Seasonality, climatic fluctuations, and food supplies (Sahelian nomadic pastoral societies)

E. Bernus

The Saharan climatic zone is one of permanent aridity interrupted only by exceptional rainfalls. It may be influenced by climatic seasonality of bordering regions such as the summer rains of the Sudanese zone or the autumn and spring rains of the Mediterranean. But it can also remain apart from any influence in an absolute state of aridity. In other words, the biological cycles here are not dependent on seasons, but on rainfall patterns. Rainfall, though it occurs neither each year nor in a determined season, is sufficient to allow the emergence of an *acheb* meadow, an ephemeral grass whose dormant seeds revive for a rapid life cycle likely to last only a few weeks.

In this short cycle, the reduced size of the plants (the young plants measure from 1 to 5 cm) allow the best adapted 'ephemera', such as *Boerhavia*, to produce seed from 8–10 days after their germination, whereas others require 15 days. These ephemera are anatomically no different from the species found in wetter regions. Scattered in the desert by the wind, the seeds undergo a long dormant period. Consequently, these pastures appear unexpectedly and in scattered patches, according to unpredictable rains. Such is the extreme case of a zone where any organism found is on the verge of survival.

The equatorial zone has no climatic fluctuations but it is characterized by permanent humidity. For instance, in the Pacific Islands, time goes by without any bench-mark and with no periodicity:

'time also is changing. Days and nights in the tropics follow each other regularly with 12 hours of each and no twilight. It is said that there are only two seasons: the rainy season which is warm and the warm season which is humid. Another form of eternity is rediscovered in the sea associated with the sun. As time goes by, memories become vague because they are not anchored chronologically. Projects lose their charm since they are not necessitated by seasonal changes. One learns to do things at the best moment; when one feels inclined to do them. Consequently, everything seems possible since it will be sufficient to act when you feel like it. The islander with eternity before him, is able to devote his time to the present, which is a favour granted to few men' (Theureau 1979, pp. 123–7).

Between these two extremes, the Sahelian zone is characterized by a short rainy season with irregular interannual intensity and space distribution which, however, recurs every year from July to September. The cycle is regulated by a precise calendar where well-marked seasons follow one another. These annual returns of rainfall and these successive seasons determine in collective memory 加速的行动。当时"自己"中华,这一家,就是他们。如何把他们的他们的自己的自己的。如何的时候的多少,就是这些时候,他们就是

See.

and tradition a chronology which highlights the outstanding facts of the past years: therefore time is characterized by names which mention the major events of each year.

The Sahelian area comprises three phyto-geographical subdivisions, limited by isohyets. Between 100 and 200 mm, there is the subdesertic Sahel or Saharan Sahel, from 200 to 400 mm, the 'typical Sahel', while between 400 and 600 mm one finds the 'Sahelo-Sudanian border'. The first area has very few trees (mainly *Acacia ehrenbergiana* and *A. raddiana*), with a sparse herbaceous vegetation (*Panicum turgidum*) on the dunes. The 'typical Sahel' contains more varied and larger species of trees (*Acacia ehrenbergiana*, *A. raddiana*, *A. nilotica*, *A. laeta*, *Balanites aegyptiaca*, *Maerua crassifolia*, *Ziziphus mauritiana*, *Salvadora persica*, etc.), and annual prairies, with, on limonous soils, *Aristida adscensionis*, *A. funiculata*, *Panicum laetum*, *Schoenefeldia gracilis*, and, on sandy soils, *Cenchrus biflorus*, *Tribulus terrestris*, and *Aristida mutabilis*.

SEASONAL CYCLES IN THE TRADITIONAL LIFE OF THE SAHELIAN STOCK-BREEDERS

The Sahelian seasonal cycles

The rainy season is the backbone of the annual cycle. One might say that it occurs at the beginning of the year and sets the pattern of the following months. Deficient and badly distributed rainfall brings about a shortage of pastures and, concomitantly, famine, death, or escape toward a safe region. On the other hand, sufficient and timely rainfall gives rise to rich pastures, flourishing herds, and balanced nutrition. Subsequently, years are given names which most often refer to the consequences of rainfall, such as 'the year of the abundant grass', 'the year of the shortage of grass', or 'famine', 'drought', or 'death'. The year begins with this crucial season and continues with a slow decrease in pastoral resources (water and forage) until the new rain falls.

The Sahelian zone, defined by the average isohyet graph, is characterized however, by the wide variability in the distribution of rain. Scanty rainfall, over a short period, occurs in the form of violent showers, following a long dry season of 9-10 months.

The inter annual variability of rainfall is very marked and the relation between minima and maxima varies with a factor of 3-10. The lighter the precipitation, the more these differences are marked, which means that this variability increases from south to north, from the Sahelo-Sudanian border to the Sahelo-Saharan fringe. Consequently, from one year to another the isohyets shift, causing the Saharan zone to advance or recede at the expense of the Sahelian area. In Mauritania, Toupet (1977, p. 76) has shown that 'the sector between isohyet 100 mm in 1941-2 and isohyet 100 mm in 1951-2, which can alternatively be a desert which stock breeders flee or a pasture land which attracts herds, covers 240,000 km² or 31.5% of the total surface of Mauritania'.

In Niger, the same isohyet, 100 mm, between 1952 (a wet year) and 1973 (a particularly dry one) moved 300 km towards the south and, during the same period, isohyet 300 mm receded 400 km southward (Bernus 1981, p. 12).

During the annual cycle, contrasts occur between humid and dry periods, warm and cold ones. These four elements are combined two-by-two: the warm and humid elements appear together in the rainy season and this association persists from September to October; the cold and dry elements are typical of the winter season which gradually becomes the warm season from March to June; then it goes from the dry to the humid phase with more and more storms occurring.

The Sahelian seasonal cycle resembles the Sudanese one, but it is characterized by a prolonged dry season at the expense of the rainy season, an increased interannual variability in rainfall, and pronounced thermal contrast. These differences lead to emphases on agricultural activities in the Sudan and pastoral activities in the Sahel. Moreover, calendars are not the same. For cultivators, the period of abundance is in the autumn at harvest time, while the period of famine corresponds to summer when granaries are empty and agricultural tasks are the most demanding. For stock-breeders, the calendar is reversed: the abundant period is in summer, once sufficient rainfall has filled up ponds, revived plants, and reinvigorated herds who begin producing milk again. Before these happy days when men and animals are once again free to move away from deep wells, there is the period of famine, when the only forage available for animals is dry straw and when men must perform the hard task of drawing water under sweltering climatic conditions, and on only a small ration of milk.

To obtain millet, the nomad herders sell their products, which are largely live animals (plus milk and butter in the case of the Fulani). However, they get very little benefit because of the seasonal pattern of livestock and cereals (cf. Fig. 13.1). Prices of millet and livestock follow opposite, and slightly out-ofphase, curves. When the millet rates decrease after the harvest, in November and December, cattle prices are high, reaching a maximum in January–February. Correspondingly, when millet is expensive prior to the harvest (in July–August) animal prices are at their lowest. This seasonal variation is exploited by the merchants who dispose of financial reserves and can stock grain in storehouses, unlike nomad herders who cannot do so.

CONSEQUENCES OF THE EXPLOITATION OF SPACE

The Sahelian nomads make use of these seasonal contrasts to exploit the complementary zones of their ecosystem. When the rainy season makes it possible for ponds to be filled up and for pastures to be revived, stock-breeders migrate northwards with their herds. They move between $16^{\circ}30'$ N and $17^{\circ}30'$ N to take advantage of herbaceous pastures composed of annual, high-yielding



FIG. 13.1. Seasonal prices of livestock and millet in Niger. (a) Dakoro (averages for 1958–1963); (b) Niamey (1963).

species. Mineralized waters are also sought, which explains the name of 'salt cure' given to this yearly movement.

The summer pastures, often monospecific, are concentrated along the argillaceous plains, where varying degrees of moisture are present as a result of topographic site. This affects the species present; the main varieties are:

Sorghum aethipicum, lpomoea verticillata, Psoralea plicata and Aristida funiculata and A. adscensionis. In a good year, yields of these species may reach 1000 to 2000 kg/h: in a year when the rains fail, yields may decline to zero. To the north of these summer pastures, on the border of the Sahara, prairies of annual bush growth (Schouwia purpurea) develop in the dry season under very special edaphic conditions (mud cracks filled with eolian sand). This milkproducing plant is sought by the herds of female camels which, when the stockbreeders leave to go south, are guarded by shepherds who live exclusively on camel milk until February.

After the rains the stock-breeders go southwards for ten months to exploit the regions with more reliable resources, such as arboreal pastures. These pastures are almost absent on the boundary of the Sahara, but further south several species (various *Acacia, Balanites aegyptiaca, Maerua crassifolia*, etc.) yield forage in the form of leaves, flowers, and fruits which replace the dry herbaceous pastures. Permanent deep underground waters, which are exploited through wells or pumping stations, replace the surface waters of ponds and drainage wells which have dried up in winter (Bernus 1979, pp. 69–71). This back-and-forth movement demonstrates the use made of seasonal contrasts by stock-breeders to exploit their ecosystem on a regular and rational basis.

Apart from these annual organized movements, the periods of prolonged drought sometimes bring about irregular and variable migrations toward safe regions. Among the well-remembered droughts, the 1914–1915 crisis provides evidence of southward migrations. In Niger, the Tuareg from the Aīr region (Igdalen, Ikazkazan, Kel Fadey, etc.) named that year the 'year of Mayatta', a well 400 km southwards to which they migrated. After the crisis, stock-breeders went back to their usual ranges.

A parallel can therefore be drawn between the cycle of men and their heres, and that of the seasons; it is broken only during the recurrent periods of drought.

However, nomads are less dependent on space than peasants in certain seasons. For example, war-like pastoral societies have made frequent use of the growing period to launch surprise attacks in the agricultural zone, thus disregarding the truce reached tacitly by agricultural societies. In summer, nomads can move freely as a result of the existence of ponds, while peasants cannot leave their fields between the sowing and the harvesting periods. This mobility has often allowed nomads to exercise their superiority resulting both from an altered calendar and the possession of rapid mounts.

SEASONAL CYCLES OF DOMESTIC ANIMALS

Domestic animals which feed exclusively on natural plant resources (with the exception of salt which is often given by stock-breeders) live in harmony with the seasons. Abundant green forage is available for them once the rainy season

begins. Then, throughout the dry season, they feed only on dry meadows with minimal food value, and sometimes on arboreal forage. At the same time, water resources decrease and the herds are concentrated around deep wells. Deficient feeding, as well as increased distances between water points and pastures, combine to weaken animals in the hot season before the return of the rains. Water requirements for cattle vary with temperatures, atmospheric humidity, and the moisture content of food. Grass, whose water content amounts to 80 per cent during its growing period, turns into straw as it dries, the water content of which is only 10–15 per cent. Therefore, daily water requirements can be evaluated according to season (Serres 1980, p.75). They are listed in Table 13.1, but are 10–20 per cent higher for dairy females.

Livestock	Rainy season	. Cool season	Warm season
Mean cattle (250 kg)	10	20	. 30
Camel (400 kg)	15	25	40
Small ruminant (30 kg)	2	3	5

TABLE 13.1. Daily water requirements (litres) of livestock according to season.

These estimates refer to a theoretical daily water intake, whereas in most cases the cattle go to the well at more or less regular intervals. When ponds become dry, the different types of cattle go to the well at various intervals according to the season: in the dry and cold seasons, cattle are watered either daily or every other day, while sheep are watered once every 4 days, goats once every 3 days, and camels once every 10 days. In the warm season (March-May), cattle are watered in the same way (daily or every other day), sheep and goats are watered every other day, and camels once every 5 days (Bernus 1981, p. 304).

وتفريدها فأولار فكالمؤلان والمقدومات والالان

Ļ

ويدار وتسميد ومساورة الكور الكرومية وتتكريب ومراجع للتركيم

12.

These seasonal variations show that the cattle are thirsty and underfed from the end of the cold period (February) onwards and, therefore, are in a weakened physical condition. This has a direct influence on milk production. As far as cattle and camels are concerned, stock-breeders do not check the reproduction periods and males are free: therefore milk production throughout the annual cycle. Births take place at variable dates and differ according to regions and species. As far as cattle are concerned, surveys showed that births were grouped in Senegal in June–July (35 per cent), in Niger in the rainy season, in the Sahel of Upper Volta in the dry and warm season (April–June), and in Chad in the dry and cold season (December–January) (Coulomb, Serres, and Tacher, 1980, pp. 15–16). As far as sheep and goats are concerned, some stock-breeders (particularly the Tuareg) regulate births by tying the male's penis to the scrotum with a small string. Consequently births take place only once a year after the rainy season for goats and in July–August for sheep. This way goats and sheep enjoy their favourite pastures, fodder trees for the former and herbaceous

DZT E. DEKINUS

meadows for the latter. Moreover, lambs which, unlike kids, can walk shortly after their birth are less troublesome for the summer migration (Bernus 1979, p. 72).

Milk production varies with the breeding periods. For instance, females which calve during the rainy season and, consequently, have rich and abundant forage give from 600 to 1000 kg of milk, while those which calve in the dry season yield only 200 to 300 kg (Coulomb *et al.* 1980, p. 42). In any case, milk production is far more abundant in the rainy season.

However, even during the summer period of relative abundance, stockbreeders on the move sometimes suffer from unpredicted food shortfalls. We observed this during a camel move with a group of Tuareg. The meals of twelve families were studied while the camp was travelling over a period of 18 days. On 16 occasions, in one or another of the family units, a meal had to be missed due to lack of milk (Bernus 1974, p. 101). This occurred when the young animals, inadequately guarded, found their way to their mothers and finished all the available milk. The different techniques used to prevent such uncontrolled nursing (muzzles for calves, cords attached to baby camels' palates, teat protectors for female camels) had been forgotten or neglected on the pretext that the young animals had been separated from their mothers–separation which the shepherds, distraught or lazy, were unable to ensure.

Consequently, the biological cycle of the herds has a direct influence on the stock-breeders' diet as do their pastoral practices. The herds meet together near the shifting camps during the rainy season, when the abundant pastures and water favour milk production.

SEASONAL CYCLES AND HUMAN NUTRITION

Seasonal cycle in the consumption of animal products

Milk forms the staple diet of stock-breeders but it is never the only food source; its primary role in the rainy season and the following months gradually decreases as summer approaches.

However, milk is more than simple food. It is almost sacred: 'Milk must never be deliberately poured on the ground; if it is poured over by mistake or clumsiness, the Fulani puts his finger in it, then on his fore-head and chest and finally on his heart and he takes an oath "through milk and butter" (A Hampate Ba and Dieterlen 1961, p. 14). The Tuareg claim to be the victims of specific disorders if they are short of milk, even if they have sufficient amounts of other food-stuffs. Milk is given and not sold among the nomadic Tuareg.

Each society values the milk of a certain type of animal which, according to its taste and properties, represents the ideal food. The Fulani favour cow's milk: 'adults value only cow's milk and they disdain camel's milk whose taste is no better to them than that of goats' milk' (Dupire 1962, p. 10). The Tuareg prefer, by far, the fresh, slightly salty and foaming camel's milk which they consider contributes to children's growth, reinvigorates sick persons, and strengthens the elderly. It is believed not to convey any disease, unlike other types of milk.

Although milk is not the only food at nomadic camps, it is often the sole food of shepherds who, all alone, follow the herds. During the rainy season, milk plays a considerable role in nutrition, while herds are moving in groups along with camps. Milk which is obtained twice a day, and sometimes three times per day from camels, is consumed immediately or served with millet porridge (rare in this season). Fresh milk is, therefore, the daily food, taken at milking time and brought to the tents each morning and evening. Milk byproducts, which do not have to be consumed immediately, also play an important role: curdled milk which fills small leather gourds or large calabashes; butter, eaten fresh (mainly by the Fulani) or cooked (by the Tuareg who keep it for long periods in rigid leather-lined bottles); and cheese, made from cows' or ewes' milk using the abomasum removed by means of a stick from a slaughtered kid's rennet, and which is dried on small mats stretched on the branches of a tree. The latter, rectangular in shape, its surface striped by the rush mat support, can be eaten fresh and soft but is more often used after long keeping; it is broken off in small pieces and accompanies tea. It is also incorporated in the raw ground millet gruel with sugar, pimento and maybe even dates. This liquid food is often used in the hot season since it is both refreshing and nourishing, and, during journeys, not only makes cooking unnecessary but also constitutes a food-stuff which is easy to transport and to store.

All stock-breeders begin milking with the small animal, which is then set aside and tied to the legs of its mother during milking before being released in order to suck the remaining milk. Therefore the competition between man and suckling animals is constantly present. Only the rich stock-breeders can allow the young animals to suckle freely during the months following birth. This competition threatens all young animals before their weaning, especially during the famine periods; i.e. often at the end of the dry season and still more during recurrent deficit years for rainfall. At these times the mortality of young animals can be very high.

According to surveys carried out in Niger, at the beginning of the dry season the death rate among calves under one year old is around 35 per cent (Coulomb 1971). Considerable differences can be observed, however, in death rates among different breeders and different areas. For example, mortality ranges from 23 per cent at Filingué and 52 per cent at Tanout among the Fulani, and from 26 per cent at Filingué and 54 per cent at Agadez among the Tuareg. This high mortality rate, due to over milking by the breeders, occurs during the shortage period, and also sometimes during moves and when there are visitors. One woman told the investigators: 'Calf mortality is high the years there are a lot of visitors, as one has to offer milk to guests'. Social constraints and compulsory hospitality, to which one must comply or be exposed to unflattering remarks,

concur with this mortality risk. In this connection mention should be made of the poems gathered by the Père de Foucauld entitled: 'Against the Kel Tazoulet, who did not offer him hospitality' and 'Against Kemma agg Ehar, who offered him insufficient hospitality' (Foucauld 1925, p. 112 and p. 271, respectively). These poems were written by travellers who considered that they had not been sufficiently honoured and who sought their revenge by way of the verb, thus leaving an indelible public trace of such and such a family's or a particular tribe's stinginess.

ALL STATE AND A STATE AND A

A had blind

and the second second

Stock-breeders who only slaughter animals if they are weak or ill, or for religious or family feasts, or in honour of an important guest, consume small amounts of meat. Religious feasts are to be found in all seasons because the lunar Moslem calendar differs from the Gregorian calendar. Family feasts (marriage) or social ones (*Gereol* among the nomadic Fulani) as well as visits are, on the other hand, more frequent during the rainy season.

Meat and milk consumption increases simultaneously among the Wodaabe Fulani of Niger during this period. 'Daily milk consumption greatly increases and can reach three to five litres per person. For about two months, while they gather in humid valleys, the meat feasts are so frequent—that the preservation of rations makes it possible to have an almost daily consumption of meat' (Dupire 1962, p. 62). Among the Tuareg, the slaughtering of animals, which is also more frequent in the rainy season, is most often limited to sheep and goats, while steers are sacrificed only for important weddings.

Each sacrificed animal is shared between guests according to a rite which varies from one nomad group to another. The meat, which cannot be kept (except in dried form), is eaten in enormous quantities; this abundance always comes after a long period of meat shortage. Although certain feasts take place during the 'fattened cow' time, the Islamic religious feasts can occur at any time and even during shortage periods. However, in many families the animals to be sacrificed are set aside in advance, fattened with this aim in mind, and fed from birth onwards on the milk of several ewes. Among the richest stock-breeders, numerous sheep are prepared this way for a particular feast (end of Ramadan, 'Tabaski' sheep feast) and, consequently, the animals do not suffer from the effects of a deficient diet due to parched grazing lands.

However, animal products represent only one food source for the Sahelian stock-breeders. Cereals represent the second one and are as important as the former, even for nomads who are not farmers.

Traditional consumption of cereals and the gathering of plant products

Nomadic pastoralists have always consumed cereals, mainly millet and sorghum. Products from stock-breeding or from gathering and hunting have never allowed the Sahelian pastoral societies to be self-sufficient. Stock-breeders tried to have relations with the southern markets and to control the agricultural zones in order to collect rents. Dependent groups often cultivated south of their nomadic masters and supplied them with part of the crops.

Cereal consumption varies throughout the annual cycle and its role in the diet increases in the dry season in order to make up for the decrease in the herd's milk production. Moreover, cereal prices are subject to an increase between one harvest and the next. Stock-breeders, who cannot store cereals in their moving encampment, are affected by prices and make regular purchases as they are needed. When prices increase at the end of the dry season and in the rainy season, they limit their purchases and keep only a small stock with which to welcome the chance visitors who are numerous during this period of general mobility.

It is common to pick wild grasses in all the pastoral societies. This is not considered as a famine harvest but as a general harvesting, likely not only to provide the daily meal but for building up stock in underground silos. In the rainy season, standing seed crops are gathered using a solid-bottomed open basket held at arm's length (Fig. 13.2) or even by a manual pressure on the





spikes of the tallest species (Panicum turgidum, Sorghum aethiopicum). During the whole of the dry season, the seeds of numerous species such as wild rice (Oryza barthii) or numerous other grasses (Panicum laetum, Echinochloa colona, Eragrostis sp., etc.) are swept up after straw mowing or burning. Last it is common to search for seeds buried in ant-hills by insects (Fig. 13.3). These resources of bush foods vary from one year to another according to the amount of rainfall and its distribution. When years are not favourable to these resources, nomads must turn to more resistant short-lived species (Cenchrus biflorus, Tribulus terrestris) or pick leaves of evergreen trees (Maerua crassifolia) or of parasitic plants, such as mistletoe (Tapinanthus globiferus), which are also evergreen (Bernus 1967, pp. 31–52; Bernus 1981, pp. 249–58, Tubiana 1969, pp. 55-83). Tree fruits also contribute considerably to nutrition. The fruits from Ziziphus mauritiana, which are ground in a mortar and reduced to flour, are cooked in a ditch dug in the ground that is lined with thick leaves (Calotropis procera), and heated by means of a wood fire from which the embers have been removed. A heavy dough is thus obtained, which is easily preserved and can be eaten as it is or mixed with thick gruel. Wild water melons (Citrullus lanatus) are eaten fresh or grilled; the pericarp of the Doum palm fruit (Hyphaene thebaïca) is eaten; and, for those living near large ponds, water lily tubers (Nymphae sp.) are often consumed.

services in the first of a list first reaction and the service of the first of the service of the service of the services of the service of the



Fire . 113.3. Woman redlecting seeds from an ant hill '(photographed' by author).

However, the largest contribution to the nomads' gathered diet is made by wild grasses, which used to be harvested collectively. The analysis of grains gathered in the Ahaggar (Gaudin-Harding and Ould Aoudia 1972, pp. 55-8) allows certain conclusions to be drawn regarding protein, amino acid, humidity, ash, and mineral content. The dry protein content of wild grasses ranges from 18-11 per cent and is higher than that of wheat (9.85 per cent) and barley (9.7 per cent). This high protein content is in keeping with a high lysine and relatively high amino acid content. It thus constitutes a valuable food, but has the disadvantage of requiring very long preparation. Once it has been reaped, swept, carried to the threshing area, and after several alternate threshing and sifting operations, a haystack over one cubic metre in size yields a winnowing basket of tiny seeds. In February 1968 we observed an encampment where all the members, men and women alike, were involved in a long 'cram-cram' (Cenchrus biflorus) harvest, which was to provide them with food and enable them to set aside stocks. During the course of one whole day, each family harvested the contents of three sieves, slightly more than their daily ration. 'In a good year, the harvest spreads from October to May. Each family usually stocks from one to three leather sacks containing 80 to 100 kg over and above the daily consumption' (Bernus 1981, p. 253). Since these cereal substitutes are reaped as standing crops, and then swept on the ground, they can be harvested from the end of the rainy season until the hot season; i.e. over a period of eight months. However, nowadays most of the gathering takes place from September to November. This way it is possible to obtain, by use of collective labour on ungrazed land, harvests which are substantial enough to limit or avoid purchases of cultivated cereals. Stocks are no longer kept in underground silos but are transported in sacks similar to those used to transport millet. The presentday quantities harvested no longer justify the use of such silos.

Therefore, the decrease in milk production at the end of the dry season is made good by this consumption of cereals and wild grasses.

THE EVOLUTION OF SEASONAL FOOD PATTERNS

Evolution in the consumption of cereals and harvesting products

The consumption of cereals has largely increased among the Sahelian stockbreeders since the end of the last century. The marabout Khamed Salegh states that in the 19th century 'poor families consumed only one sack of millet in a year and only on great occasions and for religious feasts' (Marty 1975, p. 72). A statistical survey (INSEE-Cooperation-SEDES 1966, pp. 186-6) states that cereals represent 52.9 per cent of the calories in the diet of the nomadic Tuareg from the District of Tchin Tabaraden, while the total of the dairy products represent only 44.7 per cent. However, this survey took account only of these two essential products and underestimated all the others (meat, gathering products, sugar, etc.). The same survey states that the nomadic Tuareg consume 330 E. BER

daily 0.345 kg of cereals per person, which corresponds to a sack of 60 to 100 kg per month or every six weeks for each family.

Table 13.2 demonstrates the differences between stock-breeders and farmers, who in fact are agro-pastoral people. The latter have a higher calorie intake and a larger cereal ration. One should, however, take into account the fact that such a survey is more difficult to carry out among nomads, with more foodstuffs being forgotten. For instance, the natron, chewed with tobacco all day 2612201-1

12.4

Products	Breeders		Farmers			
	Quantities ³	Calories ⁴	Quantities ³	Calories ⁴		
Tuareg						
Total cereals	345	1240 (52.9)	561	1990 (69)		
Total milk	1538	1048 (44.7)	1155	753 (26)		
Total milk by- products	4.9	15 (0.6)	. —			
Total meat	27	35 (1.5)	25	33 (1.1)		
Niebes beans	0.5	2 (0.1)	32	108 (3.8)		
Sugar	0.7.	2 (0.1)	0.2	1 1		
Dried pimento			0.2			
Fresh fruit			0.1	(0.1)		
Dried fruit	0.2	0.6	0.1	_		
Dates	0.6	1.4				
Total fruit and leaves	0.8	2 (0.1)		1		
Salt	0.2	()	. —			
Total calories		2344 (100)		2886 (100)		
Fulani		•				
Total cereals	340.4	1176 (63)	438	1518 (79)		
Total milk	837	662 (36)	609	358 (19)		
Fresh butter	0.4	4 (0.2)	2.5	18 (1)		
Total meat	0.6	1 (0.1)	10	14 (0.7)		
Total leaves ¹	0.2	_	1	()	-	
Total vegetables and miscellaneous ²	0.3	1 (0.1)	0.5	1 (0.1)		
Niebes beans	1.7	7 (0.4)	1	4 (0.2)		
Fresh fruit	7	4 (0.2)	-	— (—)		
Salt	0.3	— (—)	1	— (—)		
Total calories		1855 (100)		1913 (100)		

TABLE 13.2.	Daily av	erage food	intakes o	of the	Tuareg	and the	e Fulani	(1963-1964)
by profession ((source: IN	NSEE-Coop	ération-Sl	EDES	1966, p	o. 185–6	j).	

¹Baobab, green and dried.

² Pimento, okra, etc.

³Grammes/person/day.

*Number of calories/person/day, with percentage equivalents in brackets.

long, escapes investigation, as do numerous gathered and hunted foods, which are consumed far away from the 'kitchen'.

Presently, the consumption of wild grasses has decreased: picking tiny seeds is long and meticulous work, and successive winnowing and threshing operations are also required in order to remove all the foreign elements collected with them. Despite the excellent nutritional value of this food item, the yield is low considering the lengthy and varied operations necessary to obtain an edible product. In stratified societies, these operations were carried out by women of servile condition, and they were only helped by the men during threshing. Nowadays, the abolishment of captives limits the large-scale collective harvests and these crops are gathered only by groups who are too poor to buy cereals, or by people who were formerly slaves and who gather such crops both to consume them and to sell them. Most stock-breeders content themselves with picking daily the amount of seeds necessary for their meal and they no longer bother to build up stocks.

For the last fifty years, the Sahelian nomadic population has been characterized by a considerable increase in size resulting from two reasons, natural demographic growth and the arrival of the Fulani, driven from the southern agricultural zones where fallow lands and ranges are limited and no longer sufficient to feed animals. Consequently, herds, especially cattle, have increased considerably.

In Niger, for example, the number of cattle increased between 1954 and 1972 from 2 200 000 to 4 200 000, and sheep and goats from 6 000 000 to 9 100 000, before the drought diminished numbers.

Whereas wild grasses do form excellent pastures, these are areas where man and animals nevertheless enter into direct competition with one another. Therefore resources of wild grasses have decreased, not being needed by the richest groups who prefer buying cereals which do not require lengthy preparations. These various causes combine to bring about an inverse evolution between the consumption of cereals and harvesting products. This trend makes stock-breeders more dependent on the agricultural zone, such that bad crops and scarce or expensive cereals are as detrimental to them as is a poor fodder production.

Seasonality and health

People and animals live under relatively healthy climatic conditions, but each season brings them particular diseases.

The rainy season is characterized by abundance, new strength for animals, and a milk diet for men. However, it is a period when individuals are often feverish, undoubtedly due to malaria resulting from the considerable surface of stagnant water in ponds, as was shown in the first surveys (Larrouy, Lefevre-Witier, and Seguéla 1974, pp. 200-3). It is the time when anti-malarial tablets are welcome in all encampments. In the rainy season, nomads no longer go to

wells, but they fill up their leather bottles from ponds where animals wade up to their bellies in order to be watered. It is also a period when men are threatened with intestinal parasites.

The cold season brings about all the diseases caught during the icy nights when the temperature is close to 0° C, when men and children are badly protected and must get up in the night in order to rekindle the embers. Colds, tracheitises, bronchitis, and broncho-pneumonia as well as tuberculosis are diseases caused by cold weather and promiscuity.

1. 許 關

The east-north-east wind, bearing sand and dust, blows in the dry season. Then ocular infections are on the increase and outbreaks of cerebrospinal meningitis are the most numerous.

The warm season from March to June is the most tiring for men and animals; they are so weary and undernourished that they are very vulnerable to disease. It is said that at the time of the first rainfalls animals often die by browsing on the young shoots of grass which are uprooted with sand.

Endemic syphilis is widespread among nomads and is also related to season. For instance, the renewed outbreak of lesions occurs in the moist season, when humidity plays a significant role in symptomatology. Besides, from an endemic condition it becomes almost epidemic during the rainy season (Basset, Maleville, and Basset 1969, pp. 80–92).

In short, it can be said that tropical parasitic and infectious pathology is not very developed in nomads due to low humidity and scarcity of perennial surface waters (Treilhou 1969, pp. 42–59). However, one may expect rapid changes resulting from the building of dams and the increasing population movement toward towns and mining settlements. The emergence of foci of urinary schistosomiasis is observed by water holes in the Air and Ahaggar regions. The Sahelian nomadic zone may open up to the outside world, but it is hoped that these new relationships take place under increased health control (Unesco 1981, pp. 251–7).

Climatic fluctuations

In addition to interannual fluctuations, the Sahelian climate undergoes a series of wet or dry years, like the seven fat and the seven lean cows in the Pharaoh's dream in the Old Testament. We witness here, on a larger scale than the annual cycle variations, contrasts between wet periods (mistakenly considered as 'normal') and dry ones, since both, alternatively, constitute the classical pattern for an arid zone. Such phases have always existed, as witnessed by the Agadez chronicles, Arab manuscripts referring to successive, dramatic droughts (in 1696 and 1697 of our calendar) followed by equally catastrophic diluvian rains (1699) (Urvoy 1934, p. 175). These contrasted periods are too irregular to be considered as proper cycles. Faure and Gac (1981) detected a period of 21 years between the recent droughts (1913, 1941, 1975), on the grounds of which they forecast another crisis around 2005. To the seasonal contrast of the annual

SAHELIAN NOMADIC PASTORAL SOCIETIES 333

cycle, one must add the wet and dry phase contrasts (the latter sometimes lasting seven consecutive years), which follow each other according to a time scale ranging from 10-40 years.

The repeated deficient pluviometric periods since the beginning of the century (1910–1915, 1940–1943, 1969–1973) have resulted in crises which are reflected in all the historical calendars. These are periods during which the seasonal contrasts diminish, the vegetal regrowth is partial, and large numbers of trees die.

During such years of insufficient rainfall, the decrease in fodder potential endangers the herds which have multiplied during the previous favourable phase. Stock-breeders, deprived of their livestock, flee to the towns, where nowadays they receive temporary national or international assistance. Thereby they are increasingly dependent on the agricultural production of their country, which itself is subject to the same droughts, and on relief supplies (sorghum, rice, corn) which they do not necessarily appreciate.

CONCLUSION

In these periods of crisis, competition between man and animals is fierce in pastoral societies. The hungry stock-breeders tend to take too large a part of milk production, thus imperilling the life of young animals. They try to gather all the available harvesting plant products which are also desired by animals. The general decrease in fodder production imperils men and herds which are too numerous on the very low-yielding ranges and greatly endanger the plant environment. The Sahelian nomadic stock-breeders live in an area of high risk where men and animals are faced with the same problems in case of prolonged drought. All the policies must tend to better management of ranges in order to make stock-breeders less dependent on the outside world and to allow them to be better equipped in case of crisis.

APPENDIX: METHODOLOGY

The data presented here come from various sources: (1) investigations which I conducted in the field over the course of successive nomadic movements during the rainy seasons of 1967 (two months) and 1968 (one month), and on numerous visits over the following years during all periods of the year; (2) nutritional studies conducted between 1962 and 1964 in the same region, in the context of a statistical survey of demography and household economy published in 1966; and (3) works by other researchers, used to broaden the range of the material presented here.

Individual investigations

(a) During the course of nomadic movement with a Tuareg camp, the composition of meals was systematically recorded for three weeks. The problems raised by such an investigation were numerous.

- 49-182.24 6-¹⁶

ate to the state of the state o

To minimize the effects of the presence of a foreign guest, the investigation was carried out at the end of two months of nomadic migration. The gifts and counter gifts, our purchases of small animals which had, thanks to this unusual cash income, permitted the purchase of grain, had largely ceased. But the presence of a guest always causes some disturbance, even if only through the greater consumption of tea, thus of sugar, offered several times a day.

Difficulty in evaluating the units of consumption arose from the interdependence of certain 'kitchens'; for example, meals prepared in common by women servants for their master's family and their own family, or 'kitchens' associating widowed or divorced mothers or daughters living in a separate tent.

The variables which may have modified the nutritional regime could be noted, thanks to the method of direct observation: arrival in the evening of a visitor, movement of the camp, a birth or baptism, and proximity to the market. Finally, movement of the camp sometimes provoked a fast when the calves or young camels, poorly tended, managed to rejoin their mothers and nursed without leaving milk for people.

(b) Studies were made of the harvests of 'wild' grains, which still play a considerable role in nutrition. A film was made of the collection of cram-cram (*Cenchrus biflorus*), an activity which mobilized the entire population of a nomadic camp during one season of the year. The techniques employed and the variable yields of these harvests, from one group to another and from one year to the next, were studied.

Statistical studies

This investigation of consumption was conducted in the context of a demographic and economic study of the nomadic region which was carried out in the former Circle of Tahoua and its adjoining regions (in Niger), that is, in a region where the population was registered as being about 84 000 inhabitants.

The specific study of consumption included 70 Tuareg households and 70 Fulani households:

The mobility of the households and the difficulty of controls did not allow a representative sample to be drawn from the whole for each professional catagory. The results express an annual average calculated over the 10 months of the study period. The months of March and April (the hot dry season) were not observed; these months constituted the period of the pilot study, and results had to be set aside due to their poor quality (INSEE-Coopération-SEDES 1966, p. 173).

This investigation, despite its insufficiencies and, in particular, the underestimation of numerous foods (meat, 'wild' collected products, sugar, etc.), remains one of the only statistical studies carried out in nomadic regions. Carried out at the same time as a demographic and economic study, it constitutes a pilot study in relation to the duration (one annual cycle) and size of the population observed. Unfortunately it does not provide refined information on variation in nutrition over the seasonal cycle, between social categories, or between pastoralists and agro-pastoralists. The only distinction which is made—between Tuareg and Fulani—remains too general. However, this study did allow statistical methods to be developed for use in nomadic regions, which are still little explored by statisticians.

Works by other researchers

References to the works cited are to be found in the bibliography; in particular, variation in the diet over the course of the annual cycle. The temporary increase of food consumption at periods of major annual festivals (Fulani gereol) are covered in works cited here.

REFERENCES

- Basset, A., Maleville, J. and Basset, M. (1969). Aspects de la syphilis chez les Touaregs du Niger. Bull. de la Soc. Path. Exot. 62, pp. 80–92.
- Bernus, E. (1967). Cueillette et exploitation des ressources spontanées du Sahel nigérien par les Kel Tamasheq. *Cahiers ORSTOM, Série Sci. Hum.* IV (1), pp. 31-52.
- ------(1974). Les Illabakan (Niger), une tribu touarègue sahélienne et son aire de nomadisation. ORSTOM. Mouton, Paris.
- -----(1979). Le contrôle du milieu naturel et du troupeau par les éleveurs touaregs sahéliens. In *Pastoral production and society* (ed. ---), pp. 67-74. Editions Maison des Sciences de l'Homme. Cambridge University Press, Cambridge.
- -----(1980). Famines et sécheresses chez les Touaregs sahéliens. Les nourritures de substitution. Africa 50 (1), pp. 1–7.
- -----(1981). Touaregs nigériens: unité culturelle de diversité rétionale d'un peuple pasteur. Mémoire ORSTOM. 94, Paris.
- Coulomb, J. (1971). Zone de modernisation pastorale du Niger. Economie du troupeau. IEMVT. SEDES.
- Coulomb, J., Serres, H. and Tacher, G. (1980). L'élevage en pays sahéliens. PUF, Paris.
- Dupire, M. (1962). Peuls nomades. Etudes descriptive des Wodaabe du Sahel Nigérien. Musée de l'Homme, Paris Institut d'Ethnologie.
- Faure, H. and Gac, J. Y. (1981). Un futur cycle aride au Sahel vers l'an 2005? Paper presented at the first meeting of the European Union of Geosciences, Symposium Paléoclimats, Stasbourg, Avril.
- Gast, M. (1968). Alimentation des populations de l'Ahggar, étude ethnographique. Mémoire du CRAPE VIII, Arts et Métiers Graphiques, Paris.
- Gast, M. (1972). Céréales et pseudo-céréales de cueillette du Sahara central. I. Usages et valeurs alimentaires de quelques graines du Sahara central. Journ. d'Agr. trop. et de Bot. Appl. XIX (1-2), pp. 50-5.
- Gast, M., Maubois, J. L. and Adda, J. (1969). Le lait et les produits laitiers en Ahaggar. Mémoire du CRAPE XIV, Arts et Métiers Graphiques, Paris.
- Gaudin-Harding, F. and Ould-Aoudia, M. (1972). Céréales et pseudo-céréales de cue-

illette du Sahara central. II. Analyse de quelques graines de la région de l'Ahaggar. Journ. d'Agron. Trop. et de Bot. Appl. XIX (1-2), pp. 55-8.

1.12

- Hampate BA, A. and Dieterlen, G. (1961). Koumen. Texte initiatique des pasteurs Peul. Cahiers de l'Homme. Mouton, Paris.
- INSEE-Coopération-SEDES (1966). Etude démographique et économique en milieu nomade. République du Niger, Paris.
- Larrouy, G., Lefevre-Witier, Ph. and Seguéla, J-P. (1974). Note sur le paludisme chez les nomades du Sahara méridional. *Bull. de la Soc. de Path. Exotique* 67 (2), pp. 200-3.
- Marty, A. (1975). *Histoire de l'Azawagh nigérien*. Mémoire de l'Ecole des Hautes Etudes en Sciences Sociales, Paris.

Serres, H. (1980). Politiques d'hydraulique pastorale. PUF, Paris.

Theureau, H. (1979). Vivre dans l'Ile. Silex issue 14, p. 124.

- Toupet, Ch. (1977). La sédentarisation des nomades en Mauritanie centrale sahélienne, Univ. Lille, Lib. H. Champion, Paris.
- Treilhou, J-P. (1969). Nomades et sédentaires d'Agadès (Rép. du Niger). Etude hémotypologique. Thèse de Doctorat en Médecine, Centre d'hémotypologie du CNRS, Toulouse, France.
- Tubiana, M-J. (1969). La pratique de la cueillette chez les Zaghawa du Tchad. Journ. d'Agron. Trop. et de Bot. Appl. XVI, pp. 55-83.

Unesco (1981). Ecosystèmes pâturés tropicaux. Recherches sur les ressources naturelles XVI, United Nations Educational, Scientific and Cultural Organization, Paris, France.

Urvoy, Y. (1934). Chroniques d'Agadès. Journal de la Société des Africanistes IV (2), pp. 145-77.

Coping with Uncertainty in Food Supply

EDITED BY

I. de Garine Centre Nationale de Recherche Scientifique, Paris

and

G.A. Harrison University of Oxford

O.R.S.T.O.M. Fonds Documentaire Nº: 30 025 ex 1 Cote : B 10. 7-90 CLARENDON PRESS · OXFORD PAY6 1988

Ô