Impacts of certification, uncertified concessions, and protected areas on forest loss in Cameroon, 2000 to 2013

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ABSTRACT

Deforestation and forest fragmentation are leading drivers of biodiversity loss. Protected areas have been the leading conservation policy response, yet their scale and scope remain inadequate to meet biodiversity conservation targets. Managed forest concessions increasingly have been recognized as a complement to protected areas in meeting conservation targets. Similarly, programs for voluntary third-party certification of concession management aim to create incentives for logging companies to manage forests more sustainably. Rigorous evidence on the impacts from large-scale certification programs is thereby critical, yet detailed field observations are limited, temporally and spatially. Remotely-sensed data, in contrast, can provide repeated observations over time and at a fine spatial scale, albeit with less detail. Using the Global Forest Change dataset, we examine annual forest loss in Cameroon during 2000–2013 to assess the impact of Forest Stewardship Council certification, as well as uncertified logging concessions and national parks. We use panel regressions that control for the effects of unobserved factors that vary across space or time. We find low forest loss inside the boundaries of each management intervention, with < 1% lost over the study period. Yet those low levels of loss appear to be influenced more by a site's proximity to drivers of deforestation, such as distances to population centers or roads, than by national parks, uncertified concessions, or certification. The exception is that if a site faces high deforestation pressure, uncertified logging concessions appear to reduce forest loss. This may reflect private companies' incentives to protect rights to forest use. Such an influence of private logging companies could provide a foundation for future impacts from certification upon rates of forest loss, at least within areas that are facing elevated deforestation pressures.

1. Introduction

Habitat loss and fragmentation are the leading drivers of global biodiversity loss (Murphy and Romanuk, 2014; Tilman et al., 2017). Forests face increasing pressure as humans convert forested areas for infrastructure, mining, ranching, and industrialized agriculture (DeFries et al., 2010; Laurance et al., 2001; Swenson et al., 2011). The environmental consequences of forest loss are significant, including increases in erosion, the degradation of water resources, accelerated extinctions, and carbon dioxide emissions (Laurance, 2009; Laurance et al., 1998; Van der Werf et al., 2009; Wright and Muller-Landau, 2006).

Establishing protected areas has been the most common policy response to such pressures, with over 15% of the world's land and inland water area protected (Juffe-Bignoli et al., 2014). Recent studies indicate

environmental benefits from protected areas, albeit lower than often is assumed and highly varied in magnitude (Andam et al., 2008; Joppa and Pfaff, 2011; Pfaff et al., 2015), due in part to variable capacities of governments to monitor and enforce rules (Pfaff et al., 2014). One motivation for our study is that an expansion of protected areas at the scale that is desired for conservation is unlikely in many countries. In fact, in recent years protected areas have experienced downgrading, downsizing and degazetting, often to allow extraction activities (Mascia and Pailler, 2011; Pack et al., 2016). With the total protected area falling far short of internationally agreed biodiversity conservation targets (Aichi Biodiversity Targets; (Aycrigg et al., 2013; Scott et al., 2001)), conservation management on private lands and public lands leased to private companies is increasingly proposed as a complement to protected areas (Kamal et al., 2015). Within that approach our focus is the recent trend toward third-party certifications of management

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practices deemed more ecologically, economically and culturally sustainable.

In forested regions, there has been a concerted effort to generate incentives for logging firms to curb their impacts on forest ecosystems and initiatives for sustainable forest management largely aim to slow deforestation (Marx and Cuypers, 2010). Globally, an increasing number of logging companies have adjusted management of forest concessions to respond to states and consumers. Third-party verification is required for timber sourcing to be legal under the United States' amendment of The Lacey Act of 2008, as well as European Union Timber Regulations of 2010 and the Australian Illegal Logging Prohibition Act of 2012. Verification of adjusted practices to reduce logging impact also is required for any certification of sustainable forest management.

Many forest concessions voluntarily applied for certification by the Forest Stewardship Council (FSC), which was founded in 1993 to promote "environmentally appropriate, socially beneficial, and economically viable management of the world's forests" (FSC, 2015). By 2018, a total of 1533 FSC certificates were active in 83 countries, covering over 198 million ha of forest (FSC, 2018a). However, beneficial and verifiable impacts from FSC remain a subject of active debate. Compliance outcomes, auditing and enforcement practices and, ultimately, forest outcomes vary widely under FSC (Burivalova et al., 2016; Counsell and Loraas, 2002; Nebel et al., 2005), while rigorous assessment of FSC impacts on forest ecosystems has been limited (Romero et al., 2017).

The scale of FSC certification creates a challenge for assessment, one made even more daunting by the diversity of contexts involved across the globe. Though the world has learned a great deal from fieldwork in a number of settings (Cerutti et al., 2014; Cerutti and Tacconi, 2006; Medjibe et al., 2013), it is not currently feasible to collect fine-scale field data (e.g., biodiversity, carbon density, watersheds, adherence to management plans for concession sub-units) at sufficient time intervals across FSC-certified concessions, uncertified concessions, and in control forests to permit comparisons to assess environmental impacts of FSC. The collection of field data is expensive and time consuming, particularly in remote locations of developing countries. To address part of such assessments, we now have widely available and cost-efficient remotely sensed data and derived data products being produced regularly with global coverage over many years. The most straightforward remotely sensed outcomes measure to consider the effects of different land-use interventions is the rate of forest loss. The recent creation of global forest loss products such as Hansen et al. (2013; featured in GlobalForestWatch.org) or Sexton et al. (2013) provide consistently mapped remotely sensed estimates of forest loss, across the globe, at a fine spatial scale. Three recent studies demonstrate the feasibility of using remotely sensed measures of forest loss for inferences concerning FSC impacts (Blackman et al., 2015; Heilmayr and Lambin, 2016; Miteva et al., 2015). Overall, these studies suggest small if any reductions of deforestation by FSC certification, while also conveying that forest impacts can vary greatly across settings.

Another primary concern in terms of forest management is the need to also monitor degradation. However, this has proven more challenging to do across large tropical areas and often requires ancillary data to complement the satellite imagery available as early as 2000. Specifically, there is no "wall to wall" mapped data of degradation across Cameroon – currently or for years past (although see Zhuravleva et al. (2013) for one detailed degradation study about the DRC).

Forest regulation in Cameroon was established through a series of policy changes that began in the 1990s and stretched into the 2000s. The bulk of Cameroon's forestry policy was set by the 1994 Forestry Law No. 94-01 (Cerutti et al., 2016a) that established two zones, the permanent forest estate and the non-permanent forest estate, the latter being the default status of unclassified forests (WRI, 2012). The permanent forest estate requires that natural ecosystems be maintained in perpetuity and encompasses protected areas. Forest parcels within the

state-owned permanent forest estate can become logging concessions. First the boundaries of such concessions must be defined by the state, then they are leased on a three-year contract to a private logging company, which must design and gain approval for a management plan before obtaining a 15-year contract, which is renewable once, for a total tenure of 30 years (Cerutti et al., 2016b). Logging companies often take measures to prevent other actors from entering their concessions to extract timber or non-timber forest products. In fact, the FSC-certified logging concessions are required to take such measures (FSC, 2018b). However, staffing challenges at Cameroon's Ministry of Forests and Fauna's have, in some instances, led to companies harvesting before the boundary negotiations have been completed or the full legal contract is established (Cerutti et al., 2016a).

The European Union has had a large influence on Cameroon's forest management policy since 2006, when discussions progressed toward a FLEGT Voluntary Partnership Agreement between the European Union and Cameroon (Cerutti et al., 2016a). Timber exports from Cameroon have been on the rise since 2004 (Karsenty and Ferron, 2017). Much could be improved, as a recent study found that 40% of forest loss in Cameroon is located outside of the permanent and non-permanent forest estates, indicating that illegal logging may be a major source of deforestation (Verhegghen et al., 2016). Legality and sustainability of timber sourced from Cameroon might be improved if NGOs could collaborate with governments and companies to improve auditing and monitoring. Plans for such changes continue to be under discussion (Central African Forest Initiative, 2015; European Forest Institute, 2014; Global Witness, 2005). As Asian markets adapt to import a majority of the increased production from these areas (Cerutti et al., 2016a) it is likely to affect the future of Cameroon's forests, as logging companies respond directly to requirements for legality and sustainability from their consumers (Karsenty and Ferron, 2017).

We present a rigorous assessment of forest loss in Cameroon from 2000 to 2013 for various types of land-use management: concessions that have been certified by FSC; concessions that were never certified; and national parks. We focus on FSC's Forest Management certificate, although two other certificates, Chain of Custody and Controlled Wood, have also been applied for post-harvest timber processing (FSC, 2018a). In 2013, Cameroon had > 1 million ha of FSC's Forest Management certificates (Cerutti et al., 2016a). Given the total forest area involved, certification could have significant environmental and social impact in Cameroon and more generally across central Africa. Previous studies of FSC in central Africa found positive social impacts (Cerutti et al., 2014; Cerutti and Tacconi, 2006) and less damage from logging roads (Medjibe et al., 2013).

2. Methods

2.1. Data

We use the annual forest loss information from the Global Forest Change dataset (Hansen et al., 2013), derived from Landsat 7 ETM+, at 30-m pixel resolution, from the year 2000 to 2013. While the government of Cameroon uses the Food and Agriculture Organization (FAO) definition of forests, which is 10% or more tree cover, we used the threshold of 30% tree cover detection for each year within a pixel as an indicator of forest (Margono et al., 2014). This agrees with the United Nations Framework Convention on Climate Change's (UNFCC) definition of forests, as well as with official definitions within other tropical forest countries such as Peru and Brazil. As most of the tropical forests within our study area are primary forest, we felt that the UNFCC's definition forest cover would be more appropriate for our analysis of forest impacts.

From the Forest Atlas of Cameroon (WRI, 2012), we acquired data for protected areas and for the sites and companies associated to all the forest management units, of which there were 114 within the forest-dominated southern half of the country. We examine the following