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ENVIRONMENT-POVERTY CONNECTIONS IN TROPICAL DEFORESTATION

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- **Environment-poverty connections are many, diverse, and complex**

There are many kinds of environmental processes, interacting in baroque ways with a variety of different aspects of poverty. This makes it very hard to generalize. Even where specific processes are well-understood, outcomes and policy implications are often going to be site-specific because of the sensitivity of the processes to local social, economic, and biophysical conditions. Therefore we need to progress rapidly beyond the truism that the poor depend on environmental assets, to more rigorous examination of the impact of poverty alleviation policies on environmental conditions, and of environmental policies on poverty.

- **Environment-poverty interactions are best understood by a systematic examination of agents and impacts**

The crux of most environmental issues is that actions by a set of agents has external (usually negative) impacts on a different group. To deal with the problem, and to understand the implications for the poor, we need to use the standard economic toolkit to systematically examine:

- Who are the agents of environmental degradation? Who bears the cost of environmental improvement?
  - What proportion of them are among the poor?
  - What incentives and constraints shape their actions? To what extent would income growth by itself reduce their environment-damaging actions?
  - What are the costs to the poor of abating their environment-damaging actions? Can they be compensated? Do the external benefits of abatement exceed the cost of compensation?
  - What are the indirect costs to the poor of environmental control strategies targetted at other agents?

- Who bears the cost of environmental degradation?
  - To what extent are the poor physically exposed to these environmental impacts?
  - What value do the poor place upon environmental improvements (as compared to alternative means of welfare improvement)? Do they have enough information to make this valuation?

- **Example: poverty and tropical deforestation in frontier forests**

To illustrate these ideas, let's look at a particular poverty-environment linkage: the relation between poverty and tropical deforestation.

The conventional(?) wisdom

Until recently, a consensus view held that there was a tight interaction between poverty and tropical deforestation. In this plausible model, deforestation results from subsistence-oriented slash-and-burn cultivation in agriculturally marginal areas on the forest fringe. Returns to labor were thought to be low and risks high, so that only the poorest are involved. These populations may be indigenous, or they may be in-migrants who lack opportunities elsewhere in the economy, often due to systematic exclusion from better lands by elites. Because land-augmenting inputs such as fertilizer are expensive, unknown, or unavailable to remote, credit-constrained farmers, slash-and-burn farmers progressively mine the nutrients embodied in the forest, continually expanding cultivation into new stretches of primary forest as old fields are exhausted. The implication is that policies which intensify agriculture at the forest frontier serve both to reduce poverty and deforestation.

The emerging revisionist analysis

Emerging evidence questions the generality of this simple story, both in terms of agents and impacts.

Agents of and incentives for deforestation

Emerging evidence suggests that:

- the poor are not the only, or even the preponderant, actors in deforestation, especially in low-population density, forest frontier areas. Often the actors in deforestation are large-scale commercial entities such as ranchers or plantations. Where smallholders are involved, they tend not to be the poorest farmers, who cannot finance migration and set-up costs associated with frontier forest conversion. Subsistence-oriented slash-and-burn farming may be less widespread than thought. The only available global study based on remote sensing (FAO 1996) suggests that 60% to 70% of tropical forest conversion is to permanent or short-fallow agriculture, rather than to land covers suggestive of long-fallow slash-and-burn agriculture; moreover, some slash-and-burn agriculture is oriented to export rather than subsistence crops. A Mexico-wide study using municipio-level data (Deininger and Minten 1996) provides evidence that poverty is more closely associated with forest *cover* than with deforestation – that is, the poorest live in areas too remote to suffer from much deforestation.

- deforestation is often (but not always) profitable. Returns to the land vary tremendously, but tree crops such as oil palm offer both significant employment and substantial additional rents (Tomich *et al.* 1998). Smallholder cultivation of export-oriented tree crops was found to be closely associated with deforestation in an Indonesia-wide study using village-level census data. (Chomitz and Griffiths 1996) Research in the Western Amazon suggests that cattle ranching, once thought to be unsustainable and unprofitable, actually can provide reasonable long-term returns for smallholders. (Vosti et al 1998)

- agricultural intensification at the frontier may boost incomes but will also tend to increase incentives for intensification. Theoretical arguments and limited empirical evidence suggests that interventions to increase productivity, if attractive to frontier farmers, will tend to increase incentives for deforestation. (Angelsen and Kaimowitz 1998)

Burdens of tropical deforestation

Why do we care about tropical deforestation? What are the external impacts and on whom do they fall?

Climate change: Tropical deforestation contributes about 20% of the increase in greenhouse gases believed to cause climate change. While the economic impacts of climate change are uncertain and difficult to quantify, they are believed to fall primarily on the poorest countries and poorest people. For instance, coastal dwellers in Bangladesh will be subject to greater flood and storm damage as sea levels rise, and agriculture will become increasingly difficult in marginal areas such as the Sahel, as the frequency and severity of droughts increase. In addition, even a small chance of an induced planetary catastrophe (e.g. a major shift in the location of ocean currents) constitutes a large expected cost, broadly borne. (G. Heal, pers. comm) In general, areas responsible for deforestation differ from those that will suffer from climate change.

Biodiversity: It is extremely difficult to put a monetary value on the loss of biodiversity or to identify who bears the cost. The current market for bioprospecting rights does not generate appreciable rents. While it seems plausible that biodiversity loss might endanger production systems, this is difficult to demonstrate, especially for cross-ecosystem effects (e.g the effect of forest preservation on productivity in fields beyond the forest). Because of the uncertainties involved, it is possible that there is a significant option value to maintaining forests. However, it is clear that the current willingness to pay for biodiversity protection is primarily expressed in wealthier countries.

Hydrological impacts: Deforestation can have substantial off-site hydrological impacts, including local flooding, gullying, erosion, and sedimentation of streams, reservoirs and coastal waters. These impacts can adversely affect the poor (e.g. gullying of downslope areas, destruction of local fisheries) or the better off (sedimentation of hydropower and irrigation infrastructure). The severity and incidence of these effects depends very much on local biogeophysical conditions, settlement patterns, and water use patterns. (Chomitz and Kumari 1998) The effects are also quite sensitive to the nature of the land use that replaces the forest (Chomitz and Kumari 1998). In general we would expect more severe effects, and more impact on poverty, where the poor are expanding agriculture onto marginal hillslopes in relatively densely populated areas, rather than in forest frontier situations.

Impacts on indigenous forest-dwellers: Forest conversion or exploitation by outsiders can have severe impacts on indigenous forest dwellers. This might well be classified as a land tenure, rather than an environment, issue.

Policy issues: road building and other interventions

This analysis casts doubt on the general applicability of a simple prescription: help poor frontier farmers and reduce deforestation through agricultural interventions at the forest frontier. This may apply in certain locales but needs to be examined on a case by case basis. In general, different sets of (sometimes poor) people will be affected both by the impacts of deforestation and by forest protection.

An important policy nexus concerns road-building in forested areas:

- while the causes of deforestation are generally diverse and site-specific, the greatest single regularity in the literature is that road construction induces deforestation; recent research confirms that this is a causal relation related to the increased attractiveness of agricultural conversion and is modulated in predictable ways by soil quality and market access (Chomitz and Gray 1996)
- among all the causes of deforestation, the building of major roads in forested areas is the one most directly under government control
- rural road-building is thought to be one of the most important means for alleviating rural poverty, since it is expected to boost land rents and labor demand and reduce the local price of urban commodities.

Surprisingly, there is very little research documenting the social and anti-poverty impacts of rural roads, especially in forested areas.. The road-poverty-environment nexus suggests that rural road interventions are not automatically win-win propositions; if they are designed to fight poverty they may need to be accompanied by environmental protection policies. (And some skeptics claim that rural roads can hurt rural residents by encouraging outsiders to grab land.) An exception might be road intensification in noncritical regions close to markets, which may increase staple food supplies and therefore decrease incentives for clearance at distant forest frontiers (depending on cropping and market patterns at the frontier). Where this policy is applicable, it raises issues of geographical equity of infrastructure allocation.

More generally, the profitability of deforestation and the off-site incidence of the costs of deforestation suggests that different instruments are needed to address poverty and environment issues. Where poor farmers are constrained by unfavorable agroclimatic conditions – as they are in many marginal hillslope areas – there may be an important role for the introduction of improved agricultural technologies as a poverty alleviation device (Scherr 1999). However, maintenance of the external benefits of forests (or avoidance of the external costs of deforestation) will in general require additional regulatory, tax, or incentive instruments (e.g. payments for carbon sequestration or hydrological services; Chomitz, Brenes and Constantino 1999). Choices among these instruments will depend in part on whether rich or poor are the target actors to be affected.

- **Conclusion**

While we should always be on the lookout for policies that simultaneously promote poverty alleviation and environmental maintenance (and there are certainly examples of such policies), we should be reconciled to the general rule that multiple instruments are usuallly needed to accomplish multiple goals. Poverty alleviation and environmental goals are most likely to be coincident where there are no externalities involved. For instance, it is often feared that farmers in agronomically unsuitable locations mine soil nutrients or permit erosion at a privately nonoptimal rate. In such a case, removal of constraints (tenure insecurity? lack of credit?) or provision of new technologies (agroforestry) may improve the level and sustainability of farm incomes by maintaining the land quality on which those incomes depend.

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