

Dominant Tree Species for Increasing Ground Cover and their Distribution in Siaya County, Kenya

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Abstract – Climate change resulting from global warming is currently one of the global environmental issues of concern. Trees play a very important role in mitigating this problem through sequestering carbon dioxide which is one of major green house gases. The importance of trees is incontestable; they have many environmental, social and economic benefits, therefore, effective community participation can be an important strategy in ensuring adequate tree cover. In Kenya, environmental degradation occasioned by low tree cover is evident. The current tree cover in the study area is approximately 3% which is far below the recommended national level of 10%. It was important for a study to be carried out to establish the tree species (indigenous and exotic) available in the study area with a view to knowing the tree types that can be given priority when increasing tree cover. Therefore, the objective of this study was to determine the dominant tree species which can be used to increase groundcover and their distribution in Bondo and Siaya sub-counties, Siaya County. This study employed a cross-sectional survey research design. Reliability of 0.710 was realized when pilot tested. A total of 120 household heads were interviewed of which 67% were women and 33% were men. Data analysis used Statistical Package for Social Sciences (SPSS) software for qualitative data, resulting in tables, numbers and percentages. The study concludes that common indigenous tree species are; *Cassia siamea* (Obino), *Markhamia lutea* (Siala), *Acacia* spp (Ali/Laktar/Kudho), *Euphorbia tricullis* (Ojuok), and *Albizia zizyia* (Otur-bam) and for the exotic tree species in the area are; *Thevetia peruviana* (Achak/Maua), *Eucalyptus* spp (Bawo/ Kaladal/ Nyar-maragol), *Grevillea robusta* (Bole bole), *Mangifera indica* (Mawembe) and *Ocotea americana* (Avocado). Any planned increase in ground cover should give the identified species of trees priority for they have adapted themselves to local climatic conditions.

Keywords – Dominance, Distribution, Indigenous Trees Species, Exotic Tree Species.

I. INTRODUCTION

Tree growing involves planting and caring of tree germplasm for farm forestry, land reclamation, agro-forestry, woodlot and landscaping purposes. Different types of trees that grow in Bondo and Siaya districts in Kenya include: woody trees, fruit trees, herbal plants and ornamental trees, among others. Trees are useful in many ways as they filter pollution from the air, help recycle water, prevent soil loss, create shade, give shelter from wind and rain [1], [2], [3]. Tree planting in the farms directly diversify the productivity of the farm making the ecosystem more resilient and sustainable therefore improving the standard of living of the family [4]. In addition, it reduces the time taken by women to go to the forest to collect firewood and reduce the strain and

dangers that they are exposed to while in the forest [5]. Indicators of low tree coverage in the study area are; serious surface run-off, siltation of dams, rivers and lakes, high turbidity of water bodies after rainfall, presence of gullies, charcoal burning, open grounds, drying of springs, heavy brick making, shrinking of water bodies and increased distance covered by women while collecting firewood [6], [7], [8]. In Kenya, this problem is even more evident as a result of low tree canopy cover which has declined from 3% to 1.7% in the last decade due to human factors. 1.7% is very low compared to the international figure of 10%. Locally in Tree coverage in study area of Bondo and Siaya districts is 3% and 2.8% respectively [8].

Benefits of trees in the environment include, improved air quality for they are effective in pollution reduction, help anchor soil and reduce storm run-offs, saving the high costs of draining ditches, storm sewers, and other engineered solutions. Trees can play an important role in deadening unwanted noise, increasing soil fertility, conserving important soil nutrients, shortening the distance while looking for firewood, and has apposite impact on both crops and livestock. Sound waves are absorbed by tree leaves, branches and twigs [9], [10], [11]. It also results in social mobility and increases diversity resulting in greater economic opportunities [12]. The environment is also related to quality of life expectancy in terms of its impact on the incidence and spread of air and water borne diseases. The effective management of the environment and the prudent utilization of natural resources are critical in fostering sustainable development [13].

Studies have shown that planting trees between crops and around land plots can help prevent soil erosion, restore soil fertility and provide shade, thereby offsetting some of the effects of climate change [14]. By planting faster growing trees, shrubs, on fallow land, farmers help the soil to retain more water. Agro-forestry also contributes to climate change mitigation, since trees and shrubs absorb more carbon than other crops. The IPCC reports that agro-forestry has the potential to sequester nearly 600 million tones of carbon dioxide a year by 2040. Trees help maintain production during excessive or poor rainfall. Their deep roots system can explore a larger soil volume for water and nutrients during drought [14].

Agro-forestry is an importance carbon sequestration strategy because of carbon storage potential in its multiple plant species and soil. Average carbon storage by agro-forestry practices has been estimated as 9, 21, 50, and 63 Mg C per hectare in semi-arid, sub-humid, humid and temperate regions respectively [15]. Agro-forestry is

frequently invoked as a solution to problems of land and water degradation as well as an answer to shortages of fuel wood, cash income, animal fodder and building materials in Sub-Saharan Africa. It is important to note that agro-forestry is only one of the several approaches for improving land use in any given situation. The promise of nitrogen fixing trees for improving soil fertility in crop land and pastures, role of wind breaks, higher protein tree fodder for livestock and given the fact that agro-forestry practices are appropriate for a wide range of places with in the landscape, not just for crop land and pastures makes agro-forestry a very relevant entry in restoring degraded environment [16], [17]. Fodder trees contain high levels of digestibility. They are readily accepted by livestock and presumably because of their deep-root systems, they continue to produce well into the dry season. However, antinutritive factors can be a problem in some species [18].

The specific objective of the study was to determine the dominant tree species and their distribution in Bondo and Siaya sub-counties, Siaya County. The outcome of this study was to guide in choice of trees for increasing tree cover ie both exotic and indigenous trees. Bondo and Siaya districts fall in ecological zone IV mainly and climate condition of the semi-arid areas put the two districts in high demand on farm water management. Environmental conservation if properly done will ensure increased soil-water content, supply, retention and both crop and livestock yield significantly. Water harvesting and soil moisture retention are cheap and have successfully been used in dry land farming scenarios around the world [19]. According to [20], environmental protection has been achieved through tree planting, including soil conservation, sustainable management of the local environment and economy, protection and boosting of local livelihoods

Medicinal plants in particular are often the original materials of herbal medicine. Kinds of herbal medicine are raw plant materials, processed plant materials and medicinal herbal products [21]. Examples of these trees in Luoland include *Cassia siamea*, *Cassia didymobotrya*, and *Tamarindus indica* among others [22]. Most patients in Kenya rely on traditional herbal medicine even when conventional doctors, give them prescriptions. The continent's pharmacists make up only one percent of the worlds total. In Kenya, lack of access to hospitals due to poverty and distance as well as culture fuelled the use of traditional medicine. According to the World's Health Organization, 80% of Africans depend on traditional herbal medicine [23].

II. MATERIALS AND METHODS

Description of Study Area: Siaya County lies between latitude $0^{\circ} 26^1$ to $0^{\circ} 28^1$ north and longitude $33^{\circ} 58^1$ east and $34^{\circ} 33^1$ west with total surface area of the county is 1520 km^2 . It has six sub-counties namely; Ugunja, Yala, Ugenya, Siaya, Bondo and Rarieda. The county borders Busia county to the north, Kakamega county to the north eastern, Vihiga county to the east, Kisumu county to the

south east, with Lake Victoria to the south and west. The study location was Bondo and Siaya sub-counties. Bondo sub-county was divided into eleven locations found in three administrative divisions namely; Nyangoma, Usigu and Maranda with land surface area of 593 km^2 [24]. while Siaya sub-county was divided into ten locations contained in three administrative divisions namely; Karemo, Boro and Township with land surface area of 605.8 km^2 . Altitudinally, the sub-counties ranges from 1140 m.asl to 1200m.asl with equatorial type of climate. Fertility of soils here range from moderate to low resulting in most soils being unable to produce without the use of either organic, inorganic, or in most cases both types of fertilizers. Most of the areas have underlying murrum with poor moisture retention [6].

The study employed a sociological survey design which allows collection of information from a population with the purpose of making inference about the targeted group in a more objective way [25]. This type of study utilizes different groups of people who differ in the variable of interest but share other characteristics such as socio-economic status, educational background, and ethnicity. This design took a 'slice' of the targeted group and allows basing of overall findings on their views of those targeted assuming them to be typical of the whole group. It gives a snapshot of information, quick and cost effective [26].

The study area is dominated by indigenous trees like *Balanites* spp, *Acacia* spp, *Grewia vilosa*, *Albizia coriaria*, *Diospiros abyssinica*, *Euphorbia triculli*, *Markhamia lutea*, *Cassia siamea*, *Candelibrum* spp, etc while common exotic trees are *Eucalyptus* spp, *Thevetia peruviana*, *Casuarina equistifolia*, *Croton* spp, *Leuceana leucocephala*, *Jacaranda mimosifolia*, *Grevillea robusta*, etc [8]. The abundance and diversity of trees increased towards the upper parts of the study area and this is attributed to the fact the upper parts experience more reliable rainfall, soils are relatively fertile and less interference from termites compared to the lower parts of the study area. The various plant species have also adapted to local environmental conditions prevailing. Ecologically, the sub-counties spread a cross agro-ecological zone LM_1 to LM_3 [27]. Women are the ones who are often tend the farms when men either do off-farm work or do fishing or in towns seeking formal employment [28]. The most affected group is women. Faced with unreliable farming conditions, many people especially women look for alternative source of livelihood such as charcoal burning and selling of fire wood leading to environmental degradation [7].

Secondary data was obtained from Government reports, non-governmental reports, Journals, and Internet. Primary data was collected from 120household heads that were identified during chief's barazas. Every location was represented by 4 women and 2 men all of whom had their own homes. Total locations from the two sub-counties were 20 i.e. 10 locations from each. The dominant types of trees were identified during the interview and the extent of spread in the study area was noted. [29] recommend a minimum of 100 subjects for descriptive studies. A structured questionnaire was for household heads.

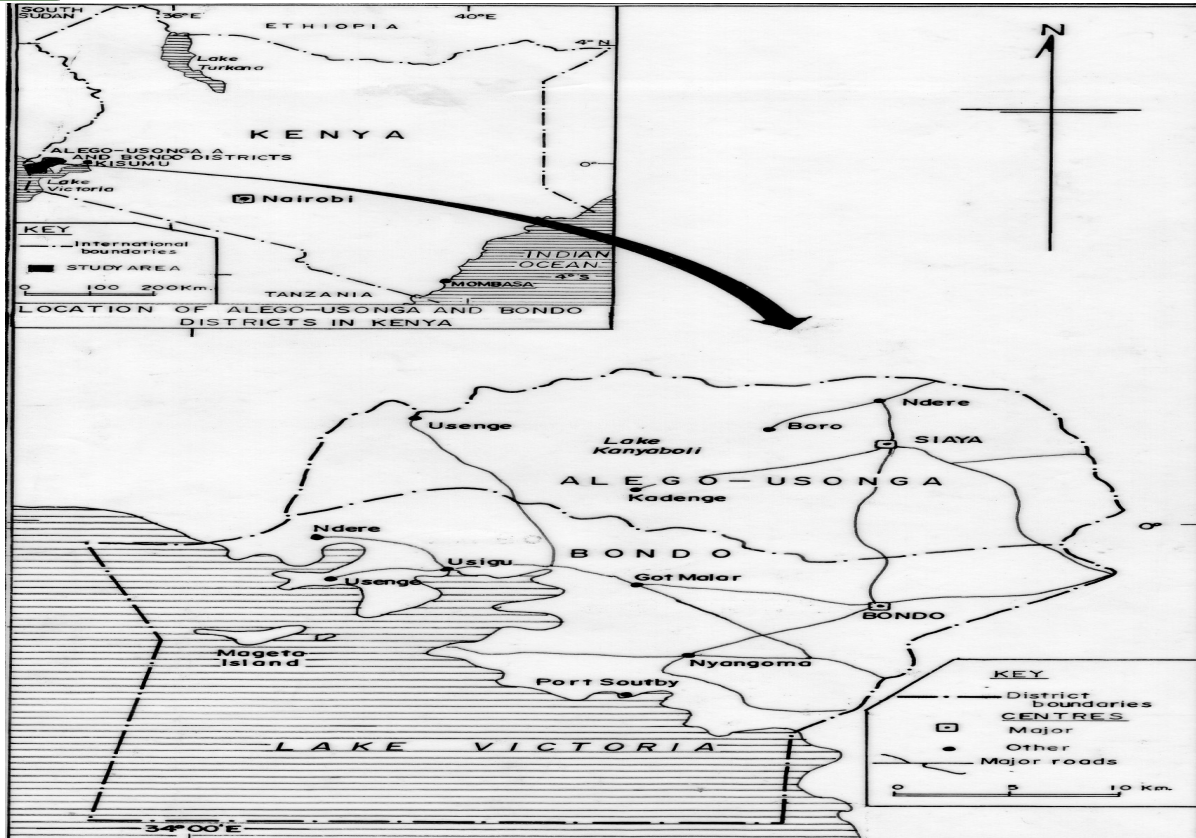


Fig.1. Map of Bondo and Siaya Sub- Counties, Source: Bondo / Siaya Districts Development Plan 2010

III. DATA ANALYSIS

Before primary data collection started, pilot-testing was carried out in a different county occupied by the same Luo community mainly i.e. Kisumu East district. Respondents were 44 household heads, 7 key informants and 2 women groups. All were identified during various chief's barazas and the latter were from District Gender and Social Development Officer (DGSDO). The results after pilot testing gave a figure of 0.710 which was a good estimate of reliability of the instruments for they were above the minimum threshold recommended. When the reliability

estimate is closer to 1.00, the instruments used are good as recommended by [29].

Qualitative data were generated and Statistical Package for Social Science (SPSS) soft ware and content data analysis were employed resulting in numbers, percentages, and tables.

IV. RESULTS AND DISCUSSIONS

This was important to determine because dominance and distribution of certain tree species can be influenced by different factors. The findings are in Tables 1 and 2 showing their dominance and distribution.

Table 1: Ten dominant indigenous tree species and their distribution

Scientific name	Common name	Local name	Rate of occurrence in homes	Distribution in %	Main uses
1. Markhamia luteau		Siala	94	23.6	building, agro-forestry
2. Albizia coriaria		Ober	49	12.25	Furniture
3. Euphorbia triculli	Finger euphorbia	Ojuok	32	8.18	Fencing
4. Mangifera spp		Mawembe	30	7.5	Fruit
5. Lannea schweinfurthii		Kuogo	27	6.75	herbal, firewood
6. Cassia siamea	Iron wood	Oyieko	19	4.75	Building, shade
7. Combretum spp		Keyo	19	4.75	Windbreak, firewood
8. Spidium guajava	Guava	Mapera	15	3.75	Fruit, firewood
9. Grewia trichocarpa		Powo	14	3.5	Building, firewood
10. Diospiros abyssinica		Ochol	9	2.25	Herbal, shade

Source: Author's survey, 2012

Table 2: Ten dominant exotic tree species and their distribution

Scientific name	Common name	Local name	Rate of occurrence in homes	Distribution in %	Main uses
1. Eucalyptus spp		Bao	86	22.4	Building
2. Grevillea robusta		Bole	63	16.38	agro-forestry
3. Thevetia peruviana	Yellow oleander	Chamama	42	10.92	Fencing, shade, firewood
4. Cyperus spp			39	10.14	Furniture
5. Jacaranda mimosifolia	Brazillian rosewood	Jakaranda	38	10.13	Shade
6. Avocado		Abakado	24	6.24	fruit, firewood
7. Terminalia brownie		Umbrella	20	5.2	Shade
8. Pinus spp		Pine	10	2.6	Furniture
9. Leuceana leucocephala	Leuceana	Lukina	9	2.34	Agroforestry
10. Azandiritcha indica	Neem tree	Arobaini	8	2.08	Herbal

Source: Author's survey, 2012

From the types and distribution of trees, respondents prefer trees with multiple benefits that can be realized at home levels especially those providing building materials, herbal, firewood, wind breaks and improving soil fertility. The trees are also the ones that have survived under harsh environmental conditions characterized by high temperatures, low and poorly distributed rainfall, and soils with varied fertility levels. The major problem with these local types of trees is that they have slow growth rates thus making profit from their sales take along time to be realized. Because of low fertility levels, exotic trees which can add elements like nitrogen, phosphorous, and other soil enriching elements are given priority. The exotic tree types have the advantage of growing faster and if done on commercial basis, then farmers can benefit. The findings of the study agrees with [14] that planting trees between crops and around land plots can help prevent soil erosion, restore soil fertility and provide shade, thereby offsetting some of the effects of climate change. By planting faster growing trees, shrubs, on fallow land, farmers help the soil to retain more water. The first specific objective was realized by identifying ten common indigenous and exotic trees

CONCLUSION

Indigenous trees common in the area are; Cassia siamea (Obino), Markhamia lutea (Siala), Acacia spp (Ali/Laktar/Kudho), Euphorbia triculli (Ojuok), and Albizia ziyia (Otur-bam) and the exotic tree species common in the study area are; Thevetia peruviana (Achak/Maua), Eucalyptus spp (Bawo/Kaladal/Nyarmaragol), Grevillea robusta (Bole bole), Mangifera indica (Mawembe) and Ocotes americana (Avocado).

RECOMMENDATION

For increased tree cover, the common trees identified (both indigenous and exotic) should be given priority

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