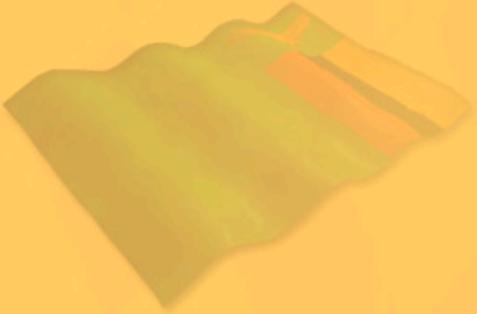# Seeing the forest for the fuel and food:
Rural poverty and forest sustainability in Zambia

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Overview

- Non-timber forest products
- Rural poverty in sub-Saharan Africa
- Zambia
- Research objectives
- Two-stage econometric model
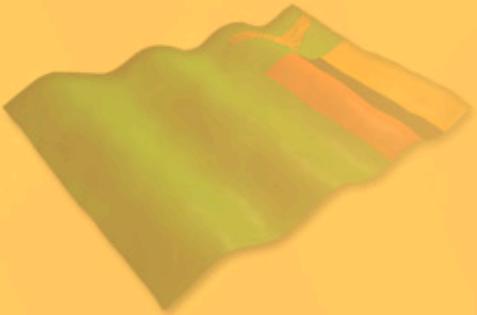- Results and discussion

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Forests in sub-Saharan Africa

- Critical sources of food, medicine, shelter, building materials, fuels, and cash income
- More than 80% of urban households use charcoal as their main source of cooking
- More than 15 million people earn their income from forest-related enterprises

- Sources of income generation and opportunities for poverty alleviation in both rural and urban areas

Kaimowitz, 2003

IEA, 2010

Non-timber forest products

- Widespread trade in non-timber forest products (NTFPs)
- Include a range of forest extracts including bark, roots, tubers, leaves, fruits, flowers, seeds, resins, honey, mushrooms, insects and firewood
- Role of NTFPs in livelihoods is not well understood
  - little attention in social science research, development
  - activities are dispersed, small scale
- Potential role in poverty alleviation
  - if forests are managed sustainably

Sunderland et al., 2003

Forests and poverty alleviation

Non-timber forest products (NTFPs) contribute to poverty alleviation through two avenues:

1. Markets for NTFPs provide opportunities for income generation
   - collection and trade in NTFPs in rural areas
   - sale in urban areas
   - safety net

2. Convenient and reliable source of energy for cooking and inexpensive food at relatively stable prices
   - charcoal is vital for poor households
   - mushrooms, wild honey, caterpillars

Arnold et al., 2006

NTFPs as a safety net

- Household income diversification

- Supplementary income during off-season

- Safety net in periods of weak crop yields

- In some cases, the only source of income for local communities

- In many cases, the only source of affordable fuel for cooking and heating

Shackleton and Shackleton, 2004

Wollenberg and Septiani, 1998

Research objectives

- Examine the contribution of NTFPs to rural household welfare in Zambia
  - household income

- Estimate the characteristics of households that participate in business activities associated with NTFPs
  - human capital, socio-demographic variables, physical assets, location, other social and institutional variables

de Janvry and Sadoulet, 2001

- Are poor households more dependent upon NTFPs?

Republic of Zambia

- Landlocked country in southern Africa

- Tropical climate

- Flat plateau (1000-1500 m)

- Nine provinces

- High poverty rate (74%)

Charcoal production

- Bigger trees cut into smaller logs
- Burned in an earthen kiln
- Primarily the work of men and older boys
- Meant for sale

CHAPOSA, 1999

Charcoal production (*continued*)

- "Energy ladder" hypothesis
  - Reliance on fuelwood decreases with higher incomes, urbanization
  - Charcoal: "transition fuel"
- Important consideration for poverty reduction
  - Also seen as "dirty," "primitive"
- Trading bans in many countries have driven market underground, increased corruption

Chaix, 2011; Sepp, 2010; Mugo and Ong, 2006; CHAPOSA, 1999

Charcoal production (*continued*)

- Ease of entry and exit

- Stable market

- Important source of income in off-season

CHAPOSA, 1999

Charcoal production (*continued*)

- Net annual benefit from charcoal production: ZMK 646,000-810,000 (US$171-214)

- Compares favorably with net benefit for maize farmers (mean = ZMK 675,000)

- Employment, social stability, income distribution

CHAPOSA, 1999

Charcoal and firewood consumption

- Most households collect firewood for own use

- Purchased charcoal is second most common source of energy

Sources of energy	% of respondents
Purchased firewood	3.3%
Collected firewood	58.2%
Purchased charcoal	*19.8%*
Produced charcoal	3.5%
Electricity	14.9%
Kerosene/parafin/gas	0.3%

Zambia Living Conditions Monitoring Survey, 1998

Theoretical model

$Y_i = \beta X_i + \varepsilon_i \sim Normal\ (0,\sigma^2)$

- where Y_i = income from NTFPs for household i

- X_i = vector of household and community characteristics assumed to influence income from NTFPs

- β = vector of parameters to be estimated

- ε_i = random error term, normally distributed with zero mean and constant variance (σ^2)

Household survey data

- Survey of rural households in 2008
- Sample of 410 Standard Enumeration Areas (SEAs)
  - 20 households in each SEA
  - target sample of 8,200 households
  - non-response, n=8,094
- Included questions about income from business activities, including NTFPs
  - charcoal/fuelwood
  - wild honey
  - wild mushrooms
  - ants/caterpillars

Households with income from NTFPs

Province	Hshlds	NTFP Hshlds	Woodfuel	Ants/ Ctrplrs	Mshrms	Wild Honey
Central	820	49 (6%)	98	2	4	2
Copperbelt	491	41 (8%)	85	5	15	2
Eastern	1,522	24 (2%)	79	0	8	13
Luapula	988	88 (9%)	64	31	18	1
Lusaka	268	10 (4%)	100	0	0	0
Northern	1,604	31 (2%)	65	26	6	6
Northwestern	566	83 (15%)	5	75	24	19
Southern	1,018	76 (7%)	84	0	15	7
Western	817	59 (7%)	97	0	7	0
TOTAL	8,094	478	314	103	63	29

NTFPs and rural food security

- Only 478 of 8,094 households reported income from NTFPs
  - literature suggests that the poor may be more dependent on forest products to meet basic needs
- Sub-sample of households in districts where the average share of household income from NTFPs at least 10%
  - greater household dependence on NTFPs
  - NTFP business activities more prevalent
- 16 out of 72 districts met the threshold (n=1,257)
- 216 households reported income from NTFPs (17%)

Distribution of income from NTFPs

- Four income quartiles
- Households in the 4th (wealthiest) quartile earned more income from NTFPs than the 1st (poorest) quartile in absolute terms
- The share of income from NTFPs was greater for poor households
  - poor rely more on NTFPs to supplement farm income
  - average income from agriculture + NTFPs = 77% of total, as compared to 60% for 4th quartile
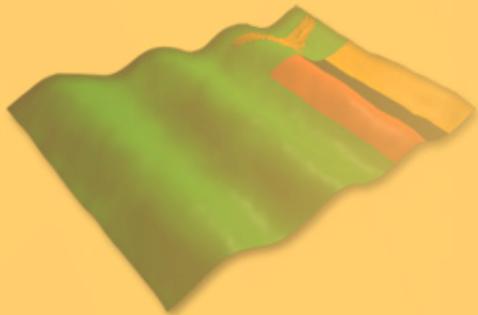
Household income by income quartile
(n=216)

Household income (000s of Kwacha)	1st	2nd	3rd	4th
Total income	3,266	4,263	4,770	9,863
NTFP income	1,253 (39%)	1,382 (36%)	1,341 (31%)	2,244 (24%)
Charcoal/firewood	883 (29%)	743 (24%)	651 (20%)	674 (15%)
Ants/caterpillars	196 (7%)	436 (9%)	537 (8%)	877 (7%)
Mushrooms	85 (2%)	51 (1%)	71 (1%)	76 (1%)
Wild honey	87 (2%)	151 (2%)	53 (1%)	588 (2%)
Agricultural income	887 (31%)	985 (30%)	1,396 (38%)	2,773 (40%)
Wage income	63 (3%)	98 (3%)	107 (1%)	357 (4%)
Trading income	858 (21%)	1,667 (26%)	1,806 (26%)	4,235 (28%)
Remittance income	205 (7%)	130 (5%)	120 (3%)	255 (4%)

Two-stage empirical model

- Cragg (1971) tobit alternative model
  - allows for separate estimation of determinants of the probability of participation and the value of income
  - consist of both a probit and a continuous regression

Stage 1: $P(D_i=1 \mid X_i) = \gamma X_i + \mu_i$

Stage 2: $Y_i = \beta X_i + \varepsilon_i$ where

- D_i = 1 if the household participated in NTFP business activities
- Y_i = NTFP **share** of total income
- X_i = vector of explanatory variables postulated to influence participation and magnitude of NTFP contribution to household income respectively, and is the same for both stages
- γ = vector of coefficients associated with X_i in the first stage
- β = vector of coefficients associated with X_i in the second stage

Results

- Age and education of the household head are negatively associated with both (i) the probability of participation in NTFP business activities and (ii) the contribution of NTFPs to household income

- Households headed by males are more likely to participate in NTFPs

- Value of maize harvest is negative, significant

- Value of household assets is negative, significant
  - positive relationship between poverty and dependence on NTFPs
  - households with more valuable assets rely less on NTFPs than those with fewer assets

Model: participation in NTFPs and income

Variable (n=1,257)	Stage 1	Stage 2	Probit	UAPE
Intercept	-0.78 **	0.99 **	n/a	n/a
Age of head (years)	-0.01 ***	-0.00	-0.002 ***	-0.001 ***
Sex of head (=1 if male)	0.31 ***	0.03	0.069 ***	0.028 **
Education of head	-0.05 ***	-0.02	0.003 ***	-0.003 **
# adult males	0.03	0.14 ***	0.007	0.011 ***
# adult females	0.01	-0.13 **	0.002	-0.007 *
Land owned (ha)	0.07 *	-0.08 *	0.017 *	-0.001
Maize harvest (kg)	-0.03	-0.11 ***	-0.007	-0.009 ***
Assets owned (ZMK)	-0.00	-0.04 ***	-0.001	-0.003 ***
Distance to town (km)	-0.01 **	-0.00	-0.001 **	-0.001 ***
Distance to road (km)	0.01 *	0.01	0.002 *	0.001 **

*, ** and *** refer to statistically significance at 10%, 5% and 1%, respectively

Implications for sustainable development

- Role of NTFPs in household food security is often ignored by technocratic forest management policies and rural development strategies (stigmatized)

- NTFPs represent about 1/3 of income of participating households

  - Poor households are more dependent

- Provide an important safety net to supplement household income

- Can integrated policies provide for sustainable NTFP use?

  - Sustainable charcoal?

Conclusions

- Income from NTFP activities decreases with higher incomes

  - Pathway out of poverty?

- Dual concern for depletion of forest resources and poverty reduction

- Highlights the importance of a comprehensive sustainable development policy

  - Rural household vulnerability

  - Environmental sustainability

- Need for broader perspectives (e.g., gender, equity, qualitative information)