



Tropentag 2010
ETH Zurich, September 14 - 16, 2010

Conference on International Research on Food Security, Natural
Resource Management and Rural Development

The Biotic (The Longhorned Beetles: *Cerambycidae*) and A Biotic (Drought) Effect on the Production and Sustainability of the *Acacia senegal*, (L). Wild, Case Study of Northern Kordofan, Sudan.

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Introduction

A. senegal is a multifunctional tree in Sudan producing gum Arabic which is the major and most important non-wood forest product in the country. In addition the tree can serve for erosion control, soil improvement, ornamental and intercropping: It is a highly suitable tree for agroforestry systems.

Gum arabic provides the farmers with important sources of income during its harvest period in the dry season, at times when income from other agricultural crops is low. Therefore gum harvest provides a way for farmers to diversify their livelihoods and to alleviate the risk for subsistence crises. However, it has to be born in mind that gum Arabic can only alleviate this risk if the money received can be used to buy food, (Rahim, 2006). However, the drought which struck the area during the last decades affected to a large extent the ecological balance leading to the disintegration of these production systems and increased desertification affecting the regenerative capacity of land (Elhadi 2009). In addition to drought gum production is affected by pest and disease problems, which result in several economic losses by killing of *Acacia* trees. Among them are the longhorned beetles. Accordingly this paper evaluates the effects of longhorned beetles (*Cerambycidae*) and drought on the production and sustainability of *A. senegal*. In

addition it identifies and analyzes the farmers' awareness about the longhorned beetles on *Acacia senegal*

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Material and Methods

The study was conducted in the north Kordofan state. This area is comprises a number of villages practicing farming. The farm households perform economics activities that combine crop farming, livestock razing and gum production. Kordofan state is located in the sub-saharan zone. Signs of degradation have been identified in the early 30's and the last 40 years have experienced several droughts with their significant effects on vegetation and animals. Pre-constructed questionnaire was used to collect transsectional data from respondents. The questions were focused mainly on personal characteristic, awareness and knowledge about the longhorned beetles, and the relative importance together with the effect of the longhorned beetles on *A. senegal* tree as well as its effect on gum production. Moreover, the questions focus on other related factors and problems of the longhorned beetles and the gum tree. Data about the effect of drought on the gum trees was also collected. Concerning the longhorned beetles 65 respondents of four locations in the gum Arabic belt in Northern Kordofan were interviewed. The four locations represent the gum Arabic belt in Northern Kordofan. Within each location 2 – 3 villages were visited to conduct the interview. The data were encoded, analyzed using SPSS statistical package (Version 15) and presented in descriptive statistics.

Results and Discussion

The results reveal that most of the respondents (95.4%) in the Northern Kordofan State stated knowledge about the longhorned beetles (Table. 1). Moreover, 55.4% of the respondents mentioned an effect of longhorned beetles by killing of the gum tree. 4.6% mentioned a reduction in gum production whereas 38.5% indicated both killing of the tree and a reduction of the gum production (Table 2).

Table 1 Gum farmers' knowledge about longhorned beetles

Do you know tree borers?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	62	95.4	95.4	95.4
	no	3	4.6	4.6	100.0
Total		65	100.0	100.0	

Table 2 Effect of longhorned beetles (borers) on gum tree

		How does borer affect the tree?			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	kill the tree	36	55.4	56.3	56.3
	reduce gum production	3	4.6	4.7	60.9
	1+2	25	38.5	39.1	100.0
	Total	64	98.5	100.0	
Missing	System	1	1.5		
Total		65	100.0		

On the other hand the study discovered the significant impacts of drought periods on the productivity and the sustainability of the gum tree. It resulted in a 90% reduction of gum and gum trees in the farmers' garden and consequently in desertification. The field survey of this study has identified many factors that contribute to the reduction in area of hashab garden (Table 3).

Table 3 Causes for Reduction in Area of Hashab Garden in the Study Area

Identified causes	% of respondents
Drought	49
Charcoal making & building materials	17
Pests	11
Expansion in agriculture	09
Gum price	08
Overgrazing	03
Effect of fire	03

Discussions

A lot of the respondents (49%) perceive that drought and related factors are the main causes for the reduction (Table 3)., 7% of the respondents relate the process to charcoal making and using of trees as building materials, 11% relate it to effect of pests, 9% attribute it to expansion in agriculture, 8% relate it to effect of decline and fluctuation of gum prices whereas overgrazing and effect of fire mention by 3% of the respondents for each.

Gum Arabic is primarily produced by small-scale farmers in traditional rainfed farming areas; large gum plantations represent less than 5 percent of the total production (Policy note, 2007). Most production occurs in the 'gum belt' proper of Central and Western Sudan, in sandy (goz) soils under water-scarce 'desert' conditions. In these areas, small farmers cultivate *A. senegal* in

scattered gum gardens or as part of a 15-25 year 'bush-fallow' rotation with other crops. In these systems, *A. senegal* serves a variety of valuable economic and ecological functions in addition to gum production, although there are large-scale private and public gum Arabic plantations in the Eastern Provinces (Barbier, 1992).

As reported by Jamal (1994) farmers were not aware of insect problems before the drought. The study of pests in northern Kordofan savanna can by no means be disassociated from the socio-economic and environmental setting of the farmers/communities living on the gum-Arabic production. Our survey results with gum land owners indicated their knowledge about the destructive tree borer, the longhorned beetles and its effect by killing the *Acacia* gum trees as well as reducing the gum production.

Jamal and Huntsinger (1993) mentioned that a survey executed in Northern Kordofan Province, starting in August of 1986, did uncover a great number of dead *Acacias* due to drought and pest attack, but from interviews with gum farmers it was concluded that the decline in gum production is largely due to unfavorable socioeconomic relationships exacerbated by the drought, leading to the deterioration of the agroforestry system of production.

Recommendations

1. Forest extension service need to work closely with farmers of gum belt to spread knowledge of *A. senegal* insect pests.
2. Efforts should be made by governmental and non governmental institutions to encourage farmers to regenerate and conserve gum trees and consequently improve the livelihood of the farmers.

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