Missing markets, poverty traps, and soils degradation in East Africa

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One fifth of the world's population lives on less than a dollar a day, and most of those ultra-poor live in rural areas and work in agriculture. So the poorest populations in the world rely disproportionately on the natural resource base on which agricultural productivity depends. Recent empirical studies using longitudinal data find that a disturbingly large share of these people suffers chronic rather than transitory poverty. They appear trapped in a state of perpetual food insecurity and vulnerability because their poverty and poor market access preclude their efficient investment in or use of productive assets.

Furthermore, those caught in a poverty trap have strong incentives to degrade natural resources in the course of their ongoing struggle to survive. Partly as a consequence, nearly two-fifths of the world's agricultural land is seriously degraded and the figure is highest and growing in poor areas such as Central America and Sub-Saharan Africa. Such degradation exacerbates pre-existing poverty traps, by discouraging capital-strapped smallholders from investing in maintaining, much less

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improving, the natural resource base on which their and their children's future livelihoods depend. The resulting degradation of the local agroecosystem further lowers agricultural labor productivity, aggravating the structural poverty trap from which smallholders cannot easily escape. The USAID BASIS CRSP project "Rural Markets, Natural Capital and Dynamic Poverty Traps in East Africa" aims to address this problem through collaborative, interdisciplinary research in multiple sites in Kenya and Madagascar.

The Project's Research Objectives

Poverty traps exist apart from natural resource degradation, arising due to the confluence of poor skills endowments, weak market access and limited access to credit or other financial products. In rural Africa, however, poverty traps are often inextricably related to resource degradation since environmental conditions materially affect farm and labor productivity. This project aims to shed light on poverty dynamics and this poverty-environment relationship so as to illuminate where decision-makers face tradeoffs between poverty reduction and resource conservation objectives and where important synergies might exist. We will do this through data collection and analysis in six sites, four in Kenya and two in Madagascar, chosen to capture important variation in agroecological and market conditions (Figure 1).

Based on the emerging theoretical and empirical literature and our team's experience in the region, we hypothesize that dynamic poverty traps arise and persist in rural East Africa because of four interrelated features of the agroeconomic system.

(i) Poor market access creates significant fixed costs to market participation. This gives larger producers net price advantages by creating a positive relationship between sales volume and net revenues per unit of output sold and a negative relationship between purchase volume and net cost per unit of input bought. Such effects can induce poorer producers in areas of weak market access to opt out of markets in favor of low-return self-sufficiency, further contributing to factor market thinness.

(ii) High return production strategies (e.g., dairy) entail significant fixed costs that generate increasing returns to scale (i.e., a minimum efficient scale of production beyond the means of the poor lacking adequate financing).

(iii) Poorer households lacking access to capital to finance productive investments may be unable to undertake lumpy investments, regardless of their expected returns

(iv) Risk and subsistence constraints discourage long-term investment for asset accumulation and productivity growth among poorer, more risk averse households.

The first objective of this project is to establish empirically the income and wealth dynamics of households in our survey sites so as to identify if and where poverty traps exist, and then to test the above hypotheses in order to establish the root causes of apparent poverty traps in the region.

Related work on herd dynamics among pastoralists in southern Ethiopia, for example, identifies a clear poverty trap for families with herds below a critical threshold size of 10-15 cattle, depicted in Figure 2. In this "exit zone" adverse shocks tend to send pastoralists into a spiral that eventually forces them off the range and into unskilled labor in towns. These wealth dynamics appear to result from a minimum herd size necessary to maintain mobility that is essential to herd productivity and survival in drylands with poor market access. Such findings have clear, practical policy implications for destocking and restocking projects and the design of safety nets. In this project, we aim to provide similar, clear depictions of the income and wealth dynamics of our survey sites and to be able to relate these more directly to changing agricultural productivity and agroecological conditions.

The second objective of the project is to explore how the existence of poverty traps affects natural resource conditions, particularly soil quality dynamics that centrally affect agricultural and labor productivity and food security. This in turn perpetuates increasing poverty levels through feedback effects. We hypothesize that the dynamic aggravation of rural poverty through the drawing down of natural capital results from a threshold effect rather like that observed in pastoralists' herd dynamics. Farmers caught in a poverty trap are unable to accumulate productive capital and thereby escape poverty, and are more likely to exit farming or to be forced to farm ever more marginal land. Farmers above the threshold can maintain, even improve their soil quality, and ultimately their economic outcomes. Missing markets and minimum efficient scales of investment or production may rationally limit some smallholders' investment in improved natural resource management techniques and in productive natural assets such as livestock or trees that improve soil quality.

Because the feedback effects among natural and human systems are complex – both in the sense of involving a complicated integration of many parts and in the sense of exhibiting nonlinear dynamics – the crucial interconnections between them are commonly lost or badly oversimplified in traditional policy analysis. We aim to develop a decision support tool based on the systems dynamics approach to bioeconomic modeling, the Crop Livestock And Soils in Smallholder Economic Systems (CLASSES) model, that can help analysts and policymakers think through the interconnections between these systems. The CLASSES model, a schematic of which appears in Figure 3, will enable virtual experimentation with a variety of alternative policy instruments and evolving climate and market conditions to help with ex ante impact assessment and policy prioritization. The objective is to make broadly available a tool that can advance the breadth and depth of discussions about policy options that could be implemented relatively easily.

Policy implications of potential findings

The first and second project objectives feed directly into the project's third, more practical, final objective: to identify and document "best-bet" policies, technologies and programs to combat dynamic poverty traps in rural east Africa. The feedback effects between poverty traps and farmer investment in natural capital suggest opportunities for "win-win" innovations, as has perhaps occurred through the recent introduction of smaller size NPK packets in the liberalized inorganic fertilizer market. Both via quantitative and qualitative research in communities and through the CLASSES model, this project will be able to address explicitly very current questions, such as whether and how to restock farmers' herds after a major drought, and how best to stimulate adoption by the poor – who are typically late or non-adopters – of improved fallows that seem well suited to smallholder integrated maize-livestock systems or of intensified rice systems that generate demonstrably increased yields. Appropriate public investments depend upon the source of the poverty trap(s) among the target subpopulation(s) of interest. By focusing explicitly on the source of poverty traps, this project can help identify interventions that have proved effective or that are likely to prove effective but have not yet been tried. Our research findings will hence be disseminated to farmers and other key policy makers at the village, district and national levels using effective dissemination strategies already in use by our collaborators both in Kenya and Madagascar. Improvement of these dissemination strategies will therefore be a priority in this research.

The project also aims to help build capacity for analysis of the linkages between poverty dynamics and natural resource conditions. One method will be regular workshops with study communities and national-level policy analysts to ignite a dialogue over lessons learned in particular sites and preliminary findings that appear generalizable. Another means is graduate training of scientists from Kenya and Madagascar at Cornell University. Finally, we will conduct non-degree workshops to develop bioeconomic modeling capacity within FOFIFA and KARI. In the project's final year, the intent is to begin holding open access user workshops in Kenya and Madagascar to introduce and train end-users in the CLASSES model.

Further reading

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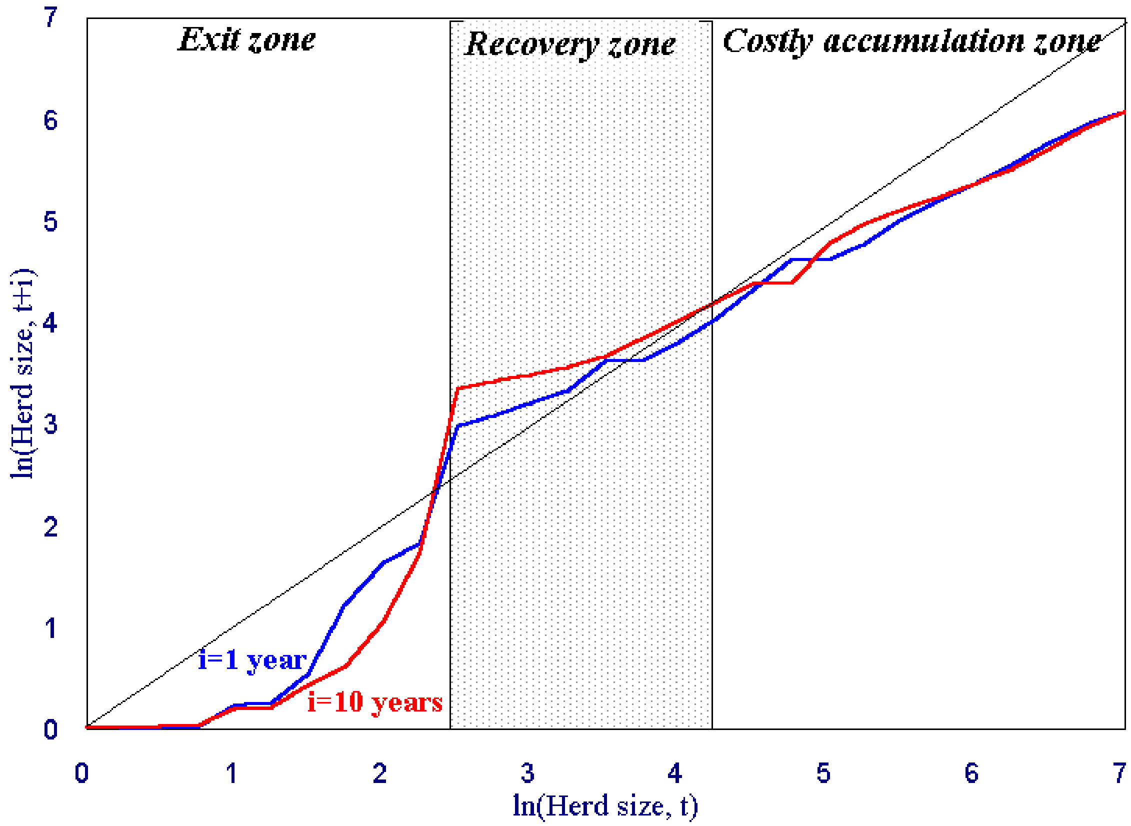
Figure 1:

Kenya project sites

Madagascar project sites

Figure 2: Southern Ethiopian pastoralists' wealth dynamics, from Lybbert et al. (2001). Horizontal axis shows herd size in one year, vertical axis shows the same household's expected herd size after one year (blue line) and 10 years (red line). The 45° degree line represents stable wealth, areas below and below that line reflect declining and increasing wealth, respectively.



Nadaraya-Watson estimates using Epanechnikov kernel with bandwidth (h=1.5)

Figure 3: CLASSES MODEL SCHEMATIC