CHAPTER 2

GRASSLANDS

"You cannot show the stars to a person who lies on his back."

[Murum proverb from Chad]

GRASSLANDS

by
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N'GUIGMI MARKET, THE NIGER

BLANGOUA MARKET (KOUSSERI), CAMEROON

GRASSLANDS PRODUCE FOOD, FIREWOOD AND MEDICINES, AS WELL AS MANY OTHER GOODS AND SERVICES

INTRODUCTION

The grassland ecosystem in the Lake Chad Basin plays a very important role in the everyday life of its inhabitants. Its area in the four riparian countries is more than half of the total land area (62 percent, corresponding to 2.5 million km^2). Just for comparison, the area dedicated to arable land and permanent crops in the same countries is less than 12 percent (0.46 million km^2) [2.1].

Grasslands provide feed for livestock, habitat for wildlife, and firewood and medicines for people. They also represent a genetic resource for crop improvement (many food grains such as wheat, rice and millet originated in grasslands), protect the soil against erosion, provide many other goods and resources, such as timber and energy, and act as a storehouse for carbon dioxide (helping to limit global warming).

Pastoralists have developed different ways of exploiting the grassland resources around Lake Chad. Some areas are grazed all year long, while others are used as a feed reserve, enabling transhumant herds to survive in the dry season. The expansion of agriculture in these areas is endangering the transhumant systems because it reduces the availability of feed resources. At the same time, the grasslands are under

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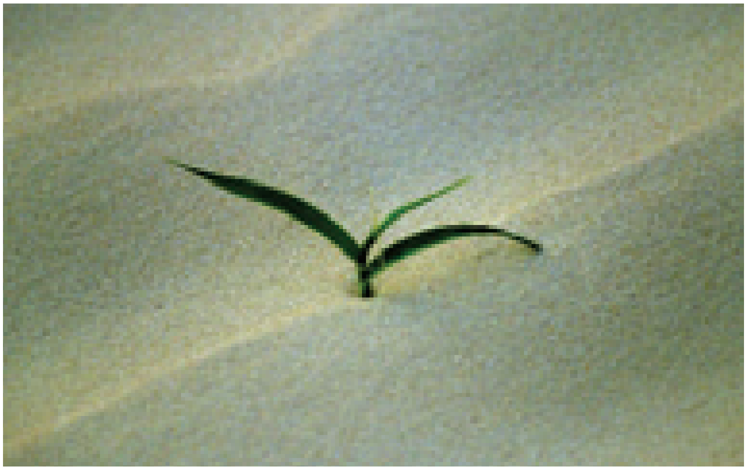
WAZA NATIONAL PARK, CAMEROON

KORRIGUM FEEDING IN WAZA NATIONAL PARK. THE NATURAL HABITAT OF WILDLIFE IS SUFFERING FROM ENCROACHING AGRICULTURE AND PRESSURE FROM INCREASING NUMBERS OF LIVESTOCK

constant pressure to support a growing number of livestock. In the Sahel region as a whole, the numbers of livestock using pastures rose from 35 million in 1962 to 114 million in 2002 [2.1].

Soils of grasslands have generally poor levels of nitrogen (N) and phosphorus (P). Above 300 mm rainfall, these represent the main limiting factors to the productivity of grasslands, while below 300 mm rainfall, lack of water becomes the factor that limits grassland growth [2.2].



TAL DESERT (N'GUIGMI), THE NIGER

GRASSLANDS ARE A PRECIOUS SOURCE OF GENETIC DIVERSITY


NEAR LOGONE-GANA VILLAGE, CHAD

ABOUT 35 PERCENT OF GRASSLAND BIOMASS IS USED FOR ANIMAL FEED

PRODUCTIVITY

In Sahelian ecosystems grassland growth is rapid after the onset of the rains and young pastures are rich in protein, vitamins and minerals. Growth reaches its peak at the end of August and by that time the maturing herbage is already relatively fibrous and low in protein. As the standing herbage dries out, its feeding value falls. Herbage quality falls yet further through mechanical loss of the finer parts (leaves and seed heads) and bleaching by the sun, which greatly reduces the vitamin A content. During the dry season the nutritive value of these pastures is no better than poor-quality straw [2.3].

The production of biomass, which varies according to the types of grasses, soils and the amount of rainfall, ranges from 200–300 to 7 000–8 000 kg of dry matter per ha. The use of this biomass for pastoral animal feeding varies according to the composition of the pastures, pastoral management techniques, grazing efficiency (the proportion of the herbage that livestock can harvest) and the maximum proportion that can be grazed without causing grassland deterioration. Harris [2.4] suggests that for African rangelands the proper use factor varies from 30 to 40 percent (and even 45 percent in the dry season) of biomass.

Haymaking from natural grasslands

It is not certain whether hay from natural grasslands was traditionally produced to feed livestock from November to June, when mature and lignified grass has a quality no better than straw. However, there is evidence to suggest that hay from *Alysicarpus glumaceus* and *Rottboellia exaltata* was made on a regular basis and sold at very high prices on the market in order to maintain high value horses in good condition. Today, this traditional practice has spread and hay is collected from *Panicum laetum*, *Brachiaria ramosa*, *Pennisetum pedicellatum*, *Cenchrus biflorus*, *Andropogon gayanus*, *Zornia glochidiata*, *Alysicarpus ovalifolius*, *Echinochloa stagnina* and *Dactyloctenium aegyptium* in order to feed the dairy animals and small livestock that are kept close to farmers' houses throughout the year. Hay can be seen on roofs and in the markets, mainly close to large villages [2,3].

There is an increased demand for good quality hay and high prices can be obtained. This suggests that it is well understood that animals produce more if they are fed with good quality hay (young and leafy grasses). On the other hand, it is uncertain whether the producers know how to make good quality hay, i.e. to harvest it at a young stage and dry it rapidly. In most cases, hay still appears to be made at an overmature stage in order to maximize production. This results in a severe drop in quality, particularly of crude protein, because the cell contents are diluted by structural components. Consequently, the digestibility of the hay also decreases and animals produce less milk and meat.

NEAR MALAM MINOURI VILLAGE (DIFFA), THE NIGER

DEMAND FOR GOOD QUALITY HAY IS INCREASING

NEAR LOGONE-GANA VILLAGE, CHAD

TRADITIONAL HAY STORAGE FOR FEEDING ANIMALS IN THE DRY SEASON

Vegetation zones of Lake Chad

There are three main vegetation domains in the Lake Chad Basin: the Sahelian and Sudanian domains and the floodplains (*yaéré*) in the south. The boundaries between the different domains are not clear cut and are influenced by the combination of rainfall patterns, soil texture, topography, substratum and microclimate. For example, in the case of sand dunes with a high water infiltration capacity, stretching into a domain with 500 mm of annual rainfall, the dominant vegetation will be very meagre and characteristic of sandy soils. Often plants demanding over 700 mm of rainfall can be found beyond their climatic range if the soils have a high clay content or there is a higher water table in the vicinity of water ponds and wadis.

SCHOENEFELDIA GRACILIS [PLATE 1]

1. SAHELIAN DOMAIN

The Sahelian domain is situated between the 100 mm and 600 mm isohyets and can be divided into three subzones [2.5].

- The northern or desert Sahel, with an annual rainfall of 50–200 mm.
- The "true" Sahel, with an annual rainfall of 200–400 mm.
- The southern or Sudanian Sahel, with an annual rainfall of 400–600 mm.

Most rainfall is concentrated in the three or four summer months and is insufficient for permanent agriculture based on rainfed crops. Most of the Sahelian domain consists of a flat or gently undulating landscape below 600 m above sea level and contains about 1 200 species [2.6], of which probably only 3 percent are strictly endemic.

1.1 The northern or desert Sahel subzone

This region is characterized by sandy or sandy-loam soils and represents the northern limit of summer pastures. The most extensively occurring grasses are the annual species *Cenchrus biflorus*, *Schoenefeldia gracilis*, *Aristida stipoides* and the perennial species *Panicum turgidum* (which is much appreciated by animals), *Stipagrostis pungens* and *Aristida sieberana*. Other plants also display specific drought-resisting features, e.g. *Tribulus ochroleucus*, *Mollugo cerviana* and *Calligonum comosum*. Certain plants are evident only in years when rainfall is above average, e.g. *Colocynthis vulgaris*, which needs plenty of water to develop its fruits, which are 10–12 cm in diameter. The woody layer is characterized by the presence of Saharan species, e.g. *Acacia tortilis*, *A. laeta* and *A. ehrenbergiana*, *Commiphora africana*, *Salvadora persica* and *Leptadenia pyrotechnica*.

1.2 The "true" Sahel subzone

The "true" Sahel subzone receives enough rain to support grasses, but not crops, except in seasonally flooded areas. This area, which covers 300 km in latitude, is commonly called the Sahel. Soils are sandy with flat or dune-type landscapes. Depressions – wadis with clayed and sometimes salty soils – alternate with dunes and sandy soils. The area has a thorny scrub vegetation of the steppe type, which changes into a more dense vegetation when soils become clay. A sparse woody layer of trees (not exceeding 30 trees per ha in non-degraded areas) comprises *Acacia raddiana*, *A. seyal* and *A. senegal*, *Commiphora africana*, *Leptadenia pyrotechnica*, *Balanites aegyptiaca*, *Maerua crassifolia*, *Ziziphus mauritiana* and *Calotropis procera*. Grasslands are dominated by annual grasses in good rainfall years (*Cenchrus biflorus*, *Aristida mutabilis*, *Eragrostis tremula*, *Schoenefeldia gracilis* and *Tragus berteronianus*) and perennial species that form the bulk of livestock and wildlife feed throughout the year if water sources are available (*Panicum turgidum*, *Stipagrostis* sp. and *Cymbopogon schoenanthus*) [2.7], [2.8].

1.3 The southern or Sudanian Sahel subzone

This is a transition zone used by both pastoralists and farmers who grow millet and sorghum. Soils are sandy, with large depressions containing clay soils and water ponds. On sandy soils, steppe vegetation persists and the tree canopy reaches 10–20 percent. The woody cover is typically more diversified than in the northern subzones and includes *Acacia nilotica*, *A. senegal* and *A. raddiana*, *Piliostigma reticulatum*, *Terminalia avicennoides*, *Prosopis africana*, *Faidherbia albida*, *Combretum glutinosum*, *Ziziphus mauritiana*, *Balanites aegyptiaca*, *Hyphaene thebaica* and *Boscia senegalensis*, as well as characteristic species such as *Sclerocarya birrea*, *Bombax costatum*, *Sterculia setigera*, *Grewia bicolor* and *Tamarindus indica*. However, natural regeneration is rendered difficult by browsing, overexploitation and climatic changes.

Dominant grasses include *Aristida adscensionis*, *Schoenefeldia gracilis*, *Eragrostis tremula*, *Brachiaria xantholeuca* and *B. villosa*, and *Cenchrus prieurii*. In depressions, where additional water is available, and on clay soils, *Echinochloa colona* and *E. stagnina*, *Panicum laetum* and *Dactyloctenium aegyptium* are found. On saline soils *Guiera senegalensis*, *Ziziphus mauritiana* and *Acacia senegalensis* dominate, and *Aristida mutabilis*, *Schizachyrium exile* and *Panicum laetum* withstand human pressure and saline soils.

During the rainy season, and for some time afterwards, some grasses exceed 1 m in height (*Cenchrus biflorus* and *C. prieurii*), making walking difficult for the traveller when they are in fruit. Some Sudanian Sahelian annual plants, e.g. *Aristida stipoides* and *Tephrosia linearis*, can reach heights of 1.5 m. Some leguminous plants also push through at the end of the rainy season (e.g. *Indigofera* spp.). In the shelter of the trees, a true herbaceous flora can develop, including large-leaved grasses, such as *Urochloa latta*; compositae such as *Sclerocarpus africanus*; prostrate plants, such as several species of Convolvulaceae (e.g. *Ipomoea aitonii*), Commelinaceae or certain euphorbias.

2. SUDANIAN DOMAIN

The Sudanian domain is shared by Cameroon, Chad and Nigeria and is characterized by a savannah-type vegetation. Rainfall exceeds 800 mm. Maize, rice, cotton and vegetables are cultivated in a combination of many farming systems, and often more than one crop per year is harvested, thanks to the influence of Lake Chad.

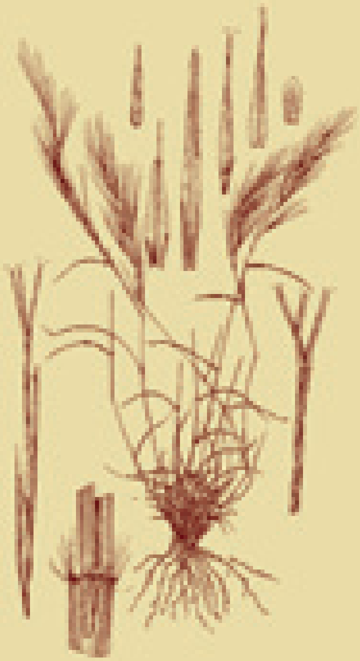
Among the many trees of the Sudanian domain, growing at different levels of density depending on soil types and land management (grazing, intensive agriculture and fallow, water availability), there are *Acacia* spp., *Anogeissus leiocarpus*, *Parkia biglobosa*, *Combretum* spp., *Vitellaria paradoxa* and *Terminalia* spp. Among the grasses are *Pennisetum pedicellatum*, *Brachiaria xantholeuca*, *Andropogon gayanus*, *Cymbopogon giganteus*, *Eragrostis tremula*, *Loudetia togoensis* and *Schizacherium exile.*

3. THE FLOODPLAINS (*YAÉRÉ*)

These areas are considered vital feed resources for grazing animals because they provide green feed reserves when the rest of the vegetation has already dried out. Some areas are under water for different periods of the year. This large ecosystem, which is based on the fluctuations of the lake, is the real asset of the Lake Chad Basin because both cropping and livestock systems do not depend exclusively on rainfall. Therefore one or more additional crops can be harvested and precious feed resources become available. The time and amount of the fluctuations are traditionally known by farmers and pastoralists, who have developed farming and grazing methods adapted to these water movements.

The vegetation of the *yaéré* is classified according to the duration of submersion. In descending order of flooding, this means grass savannahs, shrub savannahs with woody species withstanding partial submersion, and thorny shrub steppe with little tolerance to submersion.

Grassland species include *Aristida mutabilis*, *Echinochloa colona*, *Panicum laetum*, *Hyparrhenia rufa* (submerged for longer periods), *Panicum anabaptistum* and, on the water margins, *Echinochloa stagnina*, *Vossia cuspidata*, *Cyperus papyrus* and other *Cyperus* spp., *Cynodon dactylon* and *Phragmites australis*. Among the woody species, *Acacia seyal* and *A. ehrenbergiana* are present. Aquatic plants include members of the Cyperaceae, *Pistia* sp. and *Sesbania* sp., as well as *Phragmites mauritanus* and *P. australis* [1.3]. Noteworthy flora includes *Spirulina* sp., *Sporobolus* sp. and *Nymphaea* spp., as well as two interesting indigenous water legumes that form part of the Lake Chad ecosystem: *Aeschynomene elaphroxylon* and *A. crassicaulis*. The exotic *Prosopis juliflora*, which was introduced some 40 years ago, today forms thick forests around the lake border, mainly in the Niger and Chad, and is spreading into the best recessional land, where high-value agriculture is undertaken, causing many problems for fishermen trying to navigate the shallow waters of the lake [1.6], [2.9].



ARISTIDA MUTABILIS [PLATE 2]

VOSSIA CUSPIDATA [PLATE 3]

NEAR SELEYA VILLAGE (N'GUIGMI), THE NIGER

PASTORALISTS MOVE ACCORDING TO THE AVAILABILITY OF GRASSES AND WATER

>> RIGHT: NOMADISM IS AN EFFICIENT SURVIVAL STRATEGY IN FRAGILE AND DRY ECOSYSTEMS

PASTORAL MOBILITY

It is now well established that, in arid lands, nomadism is the most effective way of life, from both an economic and an ecological standpoint, because it follows the availability and seasonality of grassland growth. Nomads combine mobility with a deep knowledge of the ecosystem in which they live, and this represents the best solution to the unpredictable variations in the availability of feed.

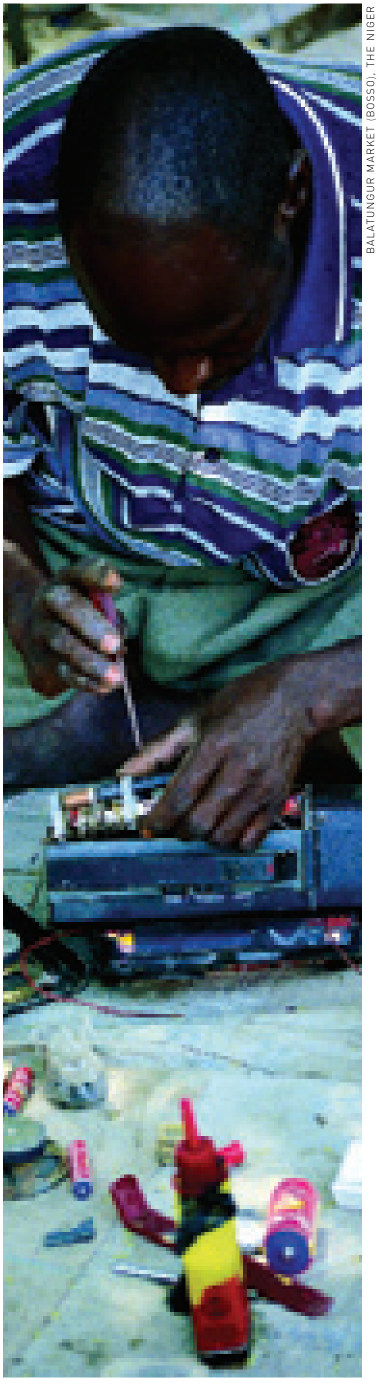
Nature itself offers countless examples of the need for mobility. Wild animals have always known that their survival depends on their ability to keep moving in order to find food and water. Plants have also developed mechanisms, such as winged seeds, in order to distribute themselves over vast distances by means of the wind. Many species distribute their seeds in the skin, wool or digestive tracts of animals and these mechanisms are facilitated by nomadic herding. Annual species need sufficient time to produce their seeds and should not be grazed before they set seed. Perennial species must be able to stock up their reserves of carbohydrates and if animals continuously graze the pasture this process cannot take place. Nomadism reinforces these natural strategies, enabling plants and animals, and the humans who depend upon them, to have a better chance of survival because it entails moving over large distances and thus covering a larger resource base.

NEAR MALAM FATORI VILLAGE, NIGERIA

TRADITION AND TECHNOLOGY

Arid and semi-arid ecosystems pose special challenges to which modern science has so far provided limited answers. They also offer considerable promise because of their special assets: space, air, sun, minerals and low population density. The skills and tools required to exploit these ecosystems are very different from those adopted by more intensively productive sedentary systems. Given the correct political, economic and social support, and by combining traditional systems with new legislation and technologies, the potential of these lands can be developed in a sustainable fashion, with nomadism and mobility at their core. Some examples of how this can be achieved are given below.

- Negotiation capacities of nomads should be supported so that their communities have a means of establishing political or family alliances for the management of herds, water, pastures and markets [2.10].
- Traditional monitoring abilities, which are related to water availability, the quantification and prediction of forage production, the prevalence of pests and animal diseases, and the predictions of seasons based on changes in plant phenology, time, intensity and distribution of rainfall, wind pattern and wildlife movements, should be combined with scientific and satellite information.
- Traditional communication methods used in meetings, fairs and ceremonies, such as the oral information exchanged among people from the same ethnic group about pasture conditions, water availability, and animal health and performance, should be enhanced by the use of modern communication tools, such as radios and mobile telephones.
- Oral education of young people should be reinforced by modern infrastructures which ensure that travelling schoolteachers and mobile facilities are adapted for the people at whom they are aimed.
- Traditional forms of payment for the use of water, pastures and veterinary services should be supported by adapted microcredit schemes, and traditional social insurance structures should be reinforced.
- Communal management of resources and traditional marketing systems should receive political support and be improved through the introduction of simple and safe processing techniques that ensure food quality and increased incomes for local communities.
- Simple tools based on renewable energy sources (basically solar energy) should be introduced. Photovoltaic generators could be used to power well pumps directly or, by means of batteries, to power communication equipment (radios and mobile telephones), torches, portable refrigerators for vaccines, etc. The key issue is the development of equipment that can withstand extreme environmental conditions, is simple to use and requires spare parts that can be made available on the local market. On the other hand, sophisticated performance and high efficiency, which are the most important market features in the developed world, are not a priority.
- Mobile medical assistance could be introduced to deal with emergencies in remote areas.
- Crops and cropping systems adapted to marginal ecological conditions, such as the production of *kreb* (see Chapter 4), should be revived.
- Cheap and transportable water-harvesting methods should be introduced, together with appropriate training for agropastoralists.



BALATUNGUR MARKET (BOSSO), THE NIGER