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### THE ECOLOGICAL AND SOCIO-ECONOMIC IMPORTANCE OF FAIDHERBIA ALBIDA IN TAITA AND TAVETA, KENYA

Luvanda A.M., R. Wangeci, J. Nicholus, P. Mwendwa\*, D. Muchiri, and M. Sheikh

Kenya Forestry Research Institute, Kenya

\*Corresponding Author's Email: [mwesh92@gmail.com](mailto:mwesh92@gmail.com)

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**Abstract:** *Faidherbia albida* is a deciduous and indigenous tree species that is characterized by fast growth and grow up to a height of 30 m tall. The tree has received little management and research attention over the years leading to over-exploitation by the local communities. A study was conducted to identify and document the ecological and socio-economic importance of *F. albida* in dryland of Taita Taveta in Kenya. The County's ecological characteristics are influenced by relief and receive rainfall in March-May and October-December every year. Both primary and secondary data was collected and analyzed using SPSS and Excel computer packages. The findings show that *Faidherbia albida* is used to control soil erosion, fix nitrogen and provide fodder, timber and firewood. The species registered low and varying stocking densities of 15 and 3 trees in Taita and Taveta sub-counties respectively. The conservation of the tree species is as affected by pests and diseases and livestock damage. Therefore, farmers are encouraged to plant and conserve the tree species as a source of secure dry season fodder and fixing nitrogen aimed at minimizing the reliance on artificial fertilizers.

**Keywords:** *Faidherbia albida*, Fodder; Ecological; Socio-economic; Taita Taveta.

**Postal Address:** Kenya Forestry Research Institute, Dryland Eco-Region Research Programme P.O. Box 892-90200, Kitui-Kenya Tel: +254 702 893251

## INTRODUCTION

*Faidherbia albida* is a fast growing indigenous and deciduous tree that can grow up to a height of 30 m tall. It has branches which can erect to a roundish crown with a greenish grey to whitish grey leaves. The flowers appear from March to September maturing into fruit from September to December (Venter and Venter, 1996). *Faidherbia albida*, formerly known as *Acacia albida*, is one of the dominant tree species on farmlands in dryland ecosystem. It's a multipurpose tree that provides fodder and fuelwood, prevent soil erosion and promote biodiversity. The capacity of the land is improved where this tree is grown, because of the excellent leaf and pod fodder produced at a time when grass is scarce and nitrogen fixing abilities. *Faidherbia albida* occurs all across the African continent. It is believed to have originated in the Sahara before desertification. It is a riverine tree

of northern, eastern and southern Africa that was introduced through pastoralism and agriculture into western Africa, where it was only found on cultivated or previously cultivated land. In northern Africa it occurs in southwestern Morocco, Mount Massifs in the Sahara and along the Nile in Egypt. *F. albida* is the most commonly cited tree in the silvo-pastoral system in Sahelian Africa. Apart from its unique reverse phenology of shedding leaves during the rainy season, it improves the soil structure, stability and permeability, thus providing microenvironment favorable for crops (Adamu, 2012). Owing to its phenology, the tree provides abundant pods and leaves for livestock feed throughout the year. Animals are reported to eat the dry pods and leaves which contain an average of 12%-40% crude protein and 42%-65% nitrogen free extract (Wilson, 1990). It has been estimated that the mature tree of *F. albida* could produce 135 kg of

Pods with average value twice that of a good hay or dried peanut (Jung, 2000). Periodic slashing for animal to browse (looping) normally result in lower production of pods and leaves (Cochrain, 1998). Although leaves, small stems and bark contribute to the fodder value of indigenous trees, pods are by far the most important (Barrow, 1988; Bonkougou 1992; Timberlake, 1980; Timberlake, 1988). There is lack of information on methods of quantifying pod production from *F. albida* and other indigenous trees (Cisse and Kone, 1992).

Information on the age at which pod production begins and productivity of *F. albida* are highly variable. Pods of the species mature very slowly. Jung is reported by Cisse and Kone, (1992) to have recorded fruit production of 125 kg from a tree of crown surface 230 m<sup>2</sup> in Bambey, Senegal, and 135 kg in Sudan (Cisse and Kone, 1992; Jung, 2000; Timberlake, 1980). According to Bonkougou, (1992), economic interest in the species dates back to the early 1950s, although research was not initiated until 1966. Initial research on the species focused on its contribution to improved yields of cereal crops such as millet, maize, and wheat, grown in association with the tree in Sudan and Sahelian zones of Ethiopia, Malawi and Niger (Bonkougou, 1992; Cisse and Kone, 1992; Edwards, 1982; Poschen, 1986). In the late 1970s and during much of the 1980s interest in the tree shifted to seed collection and the creation of seed banks to build up the genetic resource base for trial establishment (Bonkougou, 1992). *Faidherbia albida* has a remarkable capacity for recycling nutrient from underground to the surface due to its very deep root system (Le Houerou, 1980). The tree does not compete with crops for soil nutrients as it enters a period of physiological rest during the normal crop-growing season (ICRAF, 1989). The tree also stabilizes sand dunes and prevents soil erosion (Dancetta and Paulain, 1969). In addition, increase in yield from crops grown below the tree has been attributed to increase in fertility due to nitrogen fixation, dung from livestock browsing and falling leaves and pods (Radwanski and Wickens, 1969). Its seeds soaked overnight in boiled water before sowing. The swollen seeds are viable for sowing in river

sand. The seeds are covered with a layer of sand the same size as the seeds. The seeds germinate after 2-5 days and develop a long tap root ready for transplanting directly into the garden. The correct time to transplant the seedlings is when they have reached a height of 50 mm. Young trees are mostly attacked by white Australian bug that can be treated with systematic insecticides (Joffe, 2001).

Despite the fact that *F. albida* is an important component of the traditional farming systems in arid and semi-arid zones of Africa, its establishment in these areas is often difficult. In semi-arid Baringo county of Kenya where the entire annual precipitation occurs in less than one quarter of the year, soil erosion is a serious problem. Therefore, planting of fast growing, drought tolerant, nitrogen fixing tree species is an important soil conservation and fertility restoration strategy. Increase in yield from intercropping has been attributed to increased fertility due to nitrogen fixation, dung from stock browsing and fallen leaves and pods (Radwanski and Wickens, 1967). Under a full canopy (100-150 trees per ha) the trees can provide nutrients equivalent to 3000 kg per ha per year of Magnesium (Dancetta and Poulain, 1969). The species occurs as scattered individuals in a wide range of habitats, ranging from the vegetation on alluvial soils in perennial or seasonal water-courses to open Savannah wood and cultivated lands. This tree is particularly valued in agricultural areas for its unusual habit of retaining leaves during the hot weather and dropping them during the rainy season. The pod and leaf fall, together with the dung and urine of cattle that seek the shade of trees in hot weather, improve the nutrient status and organic content on the soil near established trees, so that yields of sorghum and other agricultural crops cultivated during the rains are considerably increased. It is among the most preferred species by farmers in ASAL regions because of its nitrogen fixing, shade abilities and fodder providing roles. *Faidherbia albida* is a dry land species used mainly for fodder. The tree has received little management and research attention over the years resulting from over-exploitation by the local communities in Kenya. This is attributed to the fact that the various environmental services provided by the

tree are not well understood. It has a variety of uses and it is locally endangered due to irrigation farming activities taking place in its natural range. Therefore, the main objective of this study was to understand the ecological and socio-economic importance of growing *F. albida* in Taita Taveta County. The following specific objectives were addressed: to assess the socio-economic characteristics of the local communities; to identify the ecological and socio-economic characteristics of *F. albida*; and to identify the challenges facing the conservation of *F. albida* in Taita Taveta County.

## EXPERIMENTAL

The study was undertaken in Taita Taveta County (Figure 1). The County's climatic conditions are characterized by relief. The Taita Hills, which cover an approximate area of 1,000 Km<sup>2</sup>, rise to a maximum elevation of 2,208 meters above sea level at Wuria peak. The County experiences the long rains between March and May while the short rains come between October and December. Rainfall distribution is uneven, with the highlands receiving higher rainfall than the lowland areas. The mean annual rainfall in these hills ranges from 500 mm in the lowlands to over 1,200 mm in the upper mountain zone. The average temperature in the County is 23°C, with temperatures getting as low as 18.2°C in the hilly areas (Taita, Mwambirwa and Sagalla), while on lower zones, temperatures rise to about 25°C (Government of Kenya, 2013).

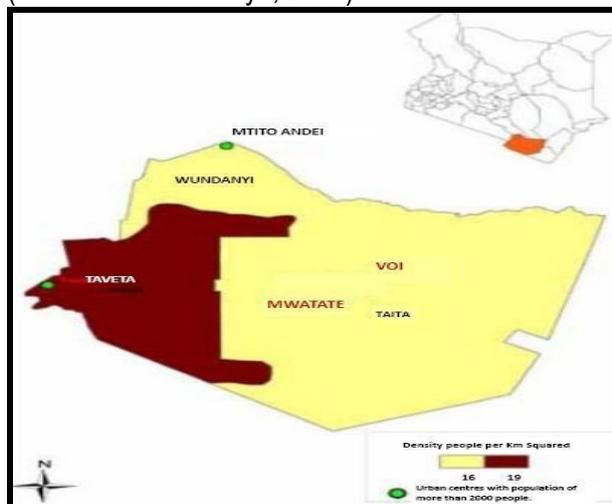


Figure 1: Location of Study Area

Source: Kenya Mpya

During the population census of 2009, the population of Taita Taveta County was 284,657 (Republic of Kenya, 2009) comprising of 139,323 females and 145,334 males. The County population was projected to increase to 306,205 in 2012 comprising of 149,869 females and 156,336 males. Further projections indicated that the total County population would increase to 329,383 and 345,800 in 2015 and 2017 respectively. Data was collected during a field survey to assess the importance of *F. albida* in Taita Taveta. Both primary and secondary data was collected to complement each other. Primary data was gathered from 36 randomly selected households from Taita Taveta County. Either spouse or a child aged over 14 years was interviewed using a structured questionnaire. Secondary data was collected from related studies and government departmental reports. The subjects covered under the questionnaires included economic activities of the study area, knowledge on *Faidherbia albida* management, intercropping abilities, its natural range, unique characteristic of managing the tree species, phenology and local uses, propagation and pretreatment methods and limitations on growth of the tree species. Collected data was analyzed using SPSS and Excel computer software packages. All the data collected was summarized and subjected to descriptive statistics involving computation of sums and means. This process permitted the production of summaries by use of graphical and tabular formats.

## RESULTS AND DISCUSSION

### Socio-economic characteristics of Local Community in Taita Taveta

The Taita and Taveta communities were involved in a number of income generating activities. The main economic activities were livestock production (37%) and farming (35%). A considerable number of people earned wages (10%), traded in tree products (10%) and businesses (8%). The income per capita was Kshs 3526.00 for Taita Taveta County (ASDSP, 2014).

**Ecological characteristics of *F. albida* in Dry Land Regions:** *Faidherbia albida* was characterized by its drought resistance, adaptations and multipurpose uses (Figure 2).

*Faidherbia albida* is well intercropped with cowpeas, maize and beans. The tree is also suitable in soil erosion control and nitrogen fixing. *Faidherbia albida* has a reversed phenology whereby it sheds leaves during the rainy seasons and regains its leaves during the dry season, which is an adaptation in the dry lands. It mostly grows in waterlogged areas and has root coppicing ability suitable in marshy areas like along the river beds.

**Uses of *F. albida* in Dry Land Regions:**  
*Faidherbia albida* is used for firewood, shade,

fodder, bee forage, timber, fencing, wind breaks, and bee hive making (Figure 3). Most of the respondents used *F. albida* for firewood to meet their energy needs and as fodder for their livestock. Timber from *F. albida* was commonly used for income generation as well as domestic purposes. A number of respondents used the tree species for bee forage, bee hive making and placement of bee hives. *Faidherbia albida* further provided environmental services such as shade, windbreaks and fencing of homesteads and farms.

Table 1. Stocking densities of *F. albida*

District		Trees per hectare	Height (m)	Density per breast height (cm)	Volume of trees per hectare
Taita	N	13	13	13	12
	Mean	<b>15.85</b>	20.50	76.47	85.7225
	Minimum	1	7	18	.77
	Maximum	100	27	127	696.28
Taveta	N	13	12	12	12
	Mean	<b>3.38</b>	22.48	97.28	37.1133
	Minimum	1	13	27	.58
	Maximum	10	29	138	124.06
Total	N	26	25	25	24
	Mean	<b>9.62</b>	21.45	86.46	61.4179
	Minimum	1	7	18	.58
	Maximum	100	29	138	696.28

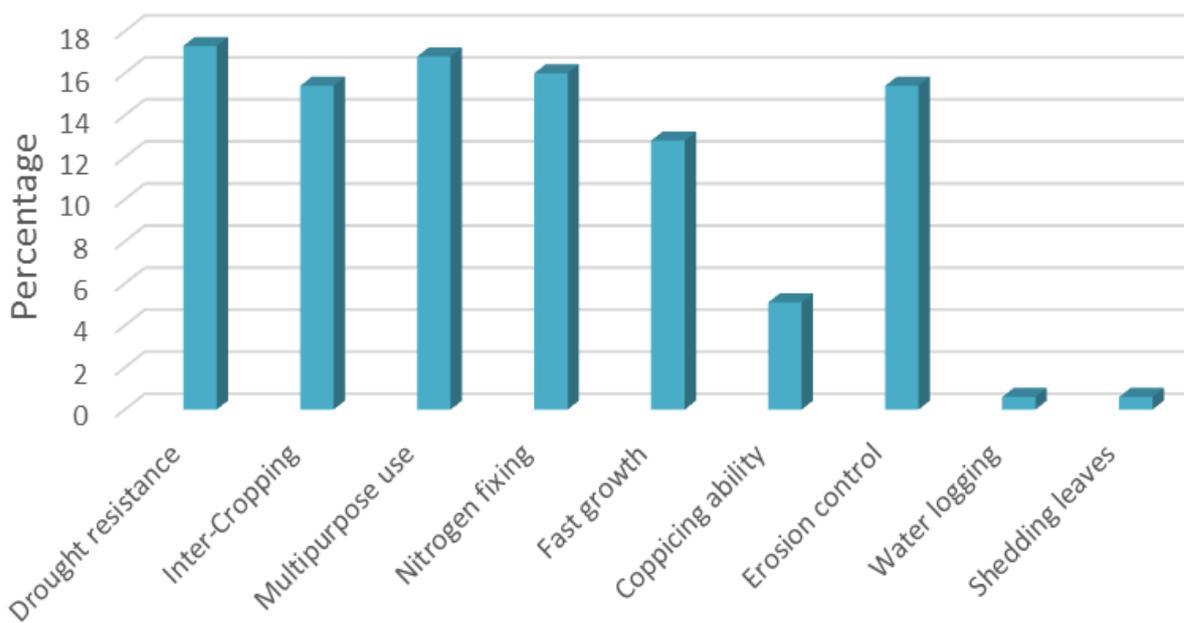


Figure 2. Ecological Characteristics of *F. albida* in Taita Taveta County

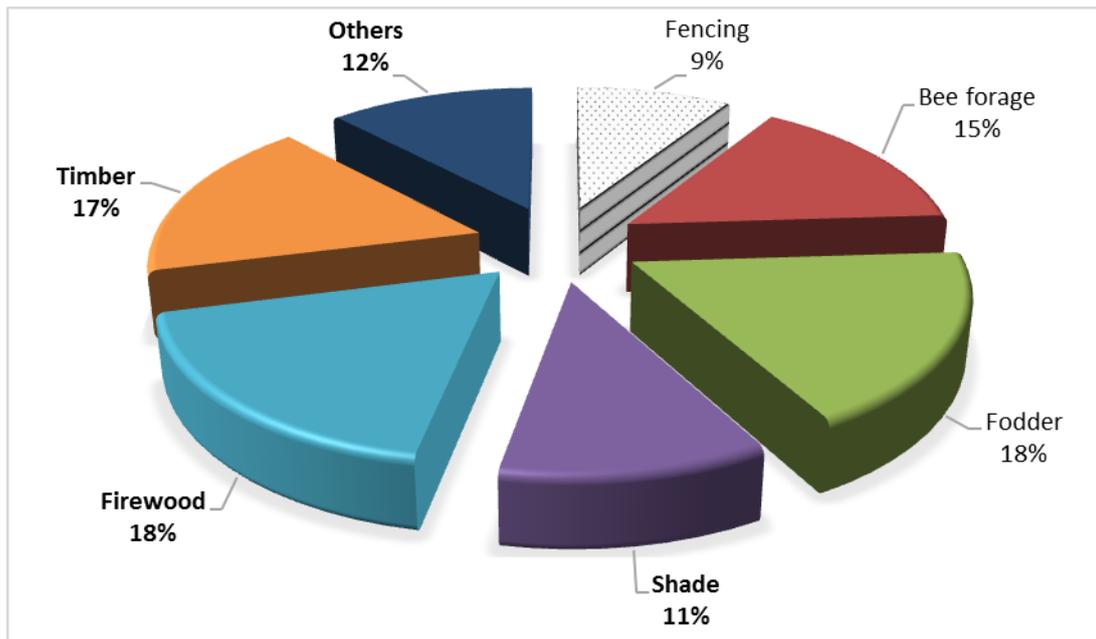


Figure 3. Uses of *F. albida*

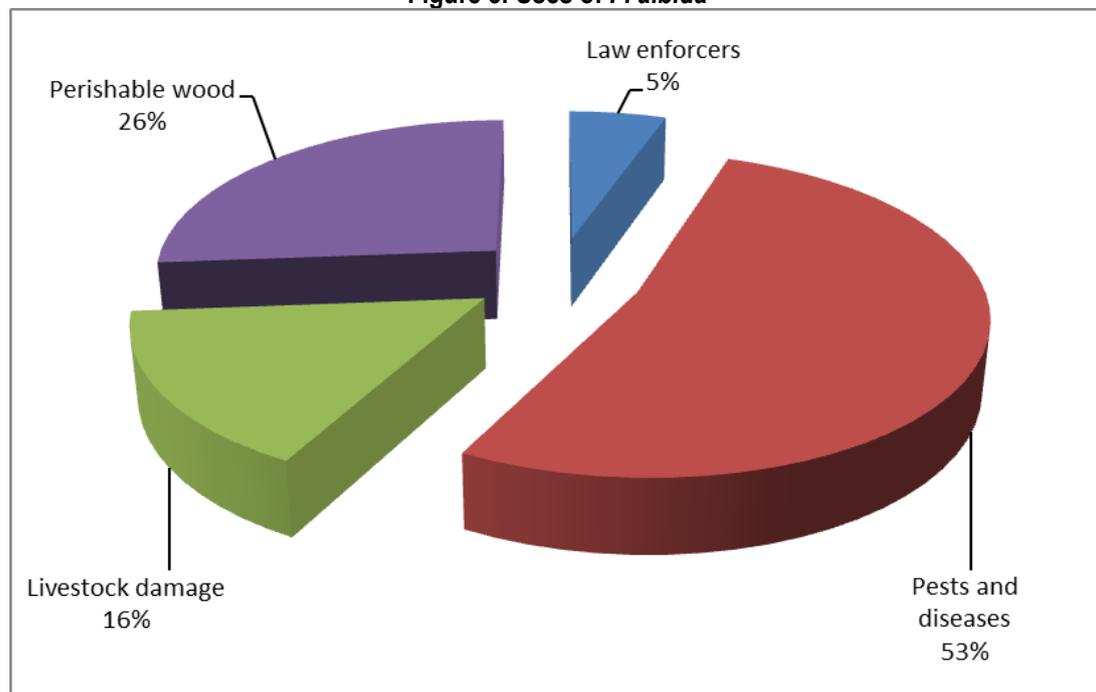


Figure 4. challenges facing the exploitation of *F. albida*

**Importance of *F. albida* as a Fodder species:**

*Faidherbia albida* is mainly used as a fodder species. This tree species produces big size pods suitable for livestock feed. The livestock mostly camp under the tree and feed on the pods that fall down. Just a few of the pods are sufficient for the livestock as compared to hay in terms of bulkiness and nitrogen content. Since this is a dry area where pasture is scarce, this tree species is the most suitable substitute as a fodder species in livestock production. *Faidherbia*

*albida* was found to be widely distributed in the Taita and Taveta County, on average Taita had a biomass of 76.47 m<sup>3</sup> per hectare and Taveta registered an average of 97.28 m<sup>3</sup> per hectare. Generally, on average the two sub counties had a mean biomass of 61.4179 per hectare. Trees in Taita Sub County were also widely spread than Taveta with a mean of 15 trees per hectare while Taveta had a mean of 3 trees per hectare bringing the total mean in the two districts to 9 trees per hectare (Table 1). This tree density fall

short of the full canopy density of 100-150 trees per ha as reported by Dancette and Poulain, (1969).

**Challenges facing *F. albida* in Taita Taveta County:** The challenges facing the management and conservation of *F. albida* were pest and diseases (52.6%), susceptible to rotting (26.3%), livestock damage attributed to browsing by feeding on the leaves and bark exposing the tree to diseases (16.6%) and poor enforcement of by-law governing the exploitation of tree resources (5.3%).

## CONCLUSION

The main economic activities of the study area are livestock and crop production under the agro-pastoral land management system. It is important to encourage the local communities to take part in increasing tree cover using *F. albida* due to their environmental and economic importance. *Faidherbia albida* is a fast growing and multipurpose tree species in the dry lands of Kenya known for firewood, timber and fodder, soil erosion control and nitrogen fixing) making it suitable source of income for livelihoods improvement. *Faidherbia albida* registered low and varying stocking densities of 15 and 3 trees in Taita and Taveta sub-counties respectively. *Faidherbia albida* is known for its shedding of leaves during the rainy seasons and regaining the leaves during the dry seasons, which is an adaptation strategy. This tree is intercropped with maize, cowpeas, beans and green grams with minimal competition for the water and nutrients. The continued conservation of *F. albida* is limited by its perishable wood and susceptibility to pests and diseases which attack the tree. Therefore, it is recommended that local communities are encouraged to domesticate *F. albida* for improved livestock fodder needs. The farmers should be encouraged to intercrop due to its nitrogen fixing abilities and reduce their reliance on artificial fertilizers. This activity will also help in increasing the forest cover in the county hence reduce global warming and mitigating climate change. The developmental partners are sensitized on the importance of the tree due to its drought tolerance and fodder provision for livestock. An integrated pest management approach should be implemented to tackle and

handle this menace. Finally, provide information on age of tree and quantity of pods production.

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