The nexus between poverty and smallholders' investments in agroforestry: A case study from Tanzania

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Introduction and Objective

- Environmental degradation and poverty of rural households are often closely linked in developing countries (Holden et al., 1998).
- In the course of environmental degradation and the awareness of scarce natural resources, special emphasis is given to the protection of high valued areas such as wetlands and forests.
- Agroforestry provides new income possibilities, substituting the extraction of firewood, timber, wild fruits or vegetables from forests implying an environmental long-term farm investment.
- The individual time preferences paraphrased as individual future evaluation play an important role in the investment decision. The rural poor are often characterized by high time preferences. They prefer consumption today compared to than in the future - which decrease the probability of investing in natural conservation (Holden et al., 1998).
- In the case of agroforestry, benefits from agroforestry such as timber, firewood and improved soil conditions accrue in the future, but input factors e.g. seedlings, fertilizers, irrigation, and manpower have to be invested in the present.
- This paper aims to analyse the nexus between poverty and smallholders' long-term investments in tree cultivation considering their future evaluation.

Conceptual Framework

- Benin et al. (2003) reported less erosion problems and higher fertility-levels on plots where trees were planted in Ethiopia. Before agroforestry can actually alleviate soil erosion, the awareness of having yield losses due to soil erosion is important together with the knowledge that agroforestry has a positive impact on soil quality and thus on the yields in the long run.
- Firewood sufficiency is increased from trees they planted on their own farms (Current et al., 1995).
- Trees serves as a collateral to get credit access (own results).
- Holden et al. (1998) claimed that poverty may lead to short planning horizons, which may prevent poor farm households from investing in conservation to protect their natural resource base. A low present value or high time preference leads to lower tree intensity.
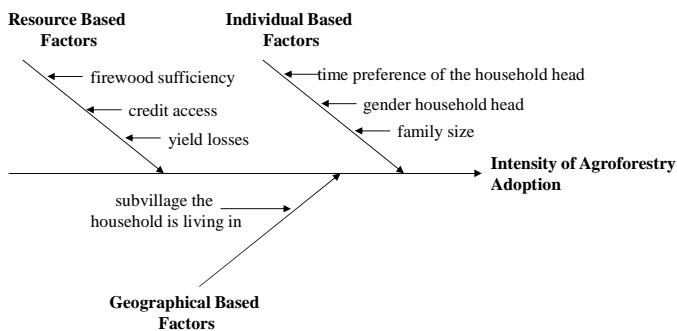
- The determination of factors influencing the intensity of agroforestry on smallholders' plots will be captured an econometric analysis assessing the impact on the dependent variable tree density

Data Source and Household Selection

- The data were collected in a comprehensive household survey undertaken in Tandai village, Kinole Ward, Morogoro District in 2010; applied with a stratified sampling.
- Within this scope, 314 (30%) out of 1015 households were selected.
- Farm households are typically small-scale farmers with an average of 4 acres agricultural land. The agricultural portfolios comprise cash cropping (banana, pineapple, and spices) and subsistence farming.
- This study is part of the Better-iS research project "Biofuel Evaluation for Tanzanian Technological Efficiency using Renewables – integrated Strategies".

References
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Methodology

- The overall objective is first of all to determine the factors influencing the investment in agroforestry which special emphasis on the individual time preferences, soil erosion and firewood sufficiency.
- classical linear regression model using ordinary least squares (OLS) is performed on the tree density as a proxy variable for the acceptance and adoption intensity of agroforestry.
- Through BETA coefficients the influence of variables measured in different units is comparable.

Results

Table 1: Relevant household characteristics of smallholders in Tandai

Variable	Mean	Std.Dev.	Min.	Max.	Obs.
Individual present value [TZS]	34788	35073	5000	100000	307
Family size [members]	6.25	2.65	1.00	17.00	314
Gender HH head male [%]	0.82	0.39	0.00	1.00	314
Firewood sufficiency [headload]	0.23	4.14	-14.00	46.00	303
Yield losses [acres]	3.05	4.85	0.00	48.00	307
Credit access [1=yes]	0.38	0.49	0.00	1	312

Source: Own calculations

Table 2: Variables influencing the intensity of agroforestry adoption in Tandai

Independent Variable	Parameter Estimate	Standard Error.	t-Value	BETA Coefficient
Individual present value [TZS]	0.000006	0.00	3.38***	0.19
Family size [members]	0.07	0.02	3.09***	0.18
Gender HH head male [%]	0.36	0.17	2.13**	
Firewood sufficiency [headlots]	0.05	0.01	3.68***	0.21
Area yield losses [acres]	-0.07	0.01	-5.40***	-0.32
Credit access [1=yes; 0=no]	0.36	0.13	2.72***	
Doga	0.09	0.21	0.42	
Kisambwa	0.32	0.19	1.65	
Lukenge	0.30	0.22	1.38	
Lusegwa	0.38	0.20	1.91	
Nyange	-0.58	0.24	-2.45	
Tonya	-0.46	0.23	-2.02	
Intercept	1.81	0.24	7.43	

n=263   R²=0.26   VIF= 1.04-1.49, Breusch-Pagan Test: n.s.

*Significant at 10%. **Significant at 5%. ***Significant at 1%.
Dependent variable: ln (tree density)
Source: Own calculations

- When the present value increases by TZS 1889 (= €1) the tree density increases by 1.13%. The parameter estimate for the variable present value indicates that the acceptance of agroforestry is higher if the rate of discount is lower.
- The parameter estimate for firewood sufficiency of 0.05 implies a rise in the predicted mean of tree density by 5% if the firewood sufficiency increases by one head-lot.
- The parameter estimate for area yield losses as a proxy variable for the awareness of environmental degradation shows a positive impact on tree intensity.
- The large positive regression coefficient for credit access indicates that a liquidity constraint is often present which hinders the smallholders of Tandai from tree planting.

Conclusion and Outlook

- The variables area yield losses and firewood sufficiency exhibit the largest BETA coefficients in absolute values.
- That is why these two variables have the largest impact on the smallholders' decision to plant trees among the non-dichotomous variables. Although, the coefficient is very small, time preferences are highly significant on the cultivation of trees.
- Next steps include the consideration of:
  - Income
  - Differences in the quantiles of tree cultivation and income ➔ quantile regression
  - Sustainability of own firewood production and growth rate of household agroforestry

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