

RISK IN DIVERSIFYING AGRICULTURAL LAND USE: PERCEIVED IMPACTS OF WOODY SPECIES AND LIVELIHOOD DIVERSIFICATION STRATEGIES IN THE CENTRAL HIGHLANDS OF ETHIOPIA

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Problem statement and research rationale

- Continuous expansion of agricultural land at the expense of natural forests
- Degradation and disappearance of natural forest resources → dwindling options to farm households in managing and coping with the risk of income reduction from livelihood activities
- Institutionally-perceived potential of woody plants to non-competitively occur on-farm for provisional and supporting ecosystem services in line with Millennium Development Goals
- Divergence of farmer's and researcher's perceptions on woody plants on-farm, particularly in farm fields → influences on tree and shrub adoption decision and behaviour
- Research on farmer's risk perception and responses to risk in farming and other livelihood activities → development of adapted land use systems incorporating ecosystem services as appreciated by farmers

Objectives

- to analyse farmers' risks perception and responses to risk in farming linked to woody species in farm fields and potential service functions
- to analyse the role of trees and shrubs on-farm in diversifying livelihood activities



Photo (Krause): Study area in Dendi district

Methodology

Theoretical setting

- Farming Systems Approach (Farming Systems Analysis)

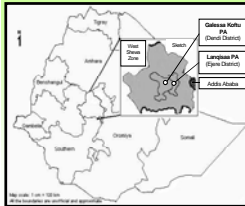
Methods in field research

- Appraisal surveys (Key person interviews, pair-wise use rankings, focus group discussions, transects and on-station botanical assessments)
- Formal surveys (Structured questionnaire approach, direct rankings, 5-point-Likert-scaled perception ratings of likelihood of risk in farming)

Analytical tools

- Descriptive statistics (Frequencies, Correlation analysis, Chi²-Test)

Study sites and sampling



Map: Administrative location of study area/sites

Village	Total number of hhs			Sample size [%]		
	M	F	Total	M	F	Total
Lanqisaa (PA1)	414	74	488	13.0	14.9	16.2
Galessa Koftu (PA2)	329	72	401	16.7	13.9	13.3
Total/ Mean value	743	146	889	14.7	14.4	14.6

- Systematic random sampling of 130 hhs (65 per village)
- Ex-post stratification (adopter/non-adopter)
- Temporal dimension: Cross-sectional
- Spatial dimension: Lumped at local administrative scale, defined by boundaries of the farm system

Results I: Perceived risk of annual crop yield reduction in farm fields with and without integrated woody plants

Presence of woody plants in farm fields	HH involved		Perceived likelihood of annual crop yield reduction									
	HH involved		PA1 ⁽¹⁾					PA2 ⁽²⁾				
	np _{PA1}	np _{PA2}	% of np _{PA1} , np _{PA2}									
Farm fields without woody plants	64*	65	3	23	52	19	3	-	8	57	34	2
Woody plants in and around farm fields	64*	65	0	48	25	23	3	-	23	43	34	0

*1 missing case.
Perceived likelihood of annual yield reduction: 1= For sure, 2= Likely, 3= As likely as unlikely, 4= Unlikely, 5= Certainly not.
⁽¹⁾⁽²⁾ = Monte-Carlo significance (2-tailed) of χ^2 at ⁽¹⁾ $\alpha=0.01$; ⁽²⁾ $\alpha=0.041$ (presence of woody plants in farm fields and the perceived likelihood of annual crop yield reduction)

- most frequently avoided woody species: *Eucalyptus spp.* (PA1 & PA2), *Rumex nervosus*, *Juniperus procera* (PA1), *Cupressus lusitanica*, *Rosa spp.* (PA2)
- most frequently stated sources of risk: soil fertility decreases, competition for water (PA1), shade on annual crops (PA2)

Results II: Responses to risk in farming linked to woody species and perceived service functions

Preferred woody species	Preference rank [% of total respondents]						Preferred service function to reduce risk [% of respondents involved in preference ranking]									
	PA1			PA2			PA1					PA2				
	1 st	2 nd	3 rd	1 st	2 nd	3 rd	1	2	3	4	1	2	3	4	5	
<i>Hagenia abyssinica</i>	2			76	14	5					X*					
<i>Croton macrostachyus</i>	58	9	6				●	●	●	○						
<i>Dombeya torrida</i>				8	47	13										
<i>Buddleja polystachya</i>				3	20	33										
<i>Acacia spp.</i>	3	22	24				●	●	●	○					X*	
<i>Juniperus procera</i>	18	9		3	6	3	●	●	○	○					●	
<i>Podocarpus falcatus</i>	3	9	8		2	5	●	●	○	○					X*	
<i>Olea africana</i>	2	6	11				●	●	x	○						
<i>Carissa edulis</i>	6	6	10				●	●	○	x						
<i>Vernonia amigdalina</i>	2	12	3				●	●	○	○						
<i>Cupressus lusitanica</i>		3	2								X*				X*	
<i>Chamaecytisus spp.</i>				3	2	2									X*	
Other	2	14	11		5	4	7	●	●	○	○				●	
Total	100	100	75	100	100	75	●	●	○	○	●	●	○	○	●	

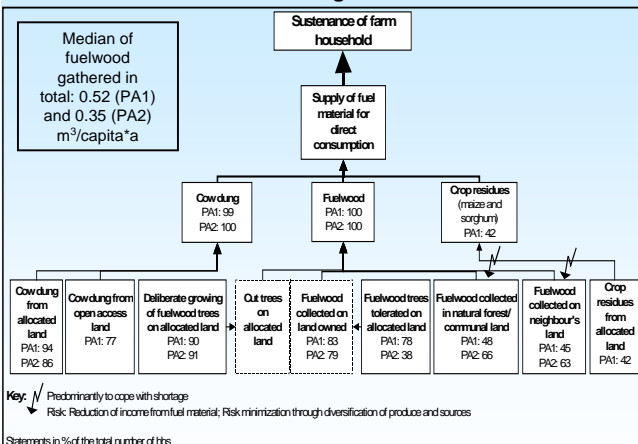
Preferred service function to reduce risk: 1=Prevention from soil erosion; 2=Wind-breaking function; 3=Soil fertilization; 4=At least no negative impact on annual crop production and harvest; 5=Protection against frost; Share of respondents perceiving service function or no influence of woody species: ● 100-67%; ● 66-34%; ○ 33-1%; x nil; X* insufficient data base

- non-competitively occurring woody species in predominantly scattered and contour-bounded spatial arrangements (Krause 2005)

Conclusions

- Farmers perceive woody species to be both sources of and means to respond to production risk in agriculture.
- The perceived competition of woody species with annual crops for natural resources coincides with the reluctant behaviour to accept particular woody species in farm fields.
- Stochastic-environmental sources of agricultural production risk are mitigated by non-competitively occurring woody species through service functions perceived by farmers.
- Although woody plants in farm fields contribute to manage and cope with the risk of income reduction from acquiring fuel material as major livelihood activity their importance continues to stay secondary to other sources of fuel material.
- The occurrence of woody species in farm fields is driven by the utility depending on (1) goods for diversifying livelihood activities, and (2) complemented by service functions perceived by farmers.

Results III: Diversification strategies on fuel material income



- 33% and 56% of tree adopters in total make use of farm fields, only 12% and 31% deliberately grow but 93% and 42% tolerate trees for fuelwood in PA1 and PA2

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