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Effectiveness of Community Forest Management at reducing deforestation in Madagascar

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ABSTRACT

Community Forest Management (CFM) is a widespread conservation approach in the tropics. It is also promoted as a means by which payment for ecosystem services schemes can be implemented. However, evidence on its performance is weak. We investigated the effectiveness of CFM at reducing deforestation from 2000 to 2010 in Madagascar. To control for factors confounding impact estimates, we used statistical matching. We also contrasted the effects of CFM by whether commercial use of forest resources is allowed or not. We cannot detect an effect, on average, of CFM compared to no CFM, even when we restricted the sample to only where information suggests effective CFM implementation on the ground. Likewise, we cannot detect an effect of CFM where commercial use of natural resources is allowed. However, we can detect a reduction in deforestation in CFM that does not permit commercial uses, compared to no CFM or CFM allowing commercial uses. Our findings suggest that CFM and commercial use of forest resources are not guarantees of forest conservation and that differentiating among types of CFM is important.

1. Introduction

The major role of tropical forests in biodiversity and climate change has led the world to search for effective ways to slow deforestation. Many approaches have come in and out of fashion. Strictly protected areas, which prohibit most human activities, were popular in the early days of conservation and remain so today. As an alternative to strict protected areas, Community Forest Management (CFM) emerged in the late 1980s (Hutton et al., 2005). By virtue of involving local forest users in management, CFM is promoted as having the potential to benefit both forests and local livelihoods (Behera, 2009). This potential, however, has been questioned (Behera, 2009) and its evidence base has been found to be weak (Bowler et al., 2012). Although Payments for Ecosystem Services (PES) have become the most recent fashion in efforts to reduce deforestation, CFM remains an important part of the forest management toolkit in many developing countries (Blaikie, 2006). It is also promoted as a means by which PES schemes can be implemented. High quality studies evaluating the effectiveness of CFM are therefore important for shaping future development and investment in approaches to reduce deforestation. We aim to provide robust evidence on effectiveness of CFM at reducing deforestation.

Studies investigating the effectiveness of conservation interventions often fail to adequately control for confounding factors that affect both the assignment of interventions and the outcomes of interest (Bowler et al., 2012; Ferraro and Pattanayak, 2006; Joppa and Pfaff, 2010). Recent studies investigating the effectiveness of protected areas at reducing deforestation have made progress in controlling for confounding factors by the use of statistical matching (e.g. Andam et al., 2013, 2008; Carranza et al., 2014; Ferraro et al., 2013). Matching selects comparison areas that have pre-intervention baseline values of confounding factors most similar to intervention area values, and thus makes it possible to control for these confounding factors (Joppa and Pfaff, 2011). However, we know of only one study (Somanathan et al., 2009) that has used matching to investigate the effectiveness of CFM at reducing deforestation.

A significant challenge for evaluating the effectiveness of CFM is the large variation in forest management practices and designs within the approach, both among and within countries (Lund et al., 2009). In terms of practices, examples of this variation range

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from cases where the community has a good understanding of their rights and responsibilities to cases where CFM exists on paper only (Benjamin, 2008; Lund et al., 2009). An example of design variation is that some CFMs allow communities to benefit from commercial use of forest resources within their managed forests while others do not (Persha et al., 2011). Failure to consider this variation compromises the potential for learning about design and implementation factors that promote CFM effectiveness.

The Malagasy government legislated CFM in the late 1990s (Raik, 2007) to reduce deforestation and protect the significant part of the world's biodiversity that is endemic to Madagascar (Le Saout et al., 2013). The number of CFM units increased rapidly and continues to grow (Aubert et al., 2013). Many publications review the institutional and political aspects of Madagascar's forest decentralization process (Pollini et al., 2014; Pollini and Lassoie, 2011; Raik and Decker, 2007; Rives et al., 2013; Urech et al., 2013), but only a few focus on empirically estimating the performance of CFM in terms of conservation outcomes (CIRAD, 2013; Sommerville et al., 2010; Toillier et al., 2011). None adequately control for factors that may confound impact estimates.

Using statistical matching to control for factors that confound impact estimates, we investigate the effectiveness of Madagascar CFM at reducing deforestation between 2000 and 2010. To our knowledge, this is the first national scale study of performance of CFM at delivering conservation outcomes. First, we assess the overall effectiveness of Madagascar's forest decentralization policy at reducing deforestation by looking at all CFM units across the country. Second, we distinguish and study effectiveness in a subsample of CFM units where we have information to suggest that CFM was implemented on the ground. Finally, we differentiate between CFM that allows and does not allow commercial use of forest resources and study effectiveness conditional on whether CFM permits or prohibits commercial use. Note that we do not consider other important potential outcomes from CFM including impacts, positive or negative, on human welfare.

2. Methods

2.1. Study areas

In Madagascar, the transfer of forest management to local communities involves three main steps; the creation of a local forest management group, adoption of forest rules, and signed contract between the local forest management group, the state forest department and possibly the municipality where the forests are located (Aubert et al., 2013; Pollini and Lassoie, 2011). In our study, CFM refers to forests managed by communities that achieved these three steps.

Our study covers CFM established between 2000 and 2005 (Fig. 1). Because 2010 is the end of the period of our analyses, selecting CFM established between 2000 and 2005 allows observing at least five years of deforestation impacts post CFM establishment. There is no national database containing current information on all CFM units. We therefore gathered information from multiple sources including organizations involved in implementation; namely, Direction Générale des Forêts, Office National pour l'Environnement, Asity, Fanamby, Durrell Wildlife Conservation Trust, Conservation International, Wildlife Conservation Society, and World Wide Fund for Nature.

Malagasy CFM varies in their implementation quality. Some were established with little input from local communities (Rives et al., 2013), and others received little or no external support (Hockley and Andriamarovololona, 2007). It is very difficult to get information of the implementation quality of the individual CFM unit. We used whether a CFM unit passed the forest department evaluation that is undertaken three years after the contract (Pollini and Lassoie, 2011) as an indicator of whether the project was indeed implemented. While not an ideal indicator, it does at least suggest the CFM unit has met the basic institutional, socio-economic and environmental criteria of the evaluation. We refer to units that passed the evaluation as CFM units that have information to suggest implementation.

CFM implementation in Madagascar varies according to regulations related to commercial use of forest resources. Commercial CFM allows commercial uses and adopts it as a conservation strategy. Non-commercial CFM does not permit commercial uses and follows a pure conservation strategy (Randrianarivelo et al., 2012). Because there are no reliable national data regarding where commercial uses are permitted within CFM, we conducted analyses on commercial and non-commercial CFM for four sites only, where we were able to ascertain information on commercial uses through field visits, interviews with site managers or search of existing literature. The four sites are Didy, Tsitongambarika, Menabe and Boeny (Fig. 1). All CFM units that we considered in these four sites had passed the forest department evaluation. Table 1 presents the number of CFM units, the area of land and natural forest covered by each type of CFM considered in our analyses.

Non-CFM areas refer to forests that, up to 2010, were not technically and financially supported by particular organizations and thus were under government control. Since the government has been weak and unable to enforce forest laws, these forests are subject to open access (Raik, 2007; Urech et al., 2013)

We excluded six out of the 22 administrative regions of Madagascar where we were unable to collect CFM data (Fig. 1). Because we analyzed CFM established between 2000 and 2005, undated CFM and CFM established before 2000 or after 2005 were excluded. We also excluded protected areas managed by Madagascar National Parks. Finally, extensions of protected areas, temporary and new protected areas created since 2003 were excluded. However, any portions of these newly created protected areas that were known to be community managed were considered as CFM (Fig. 1, see Appendix D Table D1 for how CFM, non-CFM and excluded areas fit into official Madagascar forest statuses since 2003).

2.2. Matching, unit of analysis, sampling

Conservation interventions like CFM are not randomly assigned. The site characteristics that affect where conservation interventions are assigned also affect deforestation, thus confounding attempts to estimate intervention impacts (Ferraro and Pattanayak, 2006). To control for these confounding factors, some empirical studies have used matching (Andam et al., 2008; Joppa and Pfaff, 2011). Matching selects comparison areas that are similar to the intervention areas in terms of their values of the confounding factors at the pre-intervention baseline. Thus, one assumes that the outcomes of the comparison group represent, in expectation, the counterfactual outcomes of the intervention sites had they not been exposed to the conservation intervention.

The unit of analysis is a forested pixel from the 2000 forest cover baseline (See Appendix A for limitations of using 2000 baseline forest cover and CFM established between 2000 and 2005, and Appendix B for how we deal with potential pseudo-replication in which pixels within a particular CFM are not independent). For each forested pixel at baseline, covariates take the values of each confounding characteristic at that pixel location. For each analysis (Table 2), we selected random forested pixels in intervention areas. Then, we used matching to pair each randomly selected pixel with the most similar pixel in comparison areas in terms of covariates. The outcome variable is whether a pixel remained forested or not in the 2010 land cover. The estimated difference in deforestation between intervention and similar comparison