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Borassus aethiopum, a Threatened Multiple Purpose Palm in Senegal

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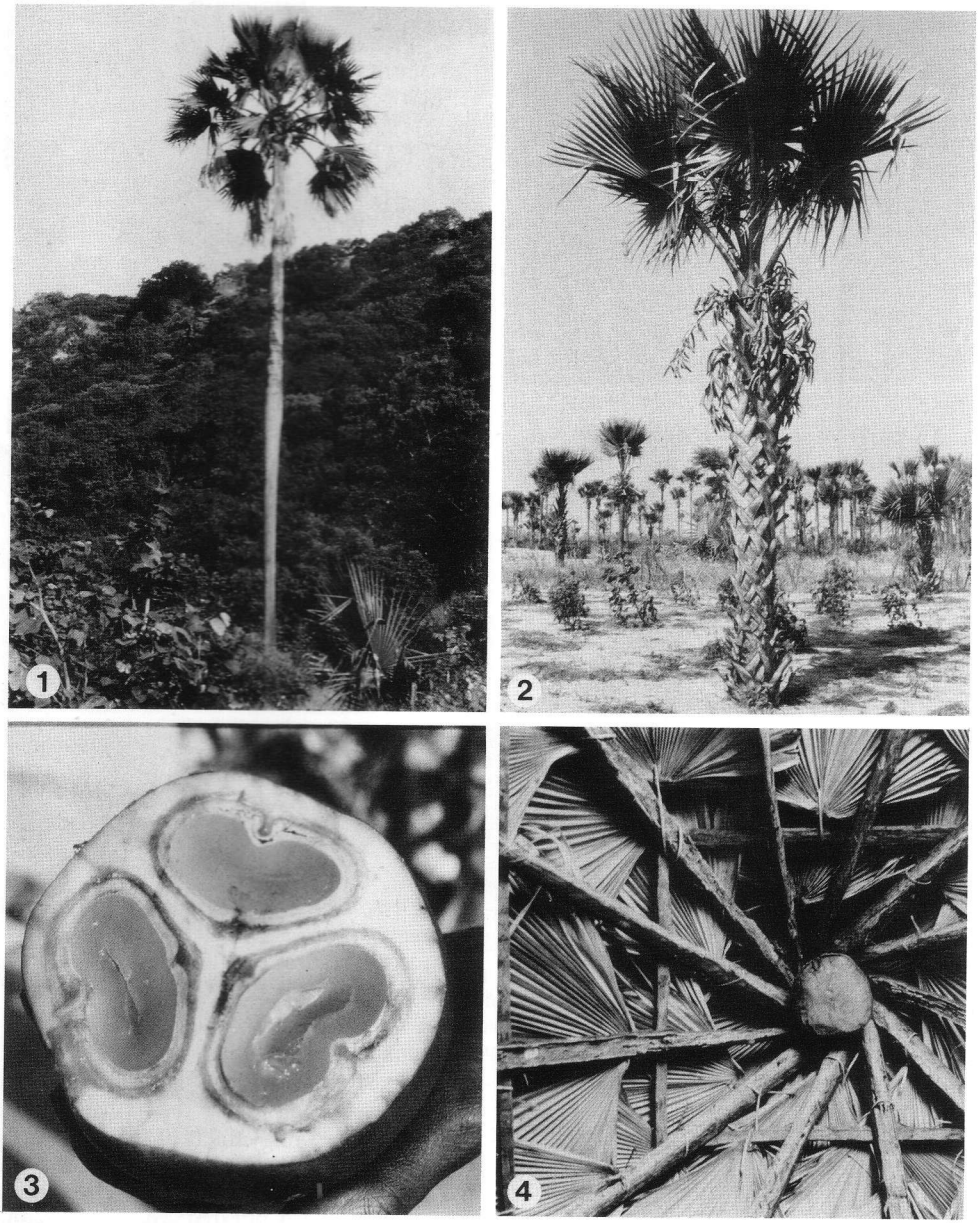
Borassus aethiopum is an economically and ecologically important palm tree of the Sahelian and Sudanian zones in Africa (Giffard 1967, Gschladt 1972). This majestic representative of the subfamily Coryphoideae is often found in dense populations in periodically inundated depressions in the landscape or along rivers and lakes (Chevalier 1949, Chevalier and Dubois 1938). *Borassus aethiopum* was originally described by C. F. P. von Martius (1838) who separated it from the widespread and closely related Asian species, *Borassus flabellifer*, based on a description of Thonning in Schumacher (1829). According to this, *B. aethiopum* is characterized by the ventricose stem (Fig. 1) of old individuals and the five to seven male flowers in each flower cluster (cincinni) as opposed to ten to fifteen in *B. flabellifer*. The number of flowers per cincinni is variable and in *B. aethiopum* it is typically 8–10, thus it is not a good distinguishing character. In other and older works, *B. aethiopum* is either cited in synonymy with *B. flabellifer* or retained as a variety under this. The only existing monographic treatment of the genus *Borassus* is that of Beccari (1924). This work includes seven species and recognizes *B. aethiopum* with three variants: var. *senegalensis*, var. *bagamojensis* and the typical form. *B. aethiopum* is distinguished from *B. flabellifer* by having a calyx that is connate to the middle and not split to the base as in this species. In modern treatments, e.g., Flore du Sénégal (Berhaut 1967), Flora of West Tropical Africa (Hepper, 1968), Flora of Tropical East Africa (Dransfield 1986) and, Flore illustrée du Sénégal (Vanden Berghen 1988) the position of *B. aethiopum* is maintained. We have accepted *B. aethiopum* in this paper based on the differences given by Dransfield (1986). *Borassus aethiopum* is accordingly more massive than *B. flabellifer*. The leaves are more rigid, less deeply folded and greater in number. Along with the ventricose stem, this gives a different appearance from *B. flabellifer*.

Borassus aethiopum plays an important role in Senegalese rural life where it is the source of a number of products (Niang 1975, Diouf 1982, Sambou 1985). It is called "ron" in Wolof dialect from which the French "rônier" is derived. Destructive agricultural practices and lack of management is now threatening populations all over the country (Bellouard 1950, Diallo 1987, Sambou 1989). Dense populations of *Borassus aethiopum* are found in the southern and southeastern parts of Senegal close to rivers and lakes where the groundwater level is high. Natural populations of *Borassus aethiopum* are rare in the northern part of Senegal, but the palm is often planted in fields (Fig. 2). The best climatic conditions for this palm prevail in the middle part of the country where large populations once occurred.



1–4. *Borassus aethiopum.* 1. Old individual. Note the swollen or ventricose stem. 2. Palm tree planted in mixed cropping system. Note the male inflorescence and the persistent leaf sheaths characteristic of young plants. 3. Cross section of immature fruit. Note the fleshy mesocarp and the three pyrenes that each contain the gelatinous endosperm. 4. Roof thatched with the leaves.

Overexploitation and habitat degradation is threatening this palm so seriously that Senegalese authorities are now trying to protect it. It is illegal to exploit the wood for commercial purposes and other laws regulate its use in the common lands of the villages (Government of Senegal 1973). Despite these efforts the destruction seems to be continuing. This paper will first describe some of the many uses of *Borassus aethiopum* and then mention the various threats to which it is exposed in Senegal.

Uses

All parts of *Borassus aethiopum* are exploited and used for a wide array of purposes (Table 1). The products can be divided into three major groups which will be treated shortly in the following: ligneous products (wood, fibers, etc.), food, and medicine.

A number of parts of the palm are edible. The young gelatinous endosperm is a highly esteemed and nutritious snack (Fig. 3). The mesocarp is fleshy when ripe and can be prepared and consumed in many ways: grilled, boiled, or mixed with sugar or honey. The cotyledonary haustorium of the germinating seed is soft and sweet and highly appreciated. The premature folded leaves of the seedling are collected from below the soil and eaten. They have a fleshy texture and are very tasty. The palm heart of *Borassus aethiopum* is also exploited although the difficulties involved in extracting it somewhat limit its importance as a food source. A sap, which is very high in sugar content, is tapped from near the apical meristem at the base of the palm heart (Bismuth and Menage 1961).

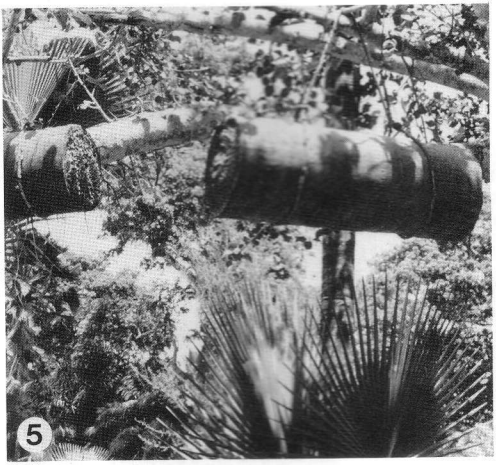
Borassus aethiopum is also used for a number of medicinal purposes (Giffard 1962). An infusion of the roots is used to treat miscellaneous ailments such as stomach ache, throat infections, bronchitis and syphilis. The flower-bearing branches or rachillae of the staminate inflorescences are used to treat venereal diseases. The stamens are mixed with Shea-butter and used to heal wounds. The mesocarp of the ripe fruit is used as a stimulant and against tetanus. It is said to be a very efficient remedy against intestinal parasites too. The eophyll (the first leaf) of the seedling and the sap are also used as stimulants. The sap tapped from the stem is believed to stimulate the growth of teeth in children.

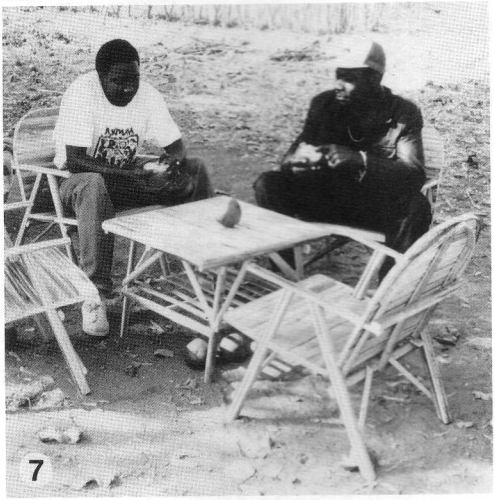
Table 1. The Different Parts of Borassus aethiopum *Used by Man*

I. Uses based on structural properties
- Stem (timber, boards)
- Leaves
  - —petiole (fences, fibers)
  - —blade (roofs, baskets, mats, rugs, furniture)

II. Uses based on nutritional and medicinal properties
- food
  - —endosperm
  - —cotyledonary haustorium
  - —palm heart
  - —mesocarp
  - —sap tapped from near the shoot apex (alcoholic beverage)
- medicinal
  - —roots
  - —male rachillae
  - —stamens
  - —mesocarp
  - —hypocotyl
  - —sap tapped from the trunk or near the shoot apex

The stem of *Borassus aethiopum* delivers a hard wood that is resistant to decay and the damaging effects of seawater. The durable wood is rarely attacked by termites and fungi and is said to have excellent working properties. It is used extensively by local carpenters for multiple purposes, to mention just a few: furniture, timber in heavy construction such as bridges and houses, boards for making floors, walls and roofs in houses. The soft swollen part of old trunks serves other purposes (Fig. 5). A rich cottage industry is based on the extraction of the leaves. The blade or seg-

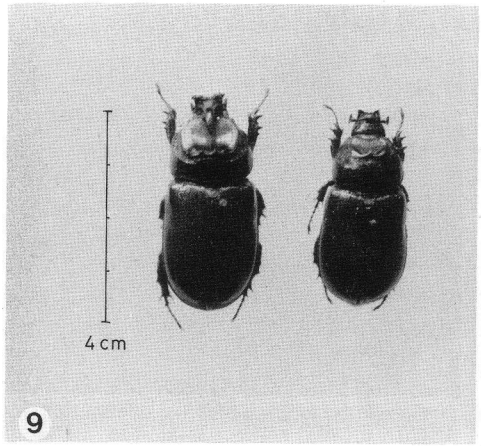


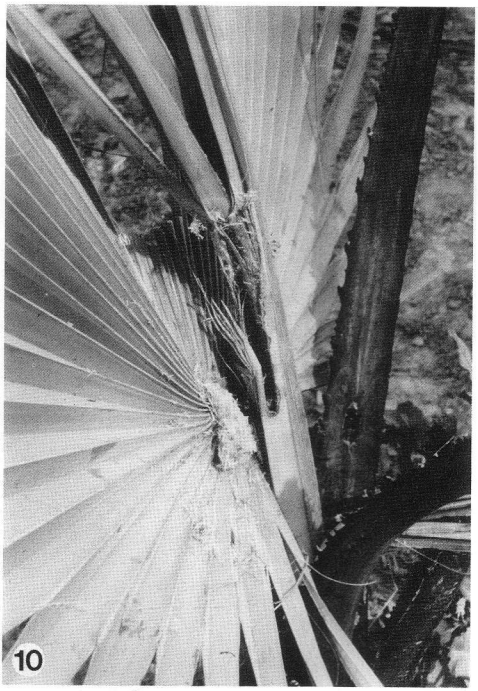


5–8. *Borassus aethiopum.* 5. A beehive made of the swollen and soft part of the trunk. 6. Baskets braided from the major veins of the leaves. 7. The fruit mesocarp offers a nutritious snack. The chairs and table are made from leaf petioles. 8. The death of some old palm trees such as these is probably related to drought.

ments of the blade are used with great ingenuity for making thatch, mats, rugs, baskets (Fig. 4), bathtubs, etc. The leaf fibers are extracted and used for brooms and baskets (Fig. 6). The leaf petioles are skillfully exploited in arts and crafts (Fig. 7) and are used to build fences around houses and pastures. In the North, where the vegetation is sparse, leaf petioles often serve as firewood.

Several aspects of the ecology of *Borassus aethiopum* make it an interesting plant from an agricultural point of view. Its fibrous root system forms a dense mat in the surface layers of the soil which helps to prevent soil erosion. It has been demonstrated that the staminate rachillae release potassium upon decomposition thereby enhancing soil fertility (Maydell 1983). These beneficial effects are exploited in many parts of Senegal where agro-forestry systems are based on managed natural populations of *Borassus aethiopum.*

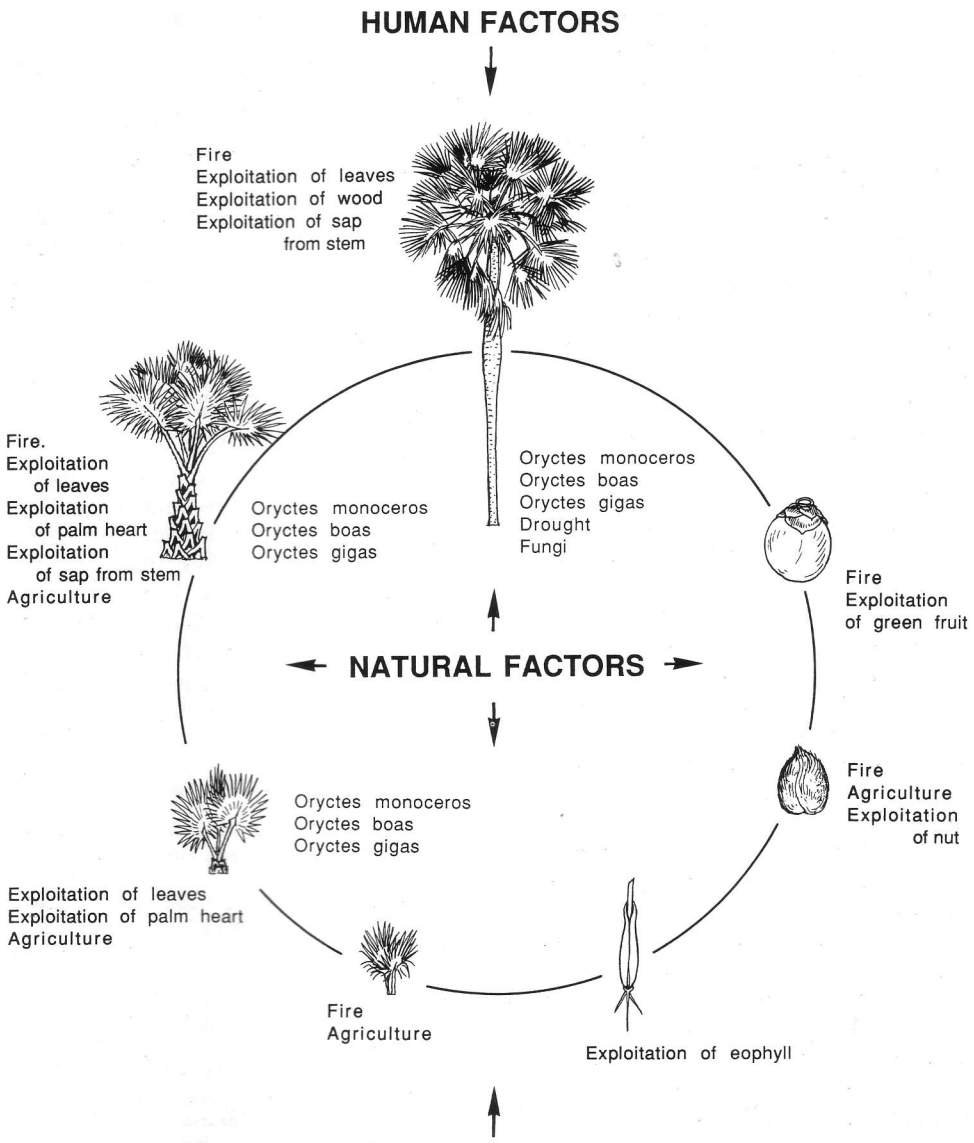




9–12. *Borassus aethiopum*. 9. Male (left) and female of *Oryctes monoceros* Ol. (family *Scarabeidae*). 10. The signs of an *Oryctes* attack in a juvenile palm. 11. Tapping of sugar from the crown. Exploitation has caused the death of the palm tree at the left. 12. *Borassus aethiopum* must give way for the cultivation of millet.

Threats

The destruction of *Borassus aethiopum* is either a result of complete removal of natural populations or a slower process where age distribution becomes progressively more skewed. This process may eventually lead to a complete lack of young stages in the population which can prevent future regeneration. The factors respon-



13. Natural and human factors causing degradation of *Borassus aethiopum* populations in Senegal.

sible for destruction of *Borassus aethiopum* can be divided into two major groups: natural and anthropogenic (Fig. 13).

The most important natural factor threatening populations of *Borassus aethiopum* is probably drought. A steadily growing rain deficit during the last two decades has caused high mortality among older palm trees that are sensitive to fluctuations in the ground water level (Fig. 8). Destructive insects also represent a serious threat to *Borassus aethiopum* (Castel-Branco and Tordo 1956, Lepesme 1947). After the apical meristem has appeared

from below the soil, it is exposed to the attack of three species of *Oryctes* Illiger (*Scarabeidae*) in particular. The two most common species are *Oryctes monoceros* Olivier (Fig. 9) and *Oryctes boas* Fabricius. The third species, *Oryctes gigas* Castelneau, is rare but is found in the humid southern part of Senegal. All three beetles dig into the base of the apical meristem (Fig. 10) and suck the sap which often results in the death of the palm tree. They can reproduce in the swollen subdistal part of the stem of old individuals. The partly decomposed dead stems offer ideal conditions for the development of larvae.

Man's activities have had a severe impact on natural populations of *Borassus aethiopum* in Senegal. The main factors contributing to the destruction are agriculture (Fig. 12), fire and, exploitation of wood, and use of palmheart and sugar sap tapped from near the apical meristem. The latter is a very destructive practice where a hole is drilled through the leaf bases (Fig. 11) and a sap is tapped from the soft and fleshy tissues near the apical meristem. Usually the palm dies after having been exploited in this way. It should be noted that in India and SE Asia, inflorescences of *Borassus flabellifer* are tapped without damaging the plant.

In some *Borassus aethiopum* populations, the age-distribution is so skewed that certain developmental stages are completely lacking. What appears to be seedlings are in fact very old individuals, that remain small due to agricultural practices such as burning of the ground cover.

Adult individuals of *Borassus aethiopum* deliver a number of products that are highly appreciated by village people and they are consequently threatened by overexploitation. Thus, repeated collection of leaves may severely limit the growth of the palm and excessive extraction of green fruits, germinated seeds or young seedlings may impede the potential of natural regeneration.

Conclusion

Borassus aethiopum, a genuine multiple purpose palm tree, is a victim of its own high utilitarian value. Both human and natural factors are threatening the natural populations in Senegal. As long as the use of this valuable palm is not regulated, the situation will probably worsen. Only strict management of the remaining natural populations will save an important plant resource for future generations.

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Biogeography of the Coconut *Cocos nucifera* L.

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ABSTRACT

The conditions under which coconut (*Cocos nucifera* L.) evolved can be quite precisely specified. Those conditions still exist today and the coconut palm can be found growing in its original habitat where it will continue to thrive, with or without human intervention. The coconut can be considered as perhaps the most successful member of the world's oldest and most durable ecosystem. Yet the major component of that ecosystem, the coral reef, is constantly changing its form. As a result the precise location of a center of origin for the coconut will probably never be known.

The coconut, like the calabash and the bottle-gourd, is used as a convenient container wherever modern man has not yet brought the ubiquitous benefits of plastic. Unlike the calabash or the gourd, the coconut comes already filled with a drinkable liquid. This liquid is pure, it is palatable and it is portable. Unlike a plastic container the coconut fruit is non-returnable, absolutely disposable and totally recyclable. These qualities are found in the immature coconut and they are well known