Reducing logging impact in Gabon

A study compares the impacts of different logging practices on above-ground biomass in production forests in Gabon

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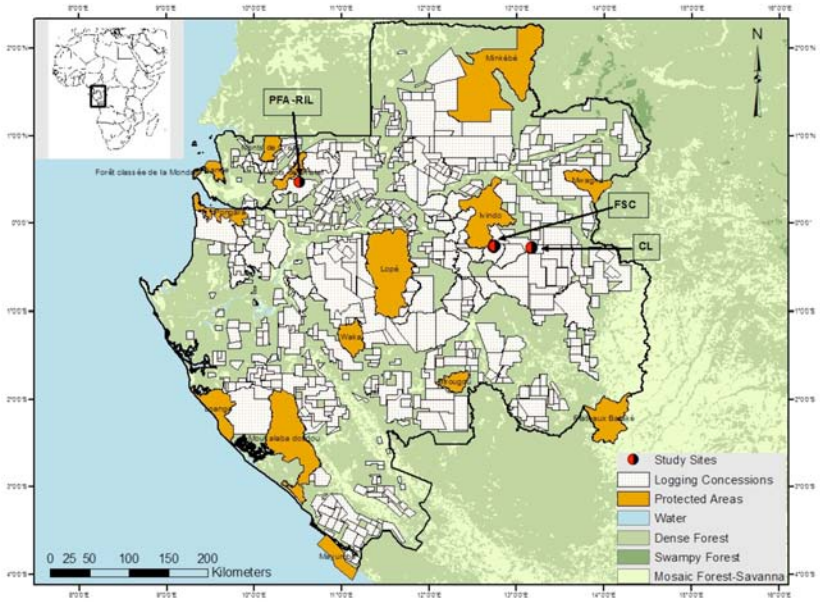
Timber harvesting is a major socioeconomic activity in Gabon (de Wasseige et al. 2009); it contributes considerably to Gabon's domestic product and is the country's second largest formal employer, employing 28% of the active population (WRI 2009). In accordance with the 2001 Gabon Forest Code, production forests are classified under several licence types: forest concessions under sustainable management (CFADs); associated forest permits (PFAs); and mutual agreement licences (PGGs; WRI 2009). All licence types are characterized by specified forest management methods and the presence (or not) of a management plan or certification.

Logging is a major cause of forest degradation and related carbon emissions in Gabon (Nasi et al. 2012; Pearson et al. 2014). On the other hand, it could serve as an opportunity for silvicultural treatment if carried out using good practices. In view of the importance of logging in the country's economic development, and given the country's strategy for reducing carbon emissions caused by logging (GoG 2013), it is essential to evaluate the impacts of various logging techniques with a view to determining policy measures for reducing carbon emissions and forest degradation and maintaining forest productivity.

Methods

Surveys were conducted in three forest concessions in Gabon: a PFA concession using reduced-impact logging (RIL) techniques with the assistance of a non-governmental organization (the Tropical Forest Foundation—TFF) specializing in RIL practices (the "PFA-RIL site"); a CFAD concession certified by the Forest Stewardship Council (FSC), where RIL techniques are applied (the "FSC site"); and a PFA concession without a management plan, where conventional logging (CL) is used (the "CL site") (Figure 1). The main objective of the surveys was to evaluate and determine the logging technique that minimizes: damage to the remaining stand; the loss of forest carbon; and negative impacts on biodiversity. In each concession, randomly located 1-hectare permanent plots were established, and all trees with a diameter above or equal to 10 cm at breast height were measured, mapped and identified before logging. After logging, collateral damage to trees resulting from logging activities was evaluated in the plots, in forest openings due to felling, along skidding trails and logging roads, and on landings at each survey site.

Figure 1: Locations of the study sites



Outcomes and discussion

The surveys showed that the loss of biomass and its equivalent carbon dioxide (CO_2) (hereinafter called "carbon stocks") vary according to the volume of timber extracted and the logging technique used. At the PFA-RIL site, the logging of 0.82 trees per hectare resulted in a 8.1% reduction in the initial carbon stock (Medjibe et al. 2011). At the FSC site, a logging rate of 0.39 trees per hectare resulted in a 7.1% loss of the initial carbon stock. At the CL site, the logging rate of 0.76 trees per hectare resulted in a 13.5% loss of the initial carbon stock (Figure 2).

The number of damaged trees per logged tree was highest at the CL site and lowest at the FSC site, and the density of roads and skid trails was also highest at the CL site (Table 1). Skidding operations damaged an average of 0.07 trees per metre of trail at the FSC site, 0.11 trees per metre at the RIL-TFF site, and 0.17 trees per metre at the CL site. On average, forest road construction damaged 0.16 trees per metre of road at the FSC site and 0.41 trees per metre at the CL site.

These results show that conventional logging is a major source of forest degradation and forest carbon emissions, but also that RIL and reduced logging intensity can greatly reduce both degradation and forest carbon emissions (Medjibe et al. 2013). The good planning of logging roads and skid trails in forest concessions is essential for minimizing the negative impacts of logging on forest ecosystems.

The PFA-RIL and FSC sites used RIL techniques, which involve the planning of logging operations in advance, worker training, the planning of roads and skidding trails, and controlled logging. At the CL site, where these practices were not employed, biomass loss and damage to remaining stands were substantially higher.

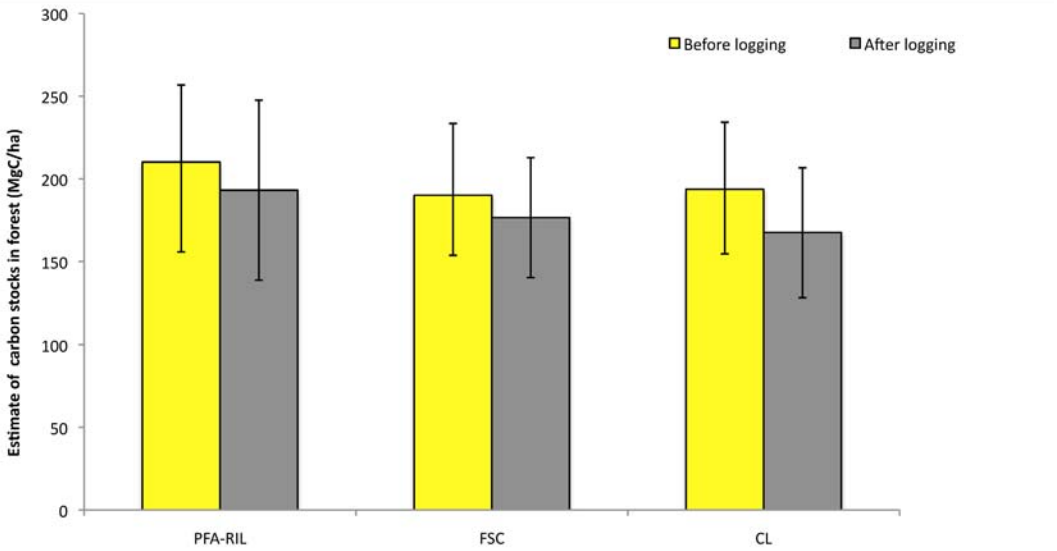
Measuring the extent of degradation caused by logging operations is a challenge for countries in Central Africa, but it might be possible to estimate degradation with reasonable accuracy by combining field studies and remote sensing data (see Pearson et al. 2014). Similar surveys to the ones reported in this article would need to be

Table 1: Comparative analysis of impacts of various forest logging techniques in Gabon

Variable	Site		
	PFA-RIL (n = 1)	FSC (n = 1)	CL (n = 1)
Survey site land area (ha)	50	508	200
Number of (1-ha) plots	10	20	12
Tree density (trees/ha)	453	304	387
Basal area (m^2/ha)	31.1	26.7	31.3
Initial carbon stocks (MgC)	210.2	190.0	193.7
Logging intensity (m^3/ha)	8.1	5.7	11.4
Number of damaged trees per logged tree	11.0	7.1	19.3
Carbon stock loss (%)	8.1	7.1	13.5
Carbon in logs (MgC)	4.3	2.8	2.4
Carbon in trees damaged by logging (MgC)	8.2	6.1	11.3
Carbon in trees damaged by skidding (MgC)	4.7	2.7	5.6
Carbon in trees damaged by road construction (MgC)	-	31.2	24.0
Emissions released per m^3 of logged tree ($MgCO_2eq/m^3$)	0.26	0.30	0.31
Skid trail density (m/ha)	69.0	45.6	86.1
Road density (m/ha)	-	7.8	16.2
Total land area affected by skidding (%)	2.8	1.7	4.5
Road width (m, average ±1 standard error)	-	18.3 ± 4.1	65.5 ± 20.3

Notes: PFA-RIL = PFA concession using RIL techniques with the assistance of the TFF; FSC = CFAD concession certified by the FSC, where RIL techniques are applied; CL = PFA concession without a management plan and using conventional logging techniques.

Figure 2: Estimate of carbon stocks (average ± standard error) in forests before and after forest logging in the PFA-RIL, FSC and CL sites, Gabon



conducted in a number of forest concessions with different types of logging licences in order to better understand the variability of logging impacts on forest carbon. Such surveys could be coupled with remote sensing data to estimate the area of forest logged under various regimes.

Conclusion

The time has come to improve logging practice in Congo Basin forests. The Central African Forest Commission (known as COMIFAC) has a stated objective of reducing forest carbon emissions through good logging practices and sustainable forest management. This survey, the first of its kind in Central Africa, will serve as a tool for policymakers in establishing measures for forest carbon conservation while promoting sustainable timber production.

Logging in Gabon focuses on a single, highly valuable tree species, okoumé, which requires a high light level for regeneration and growth. The use of RIL techniques minimizes damage to remaining stands and, in so doing, reducing the loss of forest carbon. It also reduces the size of forest gaps, however, which may affect the regeneration of okoumé. It is therefore necessary to apply silvicultural techniques to promote regeneration, taking into account the biological characteristics of logged timber species. Forest management that employs both RIL techniques and silvicultural operations to stimulate the growth and regeneration of desired species is required. This would be part of a strategy for forest-based sustainable development, which is of paramount importance for humanity.

Reduced impact, increased value: Good forest management practices reduce forest damage and carbon emissions and leave the forest in a better state to provide later harvests and perform environmental functions. *Photos: V. Medjibe*

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New fellowships awarded

The International Tropical Timber Council awarded 23 fellowships in its 2014 spring cycle. The awardees are from 15 different countries and include 13 females. The total value of the fellowships is US$148 385. The awardees are listed below.

Preparing technical documents: Mr Jean Didier Tèwogbadé Akpona (Benin)

Short training: Ms Camila Horiye Rodrigues (Brazil); Ms Agnès Kibongo Epse Ebanga (Cameroon); Ms Stella Ngeh Asaha (Cameroon); Mr Bouattenin Kouadio (Côte d'Ivoire); Ms Edith Abruquah (Ghana); Ms Harriet Ansaah Lartey (Ghana); Ing. Herless Arbey Martínez Recinos (Guatemala); Mr Pramod Kumar Yadav (India); Mr José David Bonilla Morales (Mexico); Ms Silvia Berenice Quintana Sagarnaga (Mexico); Ms Wai Wai Than (Myanmar)

Conferences and study tours: Mr Osei Asibe Asafu-Adjaye (Ghana); Dr Rashmi Ramesh Shanbhag (India); Ms Rinda Amalia Fadila (Indonesia); Ms Ivanna Febrissa (Indonesia); Dr Seca Gandaseca (Indonesia); Mr Azman A. Rahman (Malaysia)

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