Do Forest Management Plans in Congo Lead to Greater Deforestation?

(In response to the article by J.S. Brandt, C. Nolte and A. Agrawal, "Deforestation and timber production in Congo after implementation of sustainable management policy" published in *Land Use Policy 52,* 2016)

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Abstract:

An article in Land Use Policy published early in 2016 concluded that deforestation in Congo was highest in forest concessions with forest management plans (FMPs) than in those without. The impact assessment analysis which led the researchers to this conclusion is based on matching randomly selected plots in concessions with and without management plans. The researchers suggest that one factor is the more developed network of forest roads in managed concessions. Another factor is local development, which ensues from mandatory requirements for FMPs and leads to increases in population on FMP concessions and subsequently increased deforestation.

Our group of twenty researchers, knowledgeable of forest management issues in Central Africa, analyzed deforestation in concessions over the same time period. Our results show that deforestation is lower in concessions with FMPs than in those without. In a comparative analysis of deforestation with production remaining constant, concessions with FMPs are approximately twice as efficient as those without; per cubic metre produced, gross loss of forests cover was lower by half in concessions with FMPs. We do not argue that forest management planning reduces deforestation because we understand that there are other factors which play essential roles. The dynamics of these other factors need to be analysed, to avoid systematically attributing deforestation trends to forest management plans, or giving them a greater role in than deserved.

Finally, any assessment must take into account that forest management is a long-term process, with long-term objectives that include sustained timber yields and the avoidance of forest conversion.

The Context

In their article, which bears a title that equates the existence of a forest management plan with sustainable forest management, Brandt et al. (2016) use data from the Republic of Congo to address three questions:

1. Are deforestation rates lower in concessions with and without forest management plans (thereafter FMP vs. No-FMP, respectively)?
2. Does forest management plan implementation lead to lower deforestation rates?
3. Does forest management plan implementation affect wood production?

Before we point out numerous problems with their data and analyses, we question the fundamental assumptions on which they build their case against tropical forestry. First of all, even full implementation of well-formulated FMPs by well-trained and closely supervised workers does not represent sustainable forest management. We also question the assumptions by Brandt et al. (2016) that official registry of FMPs or claims by forest concessionaires that these plans are being implemented mean nothing in regards to operations of the ground.

Brandt et al. (2016) used data from 2000 to 2010 to compare deforestation rates over two consecutive 5-year periods (2000-2005 and 2005-2010) and from 2000-2013 to compare annual deforestation rates in FMP and No-FMP concessions for that period. For the first comparison they only present analysis for 2005-2010. The first set of data was extracted from the Satellite Observatory for Forests of Central Africa (OSFAC) databases[1] (Potapov *et al.* (2012) and the second one from Hansen *et al.* (2013).

FMP and No-FMP concessions were paired on the basis of a matching analysis and compared using 1 km^2 parcels. The parcels were selected randomly, and the matching process was submitted to a certain number of “controls” used to compare parcels similar in traits that affect deforestation outcomes so as to exclude the effects of potential deforestation drivers other than forest management plans. The seven covariates were distance from the concessions to active roads, distance to the nearest settlement in existence in 2005, travel time to the nearest market, proximity to the Congo and Oubangui Rivers, elevation, average slope, and above ground woody biomass. The authors arrived at the following conclusions:

1. deforestation rates were significantly higher in concessions with FMP;
2. deforestation increased on average within a concession and in no case decreased after the official starting date for the self-reported implementation of a FMP; and
3. companies that reportedly implemented forestry management plans had higher and more stable wood production rates, which resulted in more extensive forest road networks and, consequently, more deforestation.

It is worth to notice that, during the period of the analysis (2001-2013), the only concessions with a validated FMP were in the North, whereas all the concessions in the South and some in the North lacked FMP. Absolute gross deforestation rates (not statistically controlled) in the forest management units (FMU, a concession can be comprised of several FMUs) in the South were much higher (>2% for 2000-2010), compared with 0.34% for FMUs with FMPs in the North (see tables 1 and 2). South Congo is more populous and more of it is heavily farmed, which makes it impossible to blame higher deforestation in the South on concessionaires for that period of time. But is seems important to recall these facts, especially for readers who do not know the Congo and could erroneously conclude based on Brandt et al. (2016) that deforestation would be higher in the managed concessions of North compared to the South.

[1] OSFAC Data – FACET Atlases 2000-2005-2010: a forest cover threshold of 60% is used to define forests - resolution 60 m.

The methodology used by Brandt *et al.* (2016)

To answer the question as to whether FMPs affect deforestation rates, the authors performed two matching analyses. In the first one, they selected forest parcels in concessions with FMPs (all of which were in North Congo) and compared them to parcels selected from No-FMP concessions (the authors avoided comparing parcels in the North to those in the South because of the very great differences in a large number of the control criteria). Their second matching analysis was an inversion of the first: parcels in randomly selected No-FMP concessions in the North and South were compared to parcels in concessions with an FMP (in the North). The latter type of matching analysis poses a problem because, in certain cases, random selection results in parcels in the South being compared with parcels in the North, which the authors admitted is biased by differences in the socio-economic context. The only valid comparison consists of comparing FMP concessions (in the North) with no-FMP concessions in the North. When this method is applied, the deforestation rate for the 2005-2010 period was 0.2% higher in FMP concessions than in No-FMP ones. The authors explain that this difference corresponds to 6,700 ha for the 2005-2010 period (1,116 ha/yr for the entire area and 10 to 550 ha/yr per concession).

To answer the question as to whether deforestation rates increase after FMPs are reportedly first implemented, the authors used data from 2001-2013. On this basis they concluded that the plans led, at best, to stabilisation of deforestation rates and, in the worst of cases, they doubled rates relative to pre-implementation of FMP, based on forest cover data from 3 years prior to FMP. Of the six FMUs with FMPs in North Congo (3.3 million ha of forest), the difference in deforestation rates between the “before FMP” and “FMP” periods was 940 ha. The authors do not distinguish between deforestation for company facilities, agricultural fields, primary and secondary roads, tree fall gaps or urban expansion.

To assess the effects of FMPs on wood production, Brandt *et al.* (2016) measured all roads visible on satellite images and production datasets posted by the FMUs on the website of Congo’s Ministry of Environment or those published in various editions of *The Forests of the Congo Basin - State of the Forest*. But they fail to point out that forests are more degraded and the roads are less visible in the South, and they also fail to capture the real impact of the economic crisis on timber production on FMP and No-FMP companies

What is also important to point out is that the network of roads and trails reported in the GFW-WRI 2012 edition of the “Forest Atlas of Congo” and used in the article by Brandt *et al.* (2016) appears to be more extensive in concessions with FMPs because timber companies themselves provided the information and those with FMPs have more ready access to that information and may be more willing to share it. Compilers of the GFW-WRI “Forest Atlas of Congo” stated that the data for North Congo that they used was both of higher quality and more readily available than data from the South where more persistent cloud cover was an additional problem. Datasets for roads and trails were incomplete and certain roads and trails, although visible on satellite images, were not digitally transferred to the file used by Brandt *et al.* (2016).

Figure1: FMUs (in green) in North Congo in 2014 (Source: BRLi and C4 EcoSolutions)

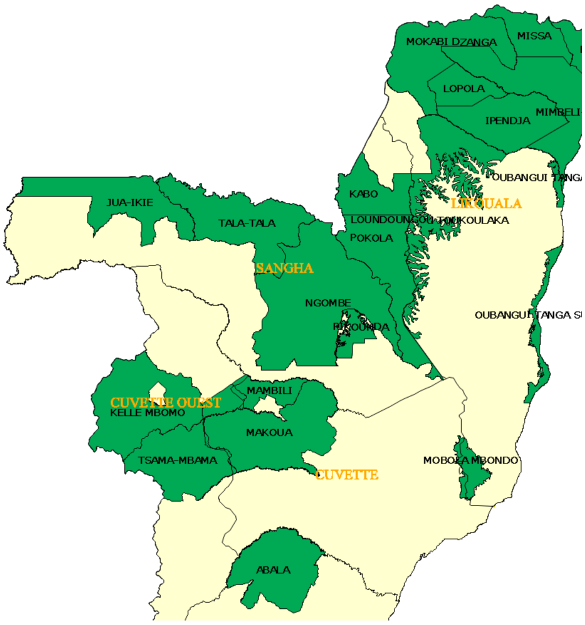
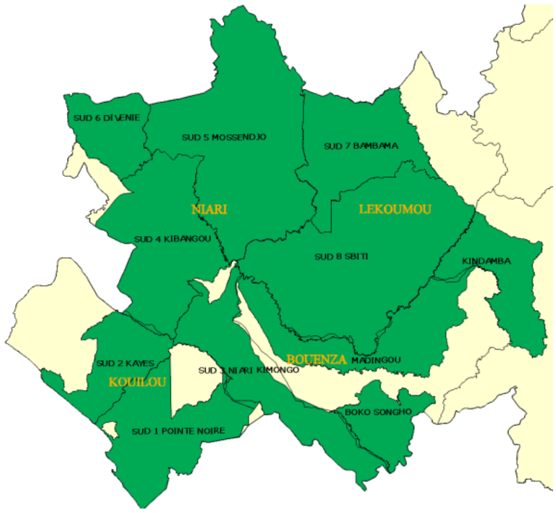


Figure 2: FMUs (in green) in South Congo in 2014 (Source: BRLi and C4 EcoSolutions)



Roads and development: the presumed causes of deforestation in managed concessions

The numbers provided by Brandt et al. (2016) should be considered from a global perspective. First of all, deforestation rates in the Republic of Congo are very low. The report from the Satellite Observatory for the Forests of Central Africa (OSFAC) stated that: “Losses in forest cover between 2000 and 2014 represent 295,957 hectares, an average annual area of 21,140 ha, with a loss rate of 0.062% (study conducted by the National Centre for Surveys and Forest and Fauna Resources Management (CNIAF), OSFAC and the National Coordinating body for REDD (CN-REDD) with technical support by the University of Maryland)”.[2] The additional 1,116 ha of average annual deforestation presented by the authors represents an exceedingly small proportion (0.0035%) of the 3.3 million ha of managed forest in the country. This value, which we question, was nonetheless used by the authors as evidence against the benefits of FMPs.

According to the authors, the differences between concessions with and without FMPs are attributable to two factors: (1) road networks in managed concessions are more extensive because wood production is higher and more stable, which results from international market demands for wood from responsibly and legally managed forests; and, (2) pressure from human activities is greater in concessions with FMPs**.** We agree that concessions with FMPs that are indeed implemented do generate employment opportunities and as such, the worker community requires settlements that might contribute to deforestation. In fact, development of local communities and social programmes in the form of “*social contracts*” are characteristic of responsibly managed concessions, especially those certified by the Forest Stewardship Council (FSC). Roads and economic development do stimulate human population growth in responsibly managed concessions (“*Economic development* […] *has led to a 69% growth in human population* […]”), which increases pressure on resources and land that may result in some deforestation for agriculture. Although the article also acknowledges the contributions of responsible forest management to economic development and the social benefits of enforcement of national laws that require the creation of on-

[2] Retrieved at http://www.observatoire-comifac.net/indicators.countries.php?country=COG&step=1.

site processing units and other social obligations including the provision of health centres, schools, and transportation infrastructure, it neglects to recognize the unavoidable consequence of these contributions to social welfare that result in increased local populations that, in turn, leads to increased deforestation, *all else being equal.*

This is an unusual line of reasoning, given that one of the major criticisms to logging companies is that they usually fail to contribute to economic development and leave communities in poverty (see, for instance, Counsell et al., 2007).

A misinterpretation of forest management practices

Brandt et al. (2016) mistakenly claim that: "*Highly selective logging required by FMPs may encourage timber companies to spread out logging activities over larger areas and exploit interior forests*" In fact, highly selective logging is not "required" by forest management plans. Forest management planning generally seeks to intensify logging so as to concentrate the impacts, but in Congo the harvest intensity is nevertheless low, with <1 tree harvested per hectare (6-10m^3/ha on average).

Legal requirements call for a minimum recovery threshold of the initial timber stock (for each commercial species) at the end of the felling cycle. To reach these targets, management plans should simulate the volume recovered after 30 years and, if appropriate, increase the minimum harvesting diameter (MHD). This logging constraint on the main commercial species pushes concessionaires to diversify the range of species harvested, as stipulated in FMPs, in order to secure a sufficient average volume per hectare. The objective of FMPs is clearly to move away from highly selective logging through some intensification.

In concessions that lack FMPs, in contrast, extremely selective and therefore highly dispersed logging is the rule; the most valuable species are targeted, generally without any long-term planning and with no regard to the rationale underpinning annual allowable cuts (AACs) or even MHDs.

The long-term value of maintaining productive forest stock

The average life-span of most logging roads is less than four years, after which they are completely covered by vegetation composed of pioneer species. Twenty years later, these roads are no longer visible on Landsat satellite images (Kleinschroth *et al.* 2015). Overall, forest biomass recovers in about 30 years after the harvest (Gourlet-Fleury *et al.* 2013). In contrast, Brandt *et al.* (2016) seem to believe that deforestation in logged areas is permanent rather than being a transient loss of forest cover, which is not considered deforestation as there was no permanent land use change (FAO, 2010).

Due to the conservation of large numbers of seed trees and less damage to future crop trees, where FMPs are implemented, forest composition and recovery rates are improved compared to where no FMP is followed. Forests rendered unproductive by poor harvesting run a greater risk of being subsequently deforested for agriculture. The impact of implementation of forest management plans can therefore not be measured over short periods of time or without field research to verify the findings of remote sensing analyses. A more rigorous but admittedly more difficult approach would be to conduct this type of analysis over several decades rather than several years (Brandt and her collaborators admit to this limitation in their discussion section). Generally, well implemented management plans come to fruition after one felling cycle, which usually takes 25-30 years. We expect that the same analysis conducted over a much longer period would provide strikingly different results, given the lifespan of unused roads (four years) and the rapid recovery of vegetation in carefully harvested forests.

There are direct consequences of logging that are minimized where FMPs are followed and reduced-impact logging techniques are utilized (Medjibe et al. 2011). Furthermore, wildlife impacts of forestry in Congo are higher in No-FMP concessions than in concessions where FMPs are followed (Clark *et al.* 2009, Stokes *et al.* 2010). This difference will become evident through time insofar as the loss of seed dispersers causes a reduction in tree recruitment rates (Terborgh *et al.* 2008).

Biased parcel selection criteria

In the "Supplementary materials" provided on-line by Brandt et al. (2016), the authors explain that deforestation is very high along the Oubangui River, an important transportation waterway with a high population density. The authors consequently excluded from their matching analysis points <15 km from the river; their map SI-4 shows the points that were compared. Due to this decision, their analysis did not include parts of the FMUs Bétou and Mimbeli-Ibenga that lacked FMPs until very recently and that suffered high rates of deforestation (nearing 1%) for 2000-2010." This exclusion meant that there was an underestimation of deforestation rates by Brandt et al. (2016) in No-FMP FMUs given that numerous parcels with high rates of deforestation were not selected.
In contrast and without apparent clear criteria, Brandt *et al.* (2016) included the Pikounda Nord FMU among those in the No-FMP group *even though it was not harvested during the study period* (it is managed as a conservation concession) and experienced no deforestation.

The analytical methods employed by Brandt et al. (2016) are at least debatable. For example, they treat human densities as a deforestation factor that is endogenous to FMPs but exogenous to No-FMPs. Their Figure 1 clearly shows that they included FMUs within a 15 km radius of the city of Ouesso, the administrative capital of the Sangha Department that borders the Ngombe and Pokola FMUs. They then do not account the re-opened and rehabilitated National Road 2 in 2004 in Sangha, that crosses 80 km of the FMP-following Ngombe FMU, despite the fact that the road is an exogenous deforestation factor that is as powerful as the Oubangui River**.**

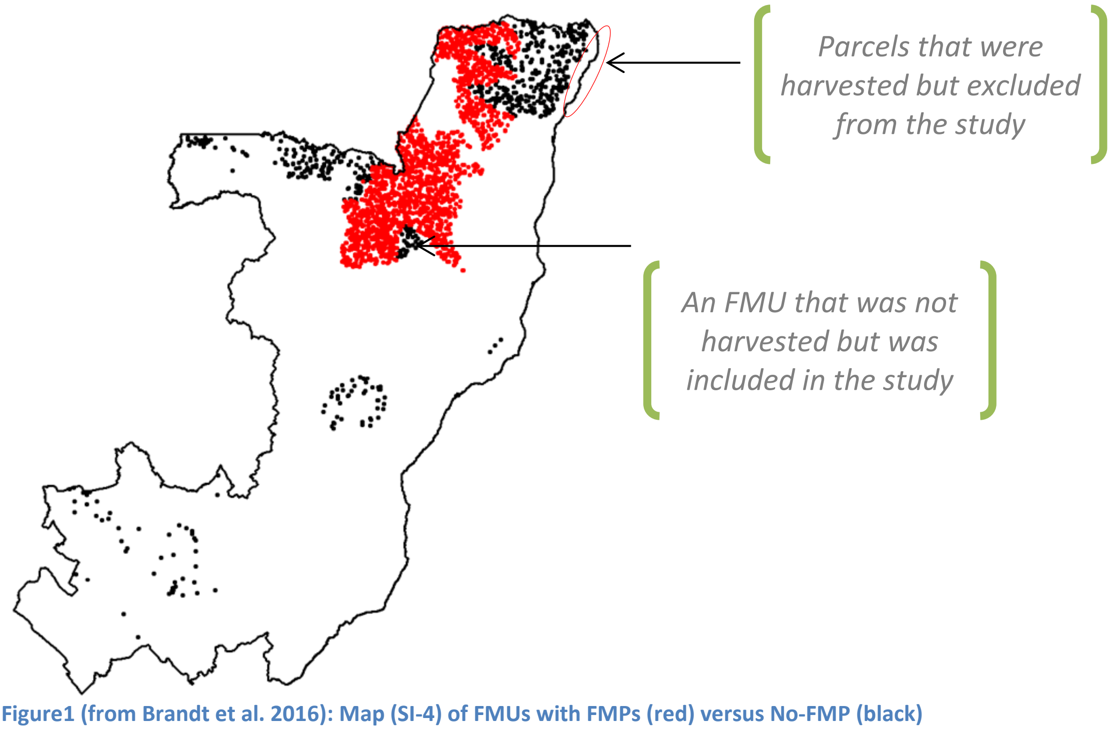


Figure1 (from Brandt et al. 2016): Map (SI-4) of FMUs with FMPs (red) versus No-FMP (black)

To conduct a more comprehensive analysis of deforestation rates, we used LANDSAT data available from CN REDD Congo from GAF AG (Germany), a company specialized in remote sensing, whose definitions and resolutions differ somewhat from those used by Brandt *et al.* (2016). In particular, GAF defines forests by applying a forest cover threshold of 10% to a minimum mapping unit of an hectare with 20 m resolution, versus the 30 m resolution utilized by Brandt et al. (2016). The results of our analyses are therefore not directly comparable with those obtained by Brand et al. (2016), but valuable insofar as they provide information on trends of deforestation rates for the same time period (2000-2010) and for a decade earlier (1990-2000).

The datasets were given to the experts who had prepared a study for the Congo coordinating body for REDD+ (CN-REDD+) on the spatial patterns and weighting of deforestation and forest degradation" (BRli and C4 EcoSolutions, 2014). They calulated deforestation rates for FMUs with FMP and no-FMP in the North and South Congo separately. The datasets were particularly useful because they distinguished between gross and net deforestation and also provided information about the type of land use (agriculture, urban development, etc.) that contributed to deforestation. The method did not involve randomly selecting sample units or matching but, instead, all FMUs were directly compared to each other on the basis of the existence or lack of FMP.

Table 1: Gross deforestation in the main FMUs, with and without FMPs, in North Congo

FMU in the North 2000-10	**Forest area 2000 (ha)**	**Gross Deforestation 2000-10 (ha)**	**Gross deforestation rate 2000-10**	**Annual rate of gross defor.**	**Loss due to agriculture (ha)**	As a percentage of initial forest surface area 2000-10	**Loss due to urban development (ha)**	As a percentage of initial forest surface area 2000-10
Pokola	516 371	2 495	0.48%	0.05%	800	0.15%	1 549	0.30%
Kabo	288 593	1 395	0.48%	0.05%	21	0.01%	1 102	0.38%
Loundoungou	555 330	1 973	0.36%	0.04%	72	0.01%	1 592	0.29%
Ngombe	1 197 563	3 243	0.27%	0.03%	717	0.06%	2 351	0.20%
Mokabi-Dzanga	564 052	1 929	0.34%	0.03%	879	0.16%	1 041	0.18%
Lopola	192 800	325	0.17%	0.02%	105	0.05%	218	0.11%
TOTAL (with a FMP)	**3 314 709**	**11 359**	**0.34%**	0.03%	**2 593**	**0.08%**	**7 853**	**0.24%**
Ipendja	453 227	928	0.20%	0.02%	265	0.06%	499	0.11%
Bétou	328 047	3 150	0.96%	0.10%	2 087	0.64%	582	0.18%
Missa	230 472	231	0.10%	0.01%	144	0.06%	41	0.02%
Mimbeli-Ibenga	653 984	6 610	1.01%	0.10%	3 268	0.50%	1 037	0.16%
Jua-Ikié	515 440	768	0.15%	0.01%	119	0.02%	568	0.11%
Kelle-Mbomo	542 587	2 085	0.38%	0.04%	962	0.18%	1 102	0.20%
Tala-Tala	624 818	889	0.14%	0.01%	167	0.03%	664	0.11%
TOTAL (without a FMP)	**3 348 575**	**14 661**	**0.44%**	0.04%	**7 012**	**0.21%**	**3 994**	**0.12%**
Change in deforestation		***+3302***						

Source: BRLi and C4 EcoSolutions (2014)

The table shows that during 2000-2010 in North Congo, **deforestation rates were higher in the seven (7) main FMUs without FMPs** (all of which were harvested during this time) than in the six harvested FMUs with FMPs. This result is opposite the one suggested by Brandt *et al.* (2016) from their matching exercise As explained earlier, there is evidence that this difference results mostly from their exclusion of FMUs close to the Oubangui River and to include densely populated FMUs with FMPs.

Table 2: Gross deforestation in six (6) FMUs without FMPs in South Congo

FMU in the South 2000-10	**Forest area 2000 (ha)**	**Gross Deforestation 2000-10 (ha)**	**Gross deforestation rate 2000-10**	**Annual rate of gross defor.**	**Loss due to agriculture (ha)**	As a percentage of initial forest surface area 2000-10	**Loss due to urban development (ha)**	As a percentage of initial forest surface area 2000-10
Mossendjo	868 136	8 783	1.01%	0.10%	5 421	0.62%	3 362	0.39%
Kibangou	181 058	4 004	2.21%	0.22%	3 917	2.16%	61	0.03%
Kimongo	126 189	11 770	9.33%	0.93%	11 612	9.20%	50	0.04%
Divenie	136 137	2 866	2.10%	0.21%	2 236	1.64%	626	0.46%
Sbiti	781 709	13 385	1.71%	0.17%	12 076	1.54%	1 306	0.17%
Bambama	437 198	3 888	0.89%	0.09%	1 368	0.31%	2 520	0.58%
Pointe-Noire	301 093	15 555	5.17%	0.52%	15 004	4.98%	373	0.12%
Kayes	136 748	1 481	1.08%	0.11%	1 389	1.02%	19	0.01%
TOTAL	**2 968 267**	**61 732**	**2.08%**	**0.21%**	**53 023**	**1.79%**	**8 317**	**0.28%**

Source: BRLi and C4 EcoSolutions (2014)

A comparative analysis with the FMUs in the South (all of which were harvested and none of which had an FMP at that time) clearly shows that deforestation was much higher in the South than in the North.

Differences between the North and the South in forest land-use change

Job creation and the social programmes undertaken by large companies, as specified in their approved FMPs, do attract people to new settlements to the areas around former remote facilities. Moreover, the phenomenon is amplified in concessions that are FSC certified, where the requirements imposed on logging companies are even more stringent. For example, the Pokola FMU case is well documented (Poulsen et al., 2012); it was transformed from a village of hundreds to a town with 15,000 inhabitants over the course of 20 years. The rates for the conversion of forestland to other uses between 2000 and 2010 show that in the South, agricultural expansion predominates whereas in the North forest conversion is due to the expansion of new settlements.

Table 3: Forest into non-forest conversion rates in FMUs - Source: BRLi and C4 EcoSolutions (2014)

Gross deforestation 2000-2010			
(as a percentage of initial forest surface area - averages)			
	Agriculture	Urban expansion	Other drivers (unspecified)
With FMP North (6 FMUs)	0.08%	0.24%	0.00%
Without FMP North (7 FMUs)	0.21%	0.12%	0.01%
Without FMP South (8 FMUs)	1.79%	0.28%	0.00%

Table 3 indicates that urban expansion in FMUs with FMPs in the North is associated with the settlement of forest dwellers in forest areas situated around urban centres generated by economic and social development derived from forestry industries that attract people looking for job opportunities and social services. In the South the pattern is very different and agricultural expansion clearly predominates, despite the fact that there are apparently fewer forest roads. If the effects of settlement are limited to shifts in deforestation vectors (i.e., urban expansion vs. agricultural development) or if the more numerous roads in the North are related to very limited agricultural expansion, then many of the conclusions in Brandt et al. (2016) need to be reconsidered. More indepth studies that take into account migration on a greater scale are needed to test these new hypotheses. Notwithstanding, the line of reasoning consisting of "management plans mean a more extensive road system which, in turn, means greater deforestation from agriculture" does not appear to apply in Congo.

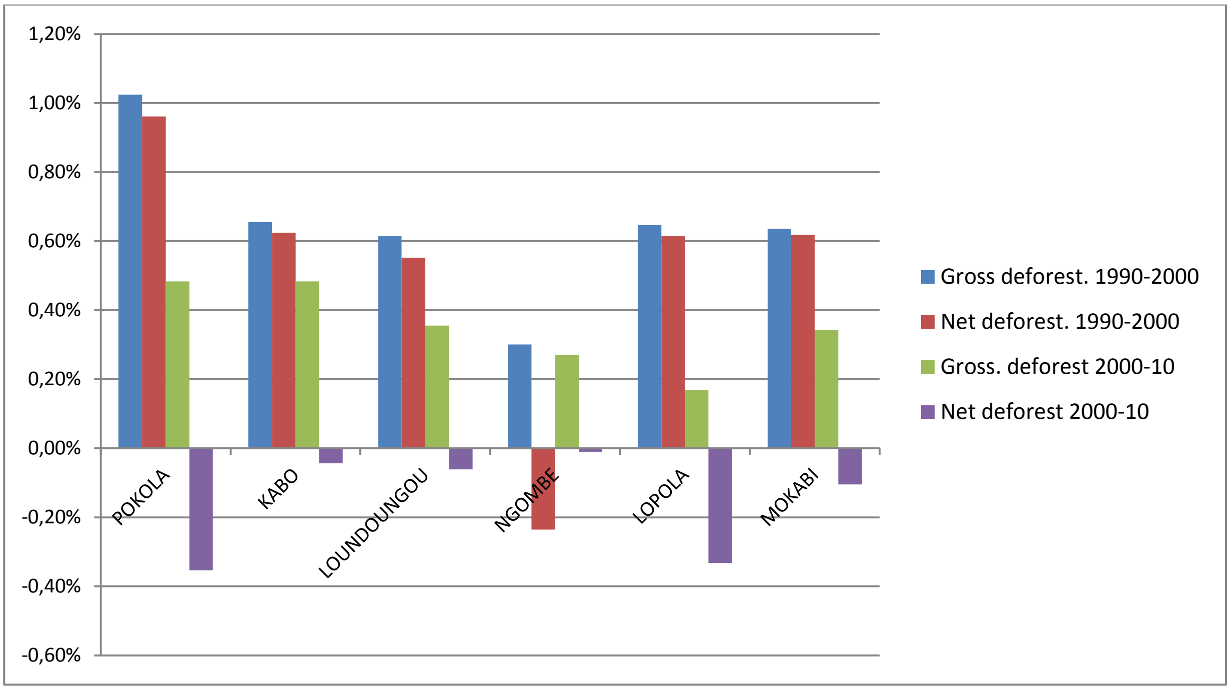
An unconvincing "before and after" comparison

In addition to the comparison of concessions with and without FMPs, the article also assesses whether deforestation declines in absolute terms subsequent to the signing of an FMP. The authors conclude that it does not and that it may even increase. Their conclusion is unjustified, for several reasons. First, how can the authors be sure they are truly eliminating time-invariant differences that might otherwise confound impact estimates? They are assuming that having FMPs mean the adoption of the same sort of practices was made across all units. This assumption is not justified for the specific case of "*when and how each logging company complied with the law, and our analysis assumes that FMP concessions followed the law similarly*"; page 17). Second, logging companies typically start to apply FMP rules several years before the official endorsement of a management plan − in Congo the time required to have a plan signed can be very long. During the intervening 1-3 years, companies implement basic management rules that include the planning of harvests. Third, the authors' conclusions are influenced by the anomalous sharp and temporary increase in deforestation in 2010. That spike seems to be linked to an abrupt upturn in road and lumberyard construction after a two-year period of stagnation due to the 2008-2009 global economic crises and had nothing to do with management plans.

When both the gross deforestation and net deforestation (i.e., gross deforestation minus forest regeneration or plantation establishment whenever the latter is detectable using remote sensing) per FMU are taken into account, the conclusions reached by Brandt *et al.* (2016) seem exaggerated. Table 4 shows the 1990-2000 and 2000-2010 gross and net deforestation rates for the six FMUs with management plans signed between 2005 and 2010.

Table 4: Gross and net deforestation in FMUs in North Congo with FMP and corresponding histogram

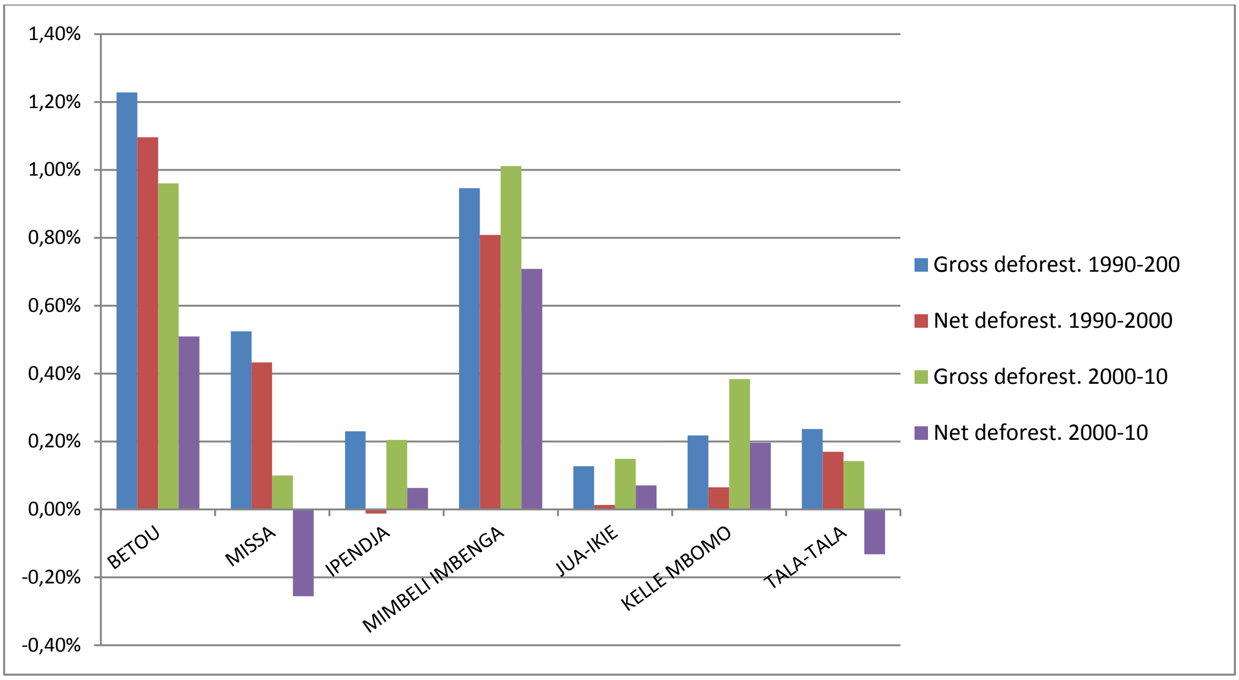
	1990-2000		2000-2010	
FMU	**Gross deforestation**	**Net deforestation**	**Gross deforestation**	**Net deforestation**
POKOLA	1.02%	0.96%	0.48%	-0.35%
KABO	0.66%	0.62%	0.48%	-0.04%
LOUNDOUNGOU TOUKOULAKA	0.61%	0.55%	0.36%	-0.06%
NGOMBE	0.30%	-0.24%	0.27%	-0.01%
LOPOLA	0.65%	0.61%	0.17%	-0.33%
MOKABI-DZANGA	0.64%	0.62%	0.34%	-0.10%



It seems unjustified to attribute the drop in deforestation, or the increase in forest cover, to management plans implemented during the 2000- 2010 period. In fact, when compared with deforestation rates in the No-FMP FMUs in the North, the downward trends in rates are generally similar for both periods but slightly less marked.

Table 5: Gross and net deforestation in FMUs without a FMP in North Congo and corresponding histogram

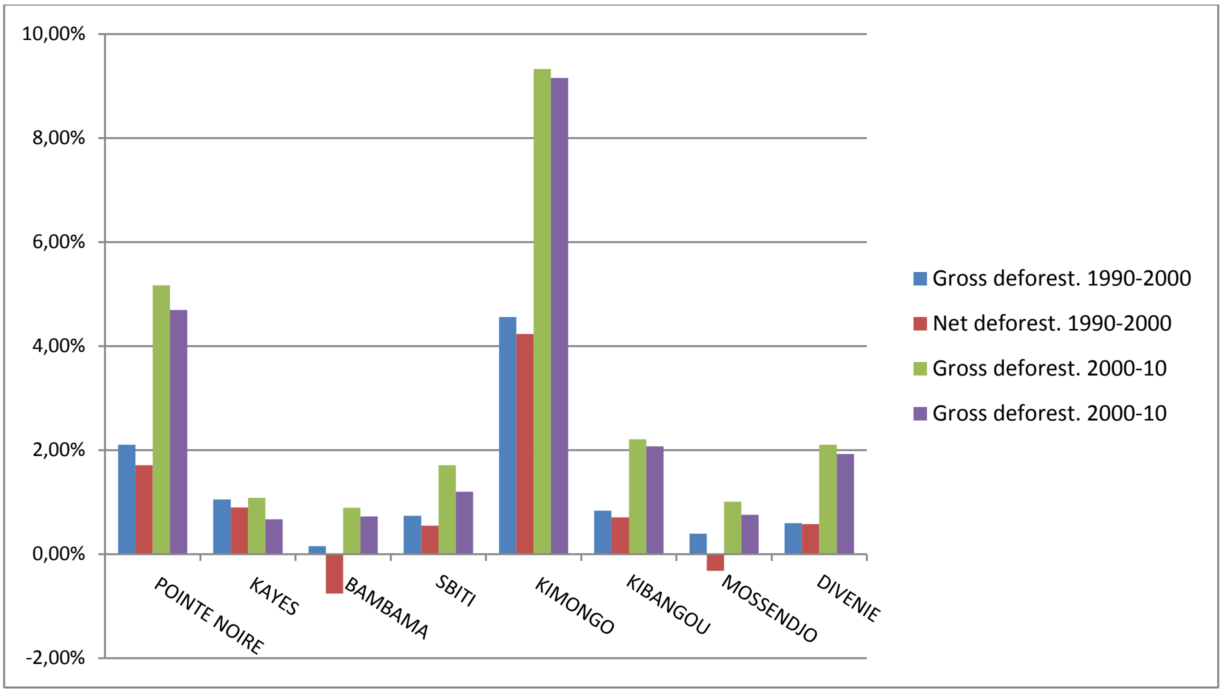
	1990-2000		2000-2010	
FMU	**Gross deforestation**	**Net deforestation**	**Gross deforestation**	**Net deforestation**
BETOU	1.23%	1.10%	0.96%	0.51%
MISSA	0.52%	0.43%	0.10%	-0.26%
IPENDJA	0.23%	-0.01%	0.20%	0.06%
MIMBELI IMBENGA	0.95%	0.81%	1.01%	0.71%
JUA-IKIE	0.13%	0.01%	0.15%	0.07%
KELLE MBOMO	0.22%	0.07%	0.38%	0.20%
TALA-TALA	0.24%	0.17%	0.14%	-0.13%



There seems to be little reason to believe that the existence of FMPs, or absence thereof, during the 2000-2010 period influenced deforestation rates in FMUs in the North. An analysis of trends in the six main FMUs in the South shows that gross deforestation increased in all FMUs.

Table 6: Gross and net deforestation in FMUs in South Congo and corresponding histogram

	1990-2000		2000-2010	
UFA	**Gross deforestation**	**Net deforestation**	**Gross deforestation**	**Net deforestation**
POINTE NOIRE	2.10%	1.71%	5.17%	4.69%
KAYES	1.06%	0.90%	1.08%	0.67%
BAMBAMA	0.15%	-0.76%	0.89%	0.72%
SBITI	0.74%	0.54%	1.71%	1.20%
KIMONGO	4.56%	4.23%	9.33%	9.16%
KIBANGOU	0.84%	0.71%	2.21%	2.07%
MOSSENDJO	0.39%	-0.32%	1.01%	0.76%
DIVENIE	0.60%	0.58%	2.10%	1.93%



According to Global Forest Watch (GFW) data, gross deforestation in 2013 and 2014 increased in North Congo and by approximately 2.5 times in Sangha, in comparison with 2000-2010. Deforestation also accelerated in South Congo in 2013-2014, by a factor of two in Niari and almost by a factor of three in Lékoumou. This pattern of accelerated deforestation appears to be the trend throughout Central Africa, with the exception of the Central African Republic, which suggests that other factors at play (e.g., public policies that foster land allocation the building of public infrastructure, or the growing interest in agribusiness) could have a greater influence on deforestation than the existence or absence of FMPs.

Debatable interpretations of production trends

A company's resilience to crises or its ability to sustain production levels has little to do with forest management planning. In their efforts to compare No-FMP concessions with production because they presumably operate on the "edges" of forests with FMP concessions that are large timber producers working in central parts of forests, the authors explain that: "Despite the [2008-2009] recession, logging offtake still increased in FMP concessions, but not in no-FMP concessions." This claim merits clarification: production rates dropped for the four companies operating in the six concessions with FMPs (drops occurred in either 2008 or 2009) to -84%, -65%, -47% and -10%, respectively (State of the Forests 2013 datasets). As for companies managing FMUs without FMPs in the North, one temporarily closed operations, another permanently ceased operations (ITBL), and the third registered a 25% decrease in production. During the same period, in contrast, the production rates of the three major companies with No-FMP concessions in the South, all of which had abundant available capital, stood at -24%, +2%, and + 63% (see annexed graphs).

Deforestation from timber production: a criterion for efficiency

The perspectives of Brandt et al. (2016) and their choice of covariates are sometime questionable. For one thing, forest concessions represent a land management policy instrument used by states for what is typically spatial specialisation or land sparing, where productive areas (concessions) are juxtaposed with protected areas and other categories of land-use. Within managed concessions, the "conservation" or "protection" subsets of parcels are mandatory (as are "production" subsets and, recently, "community development" subsets); they are the offshoots of the spatial specialisation rationale. Productive areas are meant to produce lumber, under the condition that stocks are reconstituted within the space of one felling cycle. If that is the objective set out for productive areas, we can then suggest another "control": **harvested volumes**. This leads to the following question: "Production being equal, which forestry logging practices generate the lowest rate of deforestation?" The same approach is used to determine energy efficiency in the context of the "climate" issue: for a given type of production (steel, electricity, cement, etc.), what technologies generate the lowest greenhouse gas emissions?

We have attempted to determine average timber production efficiency in FMP versus No-FMP with respect to deforestation (i.e., in ha deforested/m^3) in forest concessions in the northern Republic of Congo. The comparison was done at the FMU (or company?) level for those concessions with uninterrumpted production for the 2003-2010 period, given that some companies did not exist prior to 2003. To that end, we used the deforestation rates per FMU (BRLi and C4 EcoSolutions, 2014) and production rates for logging companies, which sometimes cover several FMUs. We excluded from our study the Tala-Tala and Jua-Ikié FMUs because they were not continuously harvested for the analysis period. We also excluded the Mimbeli FMU that was merged with that of Ibenga because only aggregate deforestation rates were available. Likewise, production rates for the logging company ITBL, which closed in 2009, are exclusively for the Mimbeli FMU (Table 7).

Table 7: Deforestation compared to production for companies operating in North Congo

Company	FMU	Gross deforestation rate 2000-10	Cleared hectares	Production 2003-2010 (m^3)	Deforestation/m^3 (ha per 1000 m^3)
CIB[1][2]	Kabo	0.48%	*1395*		
	Pokola	0.48%	*2495*		
	Loundoungou	0.36%	*1973*		
			5 863	**2 639 489**	**2.22**
IFO[1][2]	Ngombe	0.27%	**3 243**	**1 302 919**	**2.49**
Rougier[1][3]	Mokabi-Dzanga	0.34%	**1 929**	**773 193**	**2.49**
BPL [1]	Lopola	0.17%	**325**	**323 604**	**1.00**
Thanry	Ipendja	0.20%	**928**	**246 938**	**3.75**
Likouala Timber	Bétou	0.96%	*3 150*		
	Missa	0.10%	*231*		
			3 381	**614 632**	**5.50**

[1] With FMPs [2] FSC Certified [3] Certified legal

The last column contains the number of hectares lost to deforestation per 1000 m^3 of wood harvested, which represents production-linked deforestation. When we use these estimates as measures of efficiency, the four FMP companies are more efficient than the two No-FMP (aggregate figures in Table 8). Admittedly, the comparison does not control for other factors that could also affect the outcome in the two groups, and the existence of FMP is probably only one of the factors explaining this result, but again it provides an assessment of trends in deforestation rates more amenable to field verification to those provided by the analysis developed by Brandt et al (2016).

Table 8: Aggregate figures for deforestation versus production in North Congo

FMP Concessions		
Gross deforestation (ha)	Wood production 2003-10 (m^3)	Gross deforestation/1000m^3
11 359	5 039 205	**2.25 ha**
No-FMP Concessions		
Gross deforestation (ha)	Wood production 2003-10 (m^3)	Gross deforestation/1000m^3
4 290	861 570	**4.98 ha**

We conclude FMP concessions suffered half as much gross deforestation, with **production kept constant,** than No-FMP concessions in the same region (the North[3]). In this instance, forest management planning seems effective, even if future yields are still uncertain and the overall issue of sustainability remains a thorny one (*See* Karsenty and Gourlet-Fleury, 2006).

Conclusion – Which approach should we adopt?

Brandt *et al.* (2016) compare gross deforestation rates for FMUs with and without government approved forest management plans by applying a set of covariates (population, accessibility, etc.) on a relatively fine scale (pixels measuring one km²). With this approach, they excluded parcels in No-FMP concessions with the highest levels of deforestation and included some parcels that were not harvested. We find it difficult to determine which differences between our analysis and theirs are attributable to differences in the data used (i.e., forest cover threshold to define forests, pixel size, and image resolution), and which are due to the choices they made about parcel inclusion or exclusion. Our analysis, conducted for entire FMUs, resulted in the following four main conclusions:

- Gross loss of forest cover is much greater in No-FMP FMUs than in those with FMPs.
- For FMUs with FMPs, gross loss rates of forest cover declined over the 2000-2010 period, during which FMPs were implemented and net forest cover increased, with respect to the preceding decade. This recovery trend is less marked in No-FMP FMUs in the North, and the opposite trend is clearly observable in the South.
- Despite the existence of more extended forest road networks in FMUs with FMPs, forest conversion to agriculture is lower than in FMUs without FMPs. This result contradicts the conclusion of Brandt et al. (2016) that “forest management plans lead to more extensive road networks that lead to greater conversion to agriculture.” Nonetheless, the conversion of forests into urban habitat is greater in FMUs with FMPs, which confirms the hypothesis put forward by Brandt *et al.* (2016) that, in the areas surrounding settlements, local economic development is linked to forest management planning and to deforestation.
- In a comparative analysis of deforestation with production remaining constant, FMUs with FMPs are approximately twice as efficient as those without: per cubic metre produced, gross loss of forests cover was lower by half in concessions with FMPs.

We do not argue that forest management planning reduces deforestation because we understand that there are other factors, population density in particular, which play essential roles. The dynamics of these other factors need to be analysed so as to avoid systematically attributing to forest management planning a greater role in deforestation trends than deserved. The current discussion has brought to the fore the impact of settlement growth linked to the creation of jobs and social programmes, which are the result of the proper implementation of FMPs by logging

[3]The datasets we currently use does not allow us to perform the same comparative analysis using FMUs in South Congo. But given that deforestation rates are high in FMUs in general, deforestation linked to production is no doubt higher in the South.

companies, and should get logging companies and local public authorities talking about what needs to be done to curb this problem.

Another important factor, acknowledged by Brandt *et al.* (2016) but that we think deserves further stressing, is the very short time spans used to calculate average deforestation (2005-2010) and annual deforestation (2001-2013). Sustainable management is a long-term process, with long-term objectives that include sustained timber yields and avoidance of forest conversion. Forest management planning is an attempt to strike a balance between socio-economic development and natural resource conservation. Clearly, concession regimes can be improved through, for example, certification, mapping of customary land rights, benefits sharing, multiple uses and better law enforcement (e.g., Cerutti *et al*., 2016). This is the agenda we propose to focus on.

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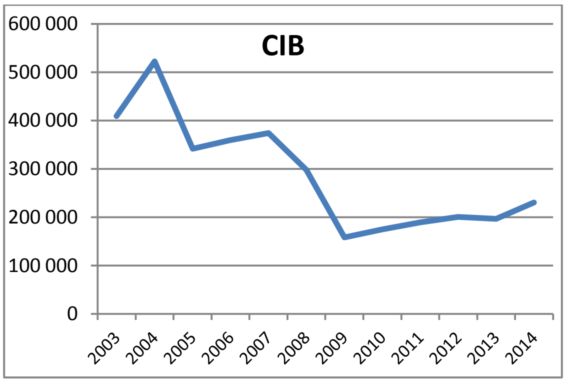
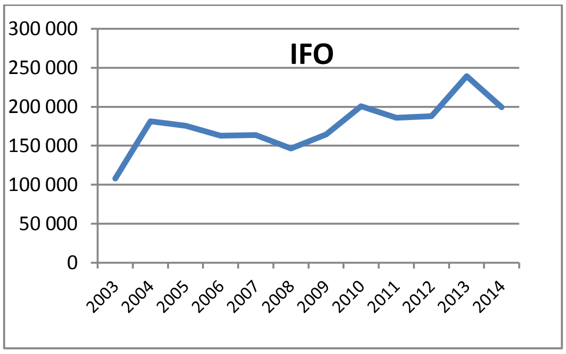
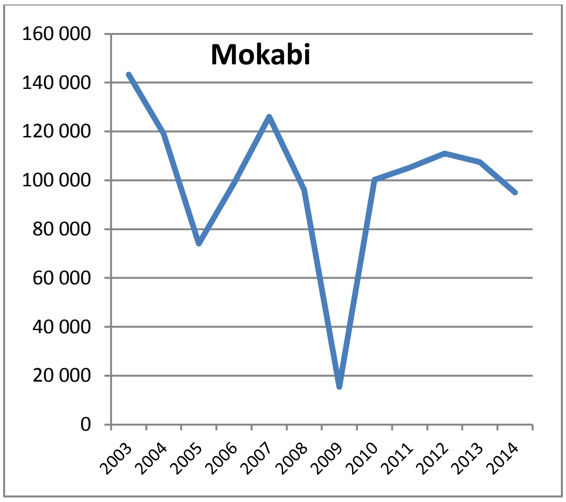
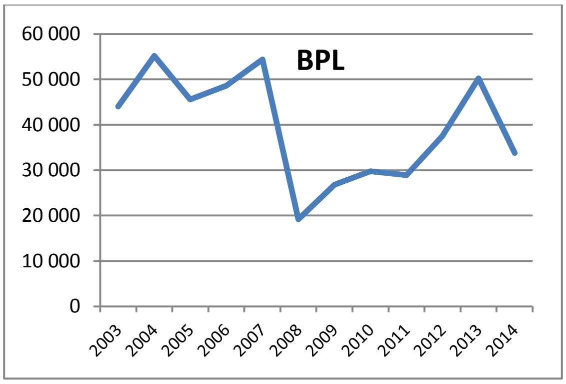
ANNEX 1: 2003-2014 wood production for logging companies in cubic metres

Companies with FMP (m^3)

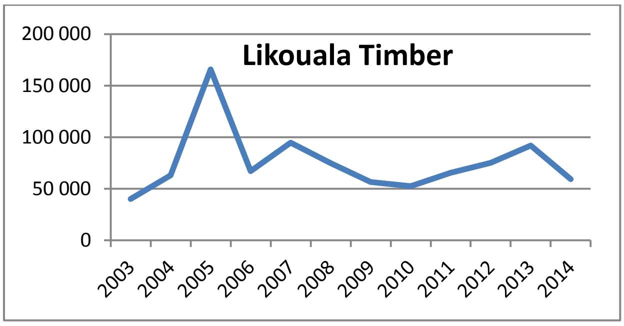


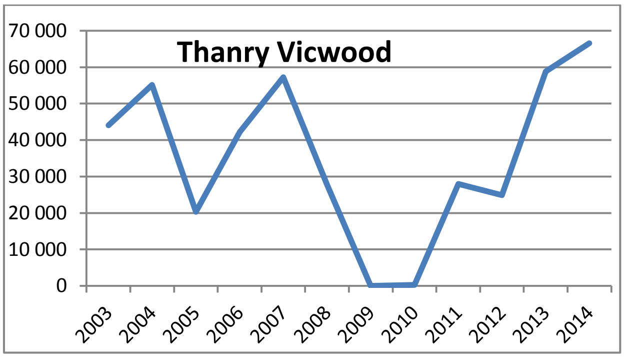




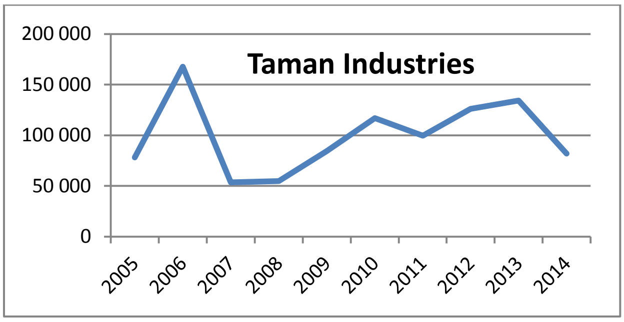


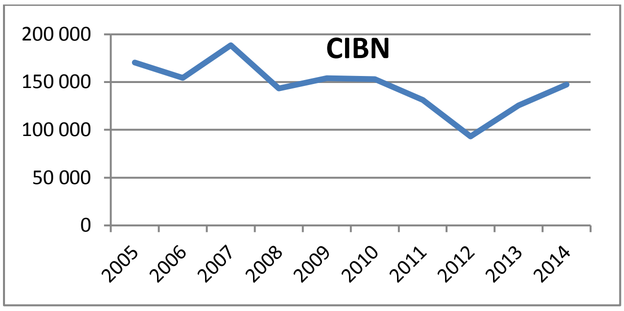
Companies without FMP (North)

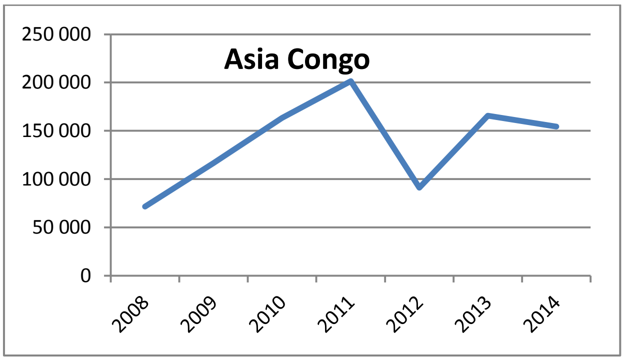




Companies without FMP (South)







APPENDIX 2: Details on the methodology used in the study and C4 BRLi Ecosolution, 2014

The data cover and change of the GAF forest cover were made from satellite data for historical periods of 1990 and 2000 scenes Landsat TM and ETM. Coverage in 2010 included SPOT4 and 5 scenes, DMC, Rapideye, Landsat 7 and 8. The final products were made at a resolution of 20 m with UMC forest of 1 hectare. Cloud cover still persists and that for both periods. Between the two periods, the coverage is different and relatively high in some areas.

With the objective to compare the changes between the two periods in the BRLi Ecosolution C4 (2014) study, the cloud cover of both periods were merged and used as common mask, in order to analyze both periods on the basis of the same reference surface. From both raster and cover_change 1990_2000 2000-2010, the two clouds masks were merged to make a unique one applied to both raster. Data analysis was carried out by extraction of evolutionary surfaces for each class of data in order to compare the evolution of data between 1990-2000 and 2000-2010 on a common base surface.

Cloud cover can be quite large, more than 30% in some departments such as the Kouilou, Niari and Lékoumou. So the results that were presented in the study and BRLi Ecosolution C4 (2014), for some UFA, do not cover the entire surface thereof due to cloud cover.

Vector UFA boundaries used are those of the WRI Atlas version 3.0 which the boundaries of protected areas have been removed