A VEGETATION-MAINTAINING SYSTEM AS A LIVELIHOOD STRATEGY AMONG THE SEREER, WEST-CENTRAL SENEGAL

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ABSTRACT A field study of the system of maintaining vegetation practiced by the Sereer people was conducted from October 2001 to July 2002 at N village, located in the Thiès Department of west-central Senegal. For centuries, the Sereer people have practiced millet cultivation in combination with livestock raising and have maintained a unique form of artificial vegetation, dominated by the tree *Acacia albida*. The aim of this study was to reveal how the Sereer use and maintain the vegetation. *Acacia albida* contributes to their livelihood in several ways by functioning, for example, as a green manure and as fodder for livestock. The Sereer deliberately maintain the vegetation through "*yar*", which means to grow *Acacia albida* seedlings in cultivated fields. A "*yar*" behavior is one associated with "upbringing" in the Sereer idiom. Use of this tree up to the 1970s helped to make the Sereer livelihood system more secure in an erratic, semi-arid climate.

Key Words: Senegal; Sereer; *Acacia albida*; Livelihood activities; Vegetation-maintaining system.

INTRODUCTION

A unique, artificial or substitutional vegetation, described as farmed parkland, is found over a broad section of West Africa, from the Sahel-Sudan to the Guinea zone. In this type of vegetation, tall trees (of different species, in different regions) are intercropped and scattered in cultivated fields. This farmed parkland has been created by local people, and is associated with their livelihood activities (Pullan, 1974).

As a typical example, the Sereer people living in west-central Senegal, located in the Sahel-Sudan zone, have for centuries been creating and maintaining a farmed parkland that is clearly different from the natural vegetation, and is dominated by *Acacia albida* (henceforth albida vegetation). *Acacia albida* (synonym: *Faidherbia albida*), a tall leguminous tree, has a unique characteristic described as reverse phenology, which means that the tree sprouts leaves in the dry season and sheds its leaves in the rainy season (Roupsard, 1999); this characteristic uniquely suits the tree to contributing to livelihood activities such as millet cultivation and cattle raising. The Sereer have been maintaining albida vegetation for centuries because it helps to make their livelihood more stable and secure under erratic climate conditions, including a long dry season and low and erratic rainfall, and high population density.

In this paper, we explain how the Sereer created and maintained albida vegetation before the 1970s, with reference to the relationship between *Acacia*

albida and the livelihood activities of the Sereer. Many studies on *Acacia albida* have been conducted since the 1960s, but most of these have been agricultural or biological studies on the availability of the tree for agroforestry or development (Louppe, 1996; Depommier *et al*., 1992; Kho *et al*., 2001). Studies of how the local population recognize, use, and maintain the albida vegetation have not been made. Although it has recently been noted that farmers, such as the Sereer, in some areas of the Sahel-Sudan are no longer protecting the natural regeneration of albida vegetation, and the use of the tree is declining in spite of its potential (Seyler, 1993: 4), the reason for this is not clear. Seyler found that albida vegetation use by the Sereer has declined since the 1970s, with a change in the people's behavior toward *Acacia albida* resulting from changes in their livelihood system. It is important to understand the vegetation-maintaining system that was formerly in place in order to understand why this transformation is taking place.

STUDY SITE AND METHOD

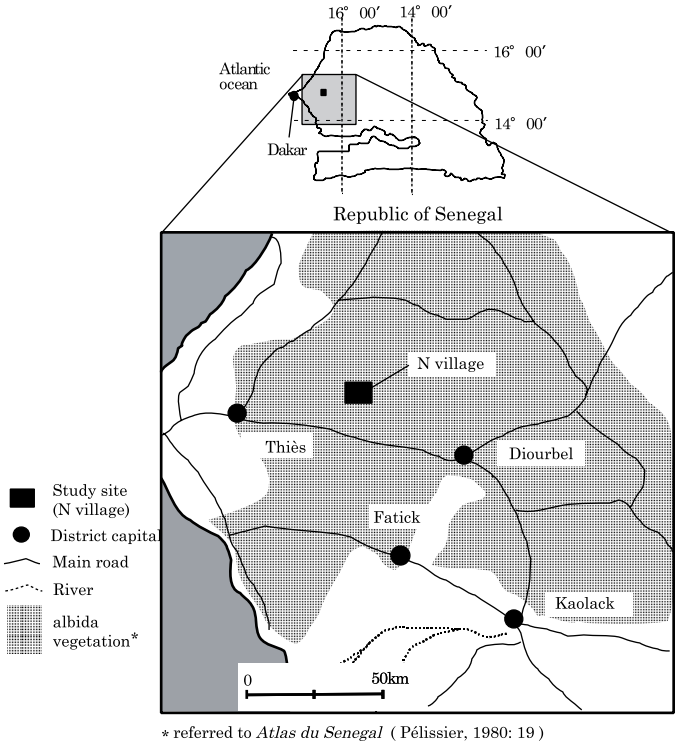
I. Study Site

The field research was conducted from October 2001 to July 2002 at N village, located in the Thiès Department of west-central Sénégal (Fig. 1).

Precipitation levels vary greatly across Senegal, from 50 to 1500 mm per year, and the flora changes in connection with the precipitation levels, but *Acacia albida* occurs over almost all of the country owing to its ability to adapt to a wide range of climate conditions: annual rainfall from 200 mm to more than 1500 mm, and temperatures from 4 to 40°C (Wood, 1992). However, the region where this tree occurs acervately is restricted to an area within west-central Senegal where the local people (Sereer) have been practicing millet cultivation and cattle raising for a long time (Fig. 1) (Pélissier, 1980). Gastellu (1981) noted that *Acacia albida* acervating in cultivated fields was one of the common features of the landscape where the Sereer lived.

N village is in the Sahel-Sudan zone, which has a mean annual rainfall of about 400–600 mm and a dry season that lasts about eight months. The potential natural vegetation is mainly acacia woodland, dominated by leguminous tall trees and germanous grass.

The Sereer people have a sedentary lifestyle and seldom move their residences. The people of N village have been living in one place for 200–300 years, or for about 11 generations. The population was 970 in 2001, with a population density of more than 200 individuals/km^2. Almost 90% of the population belong to the same clan. Their major livelihood activities are agriculture and livestock keeping. They grow bulrush millet as a subsistence crop and groundnuts as a cash crop. The keeping of cattle was common before the 1970s.



* referred to *Atlas du Senegal* (Pélissier, 1980: 19)

Fig. 1. Location of the study site and extent of the albida vegetation.

II. Method

To understand the formation and maintenance system of albida vegetation, we need to know how *Acacia albida* contributes to the livelihood activities of the Sereer. First, I recorded general points pertaining to livelihood activities that took place before the 1970s, such as types of land use, the agricultural calendar, and cattle-keeping methods, by conducting interviews and a land survey, and discussed the utilization and recognition of *Acacia albida*.

Second, I carried out a tree census, employing the line-transect method, to describe the albida vegetation from an ecological point of view. Twenty-four plots along nine transects, with a total surface area of about 9 ha, were set across the fields of N village, and all trees with a diameter at breast height (DBH) of more than 1 cm were measured for DBH and height; the frequency and basal area of each species were calculated based on these data. Likewise, vegetation located near N village, under the same climate and soil conditions but subjected to less human influence, was also measured in order to determine differences between albida vegetation and natural vegetation in terms of tree species composition and size.

I also observed the behavior of the people toward *Acacia albida*. This behavior is called *yar* in Sereer. Because the people practice this type of behavior

when they intend to keep seedlings of *Acacia albida* in their fields (Pélissier, 1966), *yar* could be a key word in describing their vegetation-maintaining system. For this reason, I have developed a description of this behavior and an analysis of the ecological, social, and cultural conditions associated with it.

UTILIZATION OF *ACACIA ALBIDA*

The land-use system clearly differs, depending on whether it is operational in the dry season or the rainy season (Fig. 2). Before the 1970s, in the rainy season, after shifting the cattle kraal to outside the field, the people employed 70% of the field to cultivate bulrush millet and groundnuts; the remaining land was left fallow for cattle grazing. In the dry season, the cattle kraal was established in the fields after crops had been harvested, and the residue of crop and leaves of *Acacia albida* were given to the cattle as forage. The distinctive feature of such a land-use system is that the field was employed throughout the year — for agriculture in the rainy season and grazing in the dry season (Pélissier, 1966; Lericollais, 1999).

This annual cycle of land use is related to the peculiar reverse phenology of *Acacia albida*. In the rainy season, the time of cultivation, usually from June to October, the trees shed their leaves and the nitrogen-rich leaves fertilize the millet growing around the tree. Moreover, owing to the absence of leaves, more sunlight reaches the crop (Louppe, 1996).

The trees sprout leaves again at the end of the rainy season and produce seed pods in the middle of the dry season. The seed pods are rich in protein and are good forage for livestock. Thus, the *Acacia albida* tree contributes to the Sereer livelihood in both the rainy season and the dry season.

The people explain the combination of trees with bulrush millet as follows: “Seven adult trees can fill up a granary with bulrush millet,” or “Bulrush millet can grow much better, even around a dead tree for several years, than at a place with no tree”. In fact, Loupe (1996) reported that bulrush millet, influenced by

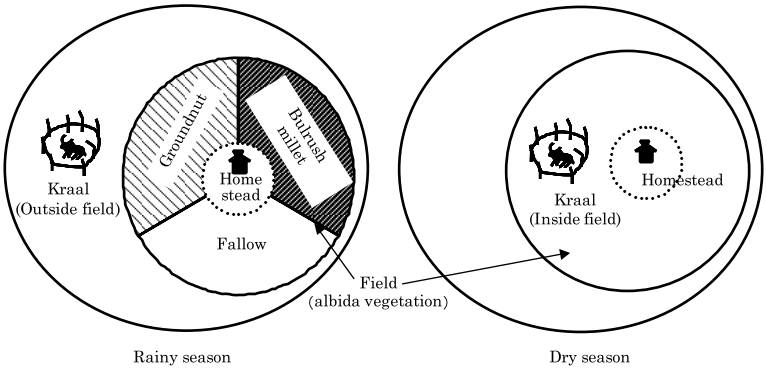


Fig. 2. Annual cycle of land use before the 1970s.

trees, can produce an increased yield (measured as the dry weight of the millet seeds) of as much as 150%. The Sereer also describe the contribution of the tree to cattle rearing in this way: "It has been possible to keep cattle by giving them only the pods of the tree in the dry season". Thus, the tree is thoroughly utilized in the long dry season.

Millet, cattle, and *Acacia albida* are thus synergistic in the cultivated fields of the Sereer. In addition to the contribution of *Acacia albida*, as described above, to the yield of millet and as cattle fodder, the cattle dung provides fertilizer for cultivated fields and the cattle can eat the stalks and leaves of millet in the fields after harvesting.

ECOLOGICAL FEATURES OF ALBIDA VEGETATION

A tree census of albida vegetation was conducted at N village to describe the species composition and size structure of the forest. At N village, 13 tree species, including *Adansonia digitata* (baobab), *Balanites aegyptiaca,* and *Acacia nilotica*, were observed with a population density of 31.1 stems/ha. The most common species was *Acacia albida*, accounting for 83% of all trees (Table 1). *Acacia albida* also represented 70% of the total basal area. The mean DBH of *Acacia albida* was 42.6 cm (N=220, minimum=22.7 cm, maximum=88.0 cm), and all of the trees in the population were adults.

In the area of vegetation outside the village, which were less influenced by human activities, overall tree density was 43.9 stems/ha and 14 species were represented (Table 1). The frequency and size of *Acacia albida* were much lower than in the albida vegetation. In addition, although the vegetation in the area less influenced by human activities had species richness, the biomass was much less than in the albida vegetation dominated by *Acacia albida*. This difference could have been caused by the intervention of the Sereer.

VEGETATION-MAINTAINING SYSTEM

I. "Upbringing"

How have the Sereer been creating and maintaining this albida vegetution for centuries? To answer this question, I observed the behavior of the people toward *Acacia albida*, or "*yar*" in the Sereer idiom, a word meaning "upbringing." By way of example, disciplinary behavior on the part of parents towards their children, such as striking them when the children did something wrong, is termed *yar*. When applied to *Acacia albida* culture, the word means "to grow the tree."

The people practice "upbringing" toward both of seedling (*njaas* in sereer) and adult tree (*saas*). First, about seedling, they start to treat it after seedlings grew in certain size (0.5 to 1 m) in cultivated field. Normally the branches of

Table 1. Frequency and Rate of Basal Area of Each Species (DBH≧1 cm) in albida vegetation and vegetation less influenced by human.

Species	albida vegetation			vegetation less influenced by human		
	Frequency (%)	Mean DBH (cm)	Rate of basal area (%)	Frequency (%)	Mean DBH (cm)	Rate of basal area (%)
Acacia albida	82.95	42.60	69.93	21.05	35.08	43.88
Acacia nilotica	1.89	44.31 (4.19)	0.98	1.75	st	
Acacia sieberiana	0.38	2.5 (–)	0.01			
Acacia tortolis	0.38	22.54 (–)	0.08	1.75	15.5 (–)	0.68
Adansonia digitata	7.95	46.73	14.19	1.75	st	
Anogeissus leiocarpus	0.38	106.91 (–)	1.88			
Azadirachta indica				1.75	13.9 (–)	0.68
Balanites aegyptiaca	2.27	13.23	0.53	24.56	20.71	19.73
Bauhinia rufescens	0.38	23.76 (–)	0.09	1.75	7.9 (–)	0.34
Borassus flabelifer	0.38	49.11 (–)	0.4			
Cassia sieberiana				1.75	26.5 (–)	2.04
Celtis integrifolia	1.52	108.5	11.2			
Combretum glutinosum				7.02	9.47 (5.99)	1.36
Parinari macrophylla				1.75	st	
Piliostigma sp.	0.38	2.27(1.5)	0.01			
Prosopis africana				29.82	24.24	27.21
Securidaca longepedunculata				1.75	9.5 (–)	0.34
Tamarindus indica	0.38	51.56 (–)	0.44	1.75	37.6 (–)	3.74
Zizphus mauritiana	0.76	27.36	0.27	1.75	st	
Total number of trees (ha^{-1})	31.1			43.85		
Total basal area (m^2ha^{-1})			5.53			2.94

* Standard deviation is given in parentheses. (–) indicates species having only one stem in the plot.

** st: Stool sprouting after cutting by local people from bottom were observed in the vegetation less influence. Among these trees, if the DBH was estimated to be more than 1cm under the normal condition, I counted it to calculate frequency.

the seedlings would spread toward wise and be disruptive to the cultivation of millet, because they are coppiced: the seedlings are so small before “upbringing” and are unconsciously cut down when the people cultivated their fields. The Sereer people interviewed for this study said, “The seedling that spread the branches itself cannot grow upwards”. So the people trim the spreading branches and retain the main stem, encouraging a more vertical growth form of the tree. Regarding the adult trees, although the people cut down branches for firewood or fodder, they cut branches very carefully, giving consideration to later growth. For example, they may first cut only branches on the left, and then after two years they may switch to cutting branches on the right. If they trim the branches well they say that the acute thorns of the tree will be flat and this type of tree are called “sweet trees”. The young branches of these “sweet

trees" can be used easily as fodder for their livestock.

It is important to note that, in the case of seedlings, the Sereer practices of "upbringing", to accelerate the growth of the tree by means of improving the tree form are designed to make the *Acacia albida* compatible with their cultivated fields. With respect to the adult trees, they focus on transforming "sweet trees" by cutting branches that provide fodder for livestock. Thus, we can

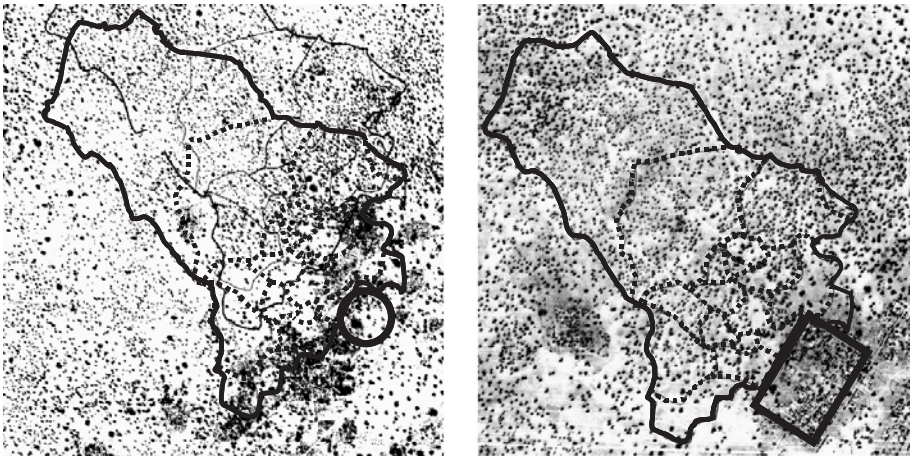


Fig. 3. Aerial photographs showing N village, 1954 (left) and 1989 (right).
Solid and dotted lines indicate the boundary of N village and the division of fields held by different households. Circles and squares indicate homesteads. Source: A079/400.334 (left), Institut Geographique National, Paris, France, and CT SGN L21A8 (Light), Direction Geographique, Dakar, Senegal.

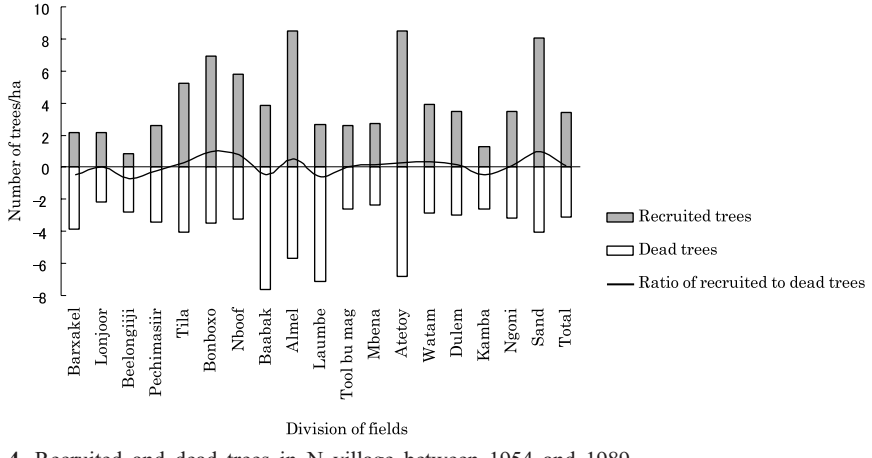


Fig. 4. Recruited and dead trees in N village between 1954 and 1989.
Letters under the horizontal axis refer to the names of each division of the fields. The total numbers of recruited and dead trees during this period were estimated at 309 and 279. The ratio of recruited to dead trees was calculated as 1 − (number of recruited trees÷dead trees).

define Sereer "upbringing" as a deliberate manipulation of the vegetation through the improvement of growth and the preservation of individual trees.

By comparing aerial photographs taken in 1954 and 1989 (Fig. 3), we can see how the people have maintained the albida vegetation through "upbringing". Two photographs showing the same individual trees in 1954 and 1989 were compared, and the numbers of dead and recruited individuals were counted. A dead individual was defined as a tree present in 1954 but not present in 1989. A recruited individual was defined as a tree that was not present in 1954 but was present in 1989. All trees counted were visible adults in one of the photographs, and at least 20 years old. The dead and recruited individuals over these 35 years were examined from 18 cultivated fields of the village (Fig. 4). The total number and density of the trees had not changed from 1954 to 1989, in all the cultivated fields, held by different landowners. The number of *Acacia albida* had been kept in dynamic equilibrium through "upbringing", practiced by the people in their fields.

II. Conditions for the Practice of "Upbringing"

Even though the Sereer practices associated with "upbringing" do not seem to be difficult, several social and ecological conditions must be met in order for treated trees to grow and become adults in the livelihood system. A seedling needs more than 20 years to become an adult, and many difficulties may be encountered during this period that could interfere with the treatment.

First, dispersion and germination of the seed in cultivated fields is a precondition for the practice of "upbringing." Livestock disperse the seed and accelerate germination by eating seed pods (Halevy, 1974; Hauser, 1994). After germination, the seedling must grow until it becomes large enough for recognition, in order that it may be treated. For establishment of the seedling, a fallow field stage, such as that practiced before the 1970s, is also required. In addition, cutting the millet with a hoe rather than with a machine is important to avoid cutting down the seedlings.

It takes more than 20 years to gain the benefits from the treated seedling, therefore a system of inheritance with respect to the cultivated fields is an important factor in perpetuating continual "upbringing." The *Acacia albida* in a villager's fields have been treated by his great-grandfather, grandfather, and father (Fig. 5). Thus the people have been able to practice "upbringing" with a long perspective in mind, because the cultivated fields are inherited through the patrilineal line by descendants. A stable land inheritance system, then, is an important social precondition for "upbringing."

The cultural value attached to the trees as Gravrand mentioned (Gravrand, 1973; 1990) is another important factor, along with the ecological and social preconditions for "upbringing". For example, parents teach their children that "if you cut down a seedling, you will die or you will never grow to be big." There are even some sacred *Acacia albida*, known as *Saas Djieu*, in the cultivated fields. The people pray to them for good harvests and leave offerings

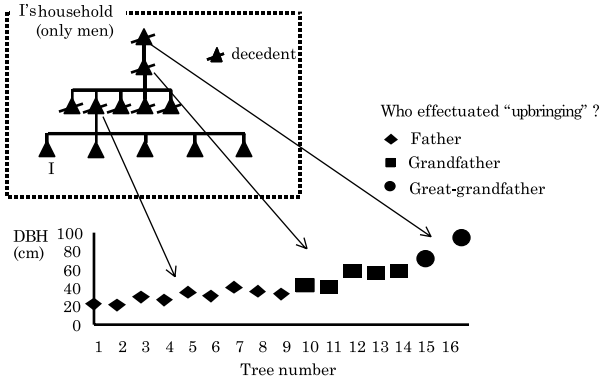


Fig. 5. Who carried out "upbringing" in the case of I's household?
I is in his fifties. He inherited the fields from his father and farms them with his brothers.

of camel bone or millet seeds at the trees.

CONCLUSION

Before the 1970s, the Sereer people maintained *Acacia albida* through the practice of "upbringing" in order to enhance the stability of their livelihood system. To perpetuate "upbringing," it was necessary that certain ecological, social, and cultural preconditions be met in relation to the Sereer society. It is possible, too, that the vegetation-maintaining system itself evolved in just such a social frame.

However, this vegetation-maintaining system seems to have transformed since 1970s. In evidence, the result of size class distribution of *Acacia albida*, based on tree census conducted in N village shows that this albida vegetation almost never has seedling or young tree of *Acacia albida*. It means that actually this vegetation is in lack of recruited trees or in no regeneration. It implies that the people has not been practicing "upbringing" for recent 20 to 30 years, considering growth rate of *Acacia albida* that would take 20 to 30 years to be 20 cm in thickness. Why they did not "upbringing" for this duration?

As it was already pointed out, the people practiced "upbringing" by reason of having good yield of millet and fodder for cattle. Only quarter of households could manage to secure millet sufficiently by their yield in 2001. The other households bought imported rice to supplement the shortage. Although the rice was seldom eaten before 1970s, it became an important lunch recipe recently. This change is related to an increase of population and frequent drought spells. The fluctuation of annual rainfalls since 1950 is quite big. Although to cultivate millet needs an average of 400 mm per year, the rainfall achieved less than 400 mm in many years especially since 1970s. The number of cattle held by each household has been also changing. The cattle number decreased so highly

since 1960s or 1970s. It would be in relation to drought and disappearance of fallow stage for feeding as well.

While the decrease of self-sufficiency rate, migration of labor in cities increases. If we see the rate of the male population being 15 to 70 years old who work in several cities and not return to the village throughout the year, it is clear that more than 40% of men have migrated. And also this causes shortage of agricultural labor and spread of horse plow for cultivation. The spread of the cultivation plow was deeply in relation to "upbringing". Although this people who cultivated by using plow detoured avoiding the seedling, generally larger part of the seedlings are cut down. Also, because the thorns of seedling injures foots of horse, the seedling become on an awkward existence.

The social conditions of "upbringing" also changes. The households belonging to the same patrilineage cultivated in form of joint labor beyond the consumption unit before diffusion of plow in 1970s. However, this labor organization has fragmented and they cultivate in individual consumption unit. Such a change is associated with shortage of labor caused by increase of migration, purchase of plow or horse with the money gained by migration work as well. The migration would influence to not only spread of the plow cultivation but also to the land tenure system. It is to say that they begun borrowing and lending of their land with diffusion of the land fragmentation. The borrowing and lending is practiced by 50% of the total household in the village. Thus, with the advance of the land mobilization, it is supposed that the people could not effectuate "upbringing" in the long view like before 1970s.

Since 1970s the Sereer people hardly practice "upbringing". As its background, first, I suggest the decline of relative importance of *Acacia albida*, caused by a decrease in dependency on the millet cultivation and holding cattle in their livelihood and generalization of migration labor. And second, as a result of such livelihood changes, the precondition for "upbringing" has also been transformed, and to practice "upbringing" is becoming more and more difficult. Actually, albida vegetation faces lacks of sustenance in the situation of no "upbringing". As changes in the people's livelihood strategy have been taking place, albida vegetation has also been transforming.

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