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Summaries

Household welfare and forest dependence in Southern Malawi

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This paper examines economic reliance on forests and its effects on the welfare of low-income households in rural Malawi. Three questions motivate the analyses. One, how dependent are sample households on forests for income? Two, does access to forests as a source of income impact income inequality at the study sites? And three, what are the determinants of economic reliance on forests, defined as the share of earnings derived from forest-based activities?

Data for the study come from a monthly survey of 99 households conducted in three villages in southern Malawi between June 1999 and August 2000 All of the sample households used firewood for cooking and heating, and 75 per cent engaged in forest occupations including sales of firewood and charcoal and employment by the logging industry. Home-consumed firewood and earnings from forest-based occupations constitute substantial shares of household income. On average, sample households earned about 30 per cent of their income from forests.

The Gini coefficient is a common measure of income inequality across individuals or households. For the sample households the Gini coefficient was computed and decomposed by six income sources: farm, forest, wage-work, self-employment, transfers, and remittances. The analysis shows that forest income reduced measured income inequality by 12 per cent during the year of the study. This reflects a pattern in which firewood collected from adjacent forests represents an important input to household income for all sample households.

Further analysis examines the factors associated with dependence on forest earnings, distinguishing between low-return forest activities (LRFA), such as firewood marketing, and high-return forest activities (HRFA), such as logging employment. The distinction is important because the latter are intensive in the use of resources, but also hold promise for helping the poor move out of poverty over time. The analysis is conducted using a pair of Tobit models for earnings shares from LRFA and HRFA. Findings suggest that households poor in human capital and animal holdings are more reliant on LRFA *and* HRFA. Reliance on HRFA, however, is conditioned also by availability of adult male labor and location.

The main policy implication of the study is that forests may have a role in poverty alleviation in Malawi, but to reduce economy–environment tradeoffs, careful targeting and a mix of forest-based and other approaches to poverty alleviation is necessary.

Seeing the forest for the fuel

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Forests play a profound role in rural livelihoods in the developing world. This has important implications for conservation policies because protected areas can impose significant human costs by excluding people or generate important local benefits by preserving access to the resource through cooperative management. This reflects the broader debate about poverty and the environment, with some arguing that there is a vicious cycle of poverty and environmental degradation, while others suggesting that the poor's dependence on the natural environment leads them to protect it. Fuelwood is a key issue in the debate both because it is the primary energy source for more than 2 billion poor people and because it is considered an important factor in forest degradation. A key to this debate and to developing an appropriate policy response lies in understanding patterns of household dependence on the forest for fuelwood. In this paper, we investigate how forests contribute to household welfare, and how that contribution varies across households along the socio-economic spectrum.

We demonstrate a new approach to the topic by applying insights from travel cost modeling in combination with household production theory to author-compiled household survey data and meso-scale environmental statistics from Ruteng Park in Flores, Indonesia. Given that markets for fuelwood are missing, we can characterize farmers' fuelwood collection as inputs into household production of utility yielding fuel services (cooking and heating). Consequently, rather than measure and model fuelwood quantity collected, we focus on the essential input to this household production activity – labor expended in collection of fuelwood from the forest. The basic proposition is that fuelwood collection trips are a function of travel cost, which is the shadow price of the time required to collect fuelwood. We implement our travel cost model of fuelwood collection by estimating the derived demand for collection trips to the forest, with a truncated negative binomial model. Because the amount of time spent collecting is possibly simultaneously determined with the number of fuelwood collection trips, which would make travel cost 'endogenous' to our model, we use bio-physical factors, household characteristics, and

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market variables to predict travel costs. We use GIS to match household survey data to environmental data on forest quality and to calculate distances from households to market infrastructure, thus identifying some of the bio-physical and market determinants of travel costs.

Our econometric models show that the number of trips is negatively related to the travel cost, suggesting that poor households behave rationally in their choices regarding forest uses. We also find that fuelwood is essential for these households. Accounting for endogeneity of travel costs results in higher elasticity, suggesting that households' ability to adapt is a critical consideration. Household wealth is negatively related to the number of trips.

Our estimation results can inform policy on three fronts. First, we find that economic benefits from fuelwood collection are significant for the local people, suggesting that restricting access to the forest could impose significant costs on local households. Second, households who are wealthier and face higher travel cost, are less dependent on the forests for fuelwood while econometrically less clear, collection appears to be discouraged by use of alternative biomass fuels. Across the models, we find that schools, roads, wage opportunities, and trees on farms are likely to reduce dependence on forest fuelwood, by encouraging collection of alternative fuels and/or raising the shadow price of collection from forests. Third, park managers interested in discouraging fuelwood collection from the forests should focus on the factors that are correlated with lower dependence on fuelwood from forests; that is, they should seek to lower the cost of fuel alternatives and raise the effective price of fuelwood collection. However, park management activities such as regular visits, communication with communities, and education about park boundaries are also important. Finally, broader development tools such as primary schools, paved roads, higher wages and overall development complement all the above approaches.

We note that our results reflect household decisions given the current market structure, that is, without an active market for fuelwood. Substantially increasing the market wage rate, for example, could lead to the development of a fuelwood market and displacement of fuelwood pressure to other forests. Thus, interventions that seek to increase the opportunity cost of household time should be part of a policy package that also supports alternatives such as stoves and planted trees, and park staff activity such as, enforcement of park boundaries.

Our study shows that access to forests for fuelwood is substantively important to local people. Consistent with the sustainable development paradigm in which ecological protection occurs in tandem with economic growth, we also find that improved economic conditions that increase household wealth and raise opportunity costs could reduce household dependence on fuelwood from forests and, thereby, potentially reduce forest degradation. By encouraging credible alternatives, enhancing returns to labor, and improving public infrastructure, policy makers could use the demonstrated economic rationality of farming households to reduce fuelwood collection. Ultimately, with greater wealth, households are likely to see the forests for more than just the fuel.

Household production and forest clearing: the role of farming in the development of the Amazon

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Global tropical forest clearing continues to be a critical environmental issue and nowhere in the world is the issue more pronounced than in Brazil. This paper examines the land-use choices of small-scale farmers in Ouro Preto do Oeste, Rondônia, Brazil and investigates how agricultural production impacts deforestation levels. The data used to explore these issues consist of observations from 152 households collected in 1996 and 2000. Overall, the empirical models indicate that access to credit, wealth, product markets, and off-farm labor opportunities, largely influence deforestation and production decisions. Among other things, the results suggest that more sustainable production methods are unlikely to be adopted by a majority of households under current conditions because the production of milk has rapidly advanced due to its moderate labor requirements and existing market infrastructure. While households often produce annual and/or perennial crops, milk production has been found to be increasing, and since cattle require cleared land, the production of this good has great implications for deforestation levels. Since the production of crops is largely influenced by access to credit, therefore, similar incentives may be proposed to support more sustainable production activities and reduce deforestation.

Risk coping strategies in tropical forests: floods, illnesses, and resource extraction

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Researchers commonly argue that the rural poor – with limited assets and opportunities – tend to rely more on common property resources

not only for income and sustenance but also for risk coping to smooth consumption after income shocks. This is because environmental assets may be the only 'wealth' the poor have at their disposal to combine with their labor, especially in locations where wage labor opportunities are limited. This link between asset poverty and resource extraction as insurance may be very significant in tropical forests where the livelihoods of the poor often depend on the extraction of biological resources in a biodiverse yet fragile environment. While many recent empirical studies explore small-scale resource extraction among rural households, very little research to date explicitly examines forest peoples' coping strategies and the role of resource extraction as insurance.

This paper examines resource extraction as a coping strategy among riverine peasant households in the Peruvian Amazon, where species degradation and biodiversity loss are the primary environmental concerns. Using a unique household data of shock history, we first construct a complete list of household responses used to cope with a large covariate flood shock and idiosyncratic health shocks. As in many other settings, the disposition of assets in the form of food stock (mainly manioc flour) and small livestock (mainly chicken) is found to be an important response to both types of shocks. In particular, livestock liquidation is the dominant strategy to cope with health shocks, followed by mutual insurance. However, for the covariate flood shock, *ex post* labor efforts in the form of upland cropping on cleared forest land and resource extraction – fishing and non-timber forest product gathering – are more common than precautionary savings, and resource extraction is particularly important for those without upland cropping options. Contrarily, hunting and aquatic extraction are rarely employed as a response to either type of shocks. Thus, flood shocks appear to exacerbate species degradation and biodiversity loss through the intensive use of forest resources that are a food source for local fauna, even though direct impacts of hunting and aquatic extraction are rather small.

We also jointly estimate household coping strategy choice of gathering and fishing using a bivariate probit model. It is shown that: (1) in environments with upland or rich fish stocks nearby as alternative insurance, gathering is almost nonexistent and fishing is employed by young households with fishing nets but with limited upland holdings; and (2) in environments without upland or rich fish stocks nearby, gathering is used especially by young (and poor) households and those households with large labor endowments. Thus, strong links exist between asset poverty and non-timber forest product gathering as insurance in certain locations.

These findings suggest a hierarchy of labor supply responses to cope with flood shocks: upland cropping, fishing, gathering – in decreasing order of preference. Non-timber forest product gathering is a unique insurance alternative for the poor who have limited options for coping with flood risk. Well-targeted interventions and programs for the poor to promote sustainable forest resource use are needed not only for environmental conservation but also for poverty alleviation.

Rural poverty, household responses to shocks, and agricultural land use: panel results for El Salvador

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This paper is about income and other factors influencing agricultural land use in rural households in El Salvador. Deforestation has reached an advanced cumulative stage in the country, which is the most densely populated place on the American mainland, and virtually all land suited to agriculture is being used for crop and livestock production. So is a lot of real estate with severe limitations for farming. Under these circumstances, agricultural extensification, which is still happening, relates less to purely commercial motivations and more to a precautionary desire shared by many poor people to hold resources that can be used for subsistence farming.

For various reasons, the precautionary demand for farmland, which exists in many impoverished settings, tends to diminish as living standards rise. Better-off households are less exposed to income-shocks because the sources of their earnings are more diversified. In addition, they have other tools for consumption smoothing, such as the use of accumulated savings and access to loans. Also related to income, however, is a household's ability to expand agricultural land use. Regardless of how it is accomplished – through purchases, rental, or colonization – acquiring land is costly. Thus, living standards and the ability to increase farmed area are positively correlated.

Given these conflicting effects of income on agricultural land use, the relationship between the former and latter variables is shaped like an Environmental Kuznets Curve (EKC). At the poorest extreme of the rural population are people whose precautionary demand for land as a site for subsistence farming is substantial. But given their limited means, they have little or no chance of getting land. At the other extreme is the least poor segment of the rural population, which can easily afford real estate but has little or no precautionary demand. The peak of the EKC occurs somewhere in between, for households with less precautionary demand than their poorer neighbors but with a greater ability to act on that demand.

Using panel data, we have estimated the EKC relating farmed area at the household level to income per capita in the Salvadoran countryside. These data were collected in a biennial survey of a nationally representative sample of the rural population that addressed economic activities, use of resources, and so forth in 1995, 1997, 1999, and 2001. In any one of these survey years, as much as 60 per cent of the participating households raised no crops. Accordingly, a Tobit random-effects estimator was used.

Our econometric analysis suggests that the linkage between cultivated area and permanent income per capita is indeed shaped like an inverted U. The latter variable was estimated from a fixed-effects regression of current income on a set of variables that reflect household assets, income diversification, and access to markets. The peak of the EKC was found to be in the top decile of the income distribution, which suggests that economic progress in rural El Salvador will create deforestation risks for some time to come. However, this study also identifies other factors that cause agricultural extensification at the household level to abate. Among these are improved access to labor markets, human capital formation, and expanded opportunities for non-agricultural work in the countryside.

Agricultural intensification, local labor markets, and deforestation in the Philippines

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This paper studies linkages between agricultural development and deforestation in a frontier region of the Philippines. Data come from a series of household surveys conducted between 1994 and 2000 in upland and lowland communities in southern Palawan. The panel datasets cover a period during which lowland farms underwent a transition from rainfed to irrigated production. The analysis has two parts. Part 1 seeks to understand the changes in lowland labor demand that resulted from irrigation development on lowland farms. Part 2 examines the impacts of employment of upland farmers on patterns of resource allocation in the uplands. In the case of the lowland panel, the regression strategy relies on a series of selection models, some of which incorporate lagged endogenous variables. These are used to measure how irrigation development affected the probability and extent of hiring on lowland farms. For the upland panel, a set of three seemingly unrelated regressions are estimated to identify variables associated with labor market participation, land clearing, and fertilizer purchases.

Data from the lowland panel suggest that irrigation increased employment and wages in the lowlands. Annual labor use rose approximately 50 per cent following irrigation, primarily because of increases in cropping intensity. Changes in input use have dampened but not reversed this trend. Regression results suggest an ongoing dynamic process of labor substitution on lowland farms, whereby hired upland workers have been replacing lowland family labor. Results show that the shadow value of labor used on a lowland farm is positively and significantly correlated with labor hiring.

A conjecture that the use of a motorized hand tractor reduces either the probability or extent of labor hiring is not supported by the data.

Upland farms display a pattern of rising labor supply over time, accompanied by intensification of existing agricultural area. Intensification (both in terms of reduced area expansion and purchases of fertilizer) appears to be more likely on larger farms, and where education and tenure security are higher. Higher observed levels of labor productivity on upland farms translate into less forest clearing. The initial exogenous shock of irrigation in the lowlands seems to have set into motion a virtuous cycle of poverty reduction and reduced forest pressure. Income gains have precipitated fertilizer purchases, and increases in labor productivity have undermined incentives to clear forest in subsequent periods. In elasticity terms, a 1 per cent increase in the marginal value product of labor in upland production led to a 1 per cent reduction in forest area cleared.

The patterns observed in southern Palawan illustrate how agricultural intensification outside forest zones can, under the correct set of circumstances, reduce forest clearing through both direct and less immediately apparent channels. In the lowlands, these circumstances include a relatively small pool of household labor, a willingness and capacity on the part of lowland farmers to supervise hired labor, and limited incentives for use of tractors as substitutes for labor. In the uplands, measures to raise the productivity of labor will encourage agricultural intensification and discourage forest clearing. Second-order effects of income changes on deforestation will ultimately depend on the relative profitability of intensification on already cleared land vs. further area expansion, as well as the extent to which economic policies encourage farmers to substitute capital for labor.