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The impact of forest management plans on trees and carbon: Modeling a decade of harvesting data in Cameroon

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ABSTRACT

By 2010, about 25% (180 million ha) of The International Tropical Timber Organization (ITTO) producer countries' permanent forest estate was being managed using an approved forest management plan (FMP). While the existence of a FMP is often used as evidence of sustainable forest management (SFM), State officials mandated to monitor and verify FMPs' implementation often lack the technical knowledge and political incentives to assess the changes that have been introduced, notably in terms of harvested volumes and species. Among tropical timber producers, Cameroon is considered to be exemplary for its progressive forest regulatory framework. Here we aim to estimate for the first time in sub-Saharan Africa the causal impact of the implementation of FMPs on harvested volumes, species and carbon stocks. We do so by using a 12-year (1998–2009) unbalanced longitudinal data set of a detailed, official harvesting inventory of 81 concessions in Cameroon. Results provide evidence to the theoretical expectations that for many years many practitioners have had on the implementation of SFM, i.e. that FMPs show a substantial opportunity to reduce carbon emissions from forest while presenting logging companies with acceptable financial trade-offs. We explore the technical and political reasons for our findings and conclude that these analyses are important for countries that are underwriting carbon-related schemes in which they propose to reduce their emissions through the effective implementation of SFM. We also demonstrate that producer countries do record useful information that, when effectively used, can help them to inform their policies and improve their sustainable development strategies.

Introduction

In the Congo Basin over the last two decades, the concept of sustainable forest management (SFM) permeated both the spirit and the letter of the new forest policies and related regulations enacted by national governments across the region (Assembe Mvondo, 2009; de Wasseige et al., 2014). In 1994, the Government of Cameroon was the first to adopt a new forest law based on the principles of the 1992 Earth Summit, in which economic, environmental and social criteria play a pivotal role (Republic of Cameroon, 1994; Karsenty, 2006). It was later followed by the Republic of Congo (République du Congo, 2000), Gabon (République Gabonaise, 2001), the Democratic Republic of Congo (République Démocratique du Congo, 2002), and the Central African Republic (République Centrafricaine, 2008), which all adopted similar principles, especially with regard to the industrial, large-scale, export-oriented forest sector based on a concessionary regime largely inherited from the colonial past.

To implement SFM, the forest laws mandate the preparation of forest management plans (FMPs) in all forest concessions. FMPs must ensure the sustained production of forest goods and services, without endangering the intrinsic values and the future productivity of the forest, or creating unwanted effects on the physical and social environment within and around the concessions (art.23, Republic of Cameroon, 1994). In theory, FMPs are documents in which the potentialities of the resource are evaluated, the trade-offs

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among the ecological, economic and social aspects of management are assessed, and balanced solutions are proposed.

In practice, such a balance has been difficult to reach. The 1994 law and follow-up regulations state that the development of FMPs is a prerogative of the State (Republic of Cameroon, 1995). However, lack of human and financial resources within the ministry – and possibly weak incentives to resist the historically powerful lobby of the forest industrial sector – led the Cameroonian Government (similar to all the other governments in the region) to delegate the preparation and implementation of FMPs to logging companies: after allocation, the winning company can immediately start harvesting but it has an obligation to prepare a FMP within a maximum period of 3 years. The FMP is then sent to the ministry, who should assess the plan's quality and either approve it or send it back to the company with a request to review and resubmit it. The logical consequence of such responsibility being left with logging companies, coupled with the historical weak analytical and monitoring capacities within the ministry, has been that the former's economic interests, especially those linked to timber production, have always played a preeminent – and *de facto* largely unchecked – role on management decisions as compared to social or environmental ones.

Since the end of the 1990s, when the first FMPs were being prepared by logging companies in newly attributed concessions, many have lauded the efforts made by the Cameroonian Government toward the implementation of SFM (e.g. IFIA, 2006; ITTO, 2006). Indeed, over the years, the growing number of approved FMPs has often been used as a proxy for improved management (COMIFAC, 2004; CBFP, 2006; GTZ and MINFOF, 2006).

Timber harvesting in logging concessions has provided the Government of Cameroon with continuous and valuable economic benefits (Cerutti et al., 2016a), including about €62 million annually entering the State's coffers as taxes and about 23,000 direct and formal jobs (Cerutti et al., 2016b). Recent data also suggest that harvesting in concessions has not contributed significantly to increasing deforestation (Bruggeman et al., 2014; de Wasseige et al., 2014), notably because infrastructural development – e.g. roads – remains low, and logging is very selective, focused on a handful of valuable species. Concerns remain, however, about the impacts on biodiversity (e.g. Karsenty and Gourlet-Fleury, 2006; Abernethy et al., 2013), the capacity to reduce long-term deforestation trends (Brandt et al., 2016; Karsenty et al., 2016), as well as about the potential of logging operations, even when conducted through FMPs, to improve the livelihoods and more generally the social conditions of the populations living within and around logging concessions (e.g. Vandenhaute and Doucet, 2006; Samyn et al., 2011; Medjibe et al., 2013; Cerutti et al., 2014).

Notwithstanding these latter caveats, FMPs are still one of the most important practical and necessary indicators used to measure progress toward the adoption of SFM. For instance, many plans require logging companies not only to carry out the standard silvicultural procedures (such as forest inventories), but also require social and community involvement and the mapping of various types of protected forests within the concession area (FAO, 2015). Yet, in addition to the existence and official approval of a growing number of FMPs, it is also necessary to understand in more detail their impact on the ground.

Indeed, in times where tropical timber producing countries are increasingly requested to establish and monitor baselines on their deforestation and forest degradation rates and report those to international conventions (e.g. UNFCCC, UNCBD), FMPs should start to be assessed for the impacts they have on forest resources and carbon stocks. In this paper, we thus test the hypothesis that the implementation of FMPs in the Congo basin leads to more trees left standing and thus to increased carbon stocks as compared to a situation without FMPs. We focus here on forest stands, timber and carbon, but are aware that the impacts on residual stands and timber harvesting are but one of the many parameters that must be assessed, such as social demands, livelihoods, tenure and resource rights, non-timber forest products (NTFPs), wildlife, biodiversity, etc.

Our objective is to quantitatively assess the causal impact of FMPs on harvesting levels by applying a standard difference-in-difference model, which uses a fixed effect estimation method, to a longitudinal data set with a reduced form econometric model. We then use the results to deduce the impacts in terms of carbon sequestered. The analysis focuses on Cameroon because, among the countries of the Congo Basin, it has the oldest legal framework mandating FMPs and thus a relatively longer time available to observe their effects. Logging concessions in Cameroon started to be auctioned in 2000. Subsequent auctions took place from 2001 to 2013. By 2015, all available concessions had been granted at least once. The first management plans were approved by the ministry in 2004 and, as of 2015, the country had about 6.2 million ha of forest allocated into 90 concessions (each concession averages about 68,000 ha) and 67 of them (about 5.5 million ha, or 74% of existing concessions) were operating under an approved FMP (Cerutti et al., 2014; MINFOF, 2015). In comparison, the Republic of Congo and Gabon currently have about 13% and 31% of active concessions managed by approved plans, respectively, and the Democratic Republic of the Congo only recently approved the first management plans (Cerutti et al., 2016b). Our aim is thus also to derive policy recommendations that could be applied beyond Cameroon and to the region's future forest policies, especially to those countries that are seemingly still experiencing difficulties in extending FMPs to all their production forests.

To the best of our knowledge, no similar quantitative impact evaluation has been carried out for two main reasons. First, official harvesting data are difficult to obtain from both governments and private logging companies. Second, as they are rarely controlled and analyzed, they often present major inconsistencies that make assessments difficult to perform. To overcome these constraints, the data used in this paper are derived from ongoing efforts over a period of a decade working in collaboration with the Cameroonian Government, as well as regular annual checks with logging companies, to detect whether major discrepancies exist between official data from the government and original data provided by logging companies.

Methodology

Data collection and validation

Harvesting data were provided by the ministry on an annual basis between 1998 and 2009. The data cover all 81 logging concessions that were operational in the country over that period. Data were generally presented in tabular format, per concession, company and species. For harvested species, both the number of trees and volumes – as declared to MINFOF – were collected.[1] Several controls were regularly used to check for possible mistakes e.g. year-on-year controls, to check for large, unexplained variations in harvesting in concessions, as well as the volume/number of trees ratios.

Where controls indicated the presence of possible mistakes, three further controls were applied. First, the original declarations

[1] In theory, for the purposes of paying the stumpage fee on the total harvested volumes, logging companies should declare on the official forms (called DF10 in Cameroon) the total volume of the felled tree (volume *abattu*). It is standard practice, however, to declare on the DF10 only the volumes that are eventually taken out of the forest (volume *roulé*). Logging companies do this in order to pay for stumpage and other fees of only the timber that is actually processed; this is tolerated by the administration.