems as a reduction in plant cover and
biomass, an increase in erosion, a reduction in productivity of range-
lands, an increase of unpalatable as well as of annual species, rare-
faction and sometimes disappearance of valuable forage species and of
wildlife. 35

As it is the purpose of this study to assess the implications and
value of a credible and reliable long-range climate forecast for the
grazing system in the Sahel, experts in various fields are being asked
to note what they would have done in the Sahel if they had had a perfect
climate forecast about the 1972/73 crop year as early as October 1972.
These experts are to assume that there would be no political, economic,
or social limitations or restrictions on what they would have done.
Such responses, coupled with similar responses to other case scenarios,
should prove to be of great value in assessing the value of the develop-
ment of a credible and reliable long-range climate forecast.
Footnotes

(1) Recent international agreement has established that the Sahel is limited by the 100 and 600 mm isohyet and is subdivided as follows:
   a) 100-200 mm Sahelo-Saharan subzone
   b) 200-400 mm Sahelian subzone sensu stricto
   c) 400-600 mm Sahelo-Sudanian subzone
Le Houérou in private correspondence noted that (a) was entirely pastoral, (b) almost entirely pastoral, and (c) mixed pastoral/farming.


(4) I.B.R.D., "Proposal for a Cooperative Effort to Rationalize the Livestock Industries of the Sahel" (October 1973), p. 1; also a recent U. N. study noted that despite the fact that relatively little had been done to organize the marketing of animal products for export in the past (except in Chad), the following percentages of export of products of animal origin (including animals) exist:
   Upper Volta...40%   Chad........ 25%
   Mali.............35%   Niger.........20%

(5) I.B.R.D., op. cit.


(9) Ibid.

(10) The subsistence needs of a nomadic family is a controversial point. For another comment see U. N. Special Sahelian Office "Livestock Report...", op. cit., p. 2-3.

(11) I.B.R.D., op. cit.


(15) R. Baker, op. cit., p. 16.


(22) Ware, op. cit., p. 3.


(29) Ibid.


(31) Temple and Thomas, op. cit.


