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Habitat Fragmentation and Systematic Conservation Planning in Low-income Countries

Considering People's Livelihoods and Decisions in Establishing Policy

BY H. JO ALBERS, RAZACK LOKINA, ELIZABETH J.Z. ROBINSON AND VICTORIA KREINBRINK
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Parks and nature reserves created for conservation often become forest islands in a matrix of other land uses. Their species populations often decline due to this forest fragmentation. There is increasing evidence that conservation outside of reserves is required to slow biodiversity loss. This evidence, coupled with the species decline due to fragmentation, implies that conservation policies require a landscape perspective that includes the land in between protected areas. In low-income countries, however, these "matrix" areas often support rural people's livelihoods. Landscape conservation policies, then, must reflect rural people's needs, decisions, and institutions in addition to ecosystem priorities. Despite this reality, systematic conservation planning rarely considers the rural people's response to reserves until after areas are chosen for conservation based on ecological characteristics. In addition, there has been little economic analysis of the causes of habitat fragmentation.

Parks aim to protect portions of landscapes to provide ecosystem services (such as natural water purification and absorption of greenhouse gases) and biodiversity protection. Yet, the corridors between the parks are also ecologically important because the parks are merely fragments of a larger landscape. Therefore, ecologists suggest that parks alone cannot provide all necessary and desirable ecosystem services. A broader landscape perspective considers ecosystem services generated both within and outside of parks. In addition, many parks cannot prevent all resource-degrading activities within their boundaries. Human activities within parks and in other parts of the landscape partially determine the amount and types of ecosystem services generated by the landscape as a whole. A landscape manager aiming to maximize the landscape's production of a particular ecosystem service must first understand how the types, levels, and patterns of human activities alter the landscape's ability to produce such services and, second, understand the changes in those activities that will occur in response to the conservation policy.

Key Points

- The ecological and socioeconomic impact of conservation policy depends on the reaction of people to such policies.
- Economic efficiency requires that decisions about the location and type of nature reserves should incorporate the people's responses.
- Rural people rely directly on forest fragments in the landscape.
- Although planners may not see much economic value in protected land, people depend on its resources and ecosystem services for their livelihood .

RESEARCH BRIEF

Habitat Fragmentation and Systematic Conversation Planning in Low-income Countries

In low-income countries, poorly-defined property rights and direct reliance on natural resources and land contribute to the reaction of people to parks and conservation policy. When property rights are poorly defined, people don't have as much incentive to conserve resources, because other people might benefit from their efforts without contributing to conservation. Similarly, when there is not much money available for enforcement (such as game wardens) and there is a great need to gather resources for subsistence (such as firewood), there is a good deal of illegal use of resources even in areas that are designated as protected.

Despite these facts, recent emphasis on "systematic conservation planning" at the landscape level rarely incorporates characteristics of the low-income country setting and the impact of people's responses to conservation activities. This omission creates economic inefficiency in conservation policy design. Similarly, the analysis of the effectiveness of parks in avoiding deforestation has looked at individual parcels rather than the landscape as a whole – for instance, people may obey rules about not cutting trees in a park but may instead cut trees outside the park, which affects the local ecosystem as a whole.

In practice, organizations establishing reserves and corridors between forest fragments often wait until after siting decisions are complete to engage local people. In addition, organizations and researchers rely on agricultural land values for the basis of cost estimates but those values do not reflect these people's reliance on the land and landscape for their livelihoods.

Because forest fragmentation threatens the biodiversity hotspot forests of the Usambara Mountains (Eastern Arc, Tanzania), several organizations have developed plans to "de-fragment" the forest, including the creation of the Derema Corridor. Although local communities were involved in the creation of the corridor and received compensation for agricultural land, whether local people feel appropriately compensated and how people will use the protected forests and affect biodiversity over time remain open questions. A recent study projects that connecting more fragments in this region would be good for the survival of species and the number of animals; the study also argues that there is a very high return on investment when the cost of acquiring the land is balanced against the benefits of preserving habitat (Newmark, et al. 2017). However, that study did not consider any other aspects of the costs of further reserves, such as people's willingness to sell land at a low price because of the low value of semi-subsistence agriculture, the value of the land to farmers as a function of landscape characteristics such as the availability of other accessible forests, nor the cost of enforcing restrictions on land or resource extraction within the reserve. Our study measured such costs to predict the reaction of people to different locations and types of expanded forest reserves.

As a first step toward that end, EfD-Tanzania research in this region gathered information from people about their dependence on forests and other policies associated with expanding the reconnection of forest fragments, including people's willingness to cooperate by selling land and their support for tree plantations on private land. Across the 5 villages surveyed, all villages reported that their livelihoods depend heavily on forest resources, including extracting resources from forests for home-use and sale and from ecosystem services such as water flow protection. This dependence varies with access to agricultural land and with the type of forest institutions near the village. On average, men and women spend 20 percent of their labor time collecting in forests and receive 7 percent of their cash income from sales of extracted products. In addition, households rely almost completely on wood for

Findings from Surveys of households interviewed:

- 99.0% gather resources from the forests (including water resources).
- 87.9% agree that money cannot compensate them for lost forest access.
- 82.9% support a tree planting project.
- 47.2% are willing to contribute land to defragmentation efforts.

cooking and heating fuels. With this large time commitment to extraction and the reliance on forest products, villagers reacted overwhelmingly favorably to questions of hypothetical tree planting in the area. In contrast, nearly half of all households would not be willing to reduce their land holdings in order to create such tree plantations. Overall, a significant majority of surveyed households stated that receiving money would not compensate for lost access to forests through increased restrictions.

This information should inform policies to de-fragment forests in the region. Villagers appear open to policies to improve and potentially expand forests if they have the right to extract forest products from these forests. This willingness to support tree planting bodes well for short- and long-run cooperation with projects that plant trees in a manner that connects forest fragments and protects species survival.

Policy planning should not expect that the cost of acquiring protected land will be the low cost of land based on semi-subsistence agricultural values, because payments for reduced forest access have to take into account the other benefits that poor rural people get from forests. Such plans are unlikely to be successful if people reject cash payments and added forest access restrictions, as reflected in our surveys.

Conclusion: Response to Forest Reserve Site Selection

There have been very few studies to determine how rural people will respond to the selection of forest reserve sites, and how their actions will in turn affect the ecological and socioeconomic outcome of the reserve network. These questions are especially important in low-income settings where property rights and restrictions are costly to enforce. Reserve networks formed without an understanding of people's responses prove either more costly or less ecologically beneficial than expected. Future research by economists should integrate rural people's decisions into systematic conservation planning and reserve network design to both improve rural well-being and increase the provision of ecosystem services from the landscape.

Photo: forest fragments and forest users in the Eastern Arc Usambara mountains, Tanzania. Credit: H. Jo Albers

ABOUT THIS BRIEF

"Rural households' forest use in fragmented forest landscapes: An example from Tanzania's Usambara Ecosystem." 2019. HJ Albers, R Lokina, EJZ Robinson, and V Kreinbrink. Environment for Development Discussion Paper Series 19-20.

FURTHER READING

"Economics of habitat fragmentation: a review and critique of the literature." 2018. HJ Albers, KD Lee, and KS Sims. *International Review of Environmental and Resource Economics* 11(2):97-144.

"Economics of Systematic Conservation Planning for Lower Income Countries: Literature Review and Assessment." 2017. HJ Albers, M Maloney, and EJZ Robinson. *International Review of Environmental and Resource Economics* 10:145-182.

"Targeted habitat restoration can reduce extinction rates in fragmented forests." 2017. William D. Newmark, Clinton N. Jenkins, Stuart L. Pimm, Phoebe B. McNeally, and John M. Halley. PNAS v. 114(38) 9635-9640

CONTACT

Professor Jo Albers, University of Wyoming, Jo.Albers@uwyo.edu
Mr. Salvatory Macha, EfD – Tanzania, University of Dar es Salaam, efdt@udsm.ac.tz

EfD Center in Tanzania, www.efdinitiative.org/centers/tanzania
doe@economics.udsm.ac.tz , Phone +255-22-2410252, Fax +255-22-2410252
Environment for Development in Tanzania (EfDT), Department of Economics, University of Dar Es Salaam, P.O. Box 35045, Dar Es Salaam, Tanzania

EfD, Environment for Development initiative, www.environmentfordevelopment.org
EfD Secretariat: info@efdinitiative.org, Phone: +46-31-786 2595, Fax +46-31-786 10 43, www.efdinitiative.org./efd-initiative/organisation/secretariat, Department of Economics, University of Gothenburg , PO Box 640, SE 405 30 Gothenburg, Sweden