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Woody composition of Tangaza north forest reserve in Sokoto state, Nigeria

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ABSTRACT

*Biodiversity assessment was conducted at Wassaniya Forest Reserve in Tangaza Local Government Area of Sokoto State (Figure 1). The study area was divided into four main plots purposively selected based on vegetation density and human interference. Three sample plots each with an area of 0.5ha were randomly selected and demarcated at each main plot, serving as the replicates. Point center quarter method was used in assessing the vegetation. Data collected include: distance from the center point, tree heights and diameter at breast height. In conclusion it was evident that some woody species were more established than others, some were taller, while others were higher in dominance than others. The well established species were not necessarily the indigenous; suggesting that introduction of exotic species (*Khaya senegalensis*) can be successful. We were opportune to learn the effects of human interference with regards to environmental degradation. Finally it was recommended that Government should revive forestry laws, more forest guards should be employed and must be empowered to enforce forest protection laws, establish more forest reserves so that more forest products can be harnessed.*

Key words: Biodiversity, vegetation density, dominant species, ecosystem, Desertification.

INTRODUCTION

The earth surface is full of diversity of life forms which ranges in size from the microscopic to the giant multicellular organisms. These organisms live in a natural ecosystem where their continued existence is guaranteed with the availability of water, air, sunlight, food and nutrients [6]. Plants are able to derive energy directly from the physical environment and produce carbohydrates (by photosynthesis) upon which all other biotic forms depend upon whether directly or indirectly. Trees are such vital components of the ecosystem that have productive, protective and recreative function. They control soil erosion, stabilize regional and global climates; provide carbon sinks, and acts in pollution control [1].

The extent to which forest trees are being exploited calls for urgent attention [9]. The world forests are diminishing rapidly and each year about 294,020 square kilo meters of forest disappear [5]. The supply of forest products to the neighboring inhabitant for consumption by the larger society has diminished over the years [4]. The rural community which was hitherto dependent on the forest resources had recess due to reduced availability of the resources.

MATERIALS AND METHODS

The point centered quarter method sampling procedure was used in data collection [8]. Four quadrants around each point were marked 1, 2, 3 and 4. The woody species had been identified and compiled [7]. Distances from the center point were measured using tapes (100m, 50m); the circumference of each identified tree species was measured using tailors tape and was used to calculate the diameter. Tree height was measured using Spegeal relascope and canopy spread was calculated [1&9].

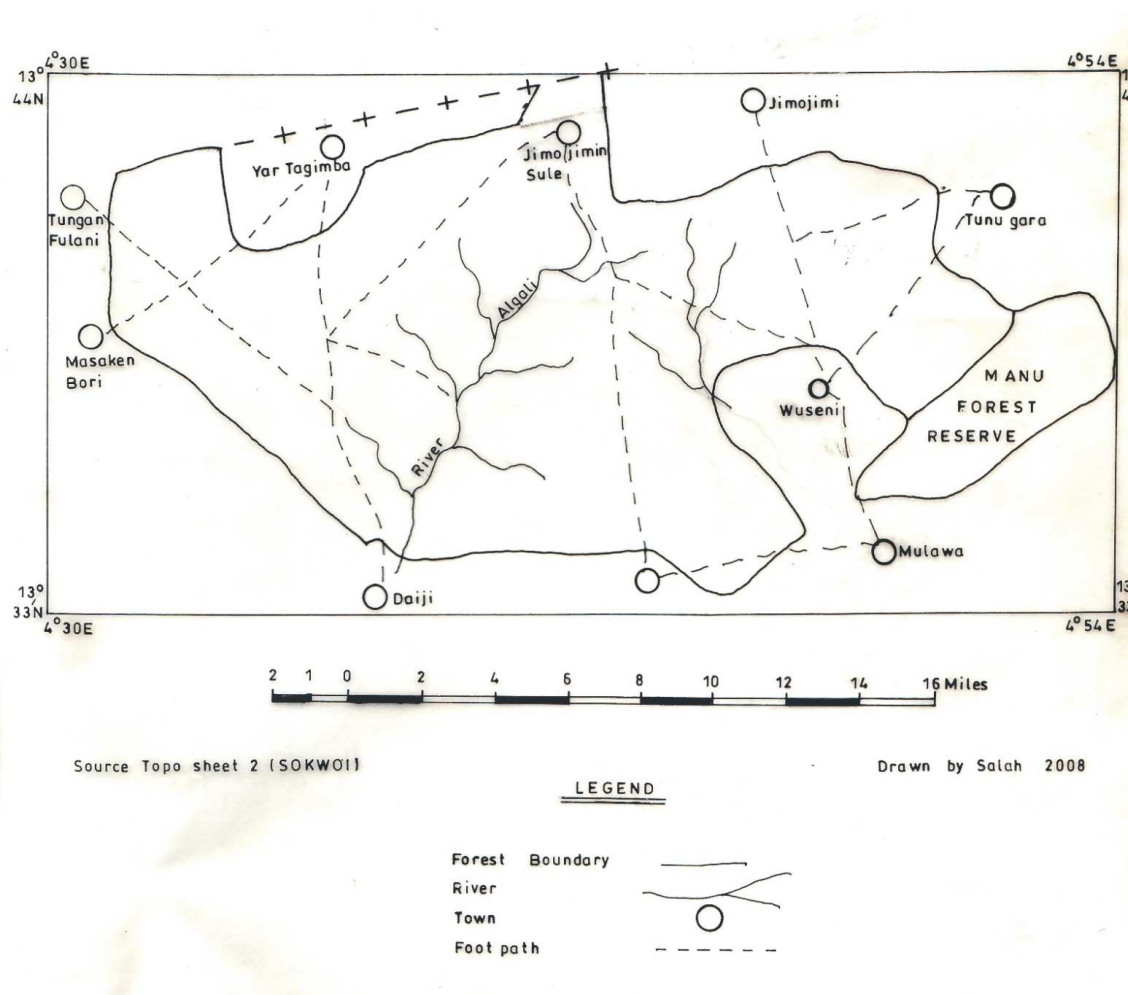


Figure 1 Showing: Map of Tangaza North Forest reserve

RESULTS

Distances of Trees from the Center Point (DCPm)

Tree species identified at different distances at Center points (DCP) from all the four sample sites are presented in Table 1. There was no significant difference in distances at center point

between the four locations in the study area ($P > 0.05$). The result shows that *Mitragyna inermis* (28.75) at Wassaniya had the longest (DCP); it was followed by *Lannea microcarpa* (23) at Jimajimi, *Combretum geitonophyllum* (22) at Wassaniya, *Grewia mollis* (22) at Jimajimi, *Guiera senegalensis* (21) at Yartagimba, and then *Combretum micranthum* (20.92) at Daiji. Tree species with very short distances from the center point includes *Combretum micranthum* (0.36) *Guiera senegalensis* (0.44) at Wassaniya. These were followed by *Balanites aegyptiaca* (1) at Daiji, *Dichrostachys cinera* (4) and *Mimosa pigra* (5) at Yartagimba and then *Faidhebia albida* (5.25) at Jimajimi.

Number of Trees (NT m)

Table 1 showed Number of trees at each location from the research area, out of the (37) different species encountered from the four sites, twenty (20) different species were found at Wassaniya and Yartagimba, fifteen (15) species were found at Daiji, while Jimajimi had the least number of (13) species. The tree species with highest concentration were *Combretum micranthum* (199), *Pterocarpus erinaceus* (26) and *Combretum nigricans* (24) at Wassaniya and *Gueirra senegalensis* (98) at Daiji. There was no significant difference in number of trees (NT) between the four locations in the study area ($P > 0.05$). Trees with lower concentration includes: *Diospyros mespiliformis* (1) at Daiji, *Khaya senegalensis* (1) and *Faidherbia albida* (1) at Daiji, *Calatropis procera* (2) at Jimajimi, *Vitex doniana* (2), *Feretia apondanthera* (2) and *Bauhinia rufescens* (3) at Yartagimba.

Diameter at Breast Height (DBH cm)

Table 2 showed the Diameter at Breast Height of all the species encountered from the research area. Significant difference was found in (DBH) between the four locations ($P < 0.05$). *Khaya senegalensis* had the largest diameter at breast height of 99.54 at (Daiji), it was followed by *Boscia salicifolia* (41.11) at Wassaniya, *Pteolepsis habeensis*, *Parkia clappertoniana* at Yartagimba, *Terminalia avicenoides*, *Azardirachta indica* and *Diospyros mespiliformis* at Daiji, each had a (DBH) of 31.84. Tree species with lower diameter at breast height includes *Guiera senegalensis*, (7.01), *Grewia mollis* (4.14) and *Zizyphus abyssinia* (10.83) at Yartagimba and *Mimosa pigra* (7.01) at Wassaniya.

Tree Heights (TH)

Difference in tree heights measured in meters (m) was shown in Table 2. (TH) was statistically different between the four locations ($P < 0.05$). Out of the (37) species encountered at the research area *Khaya senegalensis* at Daiji was the tallest (42), it was followed by *Boscia salicifolia* (35) at Wassaniya, *Diospyros mespiliformis* (32) and *Terminalia avicenoides* (32) at Daiji. Other species that were relatively tall includes the followings: *Anongeisus leiocarpus* (31) and *Azardirachta indica* (30) at Daiji, *Boscia angustifolia* (28) at Wassaniya. The shorter trees identified from the study area were: *Boscia angustifolia* (1.5), *Acacia sieberana* (1.62) at Wassaniya, *Dichrostachys cinera* (2) at Jimajimi., *Grewia mollis* (2.5) at Yartagimba, *Guiera senegalensis* (3) at Jimajimi. The height of *Boscia salicifolia* could be attributed to its age as a young species was seen at Jimajimi, but the tallest *Combretum micranthum* had not been found above (6) even though it recorded the most dominant species as shown by the results.

DISCUSSION

Distances of Trees from the Center Points (DCP)

Combretum micranthum has the maximum distance from the center point (1820m), this was followed by *Guiera senegalensis* (1208m). The results found here did not agree with [9] who conducted a similar research at Dabagi and Dogondaji Forest Reserves. From this finding *Guiera*

senegalensis had the minimum distance of (0.050cm). However the findings from the two locations had shown that *Combretum nigricans* exhibited the maximum distance at center point which was in conformity with the present work.

Number of Trees (NT)

Combretum micranthum (199) at Wassaniya and *Guiera senegalensis* (98) at Daiji had the highest and the second highest number of species present in the research area. This was in conformity with the work of [9] who found at Dabagi and Dogondaji forest reserves that the two species have the highest density. Species with lower concentrations includes *Diosperus mespiliformis* and *Khaya senegalensis* with only (1) representation, *Vitex doniana* and *Feretia apodanthera* with (2) representation.

Diameter at Breast Height (DBH)

Diameter growth in trees is dependent on two major factors; it could either be inherited traits from the genes, or environmental factors like the nutrients contents of the soil, temperatures, humidity, and moisture availability. *Khaya senegalensis* had the maximum diameter of 3m at Daiji was not native to the area but was incidentally found to exist adapt and compete favorable with the native species. This species was discovered at the other areas of the savanna [9]. Other species with bigger (DBH) included *Diospyros mespiliformis* with (1m) at Daiji, *Boscia salicifolia* (1.5m) at Wassaniya. Experienced gardeners know that certain seeds from the same collection produce plants that grow taller or have more leaves than others; or that some plants mature faster or are more resistant to diseases and insects attacks [3].

Tree Heights (TH)

Out of the 37 species encountered in the study area, tree heights ranges from very short trees like *Acacia sieberana* (1.62m), *Grewia mollis* (2.5m), and *Boscia salicifolia* (1.2m) to trees with well established bole and good branches including *Khaya senegalensis* (83m), *Diospyros mespiliformis* (45m), *Terminalia avicenoides* and *Anogeisus leiocarpus* (35m). The findings confirmed a similar work done at Dabagi and Dogondaji Forest Reserve where *Khaya senegalensis* was found to exhibits the maximum height at the same time *Guiera senegalensis* was among the shorter trees. The result also agrees with the findings made [2] who found that shrubs exist in varying heights within the Sokoto environment.

CONCLUSION

Conservation of forest biodiversity means maintaining ecological conditions sustainable for forest cover in order to fully derive maximum benefits and services from the forest and forest products. This was the reason why an assessment was conducted at Wassaniya Forest Reserve in Tangaza and Gudu Local Government areas of Sokoto State. The survey had revealed the existence of abundant woody species.

It was evident that some species were more established than others, some were taller, while others were higher in dominance than others. The well established species were not necessarily the indigenous; suggesting that introduction of exotic species (*Khaya senegalensis*) can be successful.

Table 1: Distance at Center point and Number of trees

| SPP NAME | LOCAL NAME | FAMILY NAME | DCP(m) | | | | NT | | | |
|--------------------------------|----------------|-----------------|--------|-------|-------|-------|-----|-----|-----|-----|
| | | | WAS | JIM | YAR | DAI | WAS | JIM | YAR | DAI |
| <i>Guiera senegalensis</i> | Sabara | Combretaceae | 0.44 | 16.74 | 21.57 | 12.32 | 56 | 59 | 56 | 98 |
| <i>Balanites aegyptiaca</i> | Aduwa | Balanitiaceae | 8 | NA | 10 | 1 | 1 | NA | 2 | 2 |
| <i>Combretummicranthum</i> | Geiza | Combretaceae | 0.36 | 20 | 1.89 | 20.92 | 199 | 34 | 76 | 87 |
| <i>Acacia sieberana</i> | Farar kaya | Fabaceae | 6.5 | NA | NA | NA | 1 | NA | NA | NA |
| <i>Combretum nigricans</i> | Tsiriri | Combretaceae | 7.37 | NA | 11.67 | 13.5 | 24 | NA | 9 | 10 |
| <i>Detarium microcarpum</i> | Taura | Caesalpiniaceae | 6.25 | NA | NA | NA | 4 | NA | NA | NA |
| <i>Cassia arereh</i> | Malga | Fabaceae | 9 | NA | 9.37 | 12.25 | 12 | NA | 8 | 8 |
| <i>Acacia nilotica</i> | Bagaruwa | Fabaceae | 3 | NA | NA | NA | 5 | NA | NA | NA |
| <i>Croton zambesicus</i> | Koriba | Euphorbiaceae | 9.5 | NA | 13.14 | NA | 12 | NA | 7 | NA |
| <i>Combretumgeitonophyllum</i> | Farartaramniya | Combretaceae | 22 | NA | 9 | NA | 5 | NA | 8 | NA |
| <i>Combretum glutinosum</i> | Jar taramniya | Combretaceae | 5.7 | 16 | 8.75 | 7 | 20 | 3 | 8 | 12 |
| <i>Prosopis Africana</i> | Kiryra | Fabaceae | 23 | NA | NA | 11.11 | 5 | NA | NA | 9 |
| <i>Feretia apondanthera</i> | Kuru kuru | Rubiaceae | 24.2 | NA | 6 | NA | 5 | NA | 9 | NA |
| <i>Mimosa pigra</i> | Gumbi | Fabaceae | 15.62 | 9.42 | 5 | 8 | 8 | 12 | 10 | 12 |
| <i>Mitragyna inermis</i> | Geiyayya | Rubiaceae | 28.75 | NA | NA | NA | 4 | NA | NA | NA |
| <i>Anogeisus leiocarpus</i> | Marke | Combretaceae | 9.6 | NA | NA | 6.67 | 13 | NA | NA | 6 |
| <i>Pterocarpus erinaceus</i> | Madobiya | Papilionaceae | 4.5 | NA | NA | NA | 26 | NA | NA | NA |
| <i>Boscia salicifolia</i> | Zure | Capparidaceae | 22 | NA | 12 | NA | 1 | NA | 1 | NA |
| <i>Pilliosigma reticulatum</i> | Kalگو | Caesalpiniaceae | 18.33 | NA | NA | NA | 6 | NA | NA | NA |
| <i>Boscia angustifolia</i> | Anza | Capparidaceae | 8.92 | 8.57 | 12.29 | NA | 13 | 14 | 7 | NA |
| <i>Grewia mollis</i> | Kamomowa | Tiliaceae | NA | 22 | 13 | NA | NA | 5 | 5 | NA |
| <i>Lannea microcarpa</i> | Faaru | Anacardiaceae | NA | 23 | 8 | NA | NA | 1 | 10 | NA |
| <i>Calatropis procera</i> | Tumfafiya | Asclepiadaceae | NA | 9 | NA | NA | NA | 2 | NA | NA |
| <i>Rogeria adenophylla</i> | Loda | Pedaliaceae | NA | 9.33 | 10 | NA | NA | 6 | 3 | NA |
| <i>Vitex doniana</i> | Dunya | Verbenaceae | NA | 8 | NA | NA | NA | 2 | NA | NA |
| <i>Dichrostachys cinera</i> | Dundu | Fabaceae | NA | 7 | 4 | NA | NA | 2 | 5 | NA |
| <i>Bauhinia rufescens</i> | Jirga | Fabaceae | NA | 6.67 | NA | NA | NA | 3 | NA | NA |
| <i>Faidherbia albida</i> | Gawo | Fabaceae | NA | 5.25 | NA | 13 | NA | 4 | NA | 1 |
| <i>Pteleopsis habeensis</i> | Lallen giwa | Rubiaceae | NA | NA | 10 | NA | NA | NA | 2 | NA |
| <i>Combretum ghasalense</i> | Bakartaramniya | Combretaceae | NA | NA | 12 | NA | NA | NA | 8 | NA |
| <i>Parkia clappertoniana</i> | Doruwa | Fabaceae | NA | NA | 8 | NA | NA | NA | 6 | NA |
| <i>Ziziphus Abyssinia</i> | Magarya | Rhamnaceae | NA | NA | 6 | NA | NA | NA | 2 | NA |
| <i>Chloris robusta</i> | Katsari | Fabaceae | NA | NA | NA | 11 | NA | NA | NA | 12 |
| <i>Khaya senegalensis</i> | Madacci | Meliaceae | NA | NA | NA | 10 | NA | NA | NA | 1 |
| <i>Terminalia avicenioides</i> | Baushe | Combretaceae | NA | NA | NA | 8 | NA | NA | NA | 2 |
| <i>Azardirachta indica</i> | Dogonyaro | Meliaceae | NA | NA | NA | 8.75 | NA | NA | NA | 8 |
| <i>Diospyros mespiliformis</i> | Kaiwa | Ebenaceae | NA | NA | NA | 12 | NA | NA | NA | 1 |

KEY

| | | | |
|-----|--------------------------|-----|------------|
| DCP | Distance at Center Point | WAS | Wassaniya |
| NA | Not Available | SPP | Species |
| NT | Number of Trees | YAR | Yartagimba |
| DAI | Daiji | JIM | Jimajimi |

Table 2: Diameter at Breast Height and Tree Height

| SPP NAME | LOCAL NAME | | DBH(cm) | | | | TH(m) | | | |
|---------------------------------|-----------------|-----------------|---------|-------|--------------------------|-------|-------|------|-----|-----|
| | | | WAS | JIM | YAR | DAI | WAS | JIM | YAR | DAI |
| <i>Guiera senegalensis</i> | Sabara | Combretaceae | 9.09 | 9.73 | 3.82 | 7.01 | 3.25 | 3 | 4 | 5 |
| <i>Balanites aegyptiaca</i> | Aduwa | Balanitiaceae | 11.13 | NA | 8.31 | 31.84 | 5 | NA | 7 | 35 |
| <i>Combretum micranthum</i> | Geiza | Combretaceae | 13.37 | 12.13 | 13.37 | 10.13 | 5 | 5 | 6 | 6 |
| <i>Acacia sieberana</i> | Farar kaya | Fabaceae | 16.24 | NA | NA | NA | 1.62 | NA | NA | NA |
| <i>Combretum nigricans</i> | Tsiriri | Combretaceae | 19.28 | NA | 13.05 | 13.37 | 7 | NA | 7 | 10 |
| <i>Detarium microcarpum</i> | Taura | Caesalpiniaceae | 38.85 | NA | NA | NA | 27 | NA | NA | NA |
| <i>Cassia arereh</i> | Malga | Fabaceae | 19.28 | NA | 19.92 | 19.61 | 7.2 | NA | 10 | 25 |
| <i>Acacia nilotica</i> | Bagaruwa | Fabaceae | 12.13 | NA | NA | NA | 7.1 | NA | NA | NA |
| <i>Croton zambesicus</i> | Koriba | Euphorbiaceae | 14.01 | NA | 13.37 | NA | 4 | NA | 25 | NA |
| <i>Combretum geitonophyllum</i> | Farar taramniya | Combretaceae | 18.24 | NA | 13.37 | NA | 7 | NA | 8 | NA |
| <i>Combretum glutinosum</i> | Jar taramniya | Combretaceae | 14.64 | 18.56 | 11.46 | 14.33 | 7 | 25 | 17 | 32 |
| <i>Prosopis Africana</i> | Kiryia | Fabaceae | 18.56 | NA | NA | 18.81 | 8 | NA | NA | 6 |
| <i>Feretia apodanthera</i> | Kuru kuru | Rubiaceae | 12.13 | NA | 13.05 | NA | 3.8 | NA | 4 | NA |
| <i>Mimosa pigra</i> | Gumbi | Fabaceae | 7.01 | 14.01 | 9.55 | 12.10 | 3 | 6 | 2.5 | 4 |
| <i>Mitragyna inermis</i> | Geiyayya | Rubiaceae | 14.64 | NA | NA | NA | 12 | NA | NA | NA |
| <i>Anogeisus leiocarpus</i> | Marke | Combretaceae | 38.22 | NA | NA | 19.92 | 35 | NA | NA | 39 |
| <i>Pterocarpus erinaceus</i> | Madobiya | Papilionaceae | 18.51 | NA | NA | NA | 11 | NA | NA | NA |
| <i>Boscia salicifolia</i> | Zure | Capparidaceae | 41.11 | NA | 21.66 | NA | 47 | NA | 17 | NA |
| <i>Pilliosigma reticulatum</i> | Kalgo | Caesalpiniaceae | 18.56 | NA | NA | NA | 25 | NA | NA | NA |
| <i>Boscia angustifolia</i> | Anza | Capparidiaceae | 19.28 | 19.61 | 10.19 | NA | 30 | 1.2 | 3 | NA |
| <i>Grewia mollis</i> | Kamomowa | Tiliaceae | NA | 8.28 | 4.11 | NA | NA | 5 | 2.5 | NA |
| <i>Lannea microcarpa</i> | Faaruu | Anacardiaceae | NA | 14.01 | 13.05 | NA | NA | 11.5 | 22 | NA |
| <i>Calatropis procera</i> | Tumfafiya | Asclepiadaceae | NA | 20.38 | NA | NA | NA | 7 | NA | NA |
| <i>Rogeria adenophylla</i> | Loda | Pedaliaceae | NA | 14.01 | 14.01 | NA | NA | 7 | 10 | NA |
| <i>Vitex doniana</i> | Dunya | Verbenaceae | NA | 17.52 | NA | NA | NA | 18 | 2 | NA |
| <i>Dichrostachys cinera</i> | Dundu | Fabaceae | NA | 4.11 | 7.96 | NA | NA | 2 | NA | NA |
| <i>Bauhinia rufescens</i> | Jirga | Fabaceae | NA | 10.19 | NA | NA | NA | 4 | NA | NA |
| <i>Faidherbia albida</i> | Gawo | Fabaceae | NA | 14.01 | NA | 31.84 | NA | 5 | NA | 36 |
| <i>Pteleopsis habeensis</i> | Lallen giwa | Rubiaceae | NA | NA | 9.87 | NA | NA | NA | 4 | NA |
| <i>Combretum ghasalense</i> | Bakar taramniya | Combretaceae | NA | NA | 13.37 | NA | NA | NA | 8 | NA |
| <i>Parkia clappertoniana</i> | Doruwa | Fabaceae | NA | NA | 31.84 | NA | NA | NA | 30 | NA |
| <i>Ziziphus Abyssinia</i> | Magarya | Rhamnaceae | NA | NA | 9.03 | NA | NA | NA | 4 | NA |
| <i>Chloris robusta</i> | Katsari | Fabaceae | NA | NA | NA | 10.83 | NA | NA | NA | 25 |
| <i>Khaya senegalensis</i> | Madacci | Meliaceae | NA | NA | NA | 99.54 | NA | NA | NA | 83 |
| <i>Terminalia avicenioides</i> | Baushe | Combretaceae | NA | NA | NA | 31.84 | NA | NA | NA | 35 |
| <i>Azadirachta indica</i> | Dogonyaro | Meliaceae | NA | NA | NA | 31.84 | NA | NA | NA | 32 |
| <i>Diospyros mespiliformis</i> | Kaiwa | Ebenaceae | NA | NA | NA | 31.84 | NA | NA | NA | 45 |
| | KEY | | | | | | | | | |
| | WAS | Wasaniya | | DBH | Diameter at Brest Height | | | | | |
| | JIM | Jimajimi | | TH | Tree Height | | | | | |
| | DAI | Daiji | | NA | Not Available | | | | | |

Table 3: Dependent Variables at Different Locations

| Variables | Locations | | | | | SE | Signif |
|---------------------------|--------------------|--------------------|--------------------|--------------------|--|------|--------|
| | Wassaniya | Jimajimi | Yartagimba | Daiji | | | |
| Distance at center Point | 12.69 ^a | 12.38 ^a | 10.08 ^a | 10.27 ^a | | 0.45 | NS |
| Number of Trees | 20.98 ^a | 11.31 ^a | 12.10 ^a | 18.07 ^a | | 2.14 | NS |
| Tree Height | 12.79 ^b | 7.67 ^b | 9.65 ^b | 27.86 ^a | | 0.92 | S |
| Diameter at Breast Height | 16.48 ^a | 0.41 ^b | 0.38 ^b | 0.78 ^b | | 0.25 | S |
| Total Canopy Spread | 9.86 ^b | 5.10 ^c | 6.54 ^c | 12.65 ^a | | 0.42 | S |
| Mean Density | 12.24 ^a | 12.43 ^a | 9.59 ^b | 9.42 ^b | | 0.45 | S |
| Species Density | 0.08 ^a | 0.07 ^a | 0.08 ^a | 0.07 ^a | | 0.01 | NS |
| Basal Area | 0.31 ^b | 0.15 ^b | 0.13 ^b | 0.85 ^a | | 0.06 | S |
| Species frequency | 3.17 ^a | 3.46 ^a | 2.95 ^a | 3.20 ^a | | 0.19 | NS |

Values with similar Superscript at the same vertical line are not significant at ($P > 0.05$)

Recommendations

Government should revive forestry laws and edicts enacted against indiscriminate felling of trees; uncontrolled grazing, farming encroachment and bush burning must be enforced, so that perpetrators should be dealt with.

Government should establish more forest reserves so that more forest products can be harnessed. More forest guards should be employed and must be empowered to enforce forest protection laws. They should be well paid in order to distract them from bribery by the tress passers.

All existing forests should be surveyed, illegal encroachment should be verified. Adequate amenities should be provided to the masses so that people may deter from cutting trees as source of energy.

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