

Are central African moist forests sustainably managed?



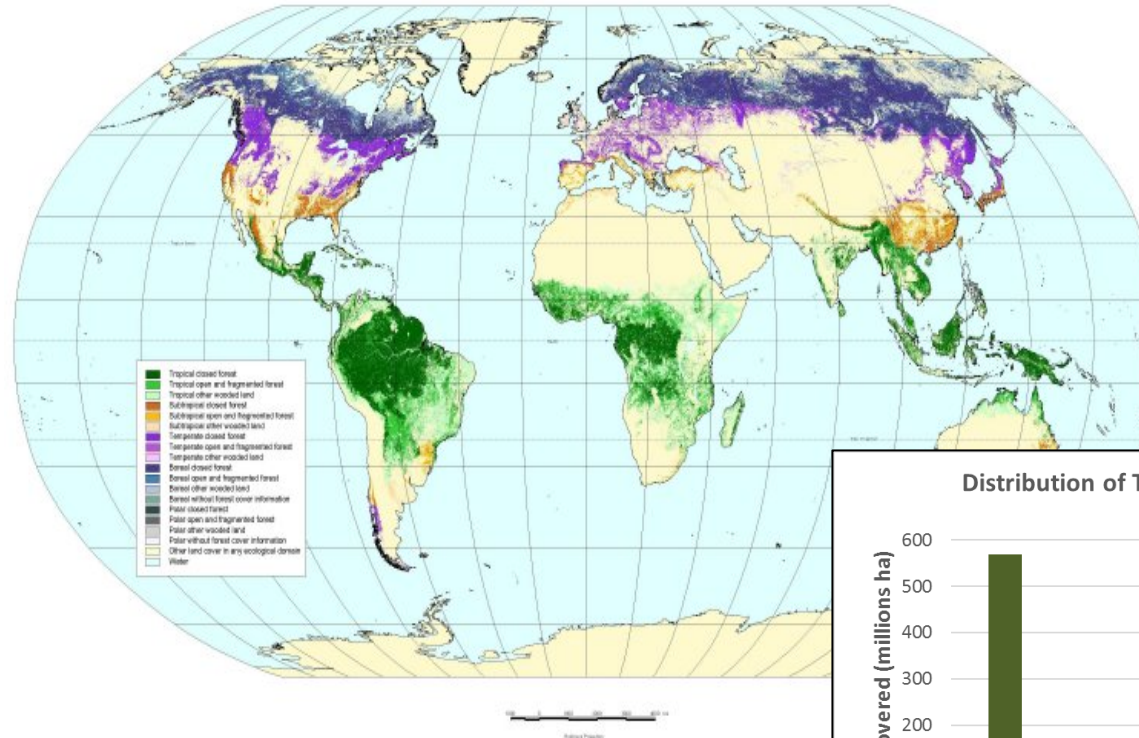
Some important results
acquired from research

S. Gourlet-Fleury and colleagues

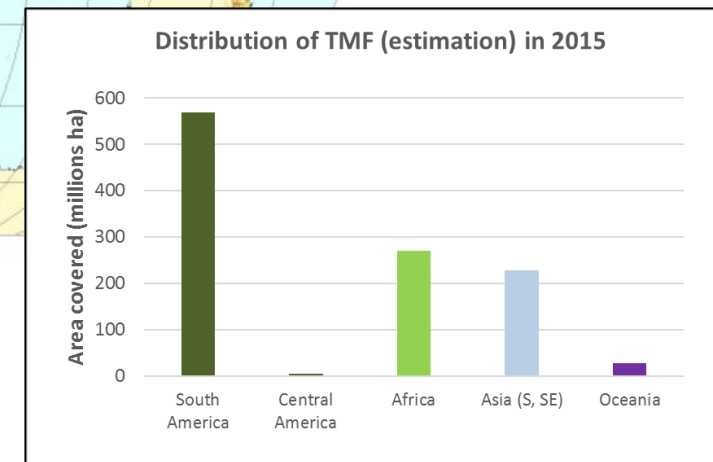
A brief remind: areas covered by moist tropical forests



FORESTS 2000 BY MAJOR ECOLOGICAL DOMAINS

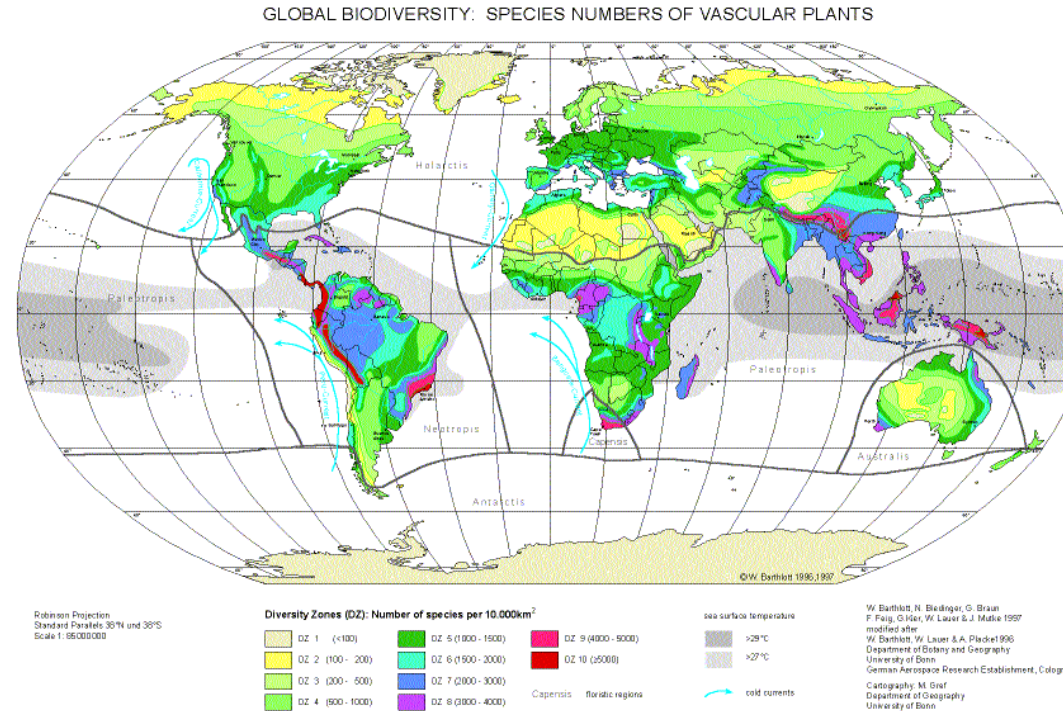


FRA 2000, 2010, 2015)



World forests: 31% of emerged lands ($3.99 \cdot 10^9$ ha)
Tropical forests: 44% of world forests ($1.77 \cdot 10^9$ ha)
Moist tropical forests: 27% of world forests ($\approx 1.07 \cdot 10^9$ ha)

A brief remind: tropical forests host a high plant and tree species diversity



Barthlott et al. (1999)

A minimum of 40 000 (~ ≥ 53 000) tree species in the intertropical area Slik & al. (2015) - To be compared to 124 european tree species and ...

A little comparison with China

Geographical Range and Local Abundance of Tree Species in China

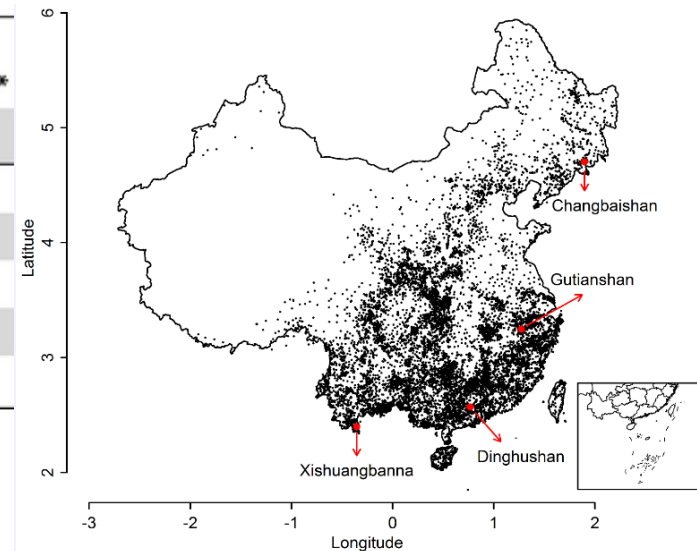
Table 1

Size, geographic location, number of species, and endemics to China for the four census plots, plus the geo-referenced record number for those species.

Plot	Area (ha)	Longitude (E°)	Latitude (N°)	Species*	Endemic*
Changbaishan	25	128.083	42.3833	52 (50)	1 (1)
Gutianshan	24	118.120	29.2537	159 (157)	55 (55)
Dinghushan	20	112.510	23.1558	208 (194)	35 (31)
Xishuangbanna	20	101.576	21.6138	357 (318)	58 (44)
Total	89	–	–	707 (651)	142 (124)

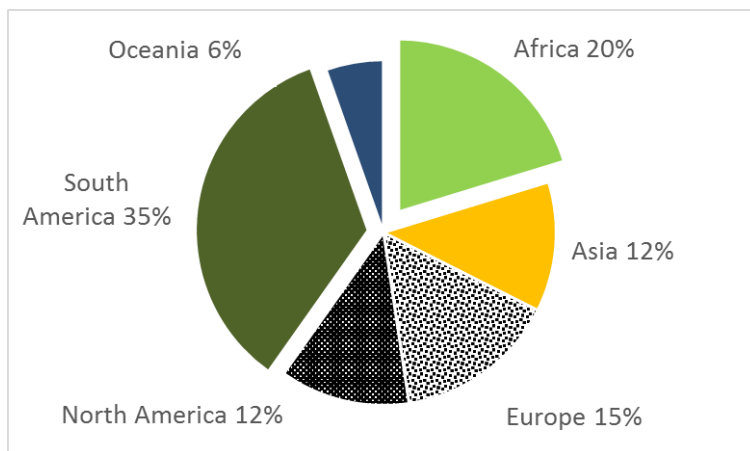
Ren et al. (2013)

doi: <https://doi.org/10.1371/journal.pone.0076374.t001>

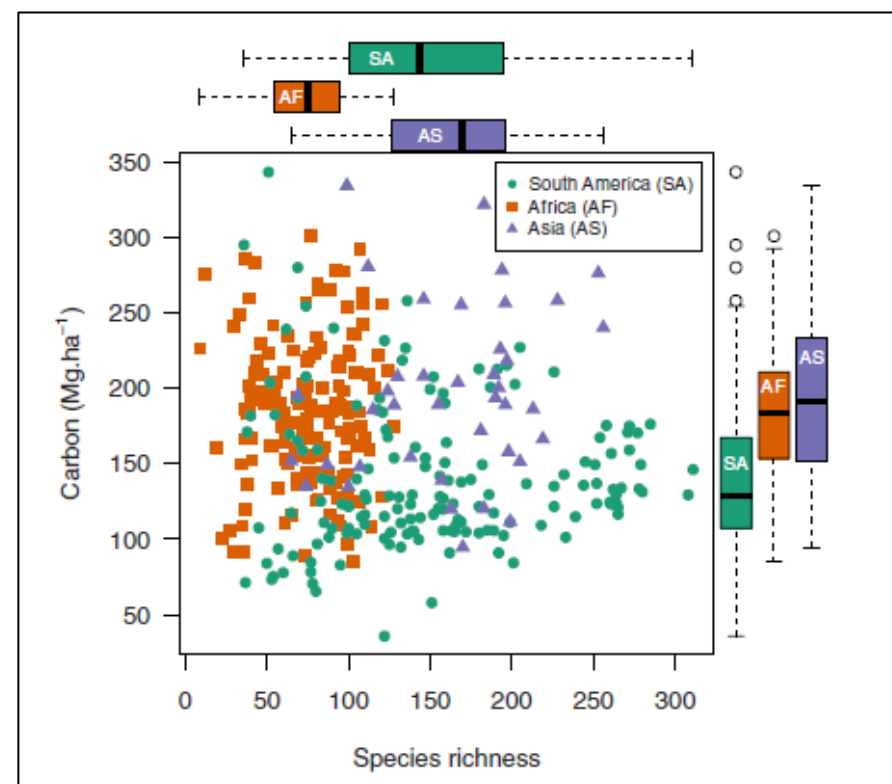


... and high carbon stocks

Total carbon in forests trees
above and below-ground
biomass (2015) : 296 Gt



FAO (FRA 2015)

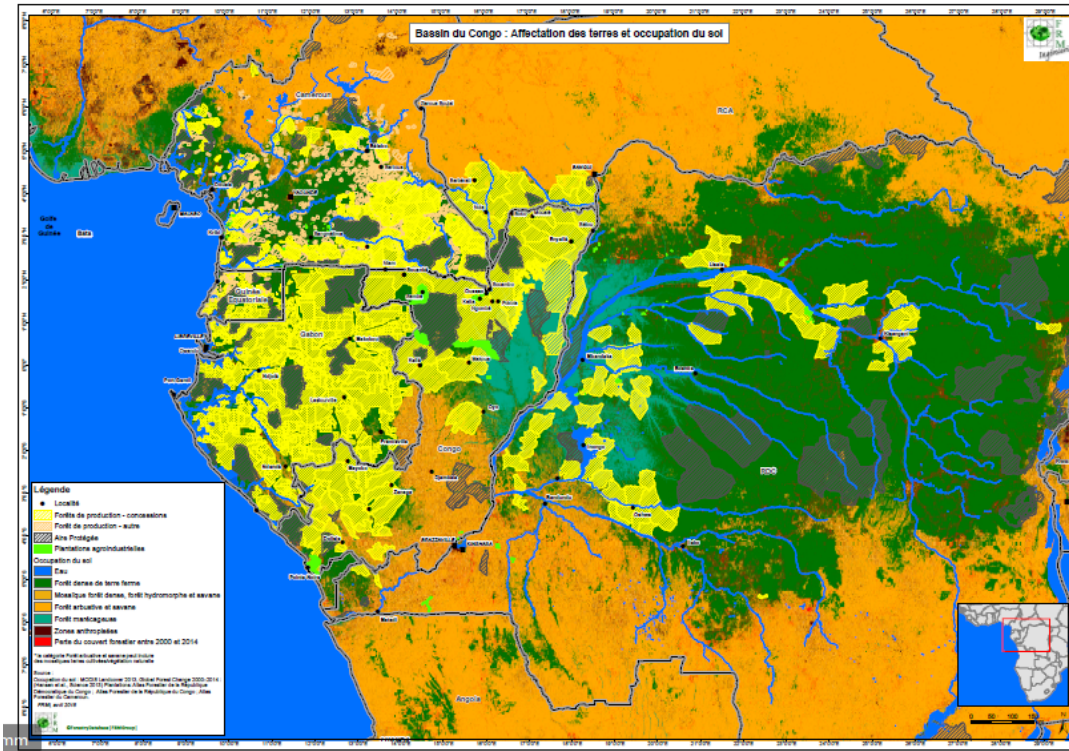


Sullivan et al. (2017)

We are loosing tropical forests

- Due to deforestation: 7.6 millions ha.yr⁻¹ lost each year between 2010 and 2015, mainly tropical forests (4.6 millions ha.yr⁻¹ gained, mostly temperate forests) FAO (FRA 2015)
- Due to degradation (selective logging, woodfuel, fire): 13 millions ha.yr⁻¹ degraded each year between 2010 and 2012 in tropical forests Pearson et al. (2017)
- Resulting in CO₂ lost: 8.30 Gt.yr⁻¹ CO₂ between 2005 and 2010 (deforestation : 6.22 Gt. yr⁻¹, degradation: 2.10 Gt. yr⁻¹) Pearson et al. (2017)

What about central african forests?



FRMi (2018)

Sources: FRA (2015), FRMi (2018)

Deforestation mostly due to agricultural activities:
0.09%.yr-1 (1990-2000) to 0.17% (2000-2005),
mainly in DRC

○ Forest areas in 2018

- Total: $168.9 \cdot 10^6$ ha
- Production: $53.4 \cdot 10^6$ ha (31.6% of total)
- Under concession: $50.9 \cdot 10^6$ ha (95% of production forests)
- Managed: $29.3 \cdot 10^6$ ha (57.6% of forests under concession)
- Certified: $9.8 \cdot 10^6$ ha (19.3% of forests under concession)

Challenges

- Management plans have been made mandatory in forest laws of central African countries
- The management is supposed to be “sustainable” (ITTO 2005, 2011), ie it should ensure:
 - “the production of a continuous flow of desired forest products and services without undue reduction in its inherent values and future productivity and without undue undesirable effects on the physical and social environment.”

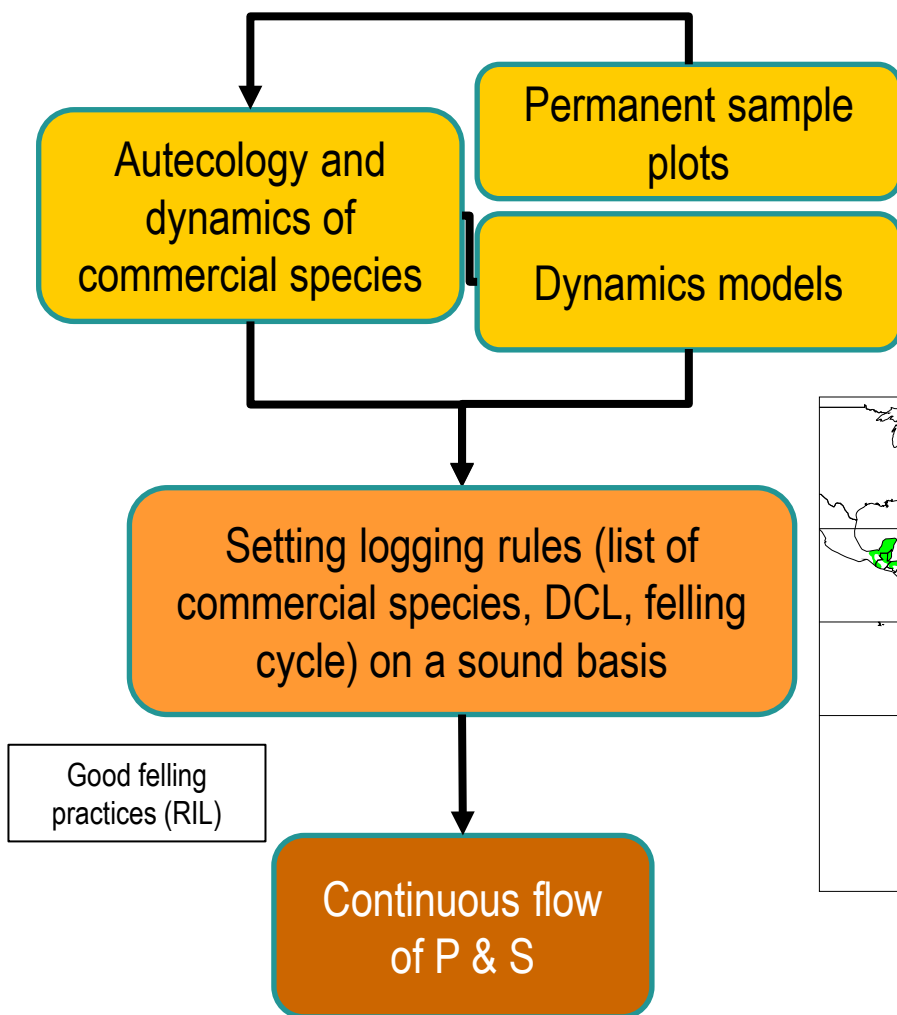
Economically
sustainable?



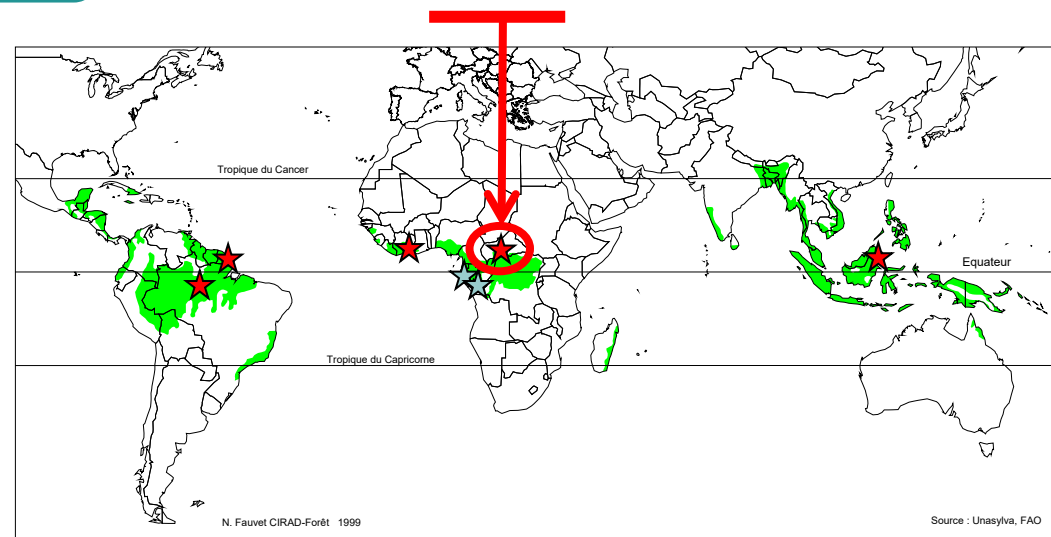
Socially
acceptable?

Consistent with ecosystem productivity and integrity?

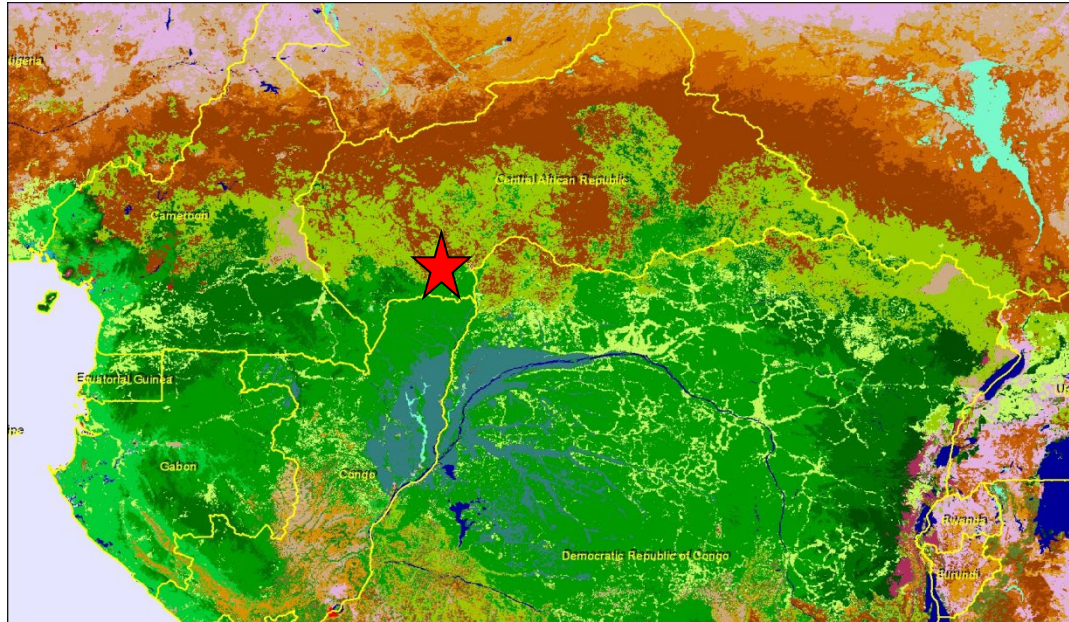
Challenges



MBaïki – 1982
(Icra/MEFCP, Central African Republic)



Assessing the impact of logging: the M'Baïki experimental site

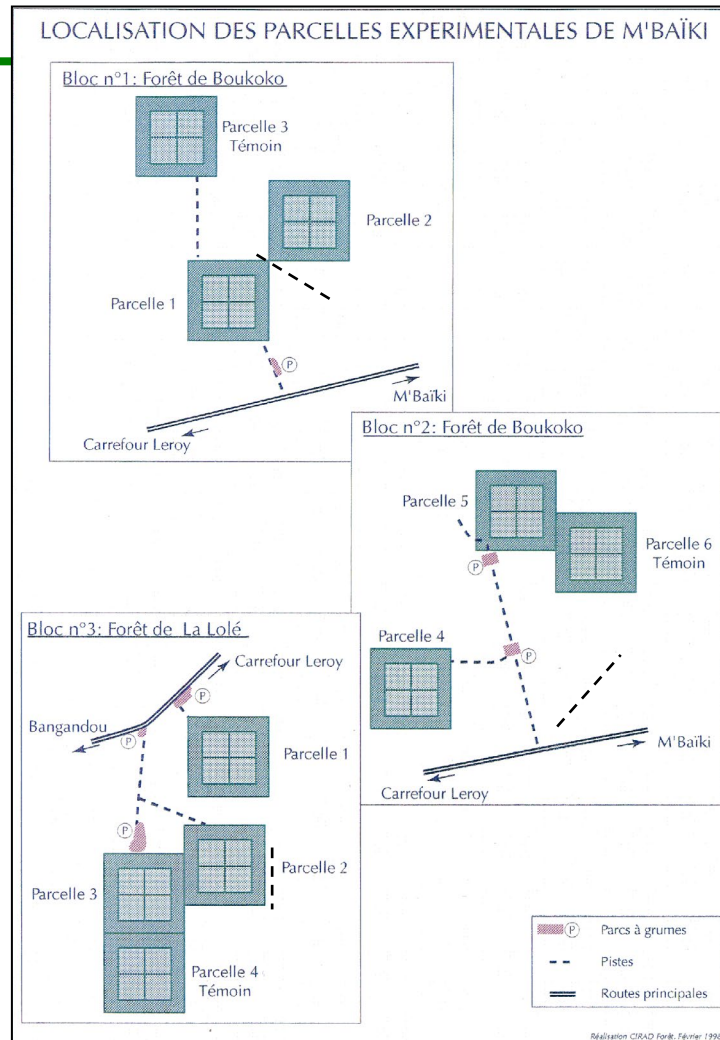


Land Cover Map of Africa (GLC 2000) – DG-JRC

- Settled in 1982
- 110 km SW of Bangui

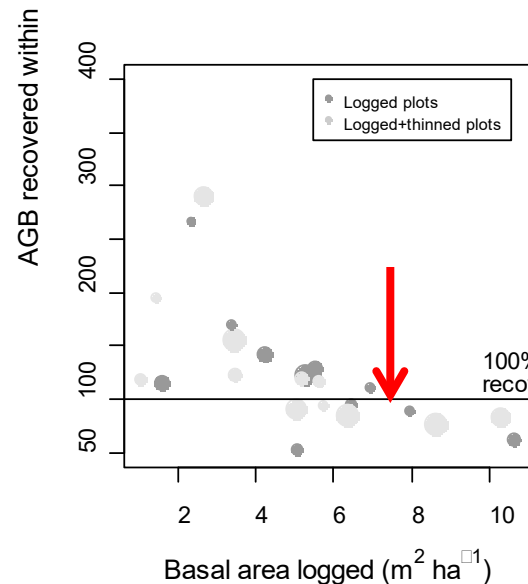
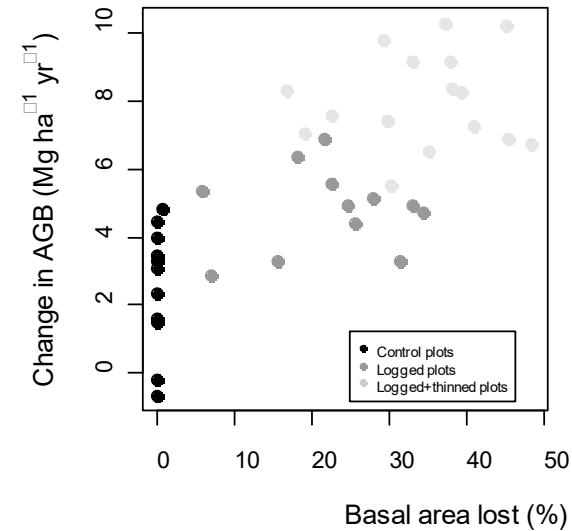
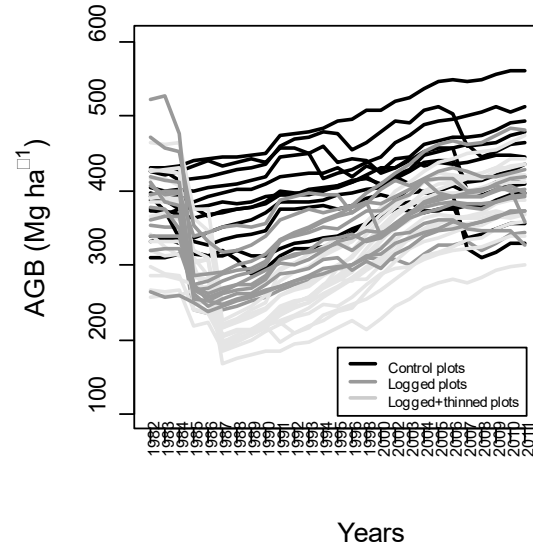
- French government massively invested in forest management in Central Africa, needing:
 - quantified data on the effects of logging
 - better knowledge on stands and tree species dynamics

Assessing the impact of logging: the M'Baïki experimental site



- 10 plots, 9 ha each
- All trees ≥ 10 cm dbh mapped and monitored every year in the 4 ha core zone ($\geq 35\,000$ trees)
- More than 310 tree species, mean species density (r): 120 sp. ha^{-1}
- Three treatments implemented between 1984 and 1987:
 - Control (3 plots)
 - Timber logging (3 plots, 4 trees ≥ 80 cm DBH)
 - Timber logging + thinning (4 plots, 23 trees ≥ 50 cm DBH)

Impact on the above-ground biomass



Productivity increased with disturbance

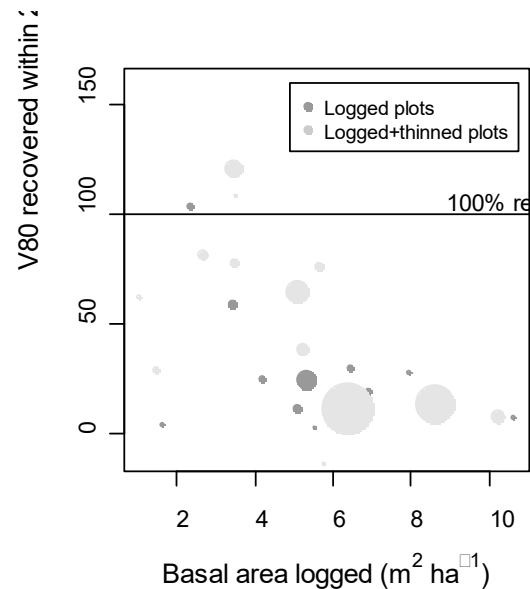
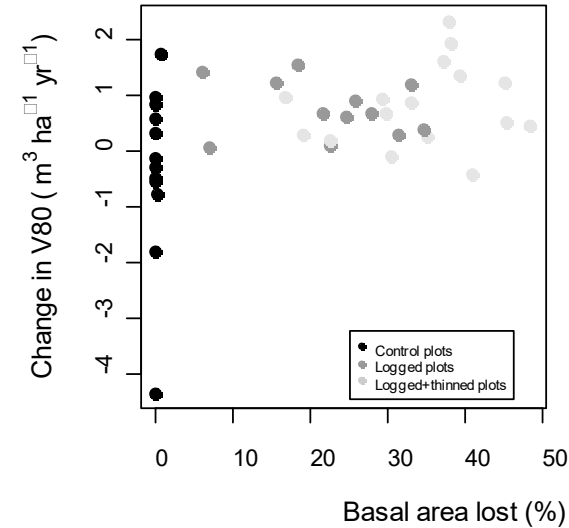
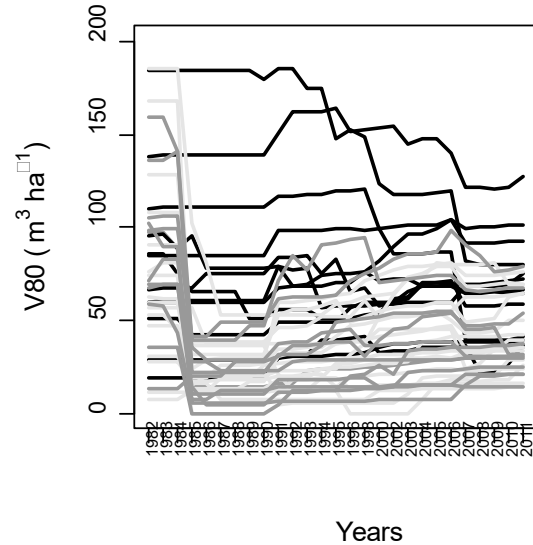
Logging: 5,2 Mg ha⁻¹ yr⁻¹

Thinning: 8,8 Mg ha⁻¹ yr⁻¹

Mean recovery rate over 24 years : 144%

63% of the plots have recovered

Impact on the commercial stock



No effect of disturbance intensity on productivity

Logging: $0,8 \text{ m}^3 \text{ha}^{-1} \text{yr}^{-1}$

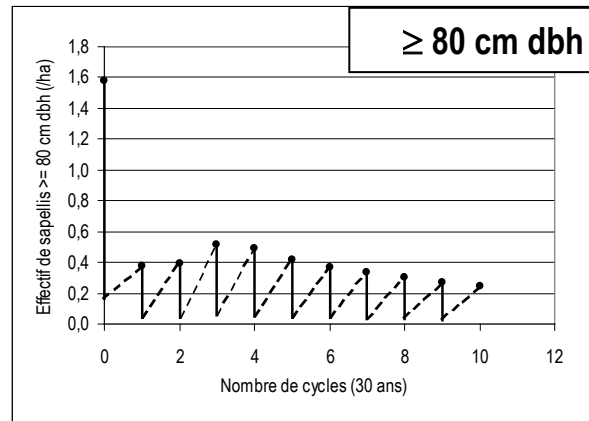
Thinning: $0,9 \text{ m}^3 \text{ha}^{-1} \text{yr}^{-1}$

Mean recovery rate over 24 years: 41%
13% of the plots have recovered

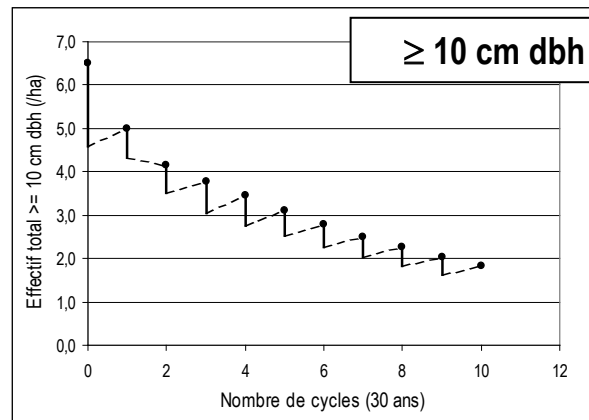
Impact on the commercial stock

- With pessimistic predictions for the mid/long-term

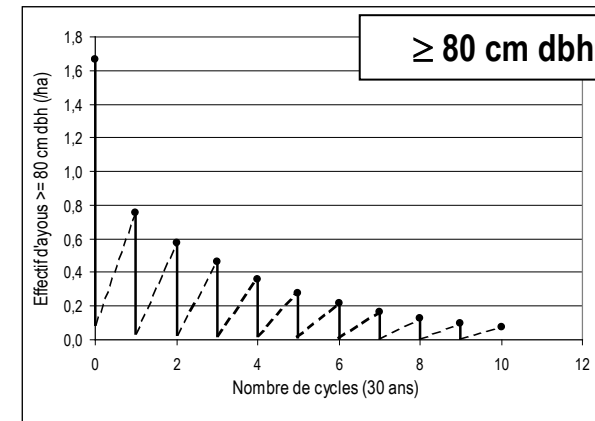
Sapelli



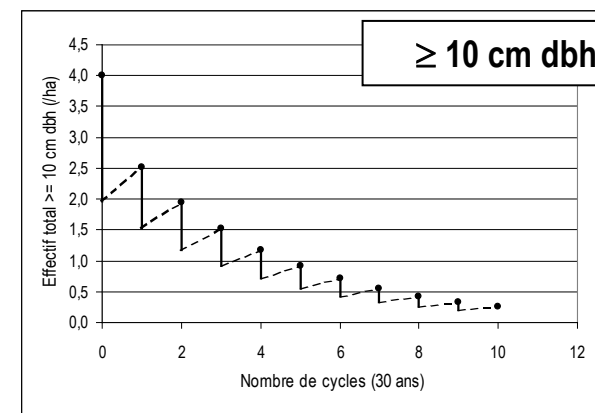
N trees ha⁻¹



Ayous



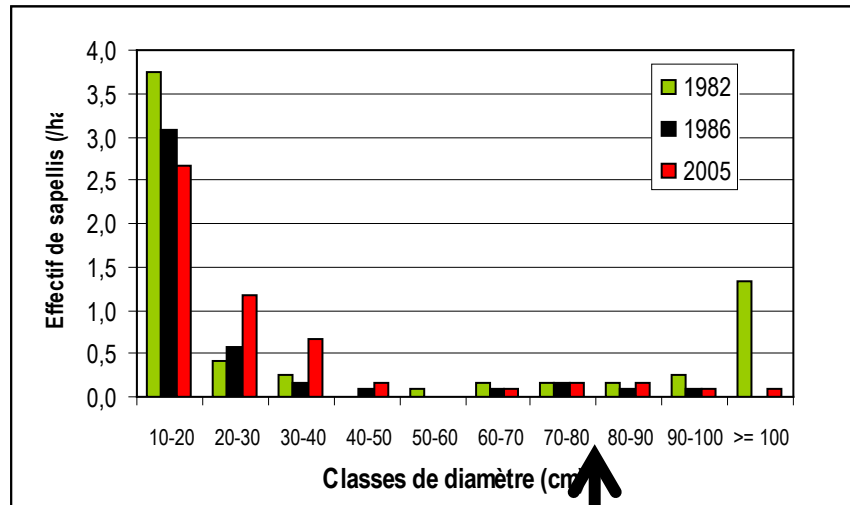
N trees ha⁻¹



Where is the problem?

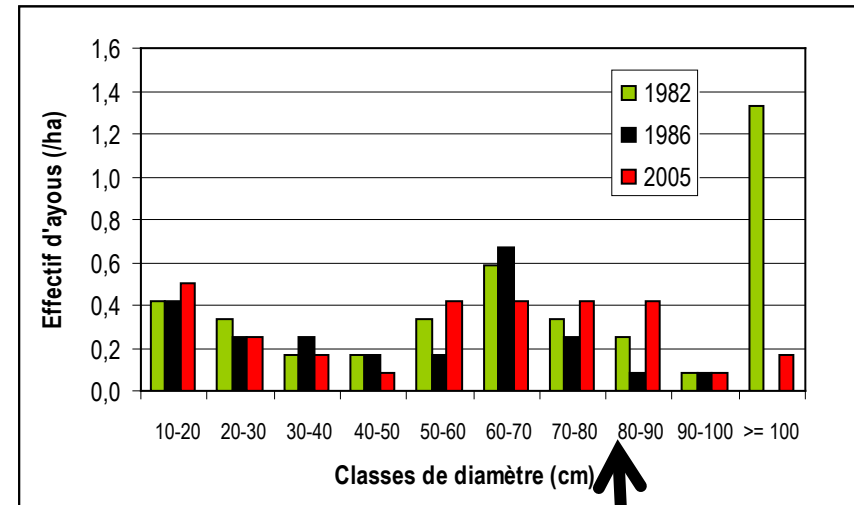
- On diameter structure and light requirement ...

Sapelli



80 cm

Ayous



80 cm

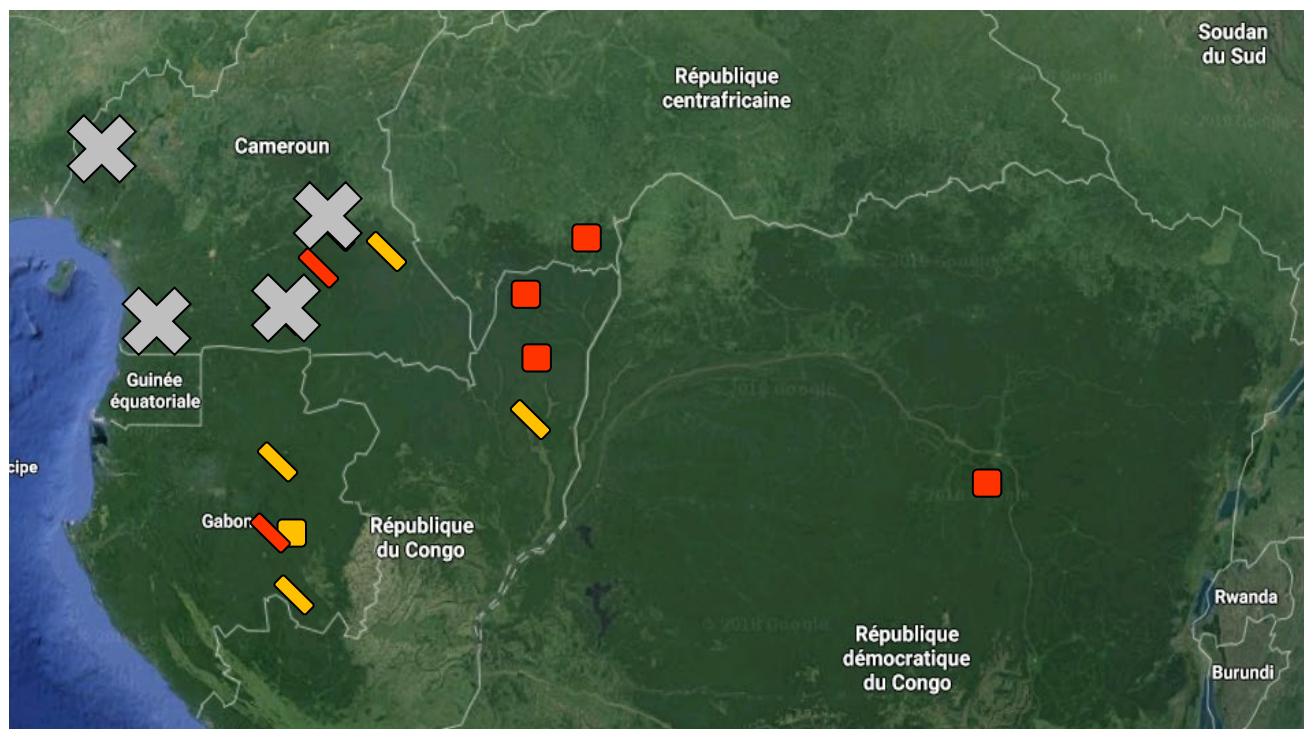
Commercial stock recovered 30 years later: **Sapelli** : 18,6% of the number of trees, 13 % of the volume – **Ayous** : 52.6% of the number of trees and 27.4% of the volume

Where is the problem?

- A higher number of trees could/should be logged per hectare: less area opened for logging and a higher opening of the canopy benefitting to light-demanding commercial species ...
- ... but a lower number of trees belonging to strongly market demanded species like Sapelli and Ayous
- Other species are valuable for their timber and less vulnerable due to a better balanced diametric structure
- However, felling cycles are probably too short to allow timber volume recovery
- ... sites like M'Baïki – large plots, logged vs undisturbed – , are lacking and desperately needed



A network launched in 2012 through the DynAfFor/P3FAC projects



Legend

Settled sites

- Large plots and trails
- Trails

Sites settlement ongoing

- Large plots and trails
- Trails

Located within different forest types, to study logging impacts on a large amount of tree species

4 trails unfortunately abandoned in concessions dropped by logging companies



FONDS FRANÇAIS POUR
L'ENVIRONNEMENT MONDIAL



LIÈGE université
Gembloux
Agro-Bio Tech



atibt



Together Towards Global Green Supply Chains
CTWPDA, CINFT-NFGA, ITTO, ATIBT, Shanghai, 22-23/10/2019

Main messages and questions

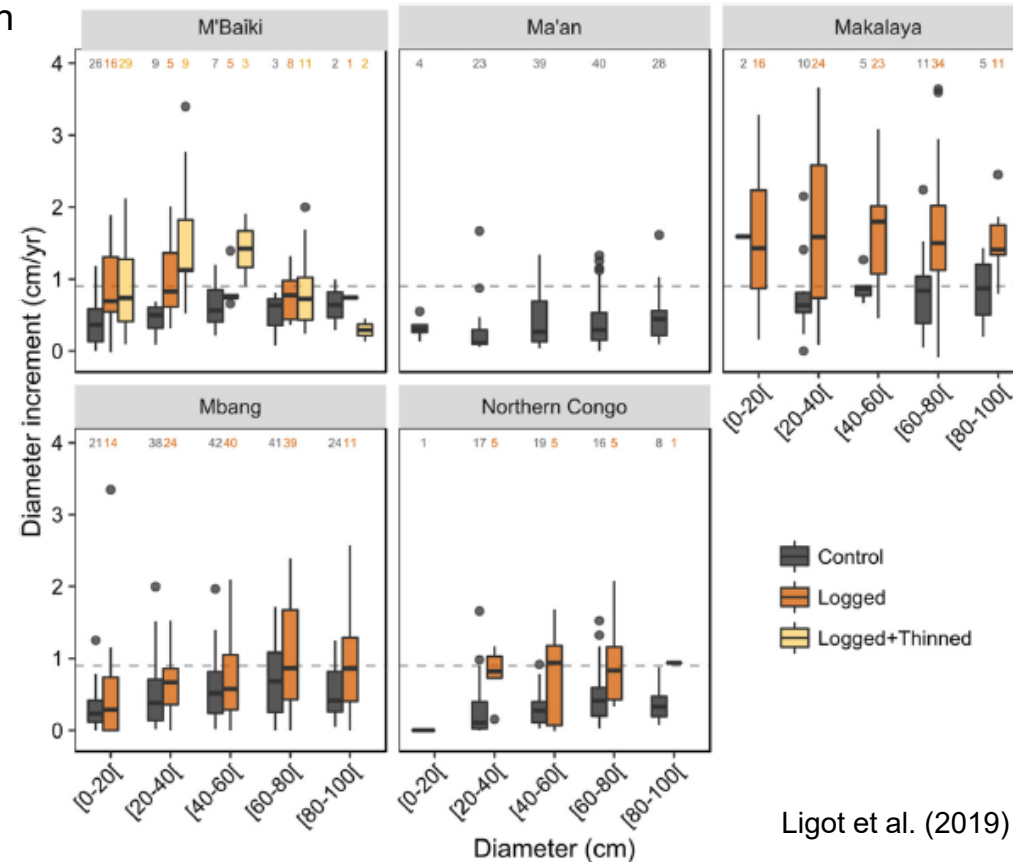
- First analyses show that specific population dynamics (growth, mortality, recruitment) differ between sites

Central African Republic

South-west Cameroon

South-east Cameroon

Northern Congo



Ligot et al. (2019)

Main messages and questions

- However, most of the data on population dynamics used to reason logging rules inside management plans come from the M'Baïki site
- Logically, there should be plots and trails settled inside each large concession of the region, or at least shared between neighbouring concessions located in the same ecological conditions
- Settling a system of large plots and trails requires about 100 000 € - Following them requires about 5000 €/yr. Which structure should be responsible for funding, settling and managing such a system?
- The unsustainability of logging is enshrined in the laws ... Why do legal recovery rates of timber stocks fixed in all central african countries are smaller then 100% ? (between 40 and 75%)

