Title: An Analysis of a Miombo Woodland, Fuelwood Collection Area – Case study of Christmas Pass Woodlands, Mutare.

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Study Area

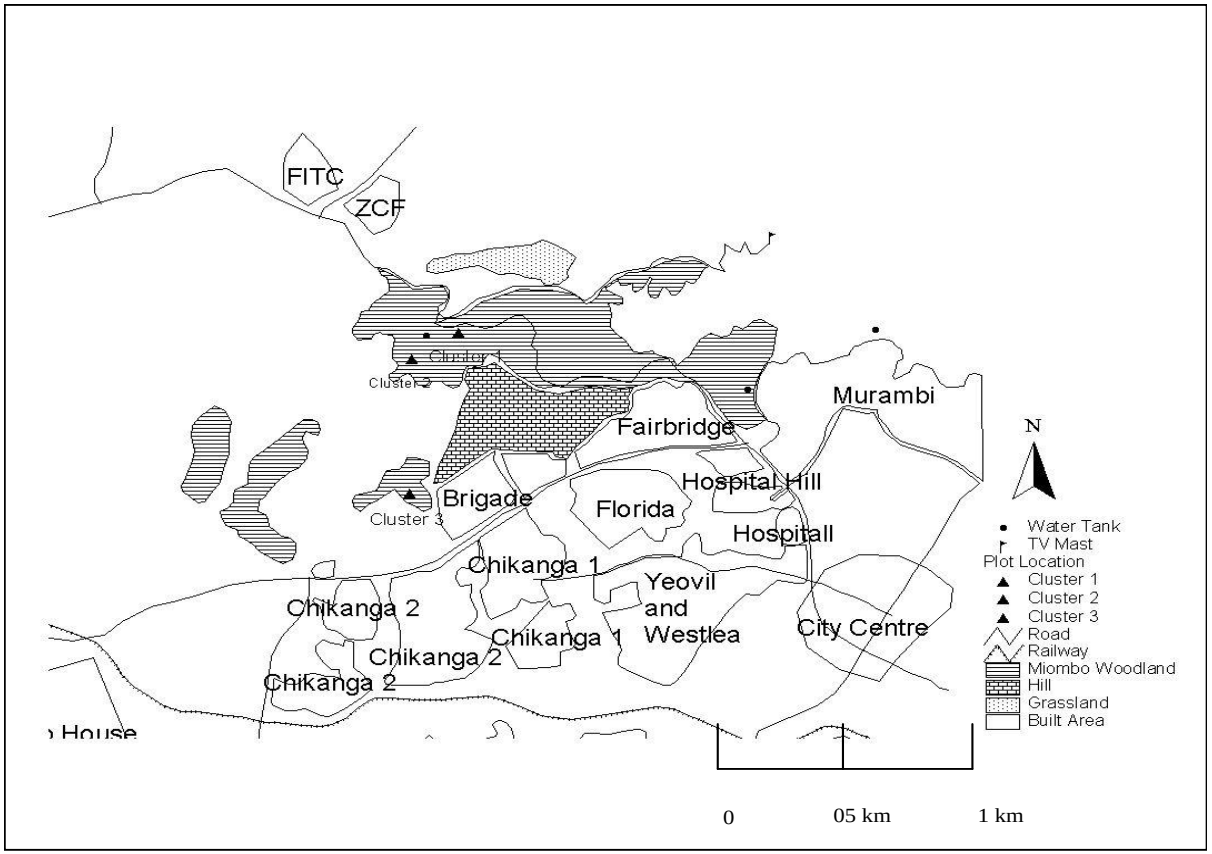


Fig. 1: The study area – Christmas Pass miombo woodlands, Mutare.

Introduction

- Zimbabwe: land-locked, area 391000 sq.km. Population was 11.9 mill. and growth rate 3% and GDP US$ 575 in 1998 but now 12,3 mill. and 0.9% rate of natural increase (CSO, 2002). HIV – AIDS and emigration contributed to this fall. Income distribution skewed due to dualistic structure of the economy.

Introduction

- Forest Resources contribute an underestimated 3% of GDP.
- Conservation and mgt of woodland resources has low priority in govt dev plans.
- Indigenous woodlands exploitation is wasteful: their contribution to sustainable agric and environ protection ignored.

Introduction

- Policy initiatives in general problems in agriculture will tend to define patterns of landuse, public and private investment and institutional development with cross sectoral implications for forestry (Bradley and McNamara, 1991).
- Most Africans south of the Sahara are resource challenged and depend on fuelwood (fw) for energy.

Introduction

- Conservation role of forests as opposed to productive and commercial roles is regarded as difficult to quantify in direct economic terms.
- Cutting of live wood for fuelwood can have significant impacts on community structure and species composition.

The Problem

- As of 1992, new residential areas have sprung up resulting in increased demand of all services including energy.
- Since ESAP, econ conditions for residents have fallen. Shortages of many basics including once subsidised paraffin, exacerbated by shortages of electricity made fuelwood the only available and affordable energy source.

The Problem

- Resource challenged families trek into the mountains around Mutare for fuelwood for own use and sale.
- The effects of wood collection are unknown and deterrents may not save the woodlands.
- The fate of the Christmas Pass miombo woodlands maybe in the hands of all stakeholders.

Objectives

- Describe structure and composition of miombo vegetation of Christmas Pass.
- Assess any visible effects of fuelwood collection in the woodlands.
- Estimate fuelwood use by the residents of Chikanga high density suburb.

Justification

- Wood is poached from private and State land.
- Murahwa Hills National Monument (Heritage site) and Cecil Kop Nature Reserve (Conservation and ecotourism).
- Miombo ecoregion is one of the Global 200 focal ecoregions because it is under threat from its inhabitants.

Justification

- The threat of wholesale tree removal from Christmas Pass is real.
- Documenting the status of woodlands and analysing the effects of fuelwood collection over the long term is overdue.
- Such information is necessary to influence policy makers address the issue and adopt a course of action that may lead to sustainable utilisation of the woodlands.

Materials and Methods

- Study area identification (Slide 2).
  - Aerial photo interpretation to stratify into vegetation zones (1981, 1986, 1996).
  - Sampling in miombo, towards Chikanga High density suburb.
  - Plots randomly selected on topographic maps and located using hand held GPS.

Materials and Methods

- Plot demarcation

  - Circular plots of radii 15m and 3m with a common centre constructed.

  - Tree characteristics recorded in the 15m radius plot.

  - Regeneration of saplings and seedlings recorded in the 3m radius plot.

Materials and Methods

- Plot Measurements
  - Identification of tree species per plot.
  - Measurement of soil variables.
  - Tree characteristic assessments.
  - Site description.

APPENDIX 1: RECORD FORM – SPECIES COMPOSITION AND DAMAGE

DATE:
PLOT No.
PLOT SIZE:
DIST. FROM RES.
SLOPE:

SOIL TYPE:
SOIL DEPTH:
ALTITUDE;
SAPLINGS: less than 50cm---- 50-100cm ----- more than 100cm ----
ASPECT:

GENERAL DESCRIPTION OF SITE:

SPECIES	HT (m)	DBH (cm)	DSH (cm)	TREE DAMAGE				DEADWOOD AVAILABILITY		
				FIRE (+/-)	%	CUT. (+/-)	OTHER	ON GROUND	IN CROWN	%

Materials and Methods

- Chikanga high density suburb survey.

  - House numbers obtained from Mutare City Council.

  - Randomly selected residents to receive designed questionaire.

  - Questionaire to capture household fuelwood use and status in Chikanga.

Materials and Methods

- Data analysis.

  - CANOCO for Windows for multivariate analysis (PCA, DCA and CCA).

  - Microsoft Excel for Windows for simple bar graphs and calculations.

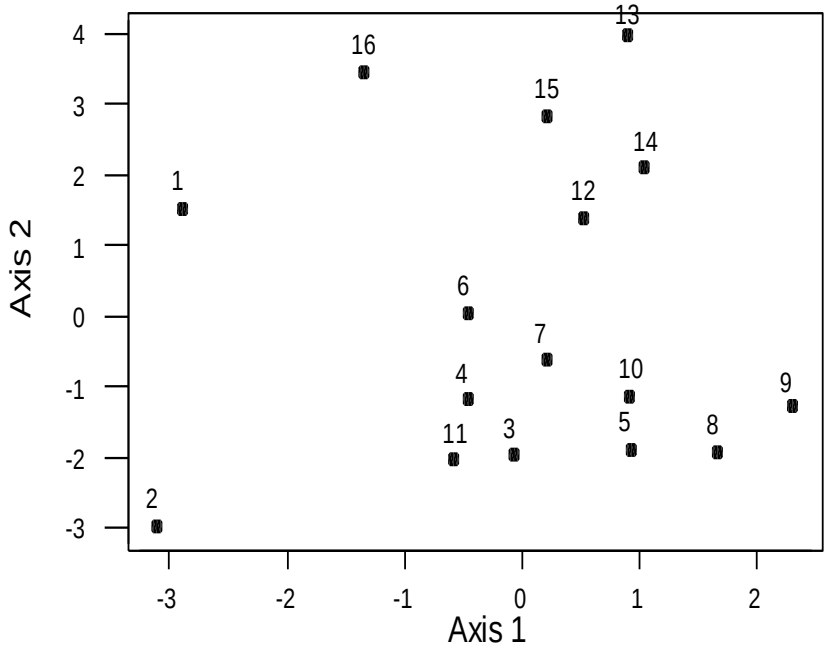
  - MINITAB for Windows for ANOVA and Correlations among variables.

Results

- Species List – 36 species, dominated by Fabaceae (Leguminosae) family.
- Principal Components Analysis (PCA)

  - Four groups dicernible for all plot information.

  - All species grouped into three with *Pterocarpus rotundifolius, Julbernardia globiflora* and *Brachystegia* spiciformis as the main species.


Axis 2
Axis 1
4
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
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15
14
1
12
6
7
4
10
9
11
3
5
8
2

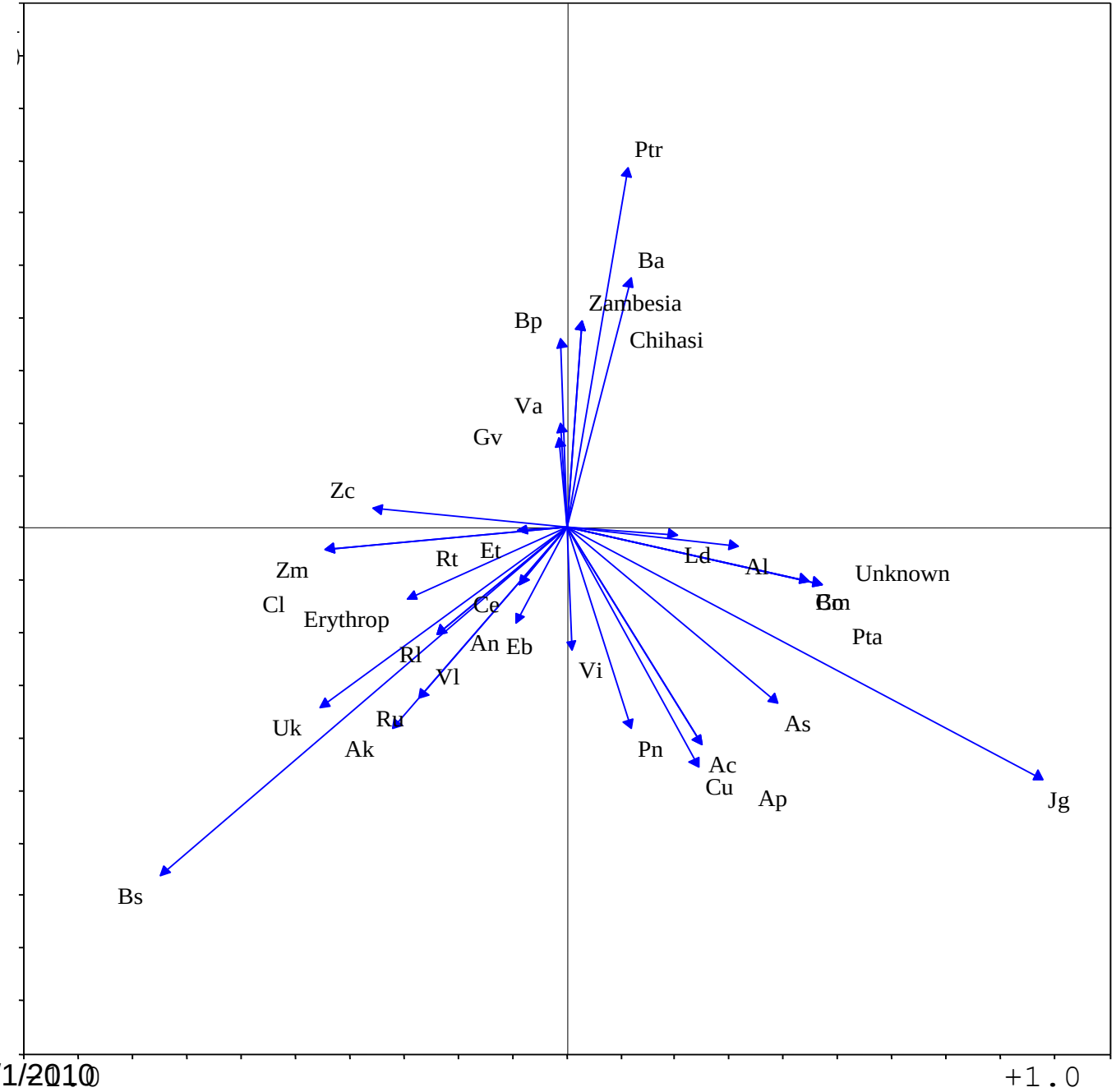


Figure 4 PCA scattergram of all species.

Results.

- Detrended Correspondence Analysis-

  - Five groupings along environmental gradients.

  - Gradient implied a moisture regime, with some species preferring moist sites and others dry sites.

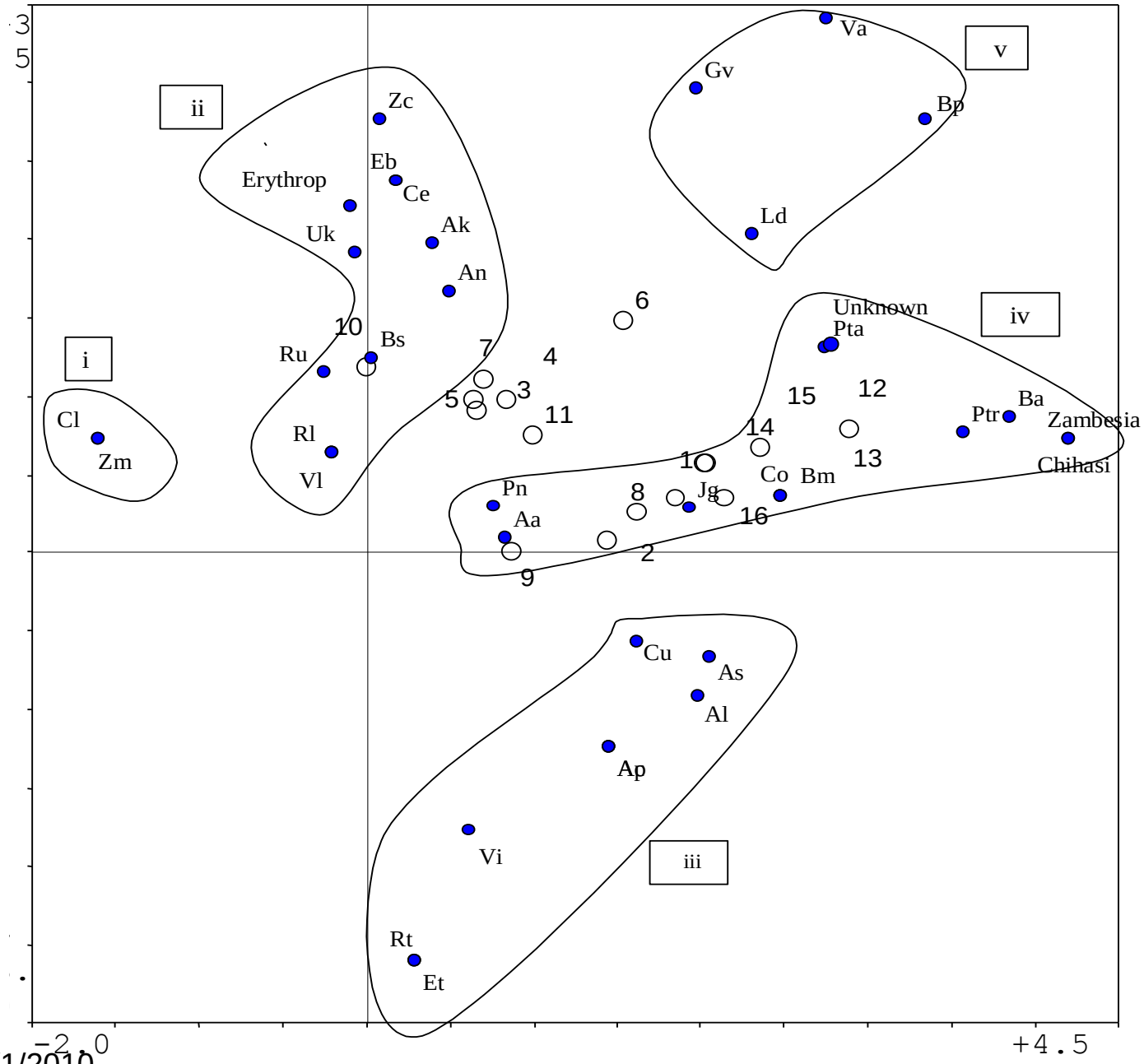


Figure 6 DCA diagram of species and plots showing five groups for all the species.

Results

- Canonical Correspondence Analysis –

  - Relationship of plots and environmental variables show cutting % to be linked to the plots shown.

  - Relationship of species and environmental variables show the vegetation present in the area suffering cutting the most.

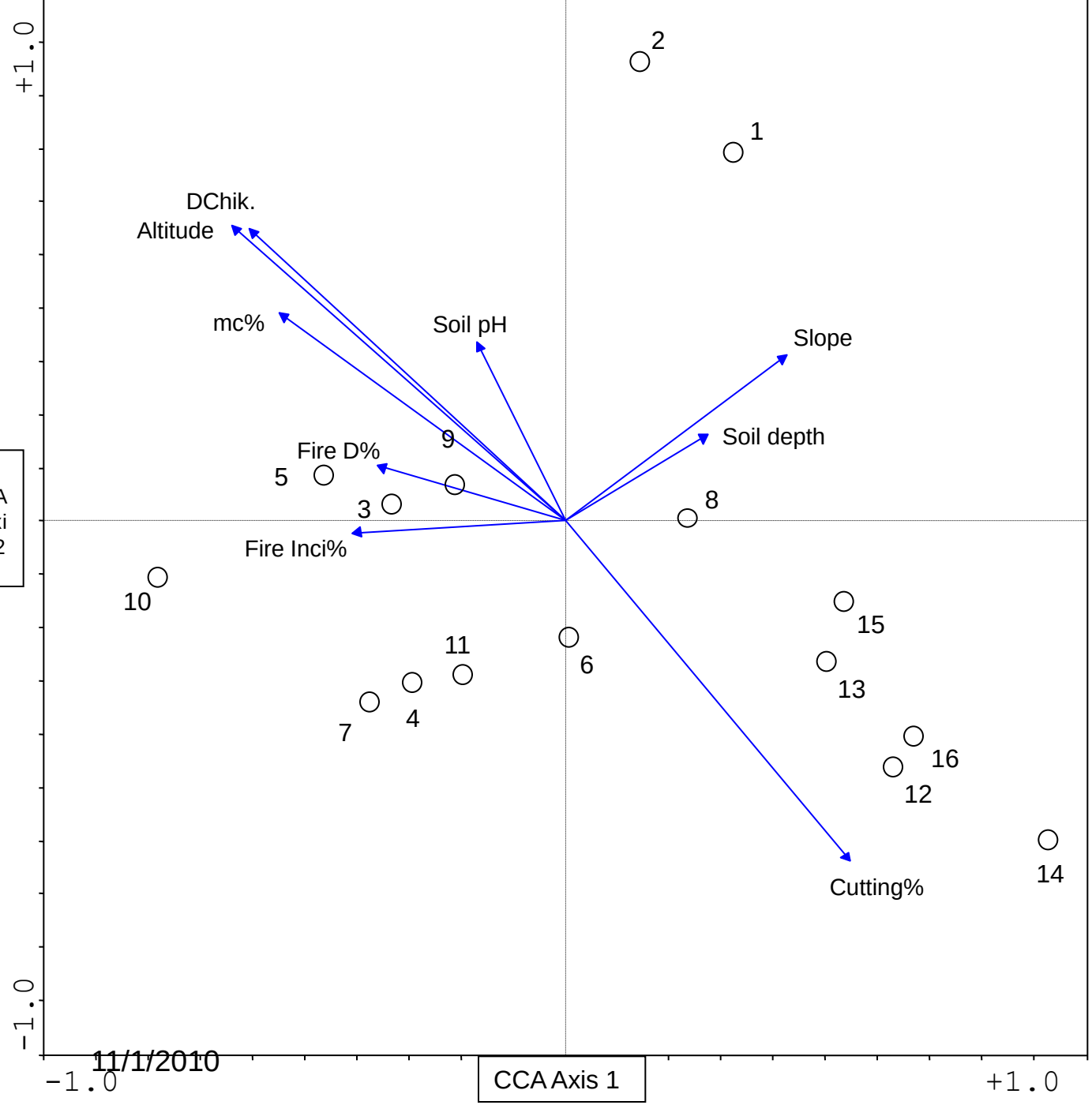


Figure 7 CCA biplot showing the relationship between plots and environmental variables.

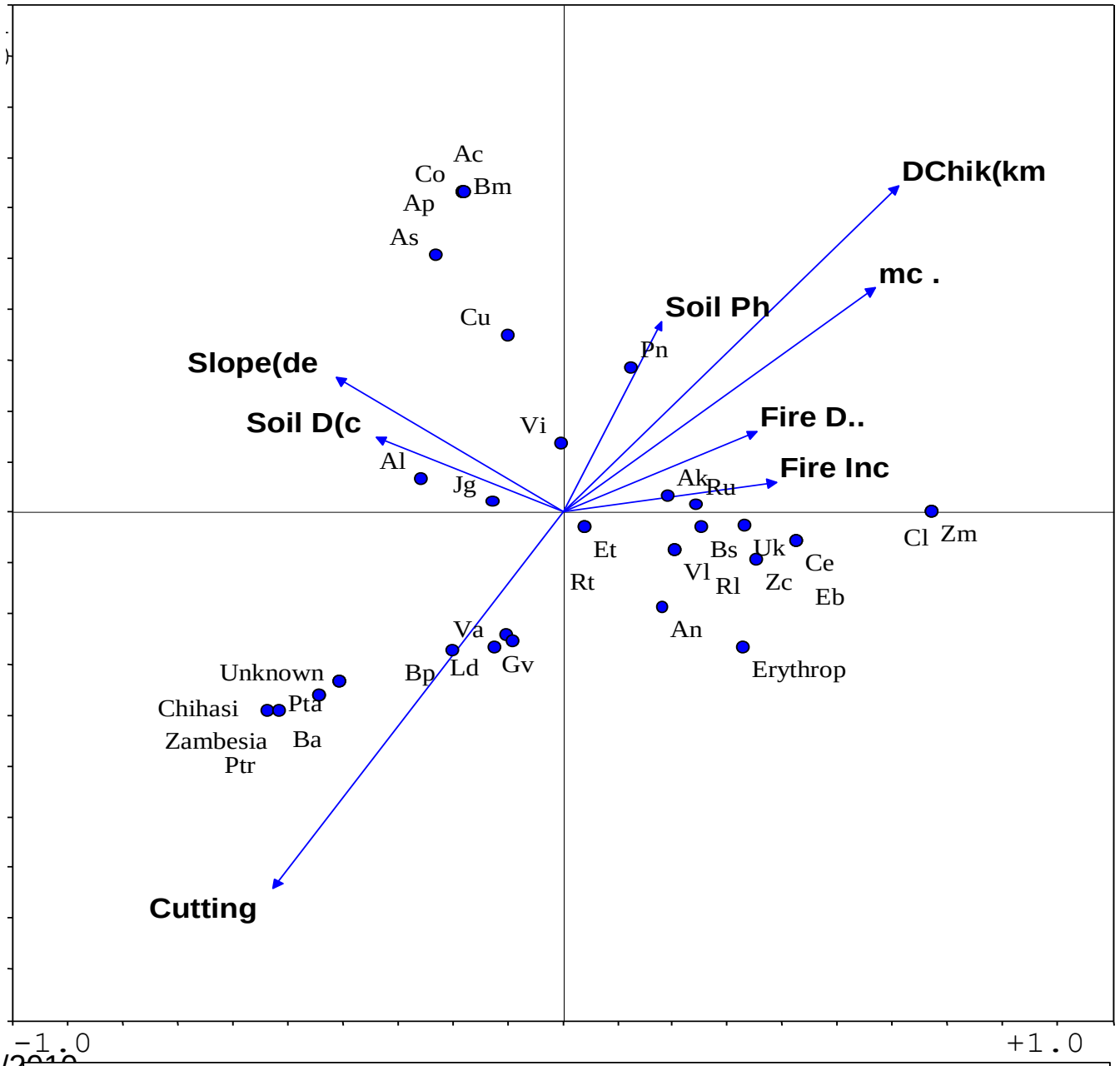
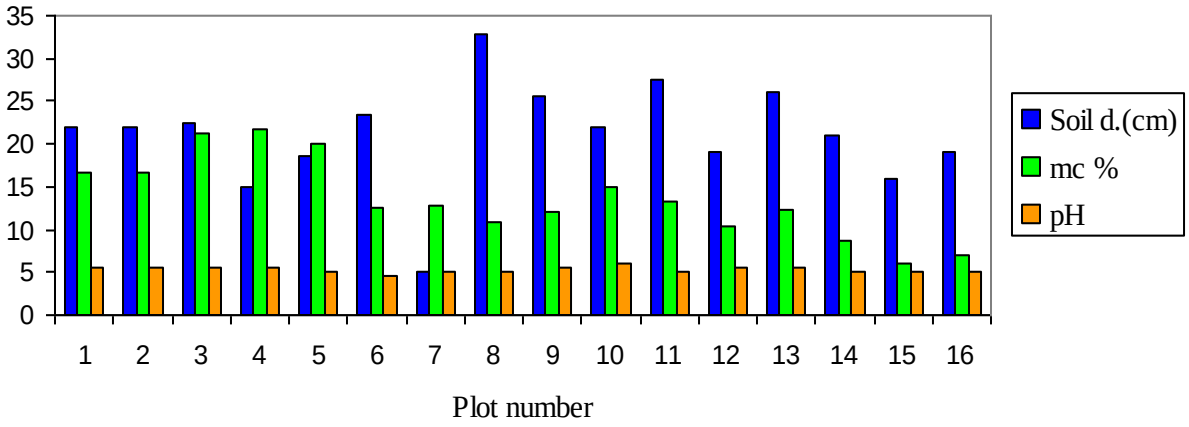
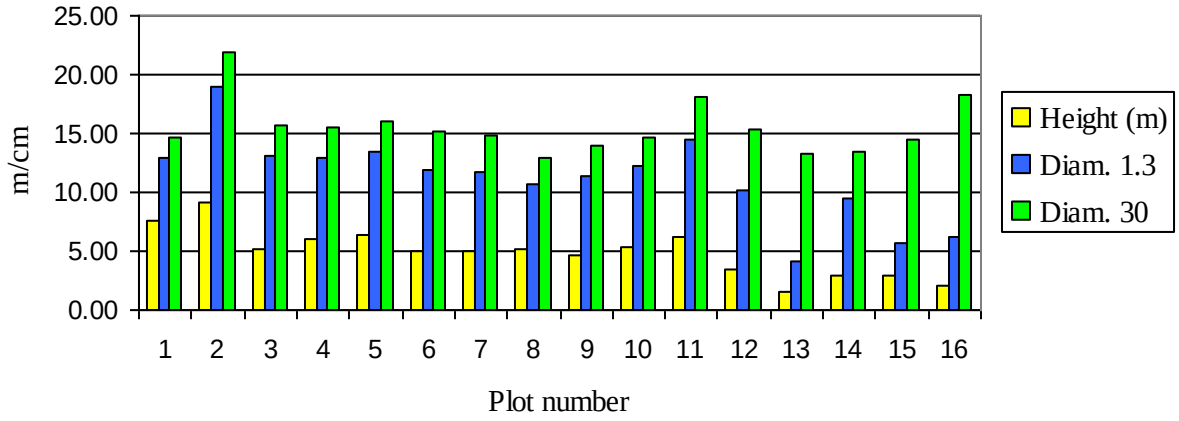


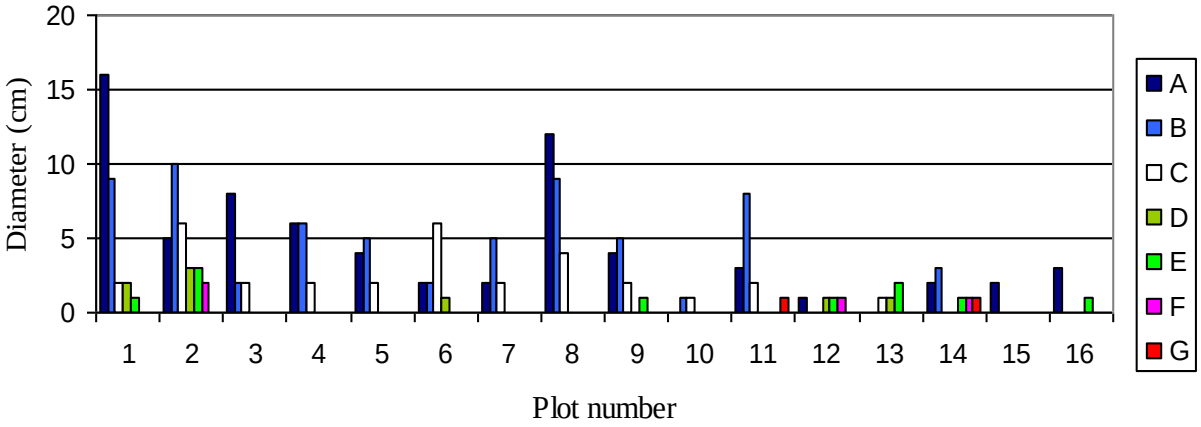
Figure 8 CCA biplot showing the relationship between species and environmental variables.

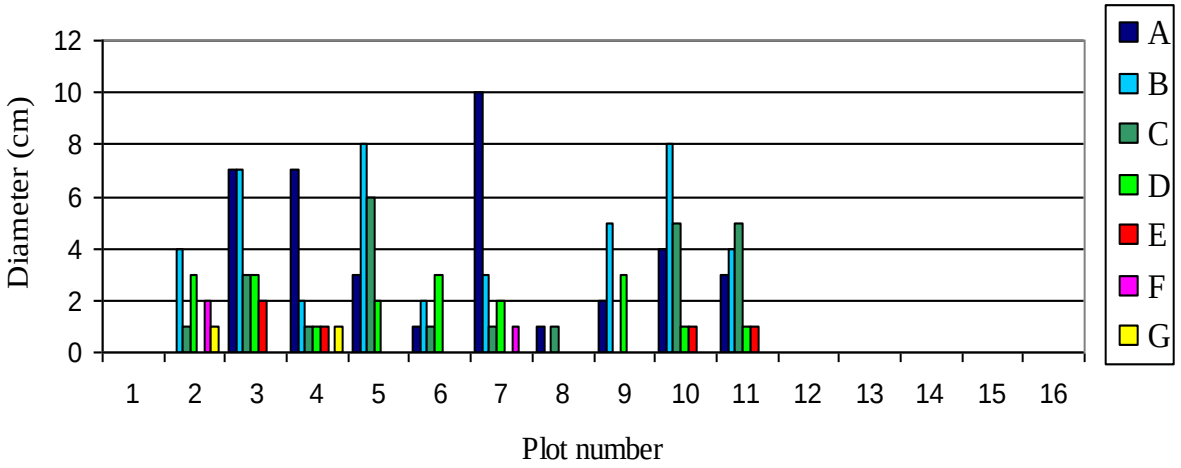
Results

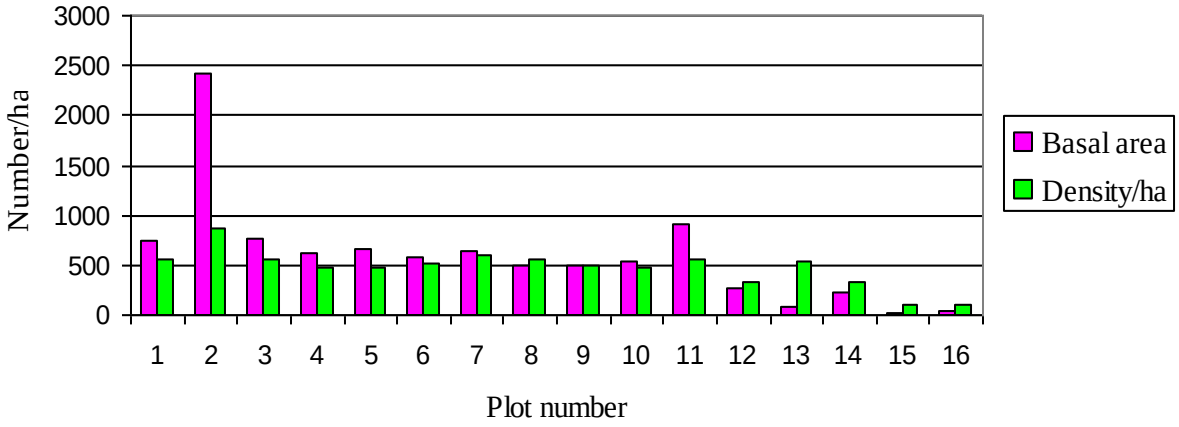
- Height (Ht), Diameter at stump height (DSH), Diameter at breast height (DBH) and Soil variables – Figure 9 and 10.
- Diameter distribution of main species – Figure 11 and 12.
- Basal area and Density per ha; Species Richness and Shannon-Weiner indices – Figure 13 and 14.
- Fire incidence and Deadwood – Fig 15,16.

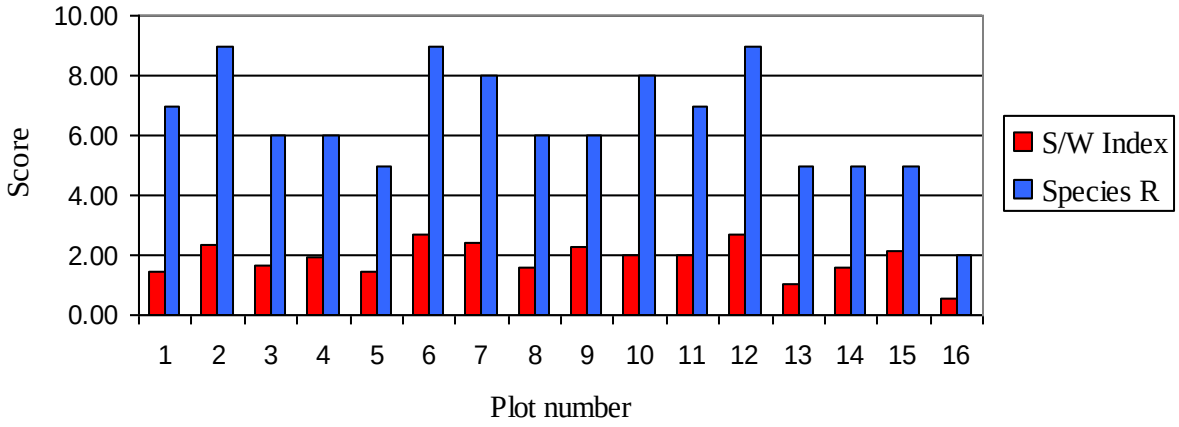

35
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
Soil d.(cm)
mc %
pH

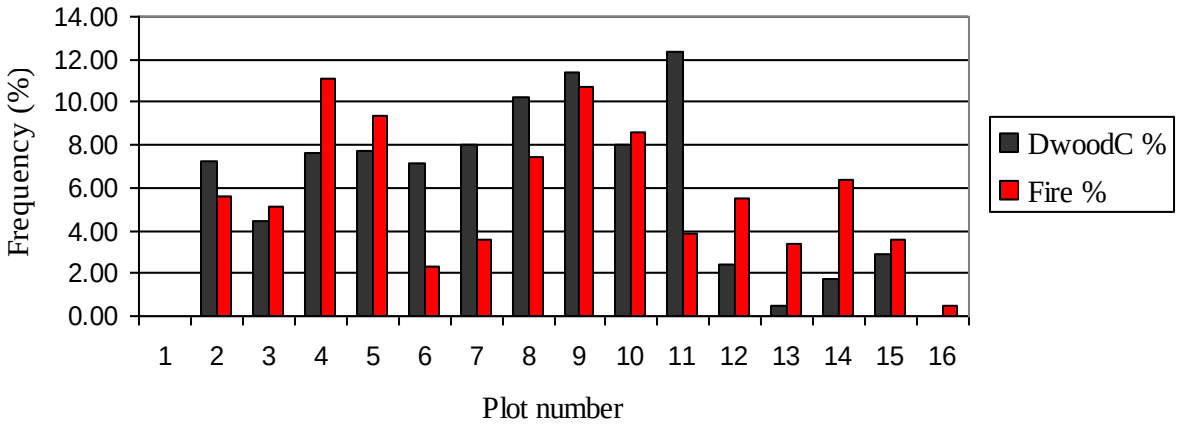

25.00
20.00
15.00
10.00
5.00
0.00
m/cm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
Height (m)
Diam. 1.3
Diam. 30

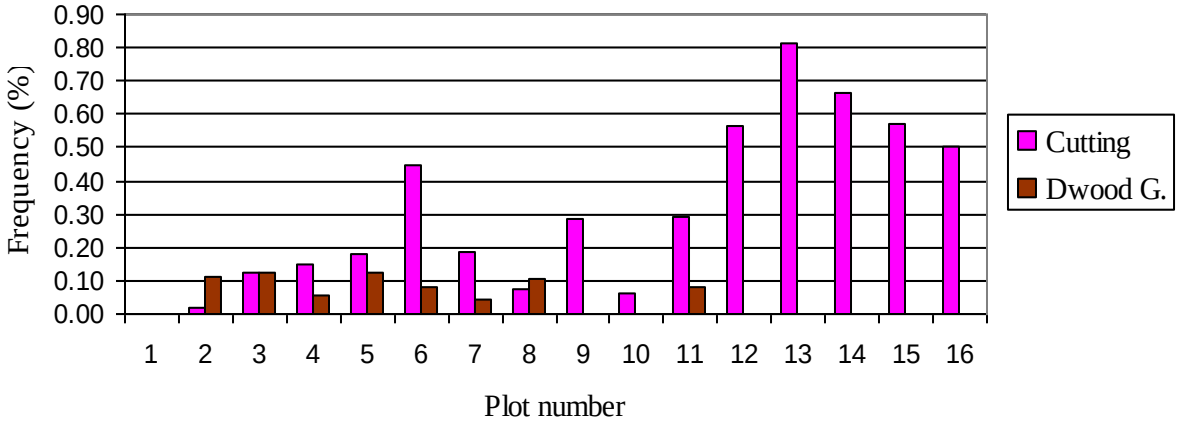

20
15
10
5
0
Diameter (cm)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
A
B
C
D
E
F
G


12
10
8
6
4
2
0
Diameter (cm)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
A
B
C
D
E
F
G


3000
2500
2000
1500
1000
500
0
Number/ha
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
Basal area
Density/ha


10.00
8.00
6.00
4.00
2.00
0.00
Score
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
S/W Index
Species R


14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Frequency (%)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
DwoodC %
Fire %


0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Frequency (%)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Plot number
Cutting
Dwood G.

Results

- Seedlings / saplings per plot –

  - Young plants were more abundant and well developed in the degraded areas near the residential area.

  - There was less regeneration in the areas furthest from the residential area due to shading effects of the older trees.

Results

- Chikanga survey: Number of Stands:4190

  - Average family size = 5.84

  - Wood used: 1 wheelbarrow/week average. Extreme case 1wheelbarrow/day in winter.

  - 56% collect fuelwood from Xmas Pass woodlands by picking and cutting.

  - User rights: 100% of respondents. They knew it was illegal.

Results

- 48% saw future energy needs as difficult.

- 80% felt there was fuelwood scarcity in Chikanga.

- For the way forward, 60% feel there is a need of a selling point. Also suggestion of electrification of all homes and zonation of the hills to allow controlled fuelwood collection.

Discussion

- Christmas Pass miombo woodlands demonstrate a complex human – fire – woodland ecosystem interaction problem, which if unattended may lead to the destruction of the woodland.
- It is a disturbed ecosystem in which directions and rates of change of processes maybe complex and unpredictable (Mapaure, 2001).

Discussion

- The woodlands stand structure and composition is negatively affected by cutting by humans. Wood removal could also affect ecosystem processes not addressed by this study. Fire, human caused or natural is also degrading the woodland.
- All stakeholders should be involved in the management of the miombo woodlands.

Future Research

- Detailed and long term research is necessary in the miombo ecoregion. Christmas Pass area is ideal because rates of change are faster due to human activity and degree of damage occurring.
- Wood use in Chikanga needs to be modelled so as to predict wood demand so as to find alternative energy sources.

Future Research

- Multi-locational sites (national, international, regional) are necessary to address the problem of ecosystem products and services that become unavailable due to degradation of the miombo ecosystem.

Thanks!

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