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Community-based land sparing: Territorial land-use zoning and forest management in the Sierra Norte of Oaxaca, Mexico

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ABSTRACT

Land sparing land-use practices have been proposed as a strategy for optimizing commodity production, whether food or timber, and biodiversity conservation. Land sparing approaches have been criticized for being unrealistic in developing countries, as sustainable land sharing is well documented, high commodity yields and biodiversity can co-exist, and the land-use pattern a particular landscape exhibits is heavily dependent on development history. As well, the kind of large-scale land use planning required is highly unlikely in developing countries and rare in developed ones. However, in situations where large-scale land sparing could be carried out with democratic participation supported by government policy, it is entirely likely that there could be benefits for commodity production, biodiversity conservation, and community well-being. We present a regional case study of the Sierra Norte of Oaxaca. Resulting from historical phases of both passive and active land-use zoning, we found that 23 communities, with a total area of 201,093.94 hectares, and with forest management plans for ten to twenty years, have zoned 36% of the total territory for conservation, 37% for timber production, 5% for restoration, and 22% for agriculture and other uses, with 78% (156,550.63 ha) of the total area, forested. An average of 39% of the timber production areas was logged in the most recent ten-year period (2003–2013), leaving 61% of the forest production area in reserve, under medium-term conservation. Over a 20-year period, this highly forested landscape has produced nearly 3 million metric tons of timber. This suggests that community-based land sparing may be a viable option for commodity production and forest conservation.

1. Introduction

In recent years, the debate about the virtues of traditional protected areas versus conservation in human inhabited areas, and specifically smallholder agriculture, has been reframed as “land sharing vs. land sparing” or optimal combinations of food production and biodiversity conservation (Green et al., 2005; Phalan et al., 2011; Law and Wilson, 2015). This has also been linked to another debate around the impacts of logging on forest biodiversity, conceived as land sharing vs. land sparing logging (Edwards et al., 2014). Land sharing/sparing for food production or timber production has been more generally conceptualized as the question of whether commodity production can be compatible with biodiversity conservation, or needs to be separated from intact forests to maximize biodiversity (Fischer et al., 2014). The argument for land sparing logging is consistent with the frequent argument that logging is incompatible with forest conservation, being linked to deforestation, loss of habitat, and the generation of greenhouse gas emissions (Keenan and Kimmins, 1993; Shwartz, 2005; Asner et al., 2009; Blaser et al., 2011; WWF, 2016). If this is correct, logging should be prohibited in large forested blocks, normally in public protected areas. The published literature on land sharing/sparing thus far has an exclusive focus on smallholder agriculture and plantation forestry which is particularly relevant for Africa and Asia, where secure common property rights for local communities and the capacity of public policy to implement large-scale spatial planning are rare. However, Latin America has many examples where various forms of common property forests, supported by public policy, make community-based land sparing at relatively large scales both possible and common. In this article, we will present a case study of common property community-based land sparing for both subsistence agriculture and logging from the Sierra Norte of Oaxaca, Mexico.

The land sparing approach, while commonly found to do the least harm to biodiversity, has been criticized on multiple fronts. It has been argued that it ignores that effective protection of large blocks of forest has had little success in tropical countries, that sustainable land sharing is well documented, that smallholder agriculture is crucial to food security in the developing world, and that high commodity yields and biodiversity can co-exist (Clough et al., 2011; Fischer et al., 2008;

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Tscharntke et al., 2012; Fischer et al., 2014). It has been usefully pointed out that whether land has been spared or shared is linked to development history (Law and Wilson, 2015), and thus it is likely to be heavily path-dependent and not necessarily amenable to policy interventions. As well, whether a given landscape or region can be classified as shared or spared depends entirely on the scale under consideration (Fischer et al., 2014). For example, land sparing has been used to conceptualize conservation practices at fine spatial grains such as field margins (Egan and Mortensen, 2012; Fischer et al., 2014).

The case for land sparing logging in particular does not take into account that if timber harvesting is well-managed, well-governed, and with integration of natural and human frameworks, it can be beneficial to forests and maintain diversity and connectivity, control fires and other disturbances, encourage new growth, and promote resilience (Biggs et al., 2012; Pace et al., 2015). For instance, selectively logged tropical forests have been shown to retain 85–100% of species of mammals, birds, invertebrates, and plants (Putz et al., 2012). The findings on land sparing logging (Edwards et al., 2014) also do not take into account how silvicultural practices, even with relatively intensive logging, can also contribute to conservation (Putz et al., 2012). Although land sharing/sparing is not tied to any particular scale, proponents of land sparing in tropical forests are clearly referring to leaving large blocks of forest intact, although the exact size is still open to question (Phalan et al., 2011).

Despite the criticisms reviewed above, if there are indeed participatory, democratic institutions that could practically achieve land sparing on a scale that would allow significant blocks of forest to be conserved while commodity production takes place in more compact areas, this could be socially and ecologically relevant. It seems evident that large blocks of forest, when combined in the same large landscape with more variegated agricultural and logging areas, creates structural heterogeneity and beta-diversity, which would accumulate to maximize regional gamma-diversity (Socolar et al., 2016). However, the proposed institutions for achieving these positive land-sparing outcomes are regional or national land-use planning (Grau et al., 2013; Hulme et al., 2013; Fischer et al., 2014). Such large-scale and effective land-use planning is highly unlikely in developing countries and rare in developed ones. Alternatively, it has been proposed that land sparing can also be achieved by "conservation concessions, indigenous reserves, areas co-managed with local communities, and habitat banking" (Phalan et al., 2011:1291). However, all current cases in the literature on land sharing/sparing are based on comparing smallholder agriculture, forest patches of widely varying size, and plantation forestry. There has thus been no consideration of how land sharing/sparing actually be more possible and successful in the case of common property indigenous and community territories.

Land sparing land-use planning is not beyond the capacity of well-organized community governance. In fact, land-use zoning and thus forms of land sparing are quite common in many territories under varying forms of indigenous and community control. For example, participatory forms of land-use zoning for conservation and production, based on full territorial community control, have resulted in positive benefits for carbon sequestration and conservation, such as with the "life plans" of Amazonian indigenous peoples and their territories (Pollon et al., 2015; Walker et al., 2014). Thus, there are likely more real opportunities for conserving larger blocks of forest with more intensive production of commodities on community and indigenous lands than in any area dominated by smallholder agriculture and government-owned lands.

In this article, we make no effort to evaluate the relative efficacy of land sparing versus land sharing, which has been the focus of most of the literature. Instead, we present evidence that effective land sparing at a significant scale can indeed be carried out by communities, in this case forest management agrarian communities in the Sierra Norte of Oaxaca, Mexico. We thus take up Phalan et al.'s (2011) suggestion that forms of community management can result in land sparing practices. In Sierra Norte, systematic community land-use zoning or sparing practices for agriculture and timber production have produced a highly forested landscape of over 200,000 ha that has nonetheless generated significant amounts of timber from relatively compact areas over many decades. Through land-use zoning practices and well managed timber production, lands entirely owned by indigenous communities have been applying both a land sparing approach, in zoning agricultural areas, forests and village areas, and a forest sparing logging approach, by zoning areas for timber production and multiple categories of conservation (Pazos Almada, 2016).

2. Study region and methods

2.1. Study region: the Sierra Norte of Oaxaca

There is substantial existing evidence that the state of Oaxaca in southern Mexico, particularly the Sierra Norte, showcases the positive outcomes of community-governed landscapes regarding sustainable land-use and conservation, in a region with no public protected areas (Bray, 1991; Robson, 2007; Robson and Berkes, 2011; Bray and Merino-Perez, 2012; Van Vleet et al., 2016). For over six decades, the community forests in the Sierra Norte have been subjected to significant logging and other natural resource extractive activities, for nearly four decades under community control. Yet, they continue to maintain high and expanding forest cover and biodiversity (Brandon et al., 2005; Gómez-Mendoza et al., 2006; Van Vleet et al., 2016). The Sierra Norte has a variety of definitions as to its geographical extent (Gómez-Mendoza et al., 2006) but in this study, Sierra Norte is defined by the contiguous forest mass occupied by Zapotec and Chinantec indigenous peoples, popularly known as the "Sierra Juarez" with a distinct land-use history based on commercial logging since the 1950s.

The forest management communities of the Sierra Norte are among the best organized nationally of the large-scale Mexican community forest sector (Bray et al., 2005). Prior to the 1980s, many Sierra Norte forests were passively conserved as a result of factors such as relatively low population densities, agricultural land abandonment, emigration, and steep slopes. Some parts of the Sierra Norte were logged for up to 30 years between the 1950s and the 1980s under concessions given by the government. However, beginning in the early 1980s, both through grassroots mobilizations and supportive agrarian and forest policies in particular periods, a vigorous sector of community forest enterprises (CFEs) emerged (Antinori, 2005, Antinori and Bray, 2005; Bray et al., 2006; Van Vleet et al., 2016). At a national scale, CFEs are associated with extensive forest cover (Barsimantov and Kendall, 2012). There are many cases of Mexican CFEs where internal corruption, the presence of *narcotraficantes*, and political prosecution hinder good forest management (CCMSS, 2006), but there are hundreds of examples where these factors are resisted with success.

The Sierra Norte communities benefit from a strong common property system with clear forest rights (Antinori and Bray, 2005). The strong incentive provided by rights over valuable forests has encouraged collective action around sustainable forest management for both timber production and strict protection. Other factors include broad community participation, the establishment of land-use rules through written community statutes including zoned agriculture, forest production and forest conservation areas, vigorous monitoring, and graduated sanctions for rule breakers (Bray, 2010), among the important elements for successful management of the commons. Sierra Norte CFEs also provide substantial local employment (Bray, 2016). Tendencies towards sustainable forest management have been reinforced in recent years by public policy support for community land-use zoning, payments for environmental services programs, and government recognition of community conserved areas (Sims et al., 2014; Van Vleet et al., 2016). Communities are governed democratically through community assemblies of all registered members (composed of heads of households, so many women are excluded) and community