Biodiversity Protection and Poverty: implications of heterogeneous environmental and social responses to protected areas

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Abstract

Protected areas represent a powerful policy tool for the preservation of ecosystems and their services. However, despite the ubiquity of protected area systems, scientific evidence related to their environmental and social impacts is weak (e.g., Coad et al. (2008)). The dearth of empirical evidence hinders resolution of an important international debate: do ecosystem conservation goals conflict with poverty alleviation goals in developing nations (Adams et al. (2004), Wilkie et al. (2006), Coad et al. (2008))?

A fundamental concern surrounding the establishment of protected areas is their potential to exacerbate poverty. There is empirical foundation for this concern. It has been demonstrated that protected areas tend to be located distant from major cities and on agriculturally undesirable land (Joppa and Pfaff, 2009); areas similarly associated with high levels of poverty. However, there are potential countervailing positive socioeconomic impacts associated with the establishment of protected areas (e.g., environmental tourism, bolstered ecosystem services, etc.). Furthermore, if land-use restrictions are not binding then there is no reason to expect any detrimental socioeconomic impacts from these so-called “paper parks.” Therefore, the environmental efficacy and social impacts of protected areas necessitate empirical study.

Addressing the interplay between environmental and social outcomes requires that empirical studies consider these outcomes jointly. Prior research on protected areas, however, focuses on either environmental or social outcomes, but not both (exceptions are Sims (2010), Ferraro and Hanauer (2011) and Ferraro et al. (2011)). Moreover, this literature tends to report only estimates of mean impacts. Mean impacts, however, may not provide sufficient information to decision makers (Manski (2005); Crump et al. (2008)). The rapidly growing conservation planning literature emphasizes targeting conservation investments conditional on observable environmental and economic characteristics to enhance conservation effectiveness (Margules and Pressey, 2000; Naidoo et al. 2006). Furthermore, policymakers and practitioners have urged societies to commit to protected area management that strives to reduce, and in no way exacerbates, poverty (Durban Accord at the Fifth World Parks Congress (2003), pp.4). Meeting the spirit of this commitment through the targeting of appropriate areas requires knowing more than just the mean impact of a protected area system.

To increase the likelihood that protected areas can reduce poverty and achieve environmental goals, conservation planners need what Manski (2005) terms conditional empirical success (CES) rules. CES rules select interventions that maximize average impacts based on observable covariates (Manski (2005), pp.75). In the context of ecosystem protection, CES rules are developed by first understanding the heterogeneous impacts of interventions conditional on observable

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biophysical and demographic characteristics. For instance, due to the varying ease of agricultural cultivation and logging on land of differing slopes, a conservation planner could optimize environmental impacts by understanding and protecting the areas where these pressures are highest. Similarly, a poverty advocate would benefit from understanding how the protection of land with varying opportunity costs, according to slope in this example, impacts socioeconomic conditions in surrounding areas. However, a social planner must understand the co-variation of these two outcomes across similar domains in order to target areas for mutually beneficial ('win-win') outcomes.

Unlike previous studies that explore heterogeneous impacts of protected areas (Pfaff et al. (2009), Ferraro and Hanauer (2011); exception Ferraro et al. (2011)), we examine impacts on both avoided deforestation and poverty alleviation and we use the nonparametric method of locally weighted scatterplot smoothing (LOESS) and a semiparametric partial linear model (PLM) to estimate more informative continuous relationships between observable characteristics and outcomes. The estimation of these continuous relationships allows us to identify covariate ranges that are associated with: 1) high conservation outcomes and high poverty alleviation ('win-win'); 2) low conservation outcomes and low poverty alleviation or exacerbation ('lose-lose'), or; 3) some combination in which one outcome is ‘win’ and the other is ‘lose’ (tradeoff). Finally, we demonstrate how these estimates can be used to create a conservation suitability map to identify contemporaneous geographic locations associated with the three aforementioned joint outcomes.

We conduct our analysis using data from Bolivia, a developing nation that has experienced a rapid proliferation of protected areas in recent years, and that has reliable spatially explicit data. Previous studies from Bolivia found that the establishment of protected areas was associated with poverty reductions in surrounding communities (Canavire-Bacarezza and Hanauer 2013) and avoided deforestation (Ferraro et al. 2013). We extend these studies using much richer socioeconomic data and by exploring the heterogeneity of the protected area impacts conditional on biophysical and demographic characteristics.

Similar to Ferraro et al. (2011) we find significant heterogeneity in the socioeconomic and environmental impacts of protected areas across biophysical and demographic characteristics. Further, while we find that the type of land associated with the most avoided deforestation is not necessarily the land on which we have observed the most positive socioeconomic responses, we are able to identify, and map, areas in which we might expect positive joint responses in the future.
References


