Assessing the impacts of bark harvest on *Ocotea usambarensis* in Bwindi Impenetrable National Park, Uganda

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Major research project
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Fieldwork together with Else Langbroek

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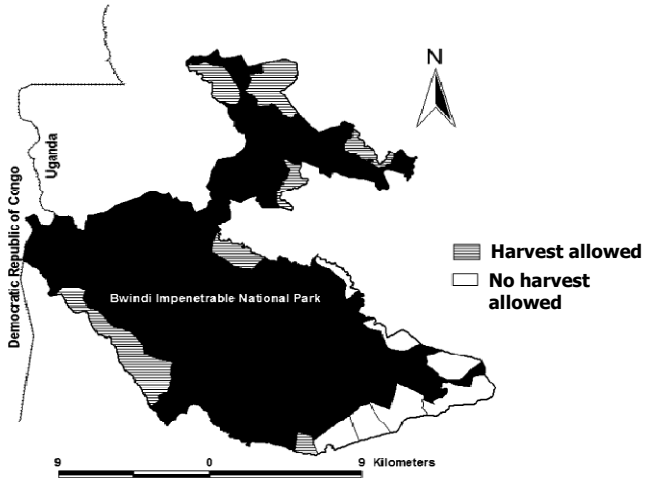
Introduction

Multiple use zones in Bwindi Impenetrable National Park:

- Controlled harvesting of non-timber forest products
- Harvest quotas based on rapid vulnerability assessment -> sustainability of approach unclear



This study:

Bark harvest tree *Ocotea usambarensis* for deworming and stomach aches

Goal

Assess impacts of bark harvest on population structure, dynamics and availability of *O. usambarensis* in future, to obtain indication to what extent current harvest levels are sustainable for longer periods

Research questions

What are the impacts of bark harvest on *Ocotea usambarensis* in Bwindi Impenetrable National Park, Uganda?

1. Current harvest → survival, diameter growth, reproduction rate (vital rates)?
2. Affected vital rates → survival of population?
3. Current harvest levels → availability resource future?

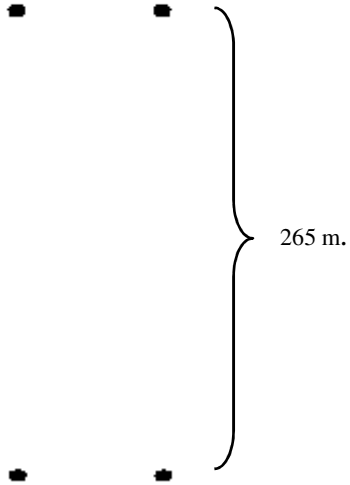
Methods

- Field measurements:

  Diameter, seedlings/sprouts, dead individuals, harvest signs

- Data analysis:

  - Description harvest levels
  - Assessment of population structures
  - Matrix population models construction (unharvested and harvested) and analysis



Constructing vital rates

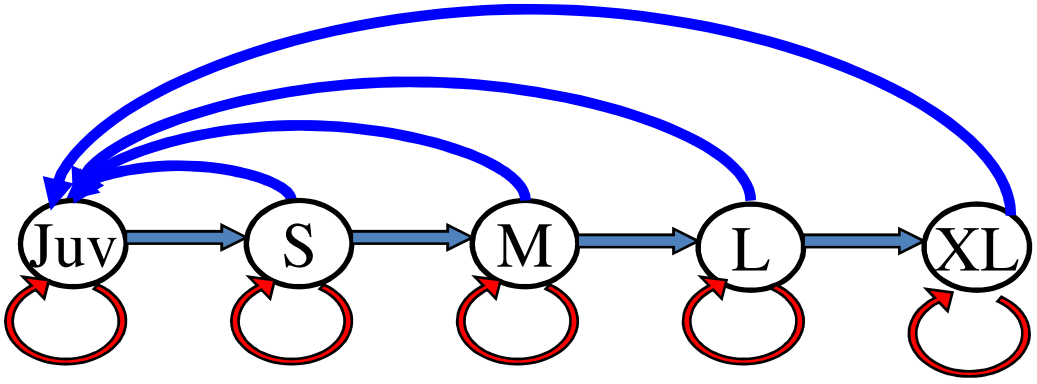
- *Growth*
  Linking diameters of individuals over years

- *Fecundity*
  Seedling data not useful

- *Survival*
  Mortality data 2009+2010

- Difference harvested and unharvested: diameter growth, number recruits

Matrix model construction



growth

stasis

reproduction

At time = t

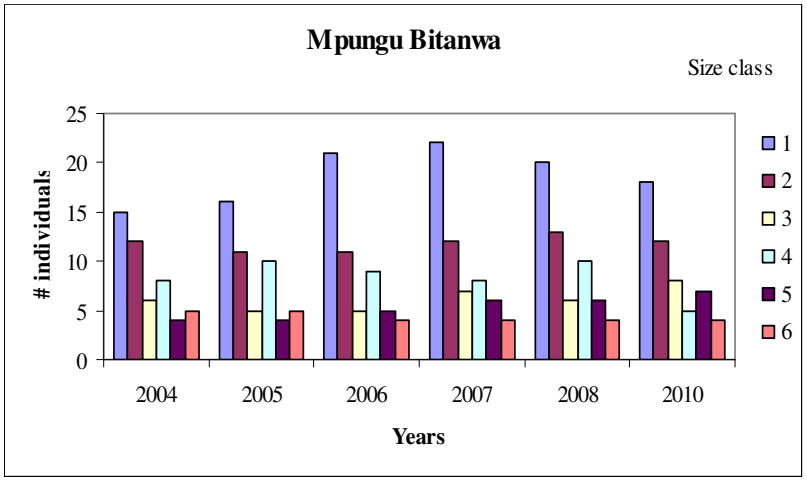
At time = t+1	Juv	S	M	L	XL
S					
M					
L					
XL					

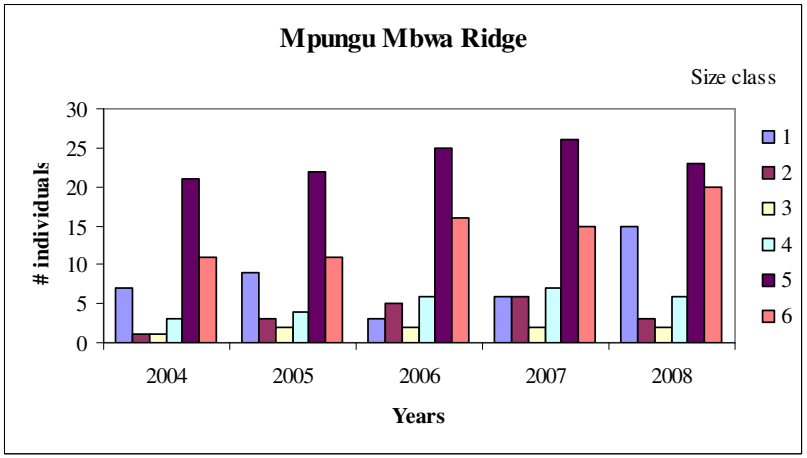
Results (harvest levels)

	Size class					
	1	2	3	4	5	6
n	276	203	124	73	40	13
% harvested	0,0	0,0	0,8	13,7	25,0	30,8

Area	% harvested trees	n
Ruhija (non-MUZ)	45,5	11
Mpungu Bitanwa (MUZ)	0,0	54
Mpungu Ntendure (MUZ)	11,4	166
Kifunjo Bushura (MUZ)	0,0	377
Kifunjo Masya (MUZ)	0,8	121

Results (population structures)





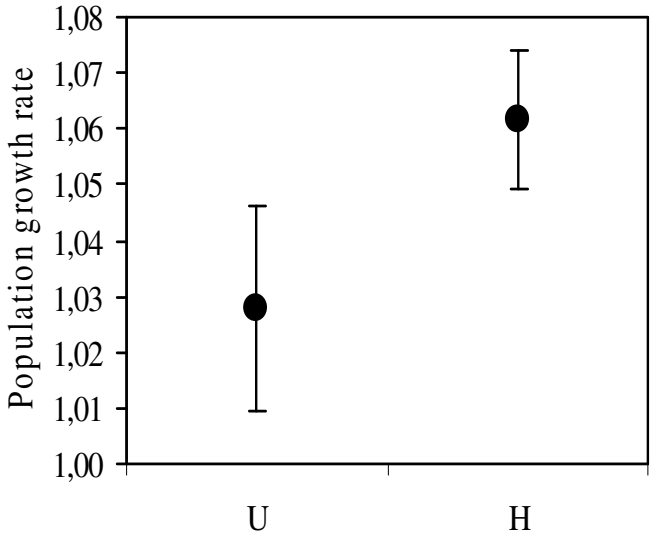
- Most areas more juveniles than adults

- Population structure between areas different

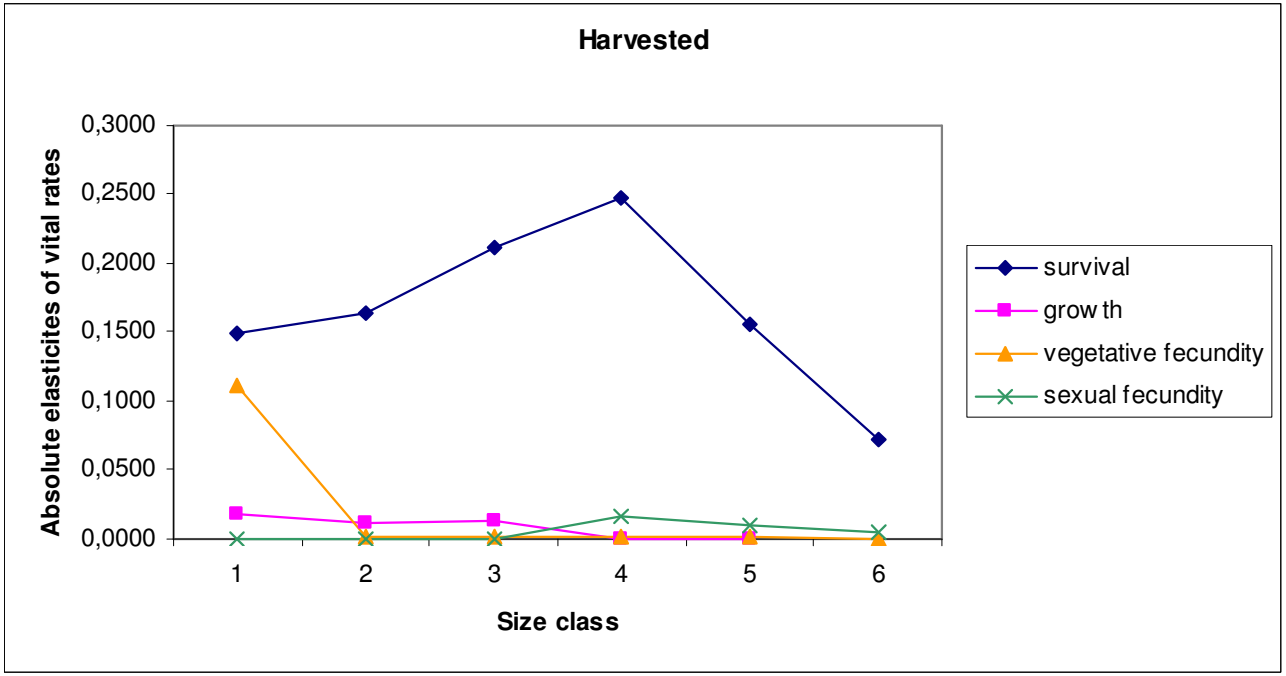
- Population structure within area stable over years

Results (population growth rates)

- Matrix unharvested population: λ= 1,0279
- Matrix harvested population: λ= 1,0615

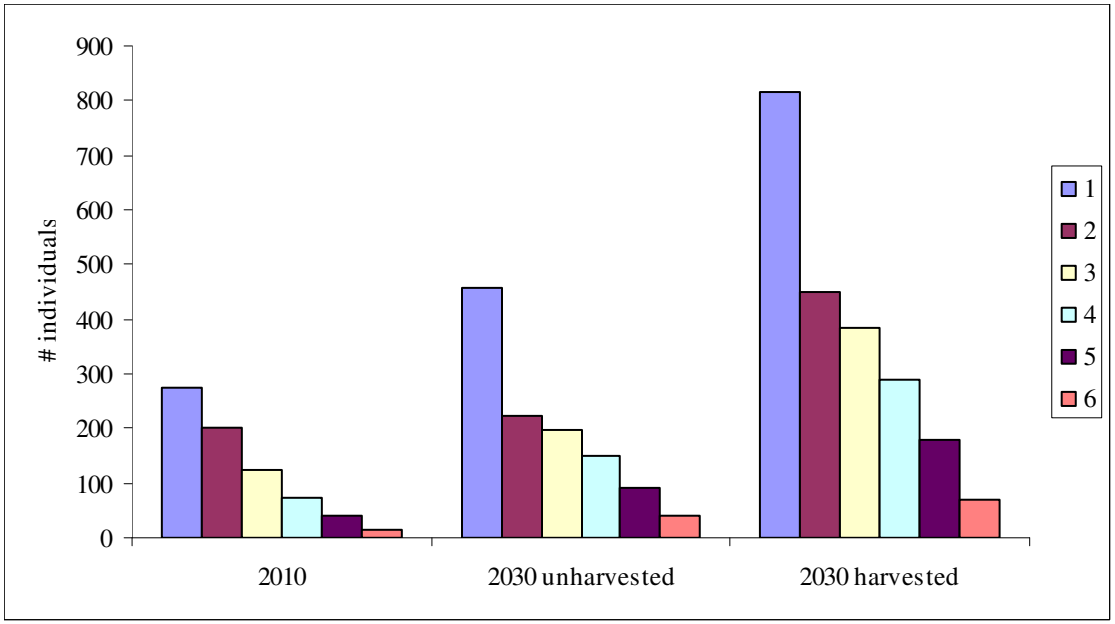


Results (elasticities vital rates)



Survival most important vital rate in determining population growth rate

Results (simulation future)



Discussion + conclusions

- Limited data (more would be better)
- Current harvest levels seem sustainable, but future monitoring of the harvest impacts will remain important
- 1. Current harvest → vital rates?

  Diameter growth (and reproduction) rate influenced by harvest

Discussion + conclusions (2)

- 2. Affected vital rates → survival of population?
  Both populations λ>1, but harvested population higher λ

- 3. Current harvest levels → availability resource future?
  Both populations increasing, harvested population more

Recommendations

- Tag individuals
- Experiment random selection harvested individuals
- More accurate estimations survival rate
- Transition probability seedlings -> juvenile trees

Many thanks to…

Else Langbroek

Pieter Zuidema
Douglas Sheil
Robert Bitariho

Our field assistants
Staff of ITFC

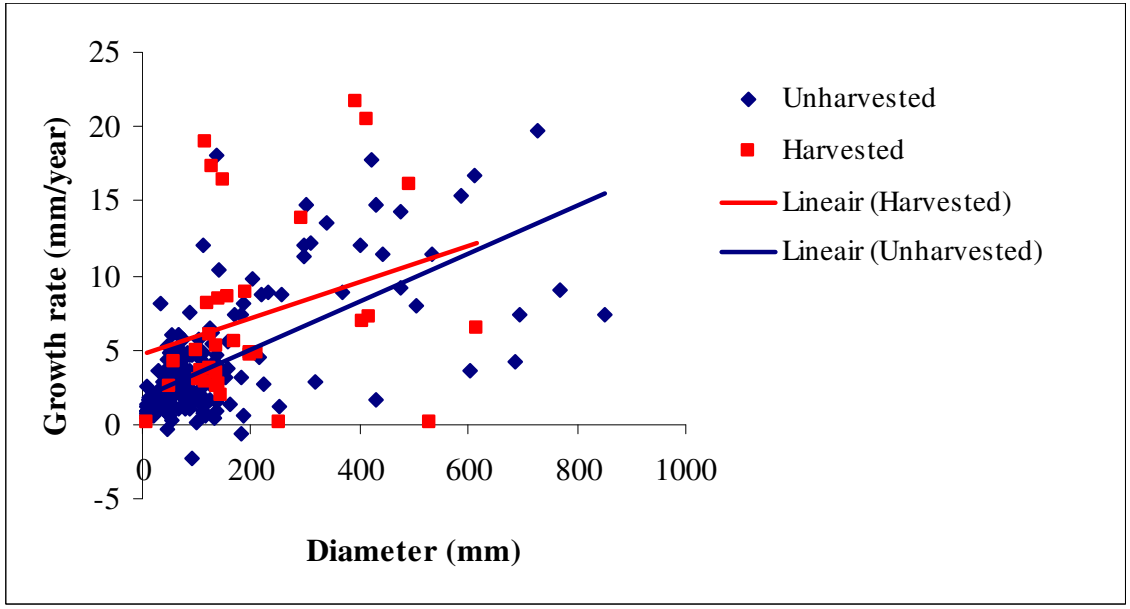
Heinjo During
Fellow students

Questions

Compare population structures

Area	Years compared	PS (%)
Ruhija	2004 - 2010	14,3
Mpungu Bitanwa	2004 - 2010	88,9
Mpungu Ntendure	2004 - 2010	85,6
Mpungu Mbwa Ridge	2004 - 2008	85,6
Kifunjo Bushura	2005 - 2010	95,7
Kifunjo Masya	2005 - 2010	77,5

Growth rates



Matrices

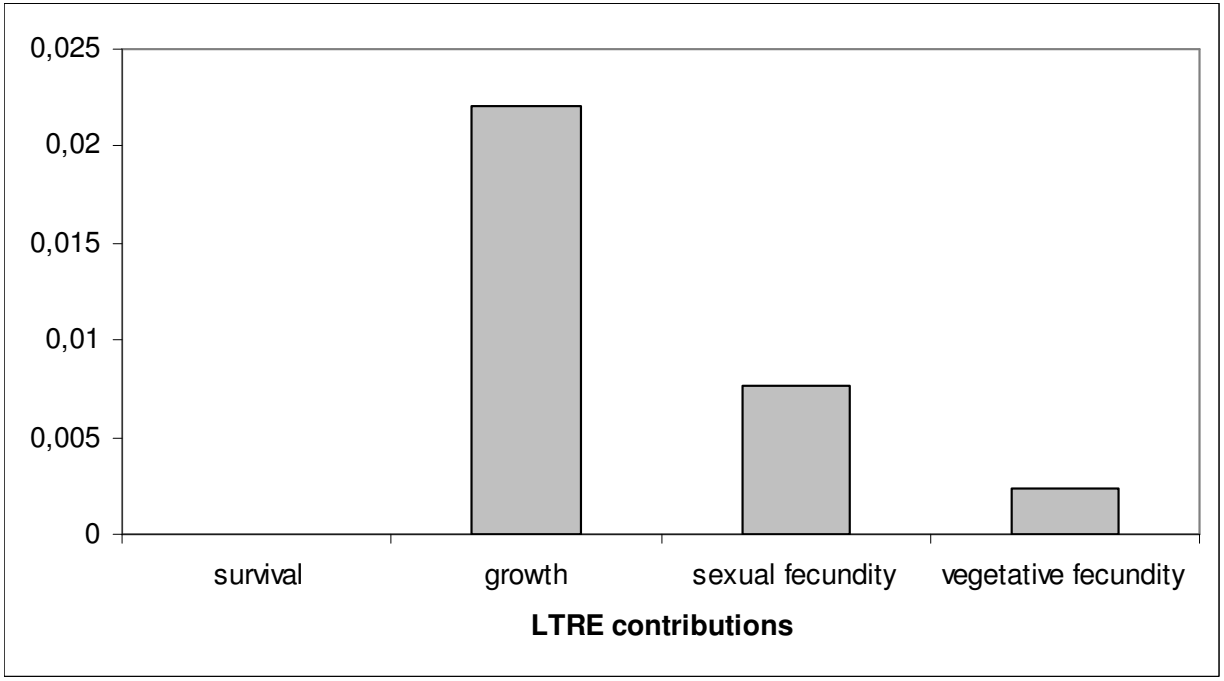
Unharvested				Vital rates						Matrix elements			
Size class	Range	Ax	Nx	sx	gx	fsx	rsx	fvx	rvx	Gx	Px	FSx	FVx
1	2,0-29,9	28	276	0,8995	2,2103 +- 0,7216	0	0	0,2099	0,1076	0,0710	0,8285	0	0,0203
2	30,0-59,9	30	203	0,9674	2,6453 +- 1,8417	0	0	0,2099	0,1076	0,0853	0,8821	0	0,0218
3	60,0-109,9	50	124	0,9863	3,2453 +- 1,7700	0	0	0,2099	0,1076	0,0640	0,9223	0	0,0223
4	110,0-199,9	90	73	0,9863	4,2953 +- 3,4516	1	0,2450	0,2099	0,1076	0,0471	0,9392	0,2416	0,0223
5	200,0-449,9	250	40	0,9863	6,8453 +- 4,8014	1	0,2450	0,2099	0,1076	0,0270	0,9593	0,2416	0,0223
6	>= 450,0		13	0,9863	11,8485 +- 5,0641	1	0,2450	0,2099	0,1076		0,9863	0,2416	0,0223

Harvested				Vital rates						Matrix elements			
Size class	Range	Ax	Nx	sx	gx	fsx	rsx	fvx	rvx	Gx	Px	FSx	FVx
1	2,0-29,9	28	276	0,8995	4,2683	0	0	0,2099	0,1491	0,1371	0,7624	0	0,0281
2	30,0-59,9	30	203	0,9674	4,7033 +- 1,2472	0	0	0,2099	0,1491	0,1517	0,8157	0	0,0303
3	60,0-109,9	50	124	0,9863	5,3033 +- 1,0359	0	0	0,2099	0,1491	0,1046	0,8817	0	0,0309
4	110,0-199,9	90	73	0,9863	6,3533 +- 5,2445	1	0,3394	0,2099	0,1491	0,0696	0,9167	0,3348	0,0309
5	200,0-449,9	250	40	0,9863	8,9033 +- 8,1520	1	0,3394	0,2099	0,1491	0,0351	0,9512	0,3348	0,0309
6	>= 450,0		13	0,9863	13,9065 +- 7,9978	1	0,3394	0,2099	0,1491		0,9863	0,3348	0,0309

SSD

		Unharvested		Harvested	
Size class	Observed (%)	SSD (%)	PS (%)	SSD (%)	PS (%)
1	37,9	40,2	37,9	37,3	37,3
2	27,8	19,6	19,6	20,8	20,8
3	17,0	15,8	15,8	17,5	17,0
4	10,0	11,4	10,0	12,7	10,0
5	5,5	7,8	5,5	8,0	5,5
6	1,8	5,1	1,8	3,7	1,8
Total			**90,6**		**92,3**

Results (LTRE)



Difference in population growth rate mainly due to difference in growth rate