



POVERTY TRAPS AND RESOURCE DEGRADATION

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Poverty that leads to resource degradation

THE POOREST POPULATIONS in the world rely disproportionately on the natural resource base. A disturbingly large number of these people suffer poverty as a chronic rather than transitory state. Escape from poverty would require significant investment in improving the productivity of their land or labor. For many rural poor, however, maintaining even current productivity requires investment beyond their means, and so they become trapped in a downward spiral of poverty and resource degradation.

The contrasting experiences of two neighboring coffee farmers in a BASIS research area in Kenya illustrate the interrelationship between poverty and resource degradation. One farmer bought a dairy cow when coffee prices were high. Once over this discrete investment threshold, daily milk sales enable the farmer to buy chemical inputs to maintain his coffee yields, buy fertilizer for his maize, and pay school fees for his grandchildren. The manure from his cows provides rich organic fertilizer for a bountiful vegetable garden, and he sells the produce in town. As his soils improve and income rises, he is able to further invest in cattle and expand his dairy to three cows.

His neighbor, by contrast, was never able to put together the savings needed to invest in that first cow. Her coffee yields are low and declining because she cannot afford to buy chemical fertilizers and pesti-

cides necessary to maintain soil quality and protect her trees from pests. She cannot access credit to purchase the fertilizer that her neighbor manages to self-finance through milk sales. Her declining coffee income forces her to stop buying fertilizer for her maize. Soil quality and yields diminish yet further. Her dwindling income limits her ability to pay school fees. Her children drop out of school and now are likely to carry the trap of poverty and resource degradation into the next generation.

If the latter farmer in this story had secure access to loans, perhaps she could have escaped this downward spiral. Absent access to capital markets, however, her only path out of long-term poverty would require unrealistic levels of personal sacrifice and savings in order to make productivity-enhancing investments in livestock, new technologies, or education. She and others like her are forced instead to rely ever more heavily on the natural resource base, mining it for current subsistence at the cost of future resource productivity and continued poverty. Partly as a consequence, nearly two-fifths of the world's agricultural land is seriously degraded, with this figure higher and growing in many of the poorest areas of the world.

Poverty that leads to natural resource degradation, which in time further traps a family in poverty, is one of the most pernicious effects of poor rural market access, especially to financial capital necessary to make investments and cushion against adverse shocks.

Policymakers confronting this challenge too often seem to face a distasteful tradeoff: preserving the resource base appears to come at the cost of yet a further assault on the livelihoods of the people who are the worst off. BASIS aims to eliminate the need for this untenable tradeoff by helping to clarify the dynamics of chronic poverty and the role played by access to markets and resource conservation. This can lead to policies that benefit both the poor and the environment.

Finding the root causes of poverty traps

People are caught in poverty traps for many reasons: lack of skills and education, limited market access, little or no access to credit and other financial products, or poor environmental conditions. While the details of the Kenyan woman coffee farmer’s story are perhaps unique to her, poverty traps are not. Systematic empirical analysis of Ethiopian pastoralists, for example, has shown how falling below a minimum sustainable herd size threshold creates a poverty trap in drier, pastoral economies.

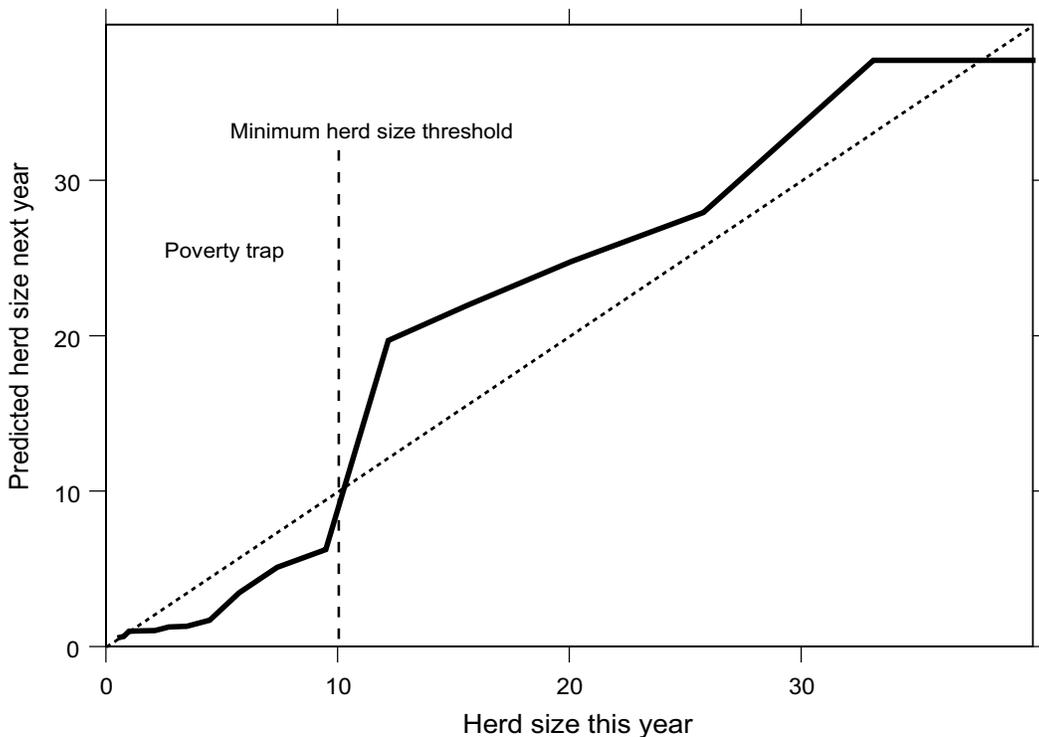
Figure 1 (adapted from Lybbert et al. 2001) shows how herd size next year evolves from herd size this year. The solid curve in the figure is a best-statistical

estimate of the actual pattern of accumulation and deaccumulation among Ethiopian pastoralists. When this curve is above the dashed diagonal line, it indicates expected positive growth in the household’s herd size from one year to the next. When the curve is below the diagonal line, it indicates deaccumulation; i.e., next year’s herd is expected to be smaller than this year’s.

As stands out very clearly in the figure, households with fewer than 10 livestock units tend to suffer declining wealth. Herds below that size are not economically viable, and households that fall below this critical minimum threshold enter a downward spiral of poverty. In contrast, households whose initial stocks exceed this threshold are expected to accumulate cattle into the future, with the data showing that a herd size of 35-50 animals is sustainable in the long run. The challenge is to identify why and in what kind of environments such poverty traps exist.

By establishing empirically the income and wealth dynamics of households in the region, BASIS researchers can identify *where* poverty traps exist. Then, by testing the following hypotheses, we can establish the *root causes*. We start with the assumption that poverty traps arise and persist in rural East Africa because of four interrelated features:

Figure 1. Herd size thresholds and poverty traps



1. Poor market access creates significant fixed costs to market participation, and poorer producers in areas of weak market access tend to opt out of markets in favor of low-return self-sufficiency.
2. High-return production strategies (e.g., dairy) entail significant fixed costs that result in a minimum efficient scale of investment and operation commonly beyond the reach of the poorest people.
3. Poorer households lacking capital to finance productive investments may be unable to undertake lumpy investments, regardless of their expected returns.
4. Risk and subsistence constraints discourage poorer, more risk-averse households from accumulating assets and increasing productivity.

The simple passage of time does not promise an escape from poverty. By testing and delineating the

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root causes of poverty traps, BASIS researchers can assist policymakers in developing mechanisms to protect people who are trapped in an enduring cycle of poverty and who are forced to increasingly degrade the natural resource base on which their lives depend.

Linking poverty traps to natural resources

In rural East Africa, where factor markets are weak, chronic poverty is most often related to resource degradation. Yet, traditional policy analysis has tended to lose or oversimplify the interconnections between natural and human systems. The project will explore how poverty traps affect natural resources, particularly soil quality. We hypothesize that the drawing down of natural capital results from a threshold effect rather like that observed in the story of the Kenyan coffee farmer. Farmers caught below the threshold are unable to accumulate productive capital or adopt improved technologies. They are then more likely to exit farming or to be forced to farm ever more marginal or fragile land.

Already we have seen evidence of this in Madagascar. Ongoing work on the high yielding,

low external input system of rice intensification (SRI) shows that adoption of SRI by poorer Malagasy farmers has been impeded by seasonal financing constraints that force them to forego a doubling or tripling of expected yields in order to satisfy immediate subsistence requirements. Previous work by our team also shows that, absent improved production technologies, increased rice price volatility in the wake of food market liberalization fuels increased slash-and-burn cultivation on Madagascar’s fragile hillsides.

In contrast, farmers above the threshold can invest in improved technologies, inputs, and natural resource management techniques so as to maintain, even improve, their soil quality. Ultimately their economic prospects improve as well.

Sites

As the prior examples and discussions illustrate, poverty traps and resource degradation result from the subtle interplay of factor market structures and agroecology. In an effort to pin down the causes of poverty and resource degradation—and, ultimately, find solutions to these problems—BASIS researchers will work in four sites in Kenya and two in Madagascar. As shown in Figure 2, these sites capture variation in both agroecological and market conditions. By pursuing integrated research strategies into income wealth and ecological dynamics across these zones, BASIS researchers will be able to derive clear, practical policy implications for strategies such as microfinance, destocking and restocking projects among pastoralists, soil and water conservation or seedling distribution initiatives among crop producers, and the design of rural safety nets.

Figure 2. Research sites

		Agroecological conditions	
		Drier	Wetter
Market access	better	North central Kenya (Baringo)	Central highlands Kenya (Embu) Central highlands Madagascar (Vakinankaratra)
	worse	Northern Kenya (Marsabit)	Western Kenya (Siaya/Vihinga) Southern highlands Madagascar (Fianarantsoa)



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We intend to develop a decision-support tool—Crop Livestock and Soils in Smallholder Economic Systems (CLASSES)—that will enable virtual experimentation with a variety of alternative policy instruments and evolving climate and market conditions. This tool will help policymakers at national levels and project managers at district or subdistrict levels assess potential impacts and prioritize policy options. By making this tool broadly available, BASIS can help broaden and deepen policy analysis.

Developing policies that break the cycle of poverty and resource degradation

The project will identify and document the best 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 Kenya’s liberalized inorganic fertilizer market.

The work will address current questions, such as whether and how to restock farmers’ herds after a major drought, and how best to stimulate adoption by the poor 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.



Suggested reading

Barrett, Christopher B. 1999. “Stochastic Food Prices and Slash-and-Burn Agriculture.” *Environment and Development Economics* 4(2): 161-176.

Barrett, C.B., and M.R. Carter. 2001. “Can’t Get Ahead For Falling Behind: New Directions for

Development Policy To Escape Poverty and Relief Traps.” *Choices* 16(4).

Barrett, C.B., F. Place, and A. Aboud, eds. 2002. *Natural Resources Management in African Agriculture: Understanding and Improving Current Practices*. CAB International.

Barrett, C.B., T. Reardon, and P. Webb, eds. 2001. “Income Diversification and Livelihoods in Rural Africa: Cause and Consequence of Change.” *Food Policy* 26(4).

Carter, M.R., and J. May. 1999. “Poverty, Livelihood and Class in Rural South Africa.” *World Development* 27(1): 1-20.

Dercon, S. 1998. “Wealth, Risk and Activity Choice: Cattle in Western Tanzania.” *Journal of Development Economics* 55(1): 1-42.

Grootaert, C., R. Kanbur, and G.T. Oh. 1997. “The Dynamics of Welfare Gains and Losses: An African Case Study.” *Journal of Development Studies* 33(5): 635-57.

Lee, D.R., and C.B. Barrett, eds. 2000. *Tradeoffs or Synergies? Agricultural Intensification, Economic Development and the Environment in Developing Countries*. CAB International.

Loury, G.C. 1981. “Intergenerational Transfers and the Distribution of Earnings.” *Econometrica* 49(3): 843-867.

Lybbert, T.J., C.B. Barrett, S. Desta, and D.L. Coppock. 2001. “Pastoral Risk and Wealth-Differentiated Herd Accumulation Patterns in Southern Ethiopia.” Cornell University mimeo.

McPeak, J.G., and C.B. Barrett. 2001. “Differential Risk Exposure and Stochastic Poverty Traps among East African Pastoralists.” *American Journal of Agricultural Economics* 83(3): 674-679.

Moser, C.M., and C.B. Barrett. 2001. “The Disappointing Adoption Dynamics of a Yield-Increasing, Low External Input Technology: The Case of SRI in Madagascar.” Cornell University mimeo,

Perrings, C. 1989. “An Optimal Path to Extinction? Poverty and Resource Degradation in the Open Agrarian Economy.” *Journal of Development Economics* 30(1): 1-24.

Reardon, T., and S. A. Vosti. 1995. “Links Between Rural Poverty and the Environment in Developing Countries: Asset Categories and Investment Poverty.” *World Development* 23(9): 1495-1506.

World Bank. 2000. *World Development Report 2000/2001*.

World Resources Institute. 2000. *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life*.