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The Role of Food from Natural Resources in Reducing Vulnerability to Poverty: A Case Study from Zimbabwe

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1. Introduction

Poverty is the major problem in rural areas of Sub Saharan Africa. In Zimbabwe in 1995, 48% of the rural population lived below the poverty threshold (Alwang et al., 2002). Many of those, however, are at risk to fall deeper into poverty as a consequence of various micro and macro shocks such as family tragedies, complete harvest failures, energy crisis and political upheavals. Likewise, people whose income is above the poverty line may fall back into poverty. Hence, any analysis of poverty reduction measures must treat poverty in a dynamic context and identify risk-reducing strategies that lower the probability of people falling back or falling deeper into poverty. Generally, risk-management strategies such as diversification and income skewing aim at income smoothing from an ex-ante perspective. Risk-coping strategies include self-insurance like precautionary savings, i.e. building up of assets, and group-based risk sharing. They deal with risk from an ex-post perspective and aim at consumption smoothing (Dercon, 2000). The collection of wild foods is a commonly used risk-coping strategy by rural dwellers in developing countries. Wild foods, e.g. fruits, bush-meat, honey, mushrooms, etc., are food from natural resources, which are collected in communal areas and along roads. They are an especially important income source for poor people since entry barriers for collection and use are low (Dewees, 1994). A variety of edible wild fruits are a popular natural resource in Southern Africa (Maghembe et al., 1998, Cavendish, 2000). They are extensively used by the local population and, apart from own consumption; they are increasingly being sold in markets (Maghembe et al., 1998; Ramadhani and Schmidt, 2002). Indigenous fruits (IF) are available during times of drought and famine, thereby contributing to food security (Rukuni et al., 1998; Mithöfer and Waibel, 2003). In the past, the fruits were a public good, but growing competition over the fruits due to an

increasing population led to increased rivalry and has changed the status of the resource to an open access good (Ramadhani, 2002). Despite their role in sustaining food security, research and development has only recently recognized their importance. Wild harvesting of forest products, especially fruits, is considered as a first major step in their domestication and commoditization (Simons and Leakey, 2004). Therefore, research in the last decade has focussed on efforts to domesticate indigenous fruit trees in addition to conservation strategies (Akinnifesi et al., 2004).

This paper analyses the role indigenous fruit tree products as currently available in Zimbabwe play in reducing vulnerability to poverty.

2. Theoretical background and methodology

Common measures of poverty are static. In contrast, vulnerability is a dynamic concept and captures the response to changes over time (Webb and Harinarayan, 1999; World Bank, 2001). An individual's or household's exposure to risk factors and their ability to cope with them determine the degree of vulnerability. Income risk and the failure to cope with it result in household consumption fluctuations. It affects nutritional, health and educational status as well as contributing to inefficient and unequal intra-household allocations (Dercon, 2000). Vulnerability results from poverty, but at the same time can reinforce downward trends of income processes and lead to poverty (Morduch, 1994). Information on factors that determine vulnerability can help to design anti-poverty intervention strategies.

Several concepts of vulnerability have been suggested (Hoddinott and Quisumbing (2003) provide a review) including vulnerability as expected poverty (Pritchett at al., 2000), as low expected utility (Ligon and Schechter, 2003) and as uninsured exposure to risk (Glewwe and Hall, 1998). Vulnerability measures based on either assets or income may not reflect households' overall exposure to risk since the total determines the capacity of a household to counteract risk (World Bank, 2001). Moreover, vulnerability is a dynamic

process of cumulative conditions. Significance of causal factors and their combination change over time and place (Webb and Harinarayan, 1999). Fluctuations in vulnerability not only result from changes in causal factors, but also from coping mechanisms available (Campbell et al., 2002).

In this paper, following Pritchett et al. (2000) vulnerability, *Vu*, is defined as expected poverty and is measured as the probability of falling below the poverty line, *PL*. The magnitude of vulnerability increases with the time horizon, *t*. A household, *n*, experiences a period of vulnerability if the household income, *Hi*, is below the poverty line[1]. Over *m* periods, the vulnerability is the probability of observing at least one period of poverty within those *m* periods, which is one minus the probability of no period of poverty at any of the periods.

$$Vu(m, PL) = 1 - [(1 - P(Hi_t^n < PL)) * ... * (1 - P(Hi_{t+m}^n < PL))]. \quad (1)$$

Poverty is usually measured based on cross section data, whereas measures of vulnerability require panel data including information on household assets, formal and informal safety nets and covariate and idiosyncratic risks that a household or individual is exposed to. Since panel data were not available, this study uses a stochastic household income simulation model, whose database is cross section data from household case studies in Zimbabwe.

The household income in period *m* is defined as the sum over gross margins, $\widetilde{GM}$, of all activities, *a*, plus additional cash, $\widetilde{IC}$, e.g. informal loans, and the surplus carried over from the previous period, *m*-1. The surplus from the previous period is that period's

[1] Contrary to the definition above, Pritchett et al. (2000) define vulnerability based on expenditure and not on income.

household income, $\tilde{H}i_{m-1}$, net of household cash expenditure, $\tilde{E}x_{m-1}$, household consumption, Co_{m-1}, and school fees, $\tilde{S}F_{m-1}$, of that period[2] (equation (2)). Household consumption is based on minimum food requirements (= MFR) estimates from Alwang et al. (2002), which is ZWD 13 per AEQ and day. Income flows and vulnerability to income poverty depend on seasonal fluctuations, which are addressed by defining several periods per year, m. ~ denotes the stochastic nature of income and expenditure.

$$\tilde{H}i_m = \tilde{H}i_{m-1} - \tilde{E}x_{m-1} - Co_{m-1} - \tilde{S}F_{m-1} + \sum_{a=1}^{A} \tilde{G}M_{am} + \tilde{I}C_m, \qquad (2)$$

with $IC = 0$, if:

$$\tilde{H}i_m = \tilde{H}i_{m-1} - \tilde{E}x_{m-1} - Co_{m-1} - \tilde{S}F_{m-1} + \sum_{a=1}^{A} \tilde{G}M_{am} \geq Co_m + \tilde{E}x_m + \tilde{S}F_m,$$

and $\tilde{I}C = Co_m + \tilde{E}x_m + \tilde{S}F_m - \left(\tilde{H}i_{m-1} - \tilde{E}x_{m-1} - Co_{m-1} - \tilde{S}F_{m-1} + \sum_{a=1}^{A} \tilde{G}M_{am} \right)$, if:

$$\tilde{H}i_m = \tilde{H}i_{m-1} - \tilde{E}x_{m-1} - Co_{m-1} - \tilde{S}F_{m-1} + \sum_{a=1}^{A} \tilde{G}M_{am} < Co_m + \tilde{E}x_m + \tilde{S}F_m.$$

The assets carried over from the previous year and surplus available in t_0 is assumed to be equal to the surplus that households had accumulated by the end of the monitoring season in 2000. The model incorporates two specific risk-coping strategies: (1) households can access additional sources of cash, and (2) households can increase indigenous fruit collection. All households have access to additional sources of cash, e.g. from a savings account, with either own accumulated savings or remittances and transfers from other family members, savings clubs and informal loans. These informal loans do not require collateral or charge

[2] Note that, due to using gross margins for household income calculations, the variable cost of production activities have already been accounted for.

96 interest, similar to observations of other rural household surveys as also shown by Fafchamps
97 and Lund (2002).

98 Indigenous fruits are available during the critical period, i.e. from August to January. In
99 the model, whenever the household income falls below minimum food requirements plus cash
100 requirements for production and household expenditure during this period, the model
101 household increases fruit collection from the Communal Areas. However, the extent to which
102 the household increases fruit collection is limited to a contribution of 42% to the natural food
103 basket, which is the average across other studies (i.e. Campbell et al., 1997; Shackleton and
104 Shackleton, 2000; Shackleton et al., 2002; Shackleton and Shackleton, 2003).

105 Receipt of remittances and the share of off-farm activities reflect further risk-
106 management and -coping strategies and are employed in the model up to the level found
107 among the survey households. Cattle and poultry are most widely owned and are the main
108 assets sold (Kinsey et al., 1998)[3]. From a risk-management perspective, the model captures
109 the degree of income diversification in the research location since it uses income data from
110 observed activities. By using gross margins, one indicator captures climatic, i.e. yield
111 fluctuations, as well as market risk, i.e. price variability.

112 In order to pool the cross-section sample for identifying the distributions of each income
113 and expenditure category, adult equivalent units are used as common denominator. The
114 distributions were fitted to the seasonal cross section data of each enterprise by using BestFit
115 (Palisade, 2004) and the distribution with the best-fit statistic ranked by Chi-square test was
116 employed. The model results for the seasonal household income obtained from the
117 simulations can be interpreted as the income of an average household of the research site.

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[3] This risk-coping strategy is not accounted for by using gross margins, since the sale of livestock is counterbalanced by the reduction in stock. However, if this risk-coping strategy is to function in the long run, the sale of livestock has to occur at a lower rate than reproduction.

Since all households of the research location use indigenous fruits, no comparison between indigenous fruit users and non-users can be drawn. The latter implies that no 'without IF' scenario can be defined. Thus, the contribution of IF towards remaining above the poverty line is assessed by subtracting the IF income from the household income while holding all other factors constant. The poverty model assesses three different scenarios depending on the degree to which indigenous fruits are used to substitute MFR.

The model excludes dependency between the periods, e.g. inputs into agricultural and horticultural production from August to January as expressed by negative gross margins, which could be expected to result in higher gross margins during harvesting time from March through to June. Neglect of these dependencies can be interpreted as the risk of crop failure, e.g. due to averse climatic conditions in the latter half of the cropping period. If a farmer plants her crops in the beginning of the wet season and uses rather high quantities of inputs, she still faces the risk of a short rainy season. If this happens, and rains fail to continue until February, the crop dries up and the inputs used are sunk.

3. Description of study area and data

Income, expenditure and labour data were collected periodically from 19 farm households of Ward 16 in Murehwa District and 20 households of Takawira Resettlement Area in Zimbabwe covering the period from August 1999 to August 2000. Data on the most preferred indigenous fruit tree species by rural communities in the region, namely Uapaca kirkiana, Strychnos cocculoides and Parinari curatellifolia (Kadzere et al., 1998) are used as an indicator of the role of natural food resources in reducing vulnerability.

The components of household income and expenditure of households living in Takawira Resettlement Area (valued at 1999 prices) are provided in Figure 1. Income of farm household enterprises fluctuates in the course of the year and includes cash income as well as the value of own consumption. Income of households in Murehwa is higher than of those in

Takawira. Murehwa is closer to capital city, Harare, than the resettlement area; also, Murehwa has a better-developed market since many buses going to Mozambique and Malawi stop here. Remittances and off-farm activities generate a higher income in the period August to January and remain relatively stable thereafter on a lower level. Horticultural income increases from June onwards and then also reaches a peak in the period August to December in Takawira, whereas in Murehwa it is relatively stable from May to February. Indigenous fruit income starts rising in August and then decreases from January onwards. All these enterprises move anti-cyclically to agricultural activities that require expenditures for inputs in the period August to November and then generate income from February through April.

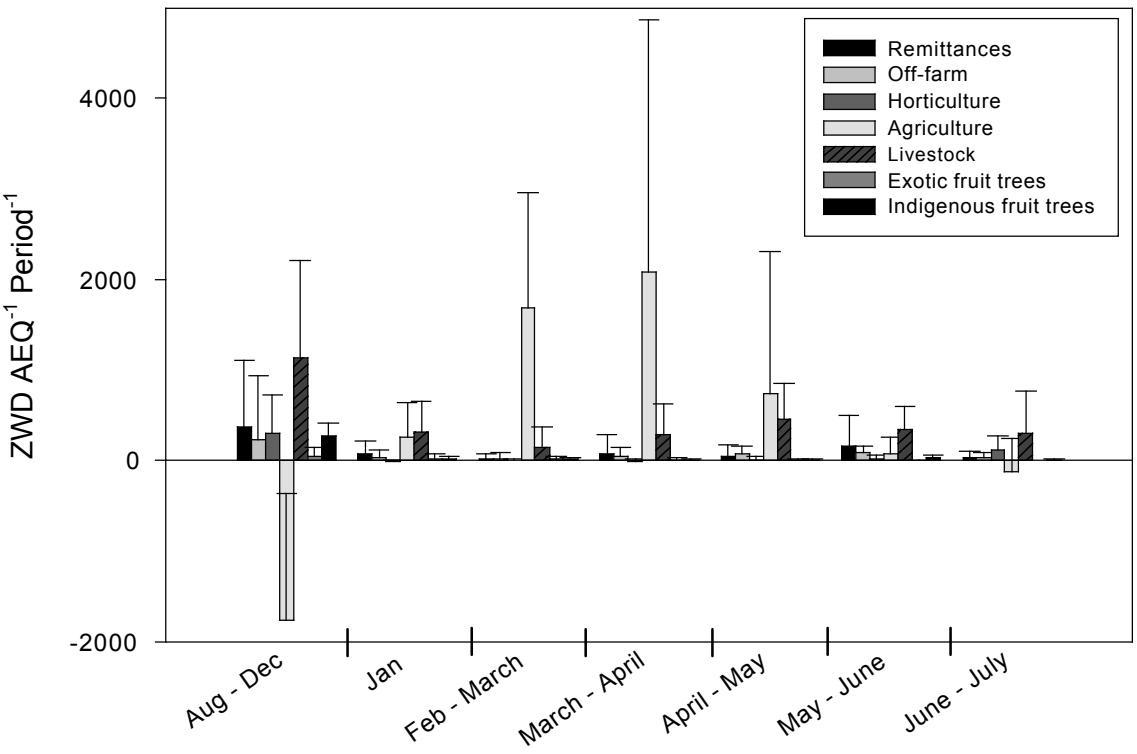

Fig. 1. Gross margins and standard deviation by household enterprise and season, Takawira Resettlement Area*.

* 1999 prices (in December 1999, 38 Zimbabwe Dollar (ZWD) = 1 US Dollar); AEQ = adult equivalent (household members above 65 years = 0.75 AEQ; 18–65 years = 1.0 AEQ; 14–18 years = 0.75 AEQ; 7–14 years = 0.5 AEQ, below 7 years = 0.25 AEQ).

Source: Household Survey.

Analysis of the contribution of indigenous fruits towards reduction of vulnerability focuses on Takawira Resettlement area since the households living here depend more heavily on indigenous fruit during times of crisis (Mithöfer and Waibel, 2003).

4. Results and discussion

The poverty line extrapolated from Alwang et al. (2002) is at 4600 ZWD per adult equivalent and year[4]. The average household income in Takawira is above the poverty line. However, 25% of the households of Takawira were below the poverty line during the research period. The estimate of the poverty headcount based on consumption data is at 48% for the rural areas and nationally at 35% for 1995 (Alwang et al., 2002). In Takawira, the households below the poverty threshold derived an average annual income of 2700 ZWD per adult equivalent. In comparison, Campbell et al. (2002) estimate that 71% of their households were below the "food poverty line" (28000 ZWD per household), which covers basic nutritional needs, and 90% were below the "consumption poverty line" (45000 ZWD per household)[5], the latter also covering some allowances for housing, clothing, education, health and transport.

Seasonality of income generating activities implies that poverty as well as vulnerability to poverty fluctuates in the course of the year. Vulnerability is high during the period from August to January, when agricultural production requires the most inputs and does not yet provide sufficient income. Depending on the harvest of the staple crop (maize) the critical period when households are most vulnerable starts in September if the maize harvest was low

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[4] 24000 ZWD per average household size of Takawira. Alwang et al. (2002) estimate a national minimum food needs poverty line for 1990 based on data of the Central Bureau of Statistics. This threshold was extrapolated to 1999 using the average annual growth rate of the food price index.

[5] In 1999 Zimbabwean dollars (Campbell et al., 2002). Both measures of poverty were defined specifically for their survey.

whereas in years with normal maize crop, the grain lasts up to the next harvest. During the critical period 80% of interviewed households of Takawira derived an income below minimum food needs.

Figure 2 shows that availability of indigenous fruits reduces the probability of falling below the poverty line. As expected, the higher the share of indigenous fruits towards minimum food requirements, the lower vulnerability to income poverty is.

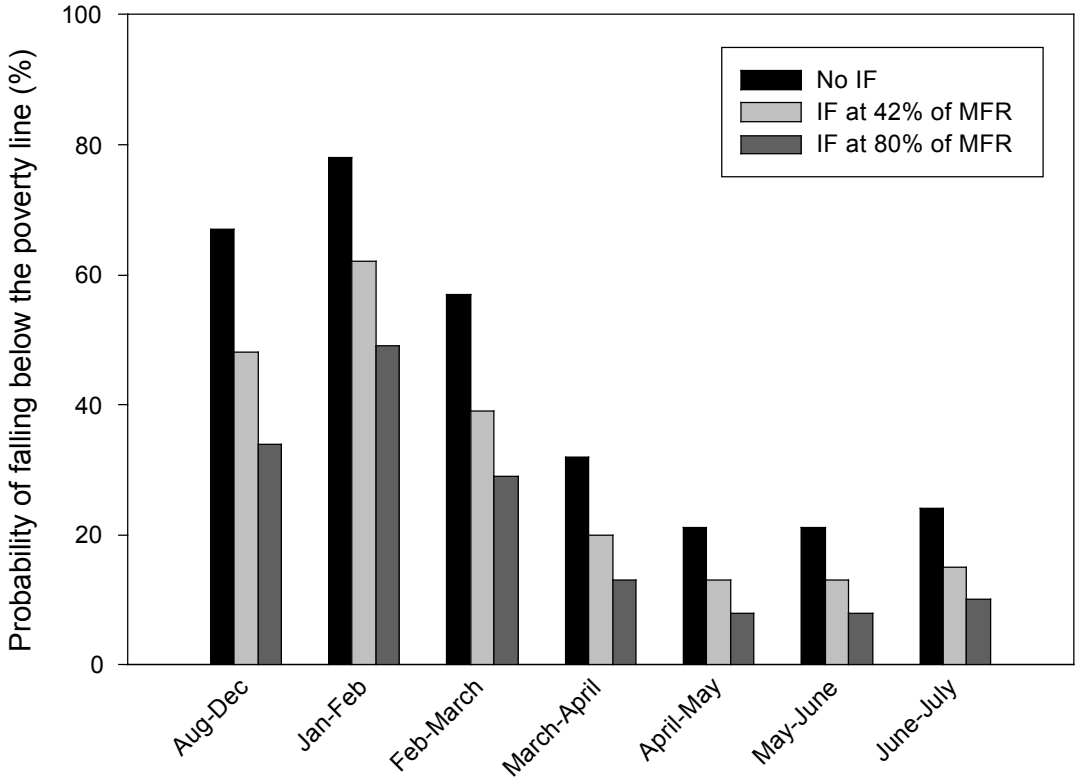

Fig. 2. Probability of falling below the poverty line, Takawira Resettlement Area (%)*.

* MFR = minimum food requirements, IF = indigenous fruits.

Source: Simulation results based on household survey data.

Overall, vulnerability to poverty is high in the resettlement area and also fluctuates strongly during the year. The impact of IF with respect to reducing the probability to fall below the poverty line is considerable. Depending on their availability, they can reduce vulnerability to poverty by up to 33% during the critical period of the year.

217 The overall likelihood that a household will fall below the poverty line at least during
218 one period of the year is high. With no surplus from the previous cropping season, the
219 likelihood to experience at least one period of poverty is higher. It ranges from 99% to 85% in
220 Takawira; the more IF can contribute to MFR, the lower it is. Rather than stating the number
221 of vulnerable households, which would include an arbitrarily set threshold under which
222 households are considered vulnerable, these figures describe the risk of becoming poor.
223 Campbell et al. (2002) show for the south of Zimbabwe that wealthy households receive more
224 remittances than poor households and that poor households depend to a larger extent on
225 woodland products. The link between wealth and indigenous fruit use is captured in the model
226 indirectly, namely by the resource stock the year of analysis starts with, the amount of
227 remittances and other income received by the household, which all influence the extent of IF
228 collection.

229 Since the household income in one season is derived from various sources, the
230 sensitivity of the household income towards each of its components is assessed for the critical
231 period, August to December. The sensitivity analysis is carried out for scenarios with
232 indigenous fruit tree use. For this purpose, simulation data are further analysed by linear
233 regression for the critical period. The functional form underlying the regression is given by
234 equation 2[6]. The sensitivity analysis uses the standardised beta coefficients as a measure of
235 the impact of a standard deviation change in each income component on the household
236 income.

237

238

[6] As expected, the regression model results in a R-square of 1.

Table 1

Sensitivity of household income to changes of income by source

	Standardised Beta Coefficient
Remittances	0.450
Off-farm activities	0.127
Horticulture	0.183
Agriculture	0.698
Livestock	0.554
Exotic fruit trees	0.044
Indigenous fruit trees	0.188
Loan	0.169
HH consumption & expenditure (incl. school fees)	0.000

Income from agriculture, livestock and remittances ranks highest in influence on household income. In comparison, the impact of IF availability is smaller. Harvesting of non-timber forest products is a subsistence strategy of households; it provides additional income to households earning the bulk of their income from agriculture or off-farm sources as findings of Ruiz-Perez et al. (2004) show for lightly managed forests.

5. Conclusions

Vulnerability to food poverty in Zimbabwe is high and fluctuates strongly during the year. Portfolios of income generating activities in Zimbabwe consist of a variety of different activities and vary amongst farmers and areas. These activities follow seasonal patterns and their extent in terms of demand for input varies in the course of the year. By combining activities farmers smoothen income fluctuations.

Wild foods like indigenous fruits reduce vulnerability. In the research area, the probability of falling below the poverty threshold is at 70% during the critical food insecure season when agricultural crops are planted if no indigenous fruits are available and about 30% during maize harvesting time. If indigenous fruit area available, they reduce vulnerability by about one third during the critical period. However, vulnerability to poverty cannot be eliminated by indigenous fruit use due to their limited availability. However, the trees contribute one risk-coping strategy, which can be further complemented by other strategies, during the agricultural off season and thus provide a cushioning effect to annually occurring poverty and hunger in August to December.

Since IF use is a low entry barrier activity during the time of need, measures should be taken to assure availability of indigenous fruit trees, e.g. through on-farm conservation. Adding value to the fruits may be another area to enhance rural incomes at the times of need.

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