This article is derived from a study on the interaction between humans and their environment in the arid Sahel region of northern Senegal. It compares the pastoral community of Maka Ndandary to the sedentary agriculturists of Teud Bitty. Both villages are situated in the Pal-Mérinaguène sylvo-pastoral reserve, an area of declining rainfall. In the period 1931–1960 average rainfall was 473 mm. Twenty years later average rainfall had declined to 258 mm and was considerably more variable. The research was part of the Long-term Environmental Monitoring in Senegal Project and was carried out by EROS Data Center (EDC), the Centre de Suivi Ecologique (CSE), and two local NGOs. The study analysed information collected by remote sensing techniques (satellite and aerial photographs) and Rapid Rural Appraisals in both communities.

Photo: EROS

In Teud Bitty the landscape has become almost treeless.

Cattle and cultivators: conflicting strategies for natural resource management

Living side by side but following different livelihood strategies, the communities of Maka Ndandary and Teud Bitty come into increasing conflict over the use of the areas diminishing resources. The pastoral livelihood system is essentially conservationist in its approach to natural resources while the agriculturists of Teud Bitty employ more extractive methods. The different impacts these communities have on their environment is startling. The study focused on how the two communities managed their natural resources and examined the causes and consequences of recurrent resource conflict. It also examined the role played by the state.

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The village of Teud Bitty

Teud Bitty was founded in the early 1900s by Wolof settlers and today has an official population of some 600 people. Only about 100 people actually live in the village all year round because at least 200 villagers are permanent labour migrants and the rest return to the village during the agricultural season but leave again when the long dry season begins. Migrants find work in the industrial rice, tomato, and sugar plantations along the Senegal River and take on any odd job they can find. Some are able to earn a reasonable livelihood in this way, the majority earn very little.

The social consequences of this seasonal out-migration are substantial. Family life is disrupted and the village is no longer able to engage in collective decision making and action. Out-migration also has several economic implications. The absence of labour has meant that certain activities like animal husbandry are no longer viable because there are not enough people left to care for them. Migrants usually take the family horse or donkey cart with them. This means there is no transport available to haul potable water to the village. The few with carts charge high rates for water transport thus impoverishing the rest of the village.

Resource management

The territory of Teud Bitty is organised along the lines of a classic Wolof village. The village is at the center of the territory and is surrounded by fields. These are in the form of two concentric circles, the smaller of which is immediately next to the village (*tooker* or house fields). The *tooker* is surrounded by the much larger circle of outer fields. Traditionally, *tooker* fields were the most intensively cultivated because they were well fertilised. Today, however, the village does not have enough animals to provide the necessary manure and the *tooker* yields little more than the fields in the outer circle where millet, cowpea, melon and groundnut are grown. In the past, when most of the villagers participated in farming, most of the land was cultivated every year. Now, because soil fertility is low and there is a lack of labour, a significant amount of land is left fallow.

Although the amount of cultivated land is falling, village fields are gradually extending over a larger and larger area. As traditional village fields are abandoned because of abysmal soil fertility, villagers seek to expand into new and more fertile areas. In many cases this has meant expanding into areas that were traditionally used as passageways by herds in the area.

Around the settlement are many varieties of trees which villagers use for shade, fruit and a variety of purposes. Trees within the village and *tooker* are generally protected and cannot be cut. The limits of these inner fields are marked by fences of live shrubs and trees and because these are close to the village and villagers work regularly in the vicinity they can be kept under rigorous surveillance. Beyond the *tooker*, however, there is hardly a tree to be seen. There are many inter-related reasons for the lack of trees. Many of the less drought resistant species died out progressively between 1945 and 1965, as rainfall slowly declined. A large number of trees also then died during the droughts of 1972-1973 and 1983-1984. Charcoal makers, attracted by the dead trees, set up kilns in the area but moved on when the supply of dead wood was exhausted. However, local families, whose agricultural output remained low after these droughts, began to turn to charcoal production, cutting live trees to supplement their income. Before long all the woody species disappeared because there were no rules to prevent villagers cutting trees on the outer fields.

The household economy

Average yields for millet in the region are less than 250 kg/ha and the study suggests that Teud Bitty's yields may be even lower. Residents estimate that the cereals produced by a "typical" family in a good year (two out of ten), will last about three months.

In the past, part of the deficit was compensated by the sale of groundnuts. Groundnut seed is now difficult to obtain, however, and yields (less than 300 kg/ha) are low. Much of the money earned from groundnut production is used to pay off the debts accumulated the previous year. What remains is used to pay taxes, medical expenses, clothes, and buy seeds for the next season. Most families maintain between 3-12 sheep and goats. Villagers admit that fattening one sheep is of more use to them than cultivating a field. The proceeds from the sale of one animal can generally purchase between 50 and 100 kg of grain. However, there are considerable constraints to keeping livestock. Villagers have difficulty in getting enough money together to invest in animals when the family is hungry for most of the year and there are the problems of poor pasture and maintaining herd size.

The money needed to feed the family for up to nine months of the year must therefore come from a patchwork of off-farm activities the most important of which is labour migration.

Lack of integration

The production system in Teud Bitty has always focused heavily on natural resource-based activities: growing crops, exploiting trees and raising animals. Yet there is little integration between these activities and each element of the production system is essentially extractive. At the moment there are no systematic ways of maintaining soil fertility and the cultivation of groundnuts has left the soil denuded and vulnerable to wind erosion further reducing soil fertility. As trees were cut and removed there was no longer leaf litter to replenish soil nutrients. In the past farmers made "fertilisation contracts" with pastoralist. Herders would tether their animals on particular fields at night in order to ensure the ground was well manured. This practice has now been abandoned because farmers claim that in years of very poor rainfall, fields that have not been heavily fertilised will produce better than those that have been intensively manured.

Livelihood strategies in Teud Bitty have become nothing more than a desperate attempt to squeeze what little remains from a depleted resource base. The population is aware that their current livelihood strategies are not viable. As one villager observed out-migration is destined to increase: "You see that few remain here now. We are afraid that even these last ones will soon have to leave."

The Community of Maka Ndandary

The residents of Maka Ndandary are Pulaars of the Wodaabe lineage. The first families settled in the area in the mid-nineteenth century. Today some 150 to 200 people live in the *hurum* (a settlement or 'that which is ours). Maka Ndandary is a scattered assortment of straw huts, animal enclosures, and pasture lands. Despite its apparently haphazard layout, Maka has a strong sense of community identity.

The population of Maka is proudly pastoralist. Nearly all families own cattle, sheep, and goats. Cattle herds can contain up to 60 animals although average herd size is about 25 animals. Sheep flocks vary in size from 10 to 80 animals. An average flock will have between 30 and 40 animals. Most families also have a few goats. Livelihood strategies are partly dependent on transhumance. Some of the *hurum* migrate seasonally with the community's livestock to find better pasture and water elsewhere. Each family also cultivates some crops and, as the study shows, they actually produce more grain than most of their Wolof neighbours.

Each household has a portion of land in the *hurum gese*. This is the most intensively used part of their territory and is roughly equivalent to the inner fields of Teud Bitty. This land is used for building houses and corrals for livestock and crops are planted in fields surrounded by hedges. The animal manure deposited at night in the *hurum gese* makes these lands particularly fertile. Families rotate their fields after five years, switching back and forth between two sites on either side of the homestead, a system that maintains soil fertility. The principal crop is millet. In addition, most families cultivate small quantities of beans, hibiscus, melon, squash, and a very small amount of groundnut for home consumption. The estimated average yield for millet was about 300-400 kg/ha, considerably higher than the 240 kg/ha considered average for the region.

Many families are able to produce enough grain to feed themselves for four to six months of the year. For six months each year they sell a sheep or goat once a week to buy food and other supplies. Even so they still manage to keep the herd size at between 30 and 50 animals. Cattle are only sold in case of emergency. There is hardly any economic necessity to look for work outside the *hurum*.

Resource management

Resource management practices in the Maka *hurum* have evolved progressively over the past 50 years. The rate of change has accelerated dramatically since the 1970s as environmental and human pressures began to increase significantly. From the mid-1950s Maka pastoralists began to be increasingly concerned about tree devastation in the areas where they pastured their

Photo: EROS

Participatory mapping combined with air photo's from earlier dates stimulate lively discussions on the evolution of land use

animals. They noticed that charcoal makers were coming into the area and beginning to wreck havoc with the vegetation. They also realised that there was no basis on which they could act to stop these incursions because they had no boundaries around a territory they could call their own. The heads of family gathered together to discuss the problem. They sent out a delegation to identify trees that would, in future, mark the boundaries of their *hurum*. In doing so, Maka became the first Pulaar community in the area to define its territory.

During the droughts of the 1970s, many Maka pastoralists left the arid north and moved their cattle further south. When they returned to their territory they were shocked to see the devastation that had taken place during their absence: many trees had been cut down by charcoal makers. Once again the community was galvanized into action and surveillance was intensified to control wood cutting. The residents decided that they would abandon the practice of moving entire families out of the *hurum* during transhumance. In future a few members of the community would stay behind with the explicit function of protecting the trees.

It was not only outsiders who were responsible for damage, but also some of the villagers themselves. Therefore, the community established a number of rules to control how the natural resources of the *hurum* should be used. No tree product, whether from live or dead trees, can be cut or collected in the *hurum gese* without the express permission of the land-holder. On the *hurum ladde* (outer pastures) people may harvest tree products for their own personal use, but they are prohibited from using them for commercial purposes. The same rules apply cutting grass because, in years when rainfall is low and fodder is scarce, there is a big demand for hay and outsiders come into the region with their carts searching for grass that they can cut and sell in the cities.

There are currently about 15 tree species found in Maka, considerably more than in neighbouring farming villages although far less than in the past when there were as many as 50 species in the area. Dense concentrations of trees are found in the *hurum gese* that occupies about a third of the *hurum* lands. Villagers patrol part of the outer pasture, the lesser *hurum ladde*. This has quite a few trees though not as many as the *hurum gese*. In the largest part of the outer pasture (the greater *hurum ladde*) there are significantly fewer trees, but there are signs of regeneration.

Conflicts over land and resources

Currently, depleted soils in the home territories of neighbouring villages are pushing Wolof farmers to expand onto new lands. Land in pastoralist communities such as Maka is relatively fertile which makes grasslands very attractive to neighbouring farmers. When pastoralists see a farmer cutting trees to prepare a field for crop production they try to reason with him to leave the territory. If the farmer will not leave voluntarily, the herder's only recourse is to ask the authorities to intervene. Maka residents report two cases where they notified the authorities and actually received a favorable ruling. However, the victory was illusory: the cultivators did not retreat and the authorities did nothing to enforce their ruling despite continued pressure from Maka residents.

While in these two instances State authorities did recognise the rights of Maka residents – at least in theory – they did so to avoid conflict between two neighboring communities. In general the State has cast a blind eye to the extension of cultivated land into Pulaar *hurum* grazing land. The authorities follow the principle that land should be allocated to those who will make it productive. "Productive land" is considered to be land that is cropped or planted with orchards…and does not include zones that are used for extensive grazing.

In fact, there are no plans for how land should be used in the area or what the rights of different populations and interest groups should be. Instead of managing the land, the Rural Community Council manages conflicts as they arise. Its main objective is to reduce the number and severity of disputes.

While the Maka residents have had only limited success in protecting their space from aggression by neighboring farmers, they have been substantially more successful in protecting the trees and grasses of their territory. They note with pride that when they confront someone found cutting a tree, the person almost always stops and leaves the territory without creating further disturbance. They feel that this is due to the fact that, for the last twenty years, they have systematically insistenced on their right to control the cutting of wood.

Pastoral livelihood threatened

The pastoralist livelihood system as practiced in Maka is essentially in harmony with its environment. This can be explained by two related factors. The first is the essential integration of all elements of the production system. Animals, trees, and crops are integrated in such a way that no resource is subject to sustained extraction without there being some compensatory input. The second ingredient is the explicitly conservationist approach of the local community. As the pressure on resources increases due to population growth, reduced rainfall, and a variety of other factors, these collective and protective strategies have become progressively more stringent and systematic. The aggressive and expansive use of land in neighbouring agricultural villages is currently threatening the sustainability of the system.

While the threat to the environment and to the pastrol livelihood is very real, it is not too late to put policies in place to improve the situation and protect the resources and the economic interests that depend on them. Time is running out, however, and only by a concerted effort that mobilises activists at the national, regional and community level can progress be made. The residents of Maka have not given up and those who share their concern for maintaining the fragile ecosystems of dryland northern Senegal should not give up either. ■

This article is based on: ***Cattle and cultivators: A study of competition over natural resources in northern Senegal.*** *Karen Schoonmaker Freudenberger and Eric Wood, 1998, EROS Data Center, Sioux Falls, South Dakota, 57198 USA.*

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Kandia: threatened forest, threatened livelihood

by Freudenberger K, Hadj A, Ndiaye T and Trappan G. 1996. 43 p. Eros Data Center, Sioux Falls, South Dakota 57198, USA.

This study describes clearly the positive side of the forestry situation in the southern part of Senegal an area that receives between 800 and 1000 mm of erratic rainfall. The study used participatory methods to identify and quantify vegetation resources. Typical tools such as village mapping, wealth ranking and individual farm sketches, were checked with secondary data from existing soil maps and satellite imageries. Special emphasis was put on resource allocation and benefit sharing issues in relation to food security by applying a gender differentiated historical matrix on roles. Villagers gave considerable attention to the issue of burning vegetation especially with regard to control strategies and their implementation. Institutional aspects such as legislation, procedures and relationships with higher administrative levels were also being examined. The study provides an interesting framework for the implementation of inventories at village level, serving as an effective tool for the participatory establishment of elementary baseline data. (KM)