ECOLOGICAL IMPLICATIONS OF HARVESTING PLANT RESOURCES FROM BWINDI IMPENETRABLE NATIONAL PARK, S. W UGANDA

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PRESENTATION BREAKDOWN

- Introduction (Important plants from tropical forests)
- A brief history of Bwindi's MUP
- Impacts of harvesting Plant Resources
- Study Justification
- Study Objectives
- Methods used
- Hypotheses used
- Data analysis used
- Results & discussions
- Conclusion
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1.Introduction

1.1Important plants from tropical forests

- Tropical forests have many useful plants that have been exploited by humans for thousands of years
- In the past, much attention to forests was focused on sustainable extraction of timber for commercial use
- NTFPs were considered a “nuisance” that suppressed the production of timber trees
- NTFPs gained conservation importance after their commercial value increased that led to their overexploitaton

1.2 Plant use in Bwindi

- Plant use by local people around Bwindi is as old as mankind that have lived there
- After gazettement, Bwindi restricted forest use to only extraction of plants (medicines & basketry) and beekeeping.
- Today over 46 plants are exploited by the local people for medicinal and basketry use
- There is also illegal extractions of plants for poles, hoe handles, walking sticks and firewood

1.3 Plant harvest impacts

- Plant harvests may affect the biological processes of individual plants or change their populations & genetic patterns

- Harvest of plant parts may cause changes in the rates of the plants' survival, growth and reproduction

- These changes may in turn affect the structure and dynamics of whole plant populations

- Most studies have focused mainly on harvest impacts on individual plants & their populations than on ecosystems

2 Why the Study?

- A Major problem to managing plant harvests is lack of data on the plants harvested and their response to harvests

- There is limited data on abundance, distribution & yield of most harvested plants = in determining sustainable harvests

- Any attempt to exploit forest resources in such a scenario has the potential to increase their over-exploitation

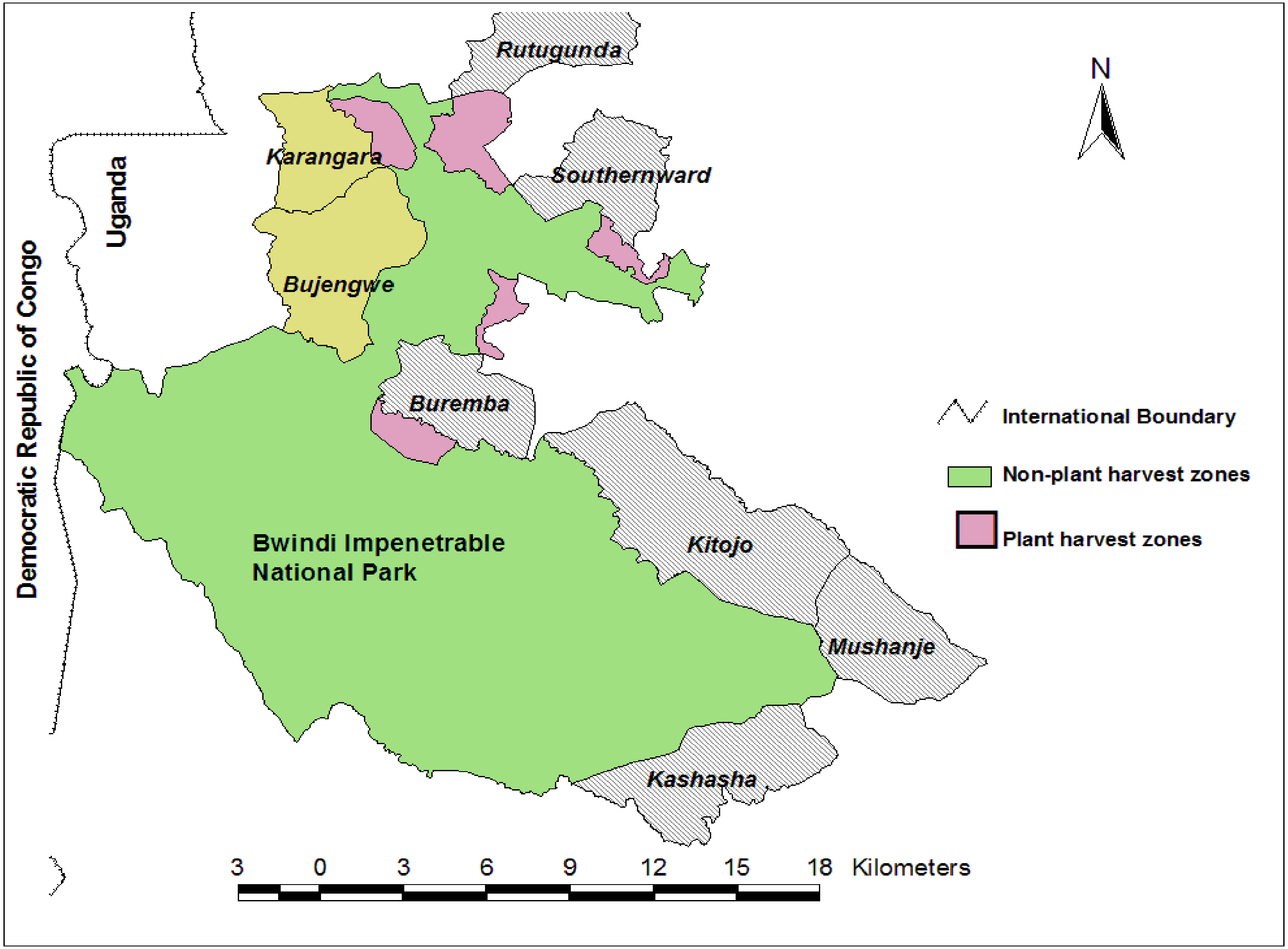
- This study addresses the above shortcomings and determines the sustainability of plant harvests in Bwindi

3 Study Objectives

- To determine & compare stem densities & size class distribution of important plants in harvest and non-harvest zones
- To assess the effects of environmental variables (tree canopy cover, altitude & slope) on stem densities of the plants
- To determine & compare annual biomass productions (yield) of the plants in harvest and non-harvest zones

4 Methods

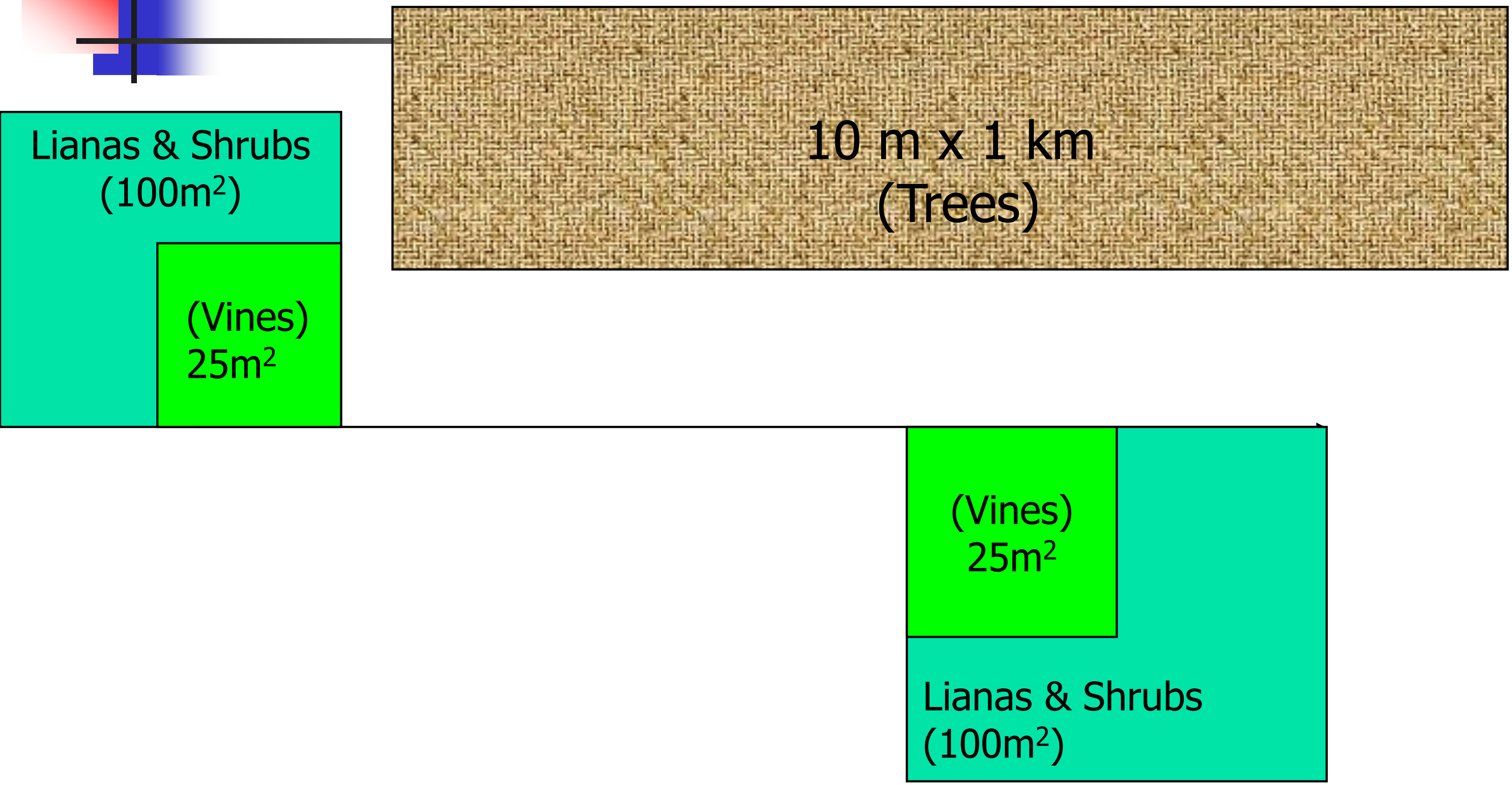
4.1 Study area



4.2 Sampling Design

- A stratified random sampling design of harvest & non-harvest zones (Clarke, 1986;Alder & Synnott, 1992)
- The Sampling design was used to compare plant population dynamics in harvest and “non- harvest” zones
- 3 belt transects were randomly established (10 m x 1 km), running from the forest edge into the forest interior (trees)
- Nested square quadrats of different sizes established every 100m along the transects to assess shrubs and climbers

4.2Transect & Plot Laying



(**Alder & Synnott 1992 ; Hall and Bawa, 1993, Tuxil & Nabhan 1998**)

4.3 Assessments made in plots

- Plants rooted in plots were measured for dbh (for trees, poles and shrubs) & basal diameters (climbers)
- Sprouts, coppices & multi-stemmed plants were counted as separate individuals (Cunningham, 2001)
- Habitat characteristics (altitude, slope % & % tree canopy) were recorded in each plot
- Plants' bark thickness (bark harvests) and stem growth rates (stem harvests) were recorded for yield assessments

4.4 Hypotheses Used

- H_o= There is no significant difference between harvest zones & non-harvest zones in plants’ stem densities
- H_o=There is no significant difference between harvest zones & non-harvest zones in plants’ size class distribution
- H_o =There is no significant relationships between environmental variables and plants’ stem densities.
- H_o= There is no significant difference between harvest zones & non-harvest zones on plants’ annual yields

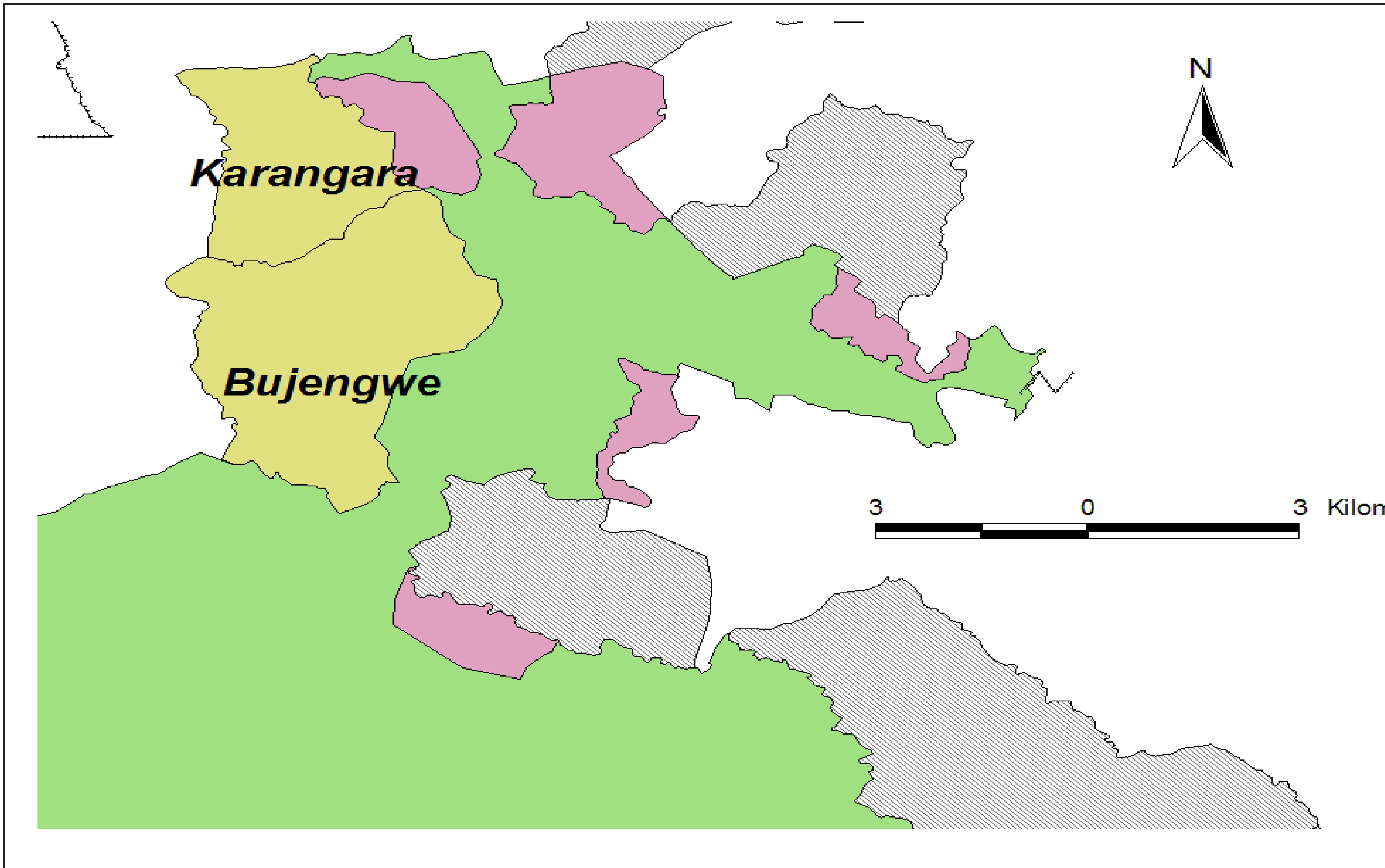
4.5 Assumptions made

- Plant harvests causes more forest disturbance in plant harvest zones than in non-plant harvest zones.

- The two selected parishes for comparison (Karangara and Bujengwe) have approximately similar environmental conditions

- The Plant harvest zone (Karangara) is more frequented by harvesters (about 120 people) than the non-plant harvest zone of Bujengwe (Ndangalasi *et al.,* 2007).

Harvest & Non-harvest zones



4.6 Data analysis (used Systat 10.2)

- **Plant stem density** = abundance = number of individuals stems per ha (Peters, 1994)

- **% frequency** = $\frac{\{\#\text{plots in which plant species occur}\}}{\text{Total number of all plots x plot area}}$ x 100

- **Plant yield** =Log BM (Kg) = 1.87253 (Log d) = 0.72118 (Log h) + 0.152919 (BT) – 0.11767 (BT x Log D) + 0.037728 (BT x Log h) – 2.04586.

BM = Bark mass, d =diameter (cm), h = height (cm) = 200cm, BT = Bark thickness (cm)-*Cunningham (2001)*

5 Results & discussions

5.1 Plant stem density & abundance

- There was a significant difference between harvest zones & non-harvest zones on the plants' stem densities (**Chi-square goodness of fit, χ^2 = 941, df 10, P value < 0.001**)
- Generally, plant stem density is highest in harvest zones than in the non-harvest zones
- The highest stem densities were depicted by *Dracaena laxissima, Piper guineense & Smilax anceps* in the plant harvest zones
- The least stem density was depicted by *Dioscorea odoratissima* and *Ocotea usambarensis* in the non-harvest zones

Plant stem densities

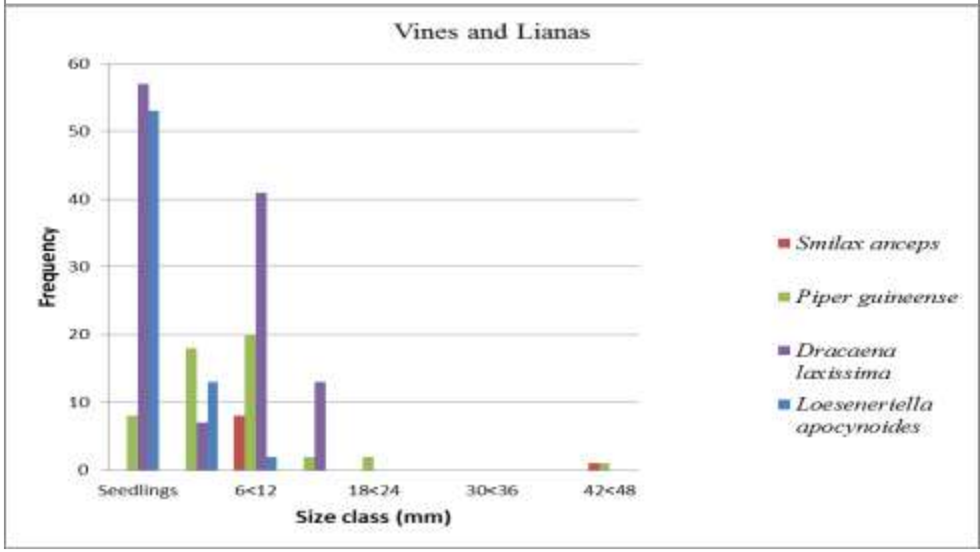
Plant species	Harvest zones		Non-harvest zones	
	stem density per ha	% frequency of occurrence	Stem density per ha	% frequency of occurrence
Smilax anceps	310	0.47	37	0.1
Ocotea usambarensis	41	0.01	5	0.01
Dioscorea odoratissima	20	0.03	3	0.02
Dracaena laxissima	633	0.67	290	0.23
Monanthotaxis littoralis	62	0.1	0	0
Piper guineense	490	0.5	140	0.2
Marantochloa manii	120	0.07	0	0
Milletia dura	67	0.02	17	0.03
Salacia elegans	38	0.03	94	0.03
Loeseneriella apocynoides	7	0.01	13	0.01
Rytigynia kigeziensis	12	0.17	25	0.05

5.2 Size class distribution

- There was no significant difference between harvest zones & non-harvest zones in plants’ size classes (***$T = 21$, P value < 0.05, Wilcoxon’s test***)

- Most plants depict a typical “inverted” J type of diameter size class distribution in both harvest and non-plant harvest zones (**Typical stable populations**)

- Only *L. apocynoides* depicts a population with many seedlings but no mature individuals (**Typical overexploited populations)**



5.3 Effect of environmental variables

- There was no significant relations between % tree canopy cover and stem densities of most plants in both harvest and non-harvest zones (**ANOVA**)

- Altitude was significantly related with stem densities of *Piper guineense, Monanthothaxis littoralis, Ocotea usambarensis, Marantochloa manii and Rytigynia Kigeziensis* in harvest zones only (**ANOVA**)

- In the non-harvest zones, altitude was not significantly related with stem densities of the important forest plants

- Most plants did not show significant relationship between slope and stem densities (except *S. anceps* , *M. manii, D. odoratissima*, *S. elegans* and *L. apocynoides)*

Stem density & % tree canopy

Plant species	Plant harvest zones		Non-plant harvest zones	
	F-ratio (F)	Probability (P)	F-ratio (F)	Probability (P)
Smilax anceps	0.43	0.94	0.52	0.83
Dracaena laxissima	0.30	0.99	0.58	0.79
Piper guineense	0.79	0.69	1.77	0.14
Monanthotaxis littoralis	1.01	0.53	0.06	1.00
Milletia dura	0.60	0.82	0.31	0.96
Ocotea usambarensis	2.49	0.11	0.42	0.91
Marantochloa manii	0.34	0.98	0.22	0.66
Dioscorea odoratissima	0.81	0.68	0.47	0.87
Salacia elegans	0.38	0.97	1.48	0.22
Loeseneriella apocynoides	0.43	0.85	0.58	0.79
Rytigynia kigeziensis	0.82	0.67	0.29	0.96

5.4 Annual bark productions (yield)

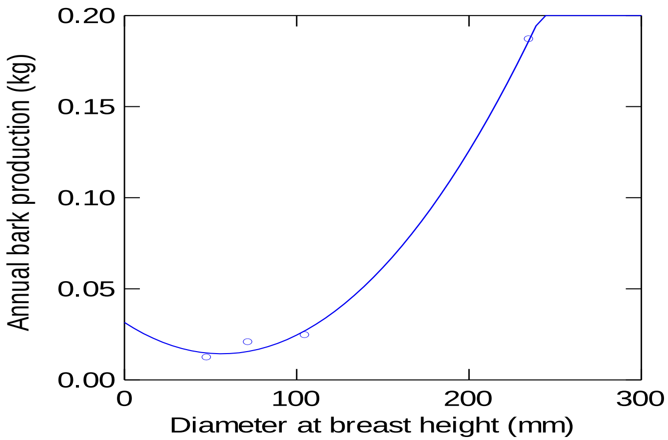
- There was a significant difference between harvest & non-harvest zones in tree bark yields of *Ocotea* (**T = 23, P value < 0.05, Wilcoxon's test)**

- There is an exponential increase in bark production with increasing plant diameters

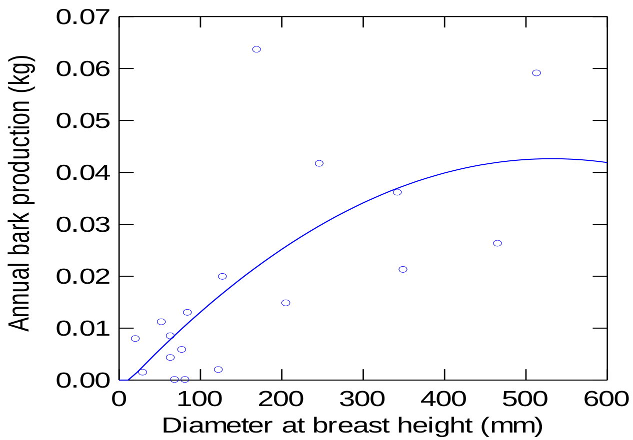
- *Ocotea* annual bark yields in plant harvest zones were 0.061±0.084kg & 0.016±0.022kg in non-plant harvest zones

- ***Mean annual bark productions are higher in harvest zones than in non-harvest zones***

Ocotea usambarensis (plant harvest zone)



Ocotea usambarensis (non-plant harvest zone)



5.5 Annual stem growth rates

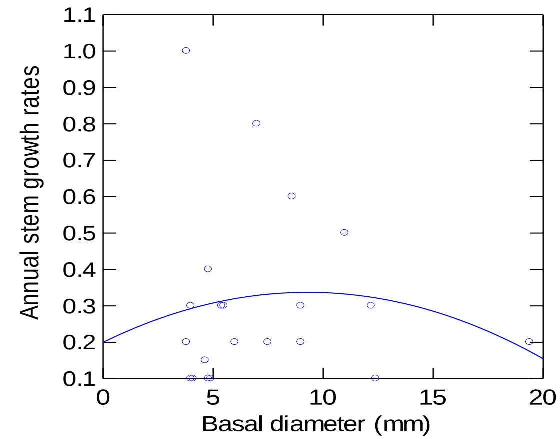
- There was significant difference between harvest & non- harvest zones in plant's stem growth rates of *Loeseneriella* (**T = 42.5, P value < 0.05, Wilcoxon's test)**

- There is an exponential increase in stem growth with increasing plant diameters

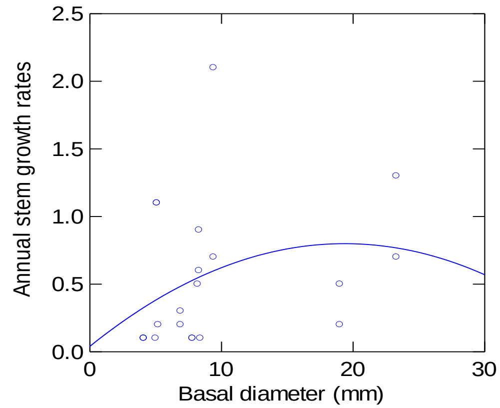
- Mean annual stem growth rates of *Loeseneriella* in harvest zones=0.31±0.24mm & 0.55±0.53mmin non-plant harvest zones

- ***Mean annual stem growth rates are higher in non-harvest zones than in harvest zones***

Loeseneriella apocynoiddes (plant harvest zone)



Loeseneriella apocynoiddes (non-plant harvest zone)



Conclusions

- Anthropogenic disturbances have played a major role in the abundance & distributions of the useful plants than env'ntal variables in Bwindi

- A part from *L. apocynoides & M. manii m*ost plants in Bwindi have experienced little or no harvest impacts

- Most plants, abundance, distribution & yields increase with increasing disturbance from harvesters

- A few plants (*L. apocynoides & M. manii),* abundance, distribution and yields decrease with disturbance from harvesters

Recommendations

- Park management should strengthen ex-situ cultivation of some important plants such as *O. usambarensis, P. africana, M. dura etc.*
- UWA should continue with the ban of the harvest *of L. apocynoides* liana and should also consider a ban for the harvest of *Marantochloa manii.*
- A proposal to harvest the *Milletia dura* tree for tool handles (hoes, axes and walking sticks) should not be allowed (slow growth rates-affected by harvests)
- UWA should consider increasing annual harvest offtakes of most plants from 1% to 10% without compromising their sustainability
- Need to strengthen the MUP monitoring by including other threatened plant species such as *M. manii, P. africana* (a CITES listed) & *P.guineense*

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THANK YOU FOR LISTENING!