How markets alter the effectiveness of enforcement, payments and agricultural projects near protected areas

By Heidi J. Albers and Jeffrey Muller

Introduction

Protected Area Managers (PAMs) in developing countries are mandated by their governments to conserve and preserve the natural resources within a protected area (PA). Rarely, however, do they have the support of the people living near the PA unless there are projects or policies aimed at compensating these people (Tisdell, 1995; Wells and Brandon, 1992). When a PA is established, these people often incur losses given their traditional reliance on resources within the PA, such as fuelwood and foods. Conflicts between PAMs and local people abound in many countries due to the clash of desired use and preservation of PA resources. To conserve PA resources, PAMs develop management plans that involve discouraging extraction by local people. PAMs may or may not face requirements or desires to address the welfare losses imposed on local people by their policies.

Both historically and currently, PAMs enforce their mandate by patrolling the PA and, punishing violators. In the past, PAMs have been relatively successful in conserving resources with these enforcement policies (Bruner, Gullison, Rice, and Fonseca, 2001), but the resulting conflict with local people and the subsequent political ramifications have led the PAMs and other conservationists to search for other methods to conserve PAs. In the 1980s, various forms of integrated conservation and development projects (ICDPs) were suggested to increase PA conservation while improving local welfare (Wells and Brandon, 1992). With the failure of many of these projects, conservationists have recently argued for conservation payments to rural people in exchange for their commitment to conserve resources (Ferraro and Simpson, 2000).

We examine the incentives for conservation and the impact on welfare of three of the most common policy options: enforcement, agricultural development projects, and conservation payments. How households respond to any particular policy depends critically upon their ability to interact with labor and resource markets. Accordingly, the PAM's best management plan dif-

Transporting grasses across the river

Photo by Don Reisman

fers across settings that have or do not have markets. In some cases, the management plans may include a group of policies, with some geared toward reducing extraction and others aimed at compensating local people for their reduced extraction.

Decisions

The PAMs seek to maximise conservation of the PA's natural resources while neighbouring households extract these natural resources either for their own consumption or for sale, depending on market conditions. Labor market conditions may constrain neighbouring households to their own labor supply. Such constraints affect how households react to conservation policies and should be considered when the PAMs choose which policies to implement within their management plans.

Rural areas of developing countries, such as agricultural villages neighbouring remote PAs, often lack markets. For example, resource markets, such as those for fuelwood, will not exist if the transaction costs of getting resource products to distant markets outweigh the benefits.[1] Villages without resource markets must rely on subsistence production for resource products such as fuelwood. Similarly, if a village's laborers are particularly similar in their skills and have similar technology, or if a village contains few landless people and its remoteness discourages in-migration, a focus on subsistence agricultural activities will discourage active labor markets (Binswanger and McIntire, 1987; Binswanger and Rosenzweig, 1986). Villages near PAs often meet the classic criteria for missing labor markets: they are far removed from employment centers, consist largely of agricultural households, and have a history of land abundance and a small, landless population.[2] Because remote villages with missing markets abound in developing countries, PAMs should consider the role of the market setting when determining their management plan.

Going to the market Photo by Don Reisman

To create a framework for looking at household decisions, we defined three market settings. In the complete markets case, the household has access to labour and resource markets. These households can buy or sell labour and extracted resources with ease. In the missing labour market setting, the household cannot buy or sell labour, and in the missing resource market setting, the household cannot buy or sell extracted resource products. These three scenarios represent extreme cases, with some real-world situations, such as households facing large transaction costs to interact with markets, falling in between these settings.

How Households Decide How Much to Extract in Different Market Settings

Our framework for looking at household decisions relies on a group of economic models known as agricultural household models. In these models, a household makes decisions about how much time to spend on various agricultural activities in order to maximise their welfare: a household allocates a fixed amount of time for agricultural production, off-farm labour, resource extraction from a protected area, and leisure.[3] The household's welfare is a function of the amount of agricultural products and extracted resource they consume as well as the amount of leisure time they have.

In a complete market setting, the household can move its labour across activities until they get the same benefit from each use of time. In economic parlance, the household gets the highest welfare by equating the benefit it receives from a marginal hour spent in each activity. Missing markets decrease the flexibility in the household's time allocation decision. For example, when the market for fuelwood is missing, households are constrained to extract the same amount of wood that they use. Similarly, when the labor market is missing, households cannot hire nor sell labor. In both cases, households cannot set the marginal benefits of activities equal to each other because they face other constraints caused by the missing markets.

---

[1] In a given village, markets may exist for some but not all resources. For example, villagers may not interact with fuelwood markets because the high transport costs of this bulky item will not be covered by the price. The same villager, however, may interact with a market for tropical birds because lower transport costs and high prices make market interaction profitable.

[2] Protected areas are often created in remote areas with low population densities and high land abundance per person.

[3] For a well-developed economic model and analysis, see Muller (2000) and Muller and Albers (2002).

The PAM's Decision

In the stylized framework considered here, the PAM's goal is to minimise the amount of extraction, and the resource degradation it can cause, in the protected area. The PAM may or may not consider the impact of their decisions on local households. The PAM considered here has a fixed budget and can use a mix of agricultural development projects, enforcement, and conservation payments to achieve his or her goal.

Impact of Each Policy on Extraction Decision

Enforcement

In our decision framework, households respond to increased enforcement by reducing extraction because the expected benefits of extracting decrease as the chance of being caught increases. In the complete market setting, these households can buy the resource on the market and can redirect time formerly spent on extraction to agriculture or to leisure. Although people can easily adjust and substitute other activities in this setting, the reduced access to resources decreases the household's welfare.

In a missing labour market, households would expect to get less from extraction when enforcement is increased but would not be able to adjust their activities as in the case with complete markets. The households do not have the option of selling the time formerly spent on extraction and so they may not reduce their extraction by as much. In our decision framework, the increased enforcement can, in extreme cases, lead to enough of a decline in welfare that households need to do more agriculture and extract more resources from the PA. The households' lack of flexibility in their choice of what to do with their time reduces the effectiveness of the PAM's enforcement policy and may even lead to more extraction.

In the missing resource market setting, households expect to bring home fewer benefits from extraction when enforcement is higher but, again, they cannot react by reducing extraction as much as in the complete markets setting. In this setting, the household's welfare relies on the extracted resource but the household cannot buy the resource in a market. The household, then, reduces extraction and allocates that time to other activities but does not reduce extraction by as much as they would if they could buy the resource. Again, the PAM's enforcement policy is less effective in the missing resource market setting but reduces both extraction and welfare.

Conservation Payments

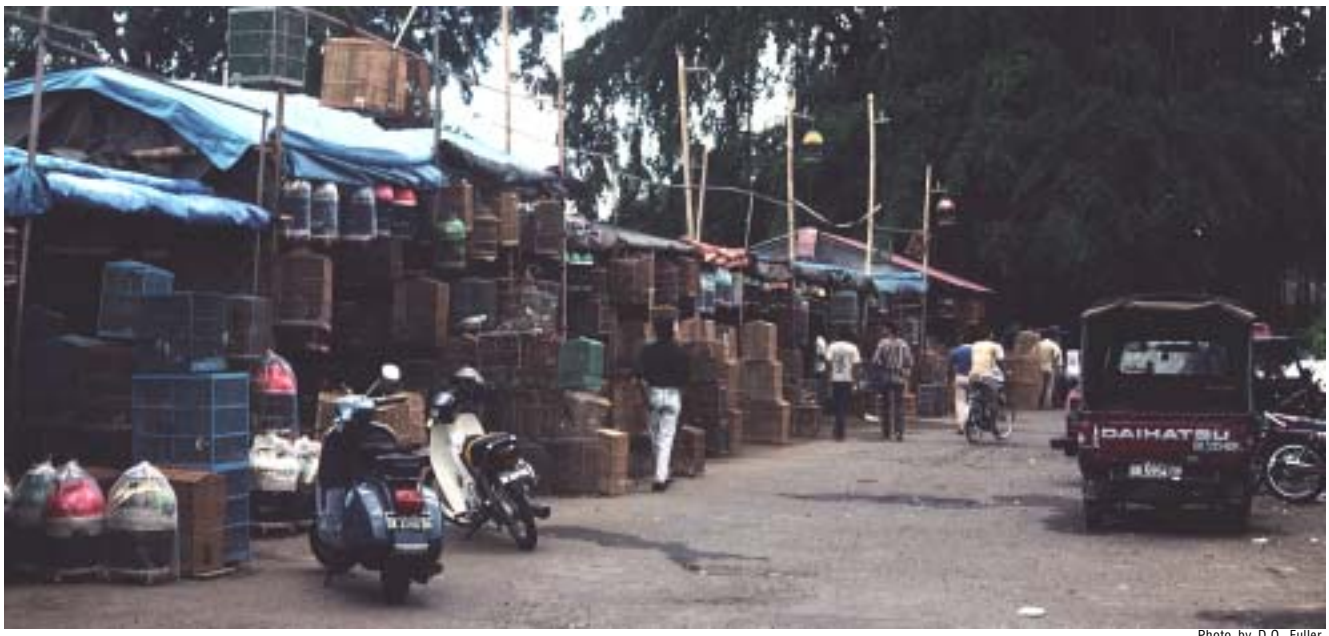
One fairly new policy is for PAMs to pay households if little extraction occurs in the household's "assigned" section of the PA. In our framework, if households are caught extracting from the PA, they do not receive the payment. However, as in the enforcement case above, the household is caught breaking the contract only some fraction of the time. In the complete market setting, conservation payments have the desired effect of reducing extraction and thereby conserving resources. Households can turn to the market to buy the resource and can reallocate their extraction time to agricultural labour or leisure. Because households can use the payment to buy the desired amount of the resource from the market and have more time for income-generating activities or for leisure, conservation payments would increase rural welfare.

In the missing labour market setting, the conservation payment increases the expected cost of extraction, which makes extraction less desirable and the household reallocates time to agriculture and leisure. As with the enforcement policy, this reduction in extraction is lower than it would be if the household could sell its labour on the labour market but, because the payment makes the household better off, the household chooses more leisure and less extraction than in the enforcement case. Conservation payments do less to decrease extraction in the missing labour market setting than they do in complete markets, but they reduce extraction and increase welfare.

In the missing resource market setting, a conservation payment again provides an incentive for the household to reduce labour allocated to extraction (although not by as much as in the complete market setting). The added income from the payment, however, creates an increased demand both for leisure and the resources, and the household can only meet that resource demand through increased extraction because the household cannot buy the resource. In some situations in our decision framework—such as where this demand increase is large and the probability of being detected and thus not receiving the payment is low—payments may actually increase extraction. Those situations may be rare in practice but the reduction in extraction associated with conservation payments is certainly lower in the missing resource market setting than in the complete market setting. Household welfare increases in response to conservation payments.

Agricultural Development Projects

In our framework, agricultural development projects are any project or policy that increases the productivity of agriculture, such as providing fertilizer, equipment, irrigation, or new high-yielding crops. In the complete market case, projects that increase the productivity of agriculture have no effect on the amount of resources extracted. The household will not reallocate time away from resource extraction and toward agricultural labour in response to these policies but will instead buy more, or sell less, labour on the labour market. Such projects, while welfare-increasing, have no conservation effect.



Wildlife market

Photo by D.O. Fuller

In the missing labour market setting, however, such projects increase the marginal productivity of labour in agriculture, which increases household demand for agricultural labour. Because the labour market is missing, the household cannot buy the additional labour and therefore reallocates labour from extraction to agriculture. This is a common motivation behind including agricultural development in ICDPs, but it requires the labour market to be missing to be effective. Because the project creates more income, households also increase leisure by further reducing their time in extraction. In addition, these projects increase rural welfare.

In the missing resource market setting, as in the complete market case, these projects do not encourage a shift of labour from extraction to agriculture because the household can hire labour on the market to take advantage of the increased agricultural productivity. Furthermore, these projects increase income and thus the demand for the resource, which, with the resource market missing, can only be met through increased extraction. Although the projects increase rural welfare, with a missing resource market, agricultural development projects cause more extraction and less conservation.

Overall

The household's response to these three policies depends on the market setting because the availability of markets determines the extent to which households can adjust the amount of time they put into different activities. Both enforcement and payment policies are less effective in the missing market cases. Agricultural development projects are only effective as a conservation policy when labor markets are missing. In that setting, agricultural development projects can work as "conservation by distraction" by pulling labour away from extraction activities and into agricultural activities.

Discussion

In determining the best management plan to maximise PA conservation, the PAM should consider the reaction of local people to each policy in addition to considering the policy's cost. In that decision, the PAM must recognize that local people react differently to policies in various market settings. Reactions are affected not only by whether a market is missing but also which market is missing. In other words, the market setting determines the cost effectiveness of individual policies and the make-up of the best management plan.

When either market is missing, the PAM should recognize that enforcement is less effective than in the complete market setting. Missing markets also reduce the effectiveness of conservation incentives created by payments. In our decision framework, the market setting also determines whether agricultural development projects increase, decrease, or have no effect on conservation in neighbouring PAs. Only in the missing labour market case do agricultural development projects encourage conservation, because labour reallocation forms an explicit link to conservation behavior. If a PAM fails to consider the market setting, his or her policies will be less effective than desired and can even backfire.

The analysis here demonstrates that the market setting (whether complete markets, missing labour market, or missing resource market) plays a major role in determining the best management plan for a PA in a developing country. The heterogeneity of market settings across the world, and even within one country, implies that no single policy or portfolio of policies will prove best everywhere. Even within one protected area, the heterogeneity of markets among villages will determine whether that area's PAM must

tailor the management plan to specific villages or apply the same policies to the entire area. Whether at the macro level of countrywide policy or at the micro level of a specific PA, the market setting determines the best mix of enforcement, agricultural development, and payment policies.

Many PAMs recognize that promoting conservation and limiting extraction in PAs places a burden of lost resource access on local households. In these cases, PAMs have looked for policies that increase conservation and rural welfare. Agricultural development programmes and payment policies have been described as "win-win" policies that encourage both conservation and the maintenance of or increase in rural welfare. However, conservation payments may not induce conservation in a village that has a missing resource market, and agricultural development projects decrease extraction only in villages that lack labour markets. Because both policies increase welfare in every market setting, it may be more fruitful to consider their contribution to welfare in the context of a management plan consisting of a portfolio of policies rather than considering their contribution to conservation alone.

Using this broader definition of a management plan, the PAM should make two interrelated decisions regarding policies that most cost effectively reduce extraction in a given market setting, and policies that most cost effectively compensate local people for that reduced extraction. The resulting management plan can include a mix of policies aimed at conservation and policies aimed at compensation. The discussion here indicates that such a portfolio of policies is likely to include conservation payments to compensate for losses caused by enforcement and, in the missing labour market setting, to include agricultural development projects as both compensation and conservation tools.

Whenever enforcement is the primary tool in resource preservation, this framework "predicts" conflict between local people and PAMs because enforcement always inflicts welfare losses on local people. Our analysis suggests that because pure agricultural development projects only reinforce explicit links to conservation actions in settings with missing labour markets and have no effect or, worse, a negative effect on conservation in other market settings, they will not lead to conservation across many settings. For the newer conservation payment programmes, this framework predicts they will not prove as effective in creating conservation in areas with missing markets, particularly those that are missing resource markets. The analysis also suggests that implementing payments and agricultural development projects as compensation mechanisms rather than pure conservation mechanisms can maintain welfare and thereby diffuse some of the conflict between local people and protected area managers.■

Transporting fuelwood Photo by D.O. Fuller

Heidi J. Albers works for Resources for the Future (Albers@rff.org) while **Jeffrey Muller** is with the World Bank.

References

Binswanger, Hans P. and Mark R. Rosenzweig. (1986) "Behavioral and Material Determinants of Production Relationships in Agriculture." *Journal of Development Studies*. **22**(3):503-9. April.

Binswanger, Hans P. and John McIntire. (1987). "Behavioral and Material Determinants of Production Relationships in Land-abundant Tropical Agriculture." *Economic Development and Cultural Change*. **36**(1):73-99. October.

Bruner, Aaron G., Raymond E. Gullison, Richard E. Rice, and Gustavo A.B. da Fonseca. 2001. "Effectiveness of Parks in Protecting Tropical Biodiversity." *Science* vol. 291 (5): 125-128.

Ferraro, Paul and R. David Simpson. (2000) "The Cost-Effectiveness of Conservation Payments." RFF Discussion Paper 00-31. July. 26 pp.

Muller, Jeffrey. 2000 Managing Protected Areas in Developing Countries. Ph.D. Dissertation. Department of Economics, Stanford University. 199 pp.

Muller, Jeffrey and Heidi J. Albers. 2002 "Enforcement, Payments, and Development Projects Near Protected Areas: How the Market Setting Determines What Works Where." In review.

Tisdell, C. A. 1995. Issues in Biodiversity Conservation including the Role of Local Communities. *Environmental Conservation* **22** (3):216-222, 228.

Wells, M. P., K.E. Brandon, K. E. and L. Hannah.1992. *People and Parks: Linking Protected Area Management with Local Communities*. Washington, D.C.: World Bank, WWF, and USAID: 99 pp.