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**"Competition for Resources in a Changing World:
New Drive for Rural Development"**

Acacia senegal (Gum Arabic Tree): Present Role and Need for Future Conservation/ Sudan

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Introduction

Sudan is the largest African country (2.5 million km^2) situated in the northeast of Africa (latitude 4' 23^o north, longitude 22' 38 ^{o} east). It shares common borders with nine African countries and has a tropical climate. From the north to the south, the climatically determined vegetation zones are: desert, semi-desert rainfall woodland savannah on clay soil, low rainfall woodland savannah on sand, high rainfall woodland savannah, special forests and the montane forests. Forests in the Sudan render a plenty of ecological and socio-economical benefits. They contribute substantially to conservation of biological diversity, protection of watersheds, and improvement of soil conditions. Moreover, they provide work opportunities as well as fuel wood for local people, food resources for domestic animals, and the opportunity for recreation. The arid parts of Sudan carry only scanty vegetation and woody species are confined to few *Acacia* species in the seasonally flooded areas. The main species currently utilized are *Acacia senegal*, the gum Arabic producing tree and *Acacia nilotica*.

Distribution of *Acacia senegal* in Sudan

Acacia senegal (L.) Wild. is a tree (or shrub) of 2-6 m, occasionally up to 8 m in height, with umbrella-shaped crown. It is very branched with many upright twigs (1). *A. senegal*, locally called hashab tree, grows in a range of annual rainfall between 100-800 mm (mainly between 300-400 mm). It is very drought resistant and tolerates dry periods of 8-11 months. The species prefers sandy soils, but grows also on slightly loamy sands (1). In the respective parts of Sudan *A. senegal* dominates the vegetation cover, and exists in the wild as well as on cultivated land - mainly on sandy hills, but also on cotton soil.

Ecological and socio-economic relevance of *Acacia senegal*

A. senegal is a multifunctional tree in Sudan producing gum Arabic, particularly in the western part of the country. *Acacia senegal* has a remarkable adaptability to drought and frost (NAS 1983). It contributes substantially to Sudan exports and, thus, to the revenues of the farming communities of gum belt. Gum production is a pillar of family economy and

considered as an income-generating source that requires only a low input of work after the rainy season (3). Besides gum Arabic production, the tree species has been used for desertification control, reestablishment of a vegetation cover in degraded areas, sand dune fixation and wind erosion control. It plays an important role in soil stabilization through a widely extended lateral root system and possibly contributes to soil improvement through nitrogen fixation as well as mineral enrichment from leaf litter.

Acacia senegal is incorporated in the famous agroforestry system known as the bush-fallow system of shifting cultivation, described by Seif el Din (1981). This system ensures optimum and sustainable utilization of the natural resources, since both the gum production and the crop cultivation form productive components of the system. Added to this is the fact that animals graze under the gum trees during the dry season without harming the trees. When the trees are felled to allow cultivation, the wood is used for fuel, for building materials and for fences around farm plots, (6). It is a typical land use practice that prevailed in Kordofan, western Sudan. The bush-fallow system was built in a way that achieves ecological balance using traditional shifting cultivation, where a long fallow period maintains the soil fertility. Until recently, the traditional *A. senegal*-based agroforestry system was recognized and considered one of the most successful forms of natural forest management in the tropical drylands, and regarded as sustainable in terms of its environmental, social and economic benefits. Traditionally, the *A. senegal* tree is managed in a time succession with agricultural crops such as sorghum (*Sorghum bicolor* (L.) Moench), pearl millet (*Pennisetum typhoideum* Rich.), groundnut (*Arachis hypogaea* L.), sesame *(Sesamum indicum* L.) and karkadeh (*Hibiscus sabdariffa* L.). This agroforestry system allows a period of 10-15 years for restoring the soil fertility after a short period of arable cultivation (4). The cycle thus consists of a relatively short period of cultivation followed by a relatively long period of fallow.

Factors affecting *Acacia senegal* growth and health conditions

Many parameters affect growth and health condition of *A. senegal.* These are physical factors (climate, soils, water balance, topography), biological factors (diseases and pests, especially insect and rodent attacks, browsing by livestock and game), traditional constraints (human land use systems), socioeconomic parameters (working opportunities, migration, revenues), and political features including land tenure, rural development policies, infrastructure and transport, organization of local trade and export, pricing and taxation, local industries as well as marketing, (i.e. the whole range of traditional and moderns structures required to collect, store, transport, grade and sell gum Arabic at home and abroad; market forecasts).

Improvement of wild *Acacia senegal*

It was stated that improvement of wild *Acacia senegal* has been carried out exclusively through silvicultural means. With the establishment of the Tree Seed Centre, breeding of *A. senegal* mainly for gum Arabic production and to some extent for fodder, fuel wood and drought tolerance was initiated. It is also mentioned that germplasm exploration, collection and field evaluation was considered a necessary first step in the tree improvement program of *Acacia senegal* in the Sudan (2).

Threats to Aca*cia senegal*

The importance of *A. senegal* conflicts with its susceptibility to different threats. Fires kill off seedlings and damage the trees. A good deal of damage is caused through cutting off large branches. The tree is e.g. vulnerable to the attack of fungi, termites, locusts (*Anacridium*

melanorhodon), grasshoppers, longhorned beetles and borers, as well as goats and camels. Frequently pests cause defoliation and thus, decrease the photosynthetic capability of *Acacia senegal* and in turn the quality of stored carbohydrates connected with a reduction of gum yield. Pest outbreaks are often difficult to predict and costly to control and may cause considerable damage, compromise national economies, local livelihoods and food security, and result in trade restrictions on forest products. Often, the knowledge of spectrum and ecological requirements of pest species is quite limited. This applies e.g. to longhorned beetles. Thus, the identification of the species of longhorned beetles in Sudan, was a key for further research in the biology and ecology and hence the development of pest control strategies.

Several species of longhorned beetles were identified:

Crossotus subocellatus (Fairmaire, 1886) (Fig. 1):

This species is known from the southern part of the Arabian penninsula, Sudan, Djibouti (type locality), Somalia, Ethiopia, Eritrea, Kenya. In northern Africa it is only known from Egypt (common in South Eastern Desert and Sinai), Libye, Sénégal, Arabie Saoudite, Maroc, Tchad, Mauritanie, Niger.

Fig. 1 ***Crossotus subocellatus Fairmaire***

Titoceres jaspideus (Audinet Serville, 1835) (Fig. 2) :

A common species throughout Africa, recorded from the most countries south of Sahara, from South Africa northward to Sudan, Chad (including Ennedi and Tibesti), Niger (including Aïr) southern Algeria (Hoggar),Western Sahara, Mauritania, Tchad, Maroc, Namibie, Sénégal, Somalie.

Fig. 2 ***Titoceres jaspideus*** **(Audinet Serville, 1835)**

Crossotus albicollis (Guérin, 1844) (Fig. 3):
C. albicollis occurs in Senegal, Mali, Niger, Chad, République Centraficaine, Nigeria, Cameroon, Ghana, Côte d'Ivoire, Burkina Faso, Mauritania (Trarza, CCECL). It is new to Sudan (first record in 2007 from *Acacia senegal*, leg. Maymoona Eisa, ex larva, North Kordofan) and East Africa North of Sahara. It was found by the coauthor (Sama) t in Western Sahara and southern Morocco reared from *Acacia raddiana*.

Fig. (3). *Crossotus albicollis* (Guérin, 1844)

Coelodon servum White, 1853 (Fig. 4).
C. servum occurs in Senegal, South Africa, Namibia, East Africa (Ethiopia, Somalia, Kenya, Tanzania, etc.). It is new to Sudan (first record in 2007 from *Acacia senegal*, leg. Maymoona). Eisa, ex larva, North Kordofan).

Fig. (4). *Coelodon servum* White, 1853

Keywords: *Acacia senegal*, conservation, longhorned beetles, tropical forest, pests, Sudan

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