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Production forests as a conservation tool: Effectiveness of Cameroon's land use zoning policy

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ABSTRACT

In 1994, Cameroon enacted a national forest law redefining the legal framework of forest use, thereby pioneering forest-related institutional reforms in Central Africa. This law provided the legal basis for the implementation of a land use zoning separating forested areas in a permanent (PFE) and non-permanent forest estate (NPFE). The PFE includes forests dedicated to protection but also to production. Although conversion to other land uses is legally prohibited, non-forest activities are sometimes present inside this estate. The NPFE comprises remaining forestlands that may be cleared, or managed by local communities through community forests. The objective of this study was to assess the effectiveness of this land use zoning for reducing deforestation and forest degradation. We used Landsat ETM+ images to analyze land cover changes between 2002 and 2010 by combining seven change detection methods. The analysis was focused on forests within and around zoning units, to evaluate possible leakage effects. We used matching to control for the effects of other variables that may influence forest cover dynamics, and thus to obtain unbiased estimates of the effectiveness of land zoning. We separated units that were only legally prescribed from those actually managed during the study period. Community surveys were conducted to assess the local perceptions of the efficacy of the land zoning. Comparison of matched samples of points showed that the land use zoning in Cameroon has effectively curtailed deforestation in the PFE. Deforestation and forest degradation were lower in units aiming primarily at forestry production compared to a rigorous counterfactual. Community forests exhibited similar rates of deforestation and forest degradation than the control groups. These results were confirmed by the community surveys. No leakage was detected. This study shows that forest production units as implemented through a land use zoning policy can be an effective tool to control deforestation in Central Africa.

Introduction

Among the policy options commonly identified to protect forest resources, two complementary strategies are traditionally implemented at a national scale: agricultural intensification to spare land for nature thanks to an increase in land use efficiency, and zoning land for conservation (Angelsen, 2010; Lambin and Meyfroidt, 2011). Strict conservation through parks and wildlife reserves is usually seen as more appropriate to protect natural ecosystems than more hybrid regimes allowing for regulated use of the land (Bruner et al., 2001; Nolte et al., 2013). However, protected areas (PAs) have several limitations, especially in developing countries. First, the lack of funding and the corruption characterizing many central governments weaken the implementation of conservation measures inside parks boundaries (Wilkie et al., 2001). Moreover, extraction of forest resources constitute a major source of income, providing various products for local population and generating substantial incomes for the State thanks to logging activities and taxes associated with them (Clark et al., 2009). Finally, strict conservation in one area can simply displace land use and activities elsewhere, resulting in increased deforestation in the surroundings – i.e., leakage. This could negate or reduce the positive outcomes of such regulation.

While protection and exploitation activities can be seen as two antagonist assignments of forestlands, different management regimes can achieve various trade-offs between both objectives. Some studies have highlighted the role of logging companies or local communities to ensure the sustainability of resources in

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production forests (Nepstad et al., 2006; Bray et al., 2008; Clark et al., 2009; Porter-Bolland et al., 2012). Different forms of land use restrictions can thus be applied across the forest estate by means of a prescriptive zoning policy separating land in units with specific land use allocations (Chomitz, 2007). Land use zoning encompasses any spatial segmentation of a territory into land units characterized by different rules and regulations for land use and land management practices. Land use zoning may thus allocate areas for strict nature conservation, timber production, agriculture, recreation, and other uses. In principle, zoning would be based on a systematic assessment of the potential of land and possible environmental impacts, in view of identifying the optimal land-use for each piece of land (FAO, 1993; Chomitz, 2007).

By restricting land use practices in specified areas, this zoning policy can also have impacts on areas not subject to restrictions. It may result in leakage, but the contraction of land available for agricultural practices may also induce agricultural intensification (Lambin and Meyfroidt, 2011). The effectiveness of a land use zoning therefore depends on the enforcement of the regulation inside assigned lands and on likely impacts on land use practices outside zoning units (Ewers and Rodrigues, 2008).

Because land use zoning results in principle from a spatial planning process aimed at optimizing the location of land uses, different land zones are not located randomly in the landscape and are therefore not subject to homogeneous deforestation and degradation pressures (Joppa and Pfaff, 2010). Evaluating the effectiveness of land use zoning therefore requires methods that control for spatial selection biases. Statistical matching techniques are increasingly used for this purpose (Blackman, 2013). Most studies assessing the effectiveness of land use zoning focused on strict PAs and their surroundings, or on areas aiming primarily at forest conservation yet allowing sustainable uses by local communities. Among others, these studies showed that PAs reduced deforestation in Costa Rica (Andam et al., 2008), Sumatra (Gaveau et al., 2009), the Brazilian Amazon (Nolte et al., 2013), and the Brazilian Cerrado (Carranza et al., 2014). Fewer studies have conducted impacts analyses on areas predominantly assigned for timber production yet also including forest protection objectives (Porter-Bolland et al., 2012). Among them, a study examining land conversion rates in Sumatra's forests highlighted the equivalent effectiveness of logging concessions and protected areas to prevent deforestation, even though production areas were more prone to degazetting and more affected by forest degradation (Gaveau et al., 2012).

The humid tropical forest of Central Africa is the second largest of the planet after the Amazonian forest (Duveiller et al., 2008). This two million km^2 forest has been spared from massive deforestation until now but is threatened by rapid population growth and various economic and political interests, including logging, mining, agro-industry, smallholder agriculture, and nature conservation (Koenig, 2008; Megevand, 2013). Investments in infrastructures could potentially multiply deforestation rates by three over the period 2020–2030 (Mosnier et al., 2014). The Cameroonian part of the humid forest of the Congo basin represents about 10% of this forest and more than 36% of the country area, concentrated in its southern part (de Wasseige et al., 2009; WRI, 2012). In the early 1990s, Cameroon initiated a broad reform of the forestry sector, by elaborating a land use zoning plan for forests in 1993 and enacting a national forest law redefining the legal framework of forest use in 1994 (Côte, 1993; Republic of Cameroon, 1994). It was the starting point of a transition from forestlands being in the national domain with customary use rights to an allocation of forestlands for specific uses and managed by different actors. Cameroon was therefore a pioneer in forest related institutional reforms in Central Africa (Eba'a Atyi et al., 2013), justifying the selection of this country for our study.

The objective of this study is to assess the effectiveness of the Cameroonian zoning of forestlands. This effectiveness was quantified in terms of reduction of deforestation and forest degradation, by combining land cover change maps derived by remote sensing. We used a matching technique to determine impacts of the zoning inside and outside its boundaries, compared to counterfactuals outside of the zoned areas. Our study area is located in the East Region of Cameroon, and we cover the period 2002–2010. The originality of this study is to evaluate the effectiveness of a range of land use zoning units, including logging concessions, rather than only protected areas. It is also the first study of this type in Central Africa.

Background

Cameroon and the 1994 forest law

Cameroon has the highest population density of the subregion and shared with the Democratic Republic of Congo the highest net rates of deforestation and forest degradation in 1990–2000 (Ernst et al., 2013). The rate of population growth is high, although recently decreasing, in the southern regions of the country (Republic of Cameroon, 2010). Annual rates of gross deforestation in Cameroon were estimated at 0.10% per year between 1990 and 2000, and 0.17% per year between 2000 and 2005 (Ernst et al., 2013). Deforestation in Cameroon is mostly caused by the expansion of agriculture, whether in the form of slash-and-burn or market-oriented cultivation (Robiglio et al., 2010). The latter is mainly concentrated in peri-urban areas, in the coastal region, and close to the borders of Gabon and Equatorial Guinea (Robiglio et al., 2010; Hoyle and Levang, 2012). Although the extent of logging activities in Central Africa is large and growing, these activities (legal and illegal) remain selective (Laporte et al., 2007). Thereby, logging has limited direct impacts on deforestation rates but represents a major cause of forest degradation – i.e., a decline in the provision of ecosystem services by the forest (Bellassen and Gitz, 2008; de Wasseige et al., 2009).

Pressed by the international community, mainly the World Bank, the government of Cameroon decided to reform his forestry sector in the late 1980s (Ekoko, 2000; Cerutti and Tacconi, 2006). It was justified by the need to increase State income derived from the logging industry. The tax system was perceived as being inefficient in the previous forest policy. Moreover, the logging sector was viewed as paying insufficient attention to forest-dependent communities and conservation of forest ecosystems (Ekoko, 2000; Topa et al., 2010). This policy reform led to the enactment of the 1994 Forest Law and the implementation decrees that followed. This new legal framework profoundly changed rules of access to forest resources by defining different types of forestlands for various uses and actors. Forest units were submitted to clearly defined allocation and management rules. These rules were translated spatially through a preliminary zoning plan of forested areas developed for southern Cameroon. This plan was elaborated according to biophysical features, and the location of human influence at that time and expected in the near future (Côte, 1993).

The lack of political will and the divergent visions of actors involved in the forestry sector have significantly delayed the implementation of the law and its associated zoning process (Topa et al., 2010). The zoning was progressively implemented in the humid forest zone of the country during the 2000s and has yet to be completed. It separates forested areas in a permanent (PFE) and non-permanent forest estate (NPFE). The PFE is permanently allocated to forests and/or wildlife habitats, with forests legally mandated to represent at least 30% of the national territory at any time and to be managed according to a forest management plan (FMP) approved by the State (Republic of Cameroon, 1994). By