

*Wood or animal proteins: How do stakeholders perceive the ecosystem services provided by tropical forests in Central Africa?*

Forest Resources Management Seminars

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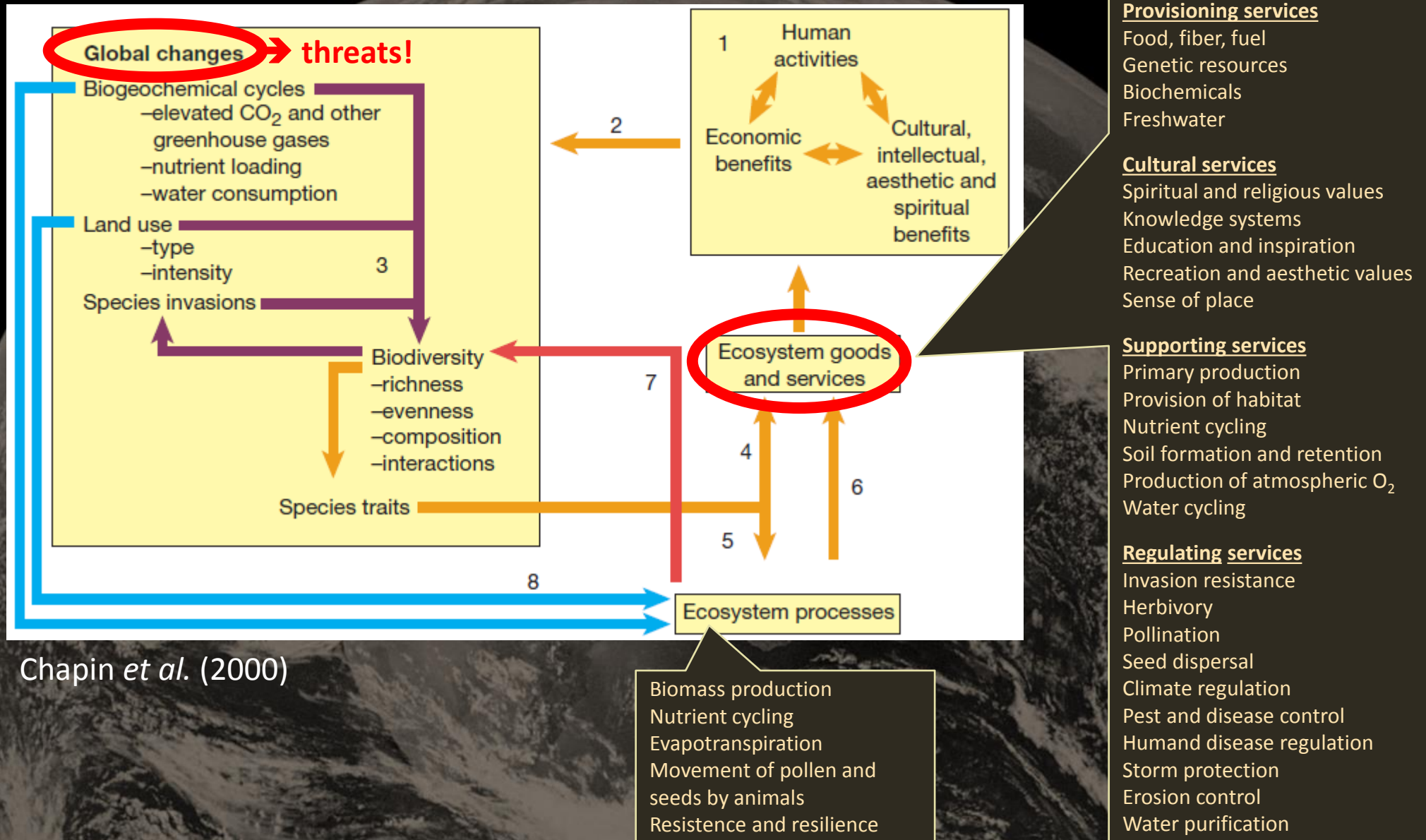


# *1. Introduction*





# Global context

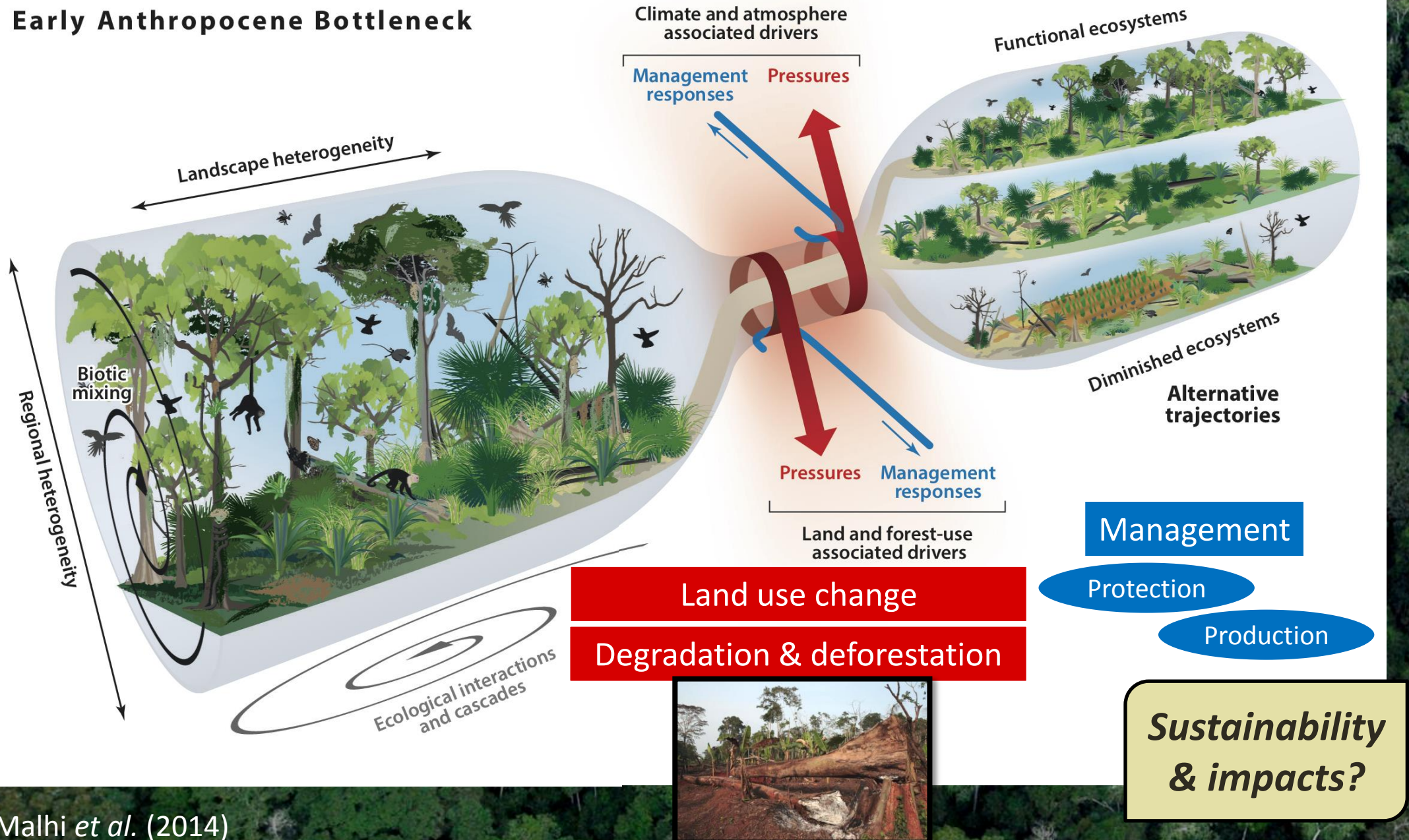


Chapin *et al.* (2000)

Diaz *et al.* (2005)

# Tropical forests

## Early Anthropocene Bottleneck



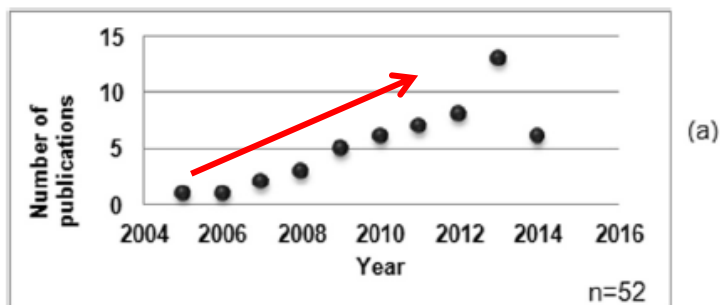


# What is the value of ecosystem services (ES) in tropical forests?

6 800 000 000 000 \$/an (Costanza *et al.*, 2014)



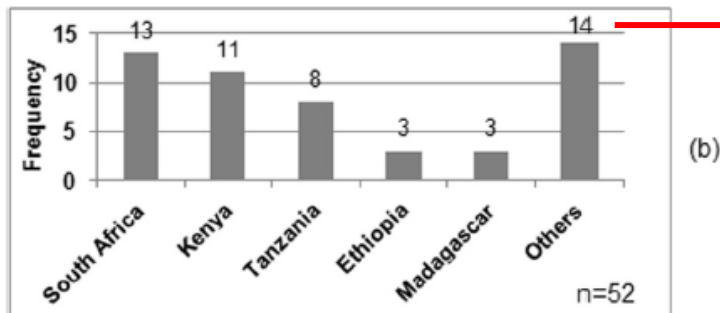
## What about ecosystem services in Africa?



(a)

52 studies

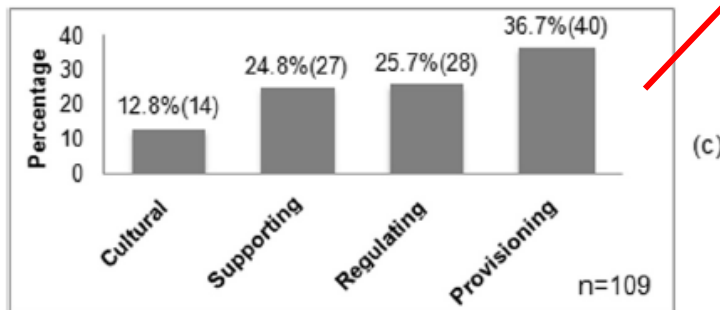
Review Article  
A review of studies on ecosystem services in Africa  
Peter Waweru Wangai<sup>a,b,\*</sup>, Benjamin Burkhard<sup>a,c</sup>, Felix Müller<sup>a</sup>



(b)

But only 2 in Central Africa!

Mainly **provisioning** services  
Much less **cultural** services



(c)

- ES **tradeoffs** and **synergies** are barely addressed
- **Economic valuation & ES mapping** = more than ¾ of the studies

- Urgent need to :
  - Extend ES studies in **other African countries** (capture spatial and socio-economic uniqueness!)
  - Focus more on **local-scale assessments of multiple ES** (address ES tradeoffs and synergies!)

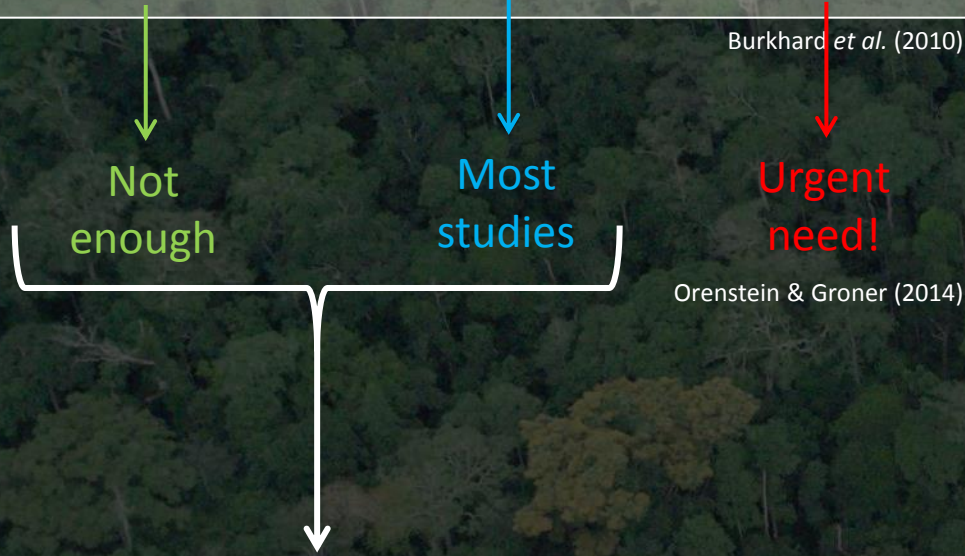
Figure 2. (a) The development of ES studies in Africa between 2005 and July 2014, (b) the distribution of ES studies in African countries, and (c) the percentage and number of ES represented in each category.



# Research needs in ES assessment?

## Integrative approach:

**Ecological + Economic + Social**



## Some faults & limitations:

- Commodification of nature
- No ethical dimension of nature & biodiversity
- No consideration of the human dimension

Knights et al. (2013), Turnhout et al. (2013), Kosoy & Corbera (2010), Luck et al. (2012)

« To assess ecosystem services in a particular region, we have to work our way backwards from society and its specific needs to ecosystem processes – and not vice versa, as scientists mostly do » (Jax, 2010)

Some studies in developed countries  
Fewer studies in developing countries, particularly in Central Africa!

## Social approaches to ES assessment:

- 1) Research methods from social sciences
- 2) Valuation of ES in non-monetary terms
- 3) Explicitly make stakeholders the focal point of the research

## Some advantages:

- + Valuation of cultural services
- + Understanding complex socio-ecological systems
- + Assuring social relevance of the ES assessment
- + Strengthening the policy relevance of ES assessments



# Objectives

Understand the perceptions of forest stakeholders concerning the ecosystem services provided to the local populations in southeastern Cameroonian forests



- (i) What are the general synergies and tradeoffs between ES perceptions?
- (ii) Does the forest management type have an impact on the perceptions of ES supply?
- (iii) Are there any specific influence of socio-demographic factors on the perceptions of ES?



## *2. Material & Methods*

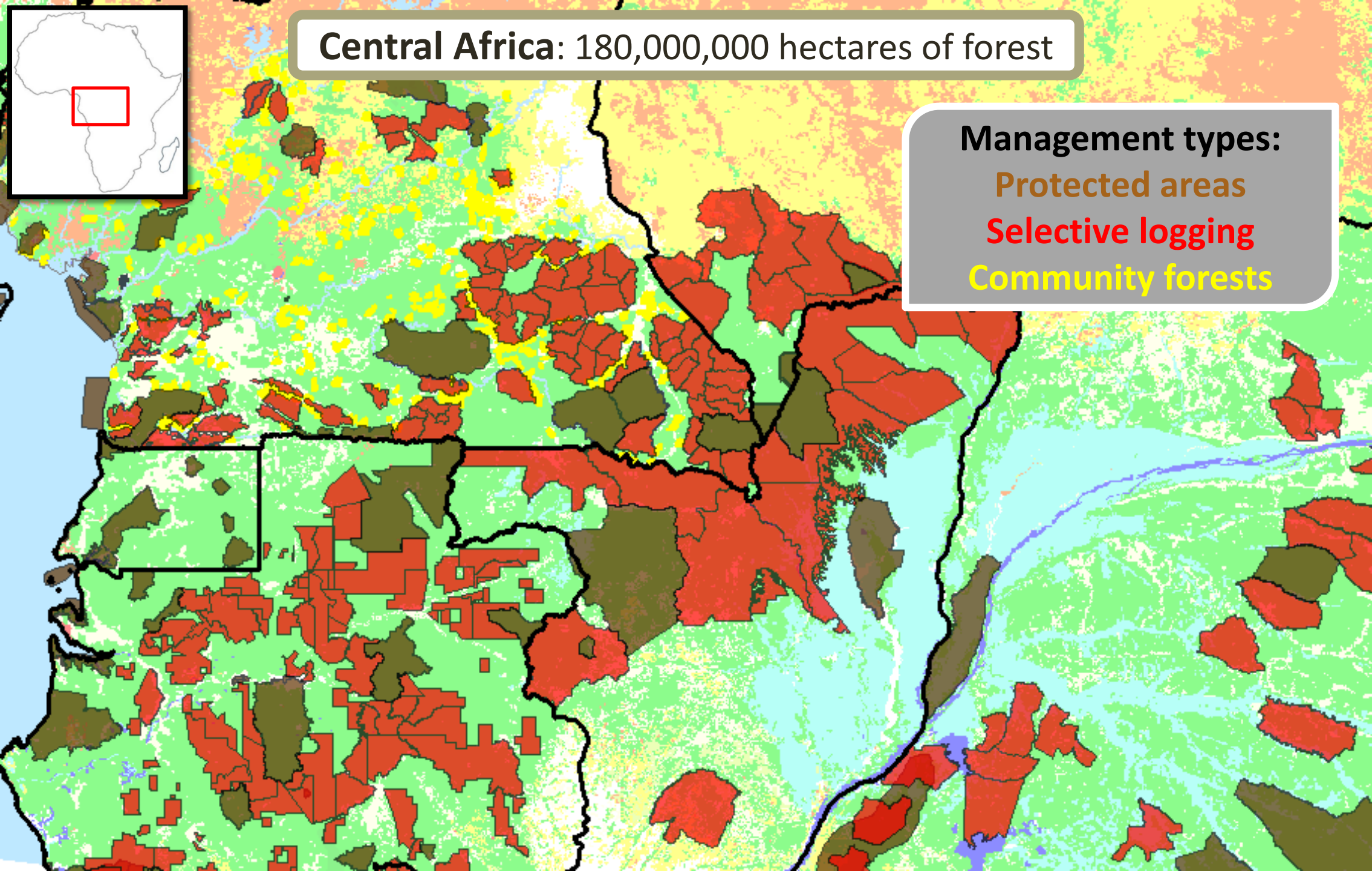
A blue rectangular sign with white text is mounted on a rusty metal pillar. The sign reads "JE ME CONCENTRE ET JE TRAVAILLE EN SECURITE". The background consists of a brick wall and a dark interior space with a light fixture visible on the left.

**JE ME CONCENTRE  
ET JE TRAVAILLE  
EN SECURITE**



**Central Africa: 180,000,000 hectares of forest**

**Management types:**  
Protected areas  
Selective logging  
Community forests





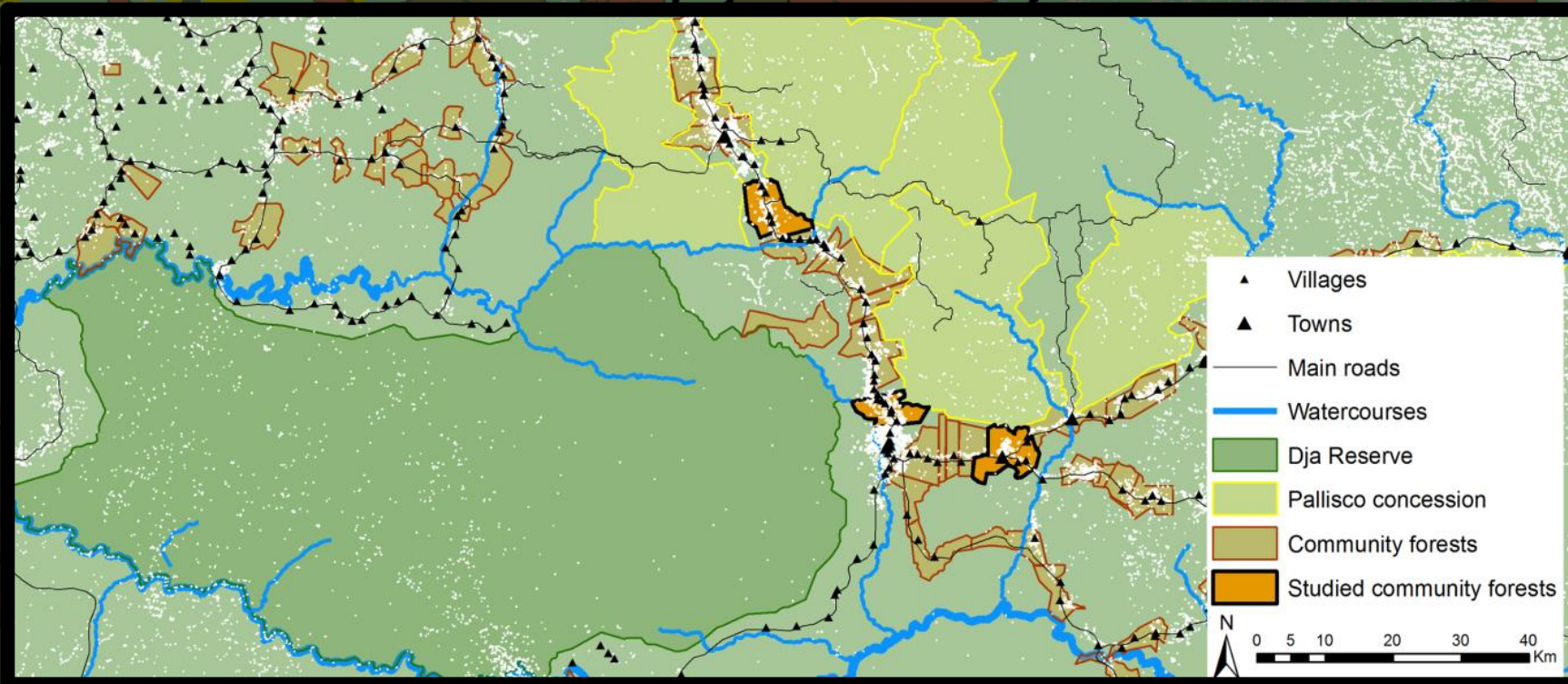
# Central Africa: 180,000,000 hectares of forest

## Local populations:

Bantu and Baka Pygmies

Widely dependent on forest for their daily activities  
(hunting, fishing, gathering of forest products, extensive agriculture)

Different management types with  
different customary rights for rural  
populations





# Interview methodology

- 225 individual interviews of forest stakeholders + 7 experts
- Perceptions of ES provided to local populations
- Stratified sampling approach:  
75 interviews in each management types, in a total of 23 locations
- Social parameters:

		Forest management types			
		<i>Dja Reserve</i>	<i>Pallisco concession</i>	<i>Community forests</i>	<i>Total</i>
<b>Gender</b>		21% ♀ 79% ♂	21% ♀ 79% ♂	24% ♀ 76% ♂	22% ♀ 78% ♂
<b>Age: median [minimum - maximum]</b>		48 [20 - 79]	40 [18 - 62]	49 [15 - 75]	42 [15 - 79]
<b>Ethnic groups (%)</b>	<i>Local Bantus</i>	83	25	85	64
	<i>Local Bakas</i>	3	12	5	7
	<i>Other Cameroonians</i>	15	49	9	24
	<i>Expatriates</i>	0	13	0	4
<b>Jobs (%)</b>	<i>Farmers</i>	28	52	52	44
	<i>Managers</i>	29	5	23	19
	<i>Workers</i>	31	9	3	14
	<i>Officials</i>	4	8	8	7
	<i>Teachers</i>	0	9	7	5
	<i>Others</i>	8	15	9	11



# Questionnaire structure

1

General open question (awareness of ES):

*“What are the usefulness and interest of this forest for you?”*

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2

Perceptions of 18 particular ES, with numerical values & short justifications:

- 0 = *“The service is not provided”*
- 1 = *“The service is provided in an intermediate way”*
- 2 = *“The service is clearly provided”*

<b>Provisioning ES</b>	Meat (hunting)
	Fish (fishing)
	NTFP
	Traditional medicine
	Construction wood
	Fuelwood

<b>Regulating &amp; supporting ES</b>	Biodiversity
	Pollination (fruits)
	Climate
	Water quality
	Air quality
	Soil quality
	Protection against disturbances

<b>Cultural ES</b>	Heritage
	Rituals, customs, traditions
	Recreation
	Education
	Tourism



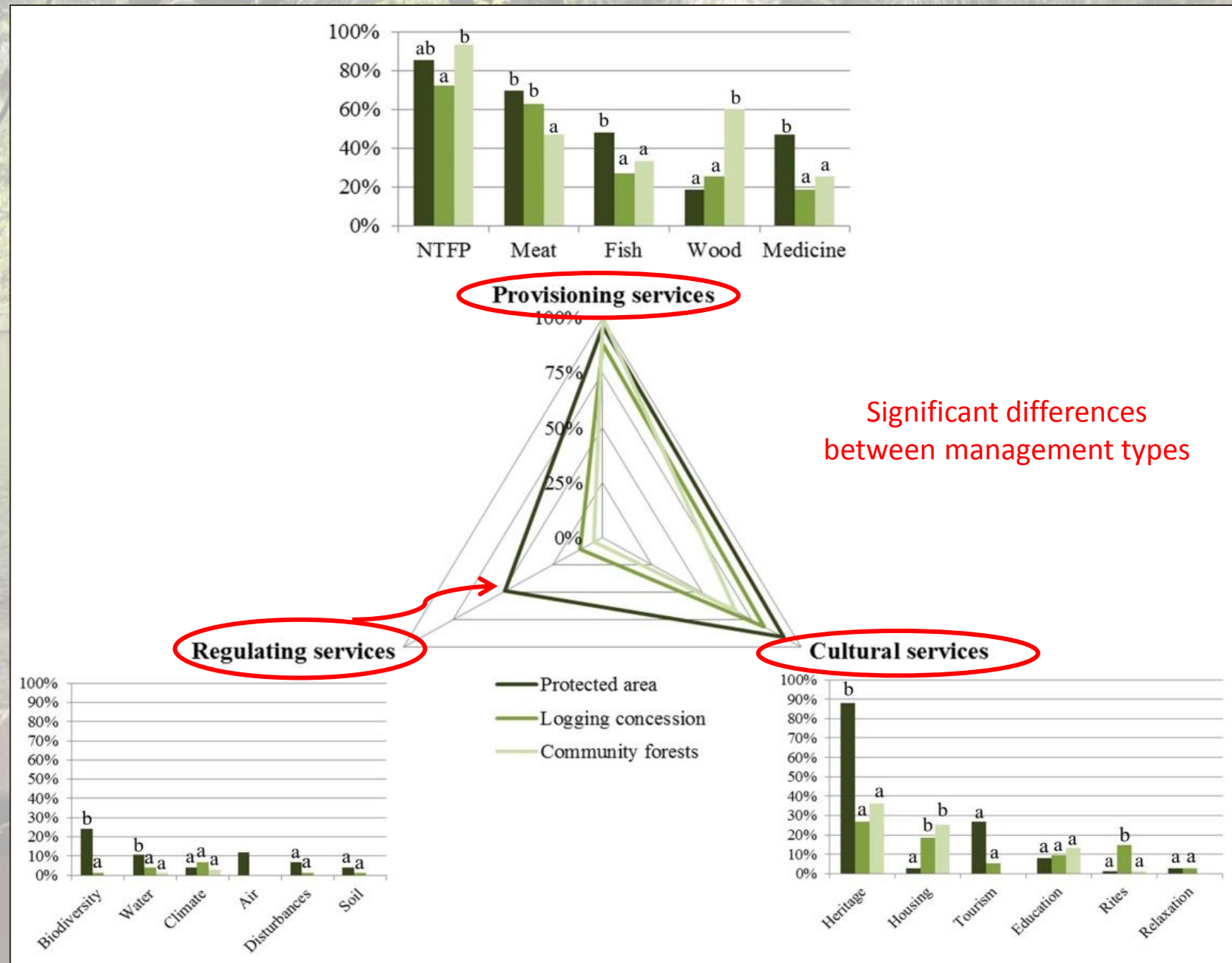
# *3. Results & Discussion*





# ① Awareness of ecosystem services (binary values)

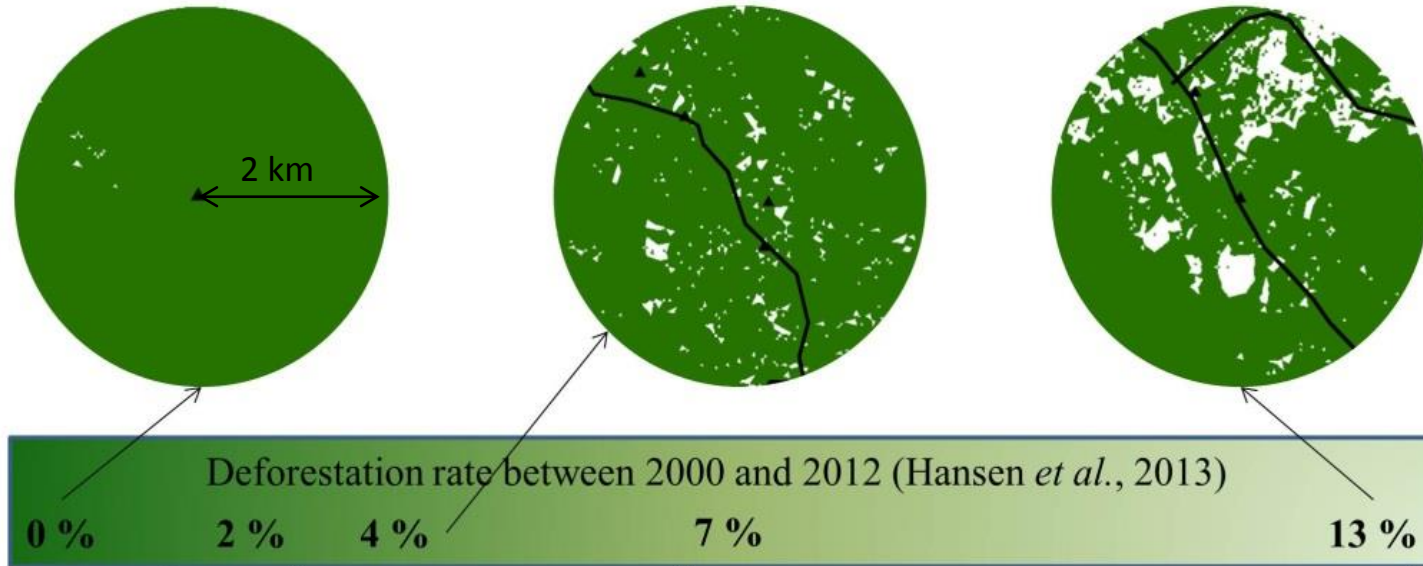
Qualitative answers to the open question were coded in binary values for each ES



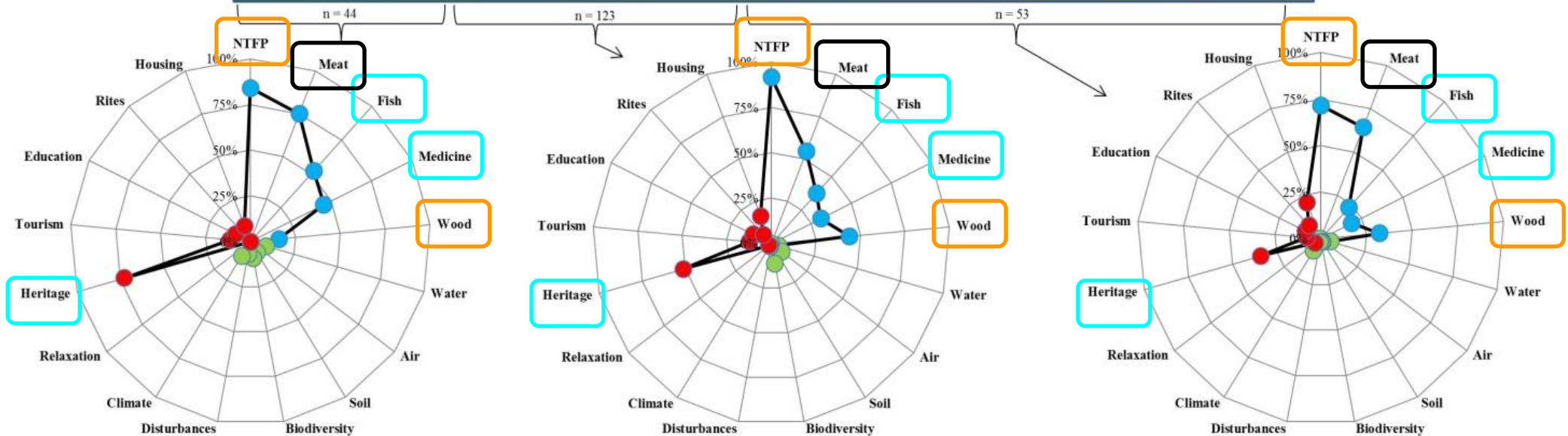


# ① Awareness of ecosystem services (binary values)

↳ In relation to the deforestation rate



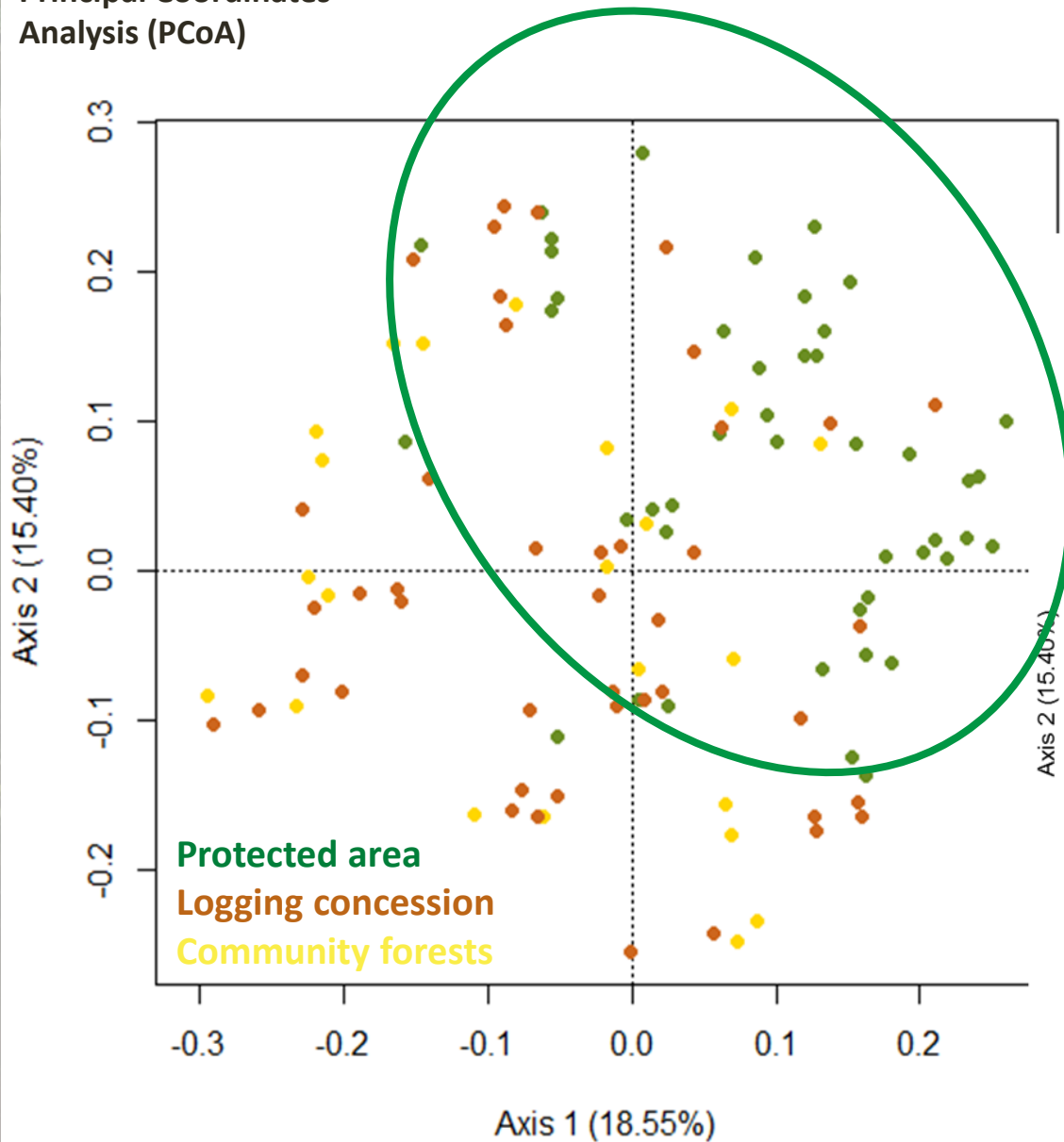
**But only 3 classes...**





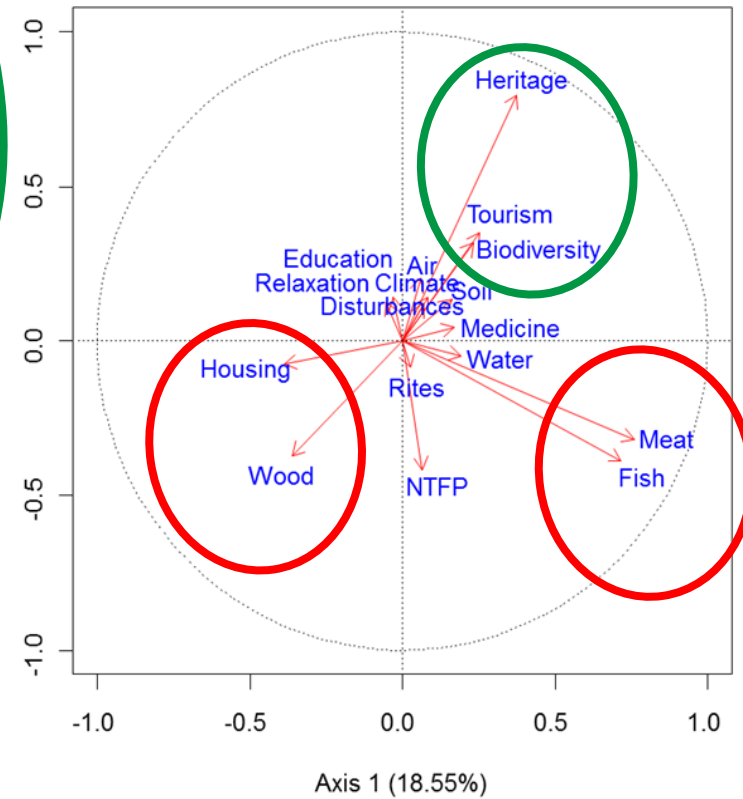
# ① Awareness of ecosystem services (binary values)

Principal Coordinates  
Analysis (PCoA)



No particular pattern as an influence of social variables (gender, job, and ethnic group)

Correlation circle

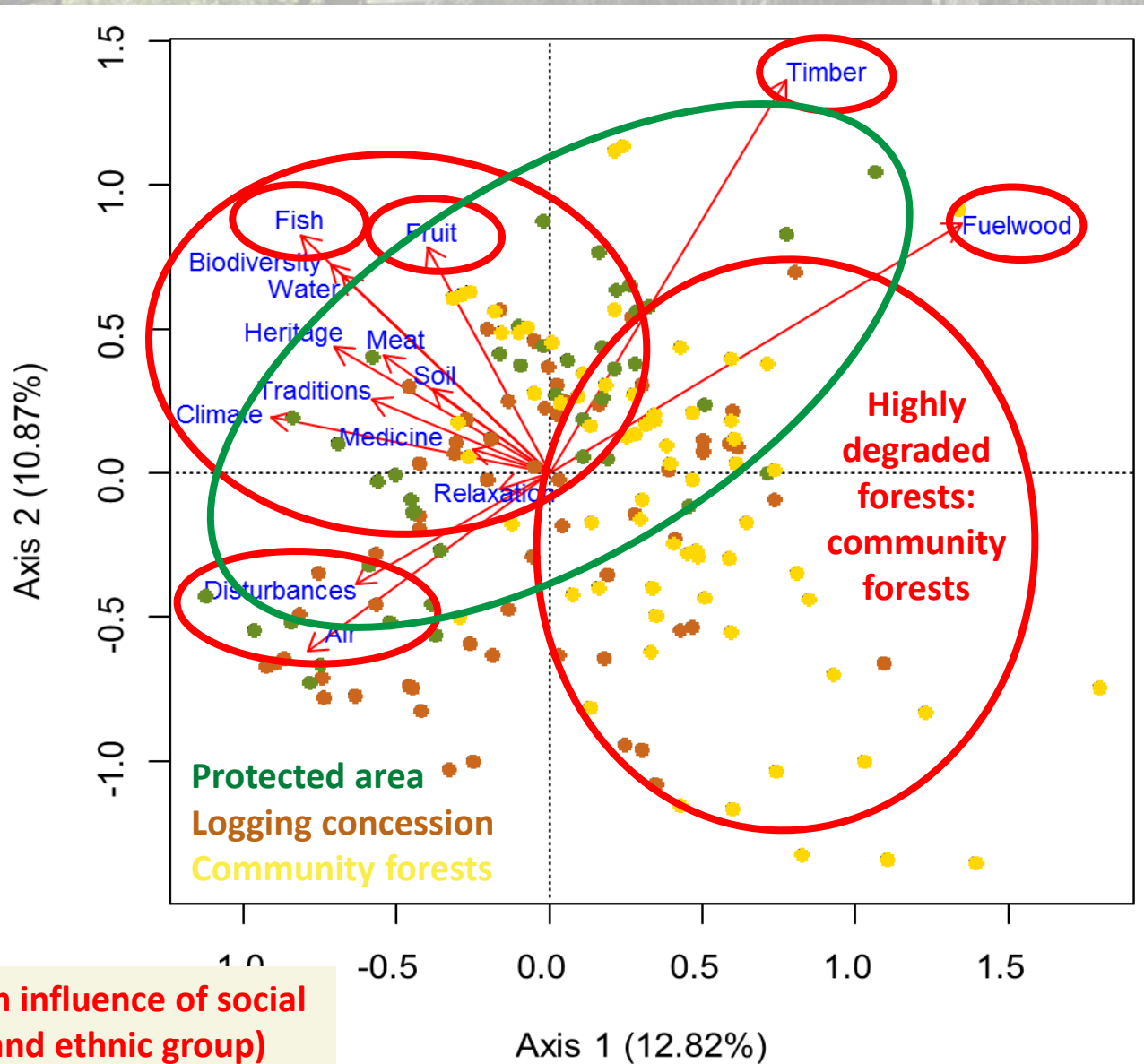




## ② Perceptions of ecosystem services

### a) Quantitative perceptions (values 0/1/2):

Principal  
Components  
Analysis (PCA)



No particular pattern as an influence of social variables (gender, job, and ethnic group)



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Provisioning services

#### *Non-Timber Forest Products:*

Most mentioned alimentary NTFP	Number of mentions
<i>Baillonella toxisperma</i> Pierre	150
<i>Irvingia gabonensis</i> Baillon	149
<i>Pentaclethra macrophylla</i> Benth.	89
<i>Ricinodendron heudelotii</i> (Baillon) Pax	85
<i>Afrostryax lepidophyllus</i> (Harms) Mildbr.	59
<i>Gnetum africanum</i> Welw.	40
Mushrooms	21
<i>Garcinia kola</i> Heckel	21
<i>Trichoscypha</i> spp.	16
Honey	12

#### Logging concession :

- Use rights to collect small quantities
- Barks remedies in the logyards
- Mapping of important standing trees in concertation with local populations before logging

- Mainly alimentary NTFP, raw materials (lianas, mats, rattans, raffia palms), and traditional medicine (barks, leafs, fruits, roots, honey)
- Natural production is highly variable between seasons and years
- Self-consumption + sales
- The majority of tree species are considered as suitable with the demand, but the supply is much more reduced since the past for some of them (*Baillonella toxisperma*)
- Traditional medicine is largely preferred to health centres: against flu, malaria, yellow fever, typhoid



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Provisioning services

##### *Bushmeat:*

##### **Logging concession :**

- Hunting is forbidden for main species
- Anti-poaching actions
- Awareness-raising measures
- Systematic controls and strict regulations at road barriers
- Small grocery with alternative proteins (fish, chicken, pork)

##### **Protected area:**

- Hunting is forbidden
- The Nature Protection Service is actively involved in the repression and sensitization
- Poaching is a real threat, especially for emblematic species such as the forest elephant or the giant pangolin
- Need of external fundings to struggle against unemployment

- Essential for the diet of hunters-gatherers with a cultural heritage completely depending on forest resources
- Illegal hunting practices are prevalent
- Traditional hunting for self-consumption VS poaching for sales at a larger scale
- Animals are clearly rarer than before, particularly in the community forests (noises, logging, hunting)
- Small-scale breeding and fish farming = alternatives for the future?



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Provisioning services

##### *Fish:*

##### Logging concession :

- Fishing is not forbidden

##### Protected area:

- Fishing is more culturally widespread

##### Community forests:

- Fishing can be seen as an alternative to wood production where the logging activities have been stopped due to administrative complications

- Fishing yields are highly variable between seasons
- Only a few people bring back fish from large rivers to the villages to sell it
- Only artisanal fishing techniques → fish stocks remain sufficient for local consumption
- Some people use forbidden harmful products to kill fishes in order to facilitate the fishing process



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Provisioning services

##### **Wood:**

##### **Logging concession :**

- A part of the sawmill waste are freely provided to the workers and their family
- Bringing wood back from the field work is now forbidden
- Neighbouring populations can buy timber lots to the logging company but do not have any particular privileges
- Timber is mainly exported abroad (85-90%) and in a small way to the national market
- Houses in the camp and some public buildings (schools and health centres) in the neighbouring villages were built by the logging company

##### **Community forests:**

- Artisanal logging is the rule
- Sometimes have the necessary equipment to process sawn timber (chainsaws, lucas mill)
- All local populations use fuelwood to cook, and no gas or oil at all
- Fuelwood: surroundings of villages (agricultural fields, fallow lands)
- Timber (construction wood) can be bought in some villages with appropriate material, in logging companies or in larger towns



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Regulating services

#### *Biodiversity:*

**Protected area > Logging concession > Community forests**

#### **Protected area:**

- Increasing human pressure implies strengthened conservation actions
- Higher financial support is essential from the international community
- The vegetation is nearly intact considering that logging activities have never been conducted

#### **Logging concession :**

- Forest stands are still relatively undisturbed thanks to a selective logging system & reforestation after logging in some areas
- Numerous strict rules (FSC certification, national and international standards, management plans)
- Forest fragmentation (roads network) & logging activities could be a driver of biodiversity decline

#### **Community forests:**

- Both wildlife and tree species richness are considered as clearly lower than in the past (increasing human pressure)
- Exploitation > reconstitution



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Regulating services

##### **Water quality:**

Water in forest

VS

Water from wells and drillings in villages ?

##### Better quality in forests:

- Better colour, taste, absence of any diseases
- No pollution in the forest >< human waste, laundry, fuel and other damaging products in the vicinity of villages

##### Lower quality in forests:

- Water is not treated as in villages
- No one knows what happened upstream (animal faeces, rotten animal or trees, harmful products for fishing, etc.)

→ Water quality is not inherently linked to the forest or the village. It depends on local pressure, river types, seasons, circulating water from a source or stagnant water, and potential impacts of upstream elements.

##### **Logging concession :**

Are the logging operations impacting the water quality in forests rivers?

→ Extremely strict rules (FSC certification) → careful preservation of abiotic resources:

- No logging activities nearer than 30 meters to the river banks (integral protection)
- Absolutely no material can fall down in a river while the construction of a bridge
- Swamp areas have to be preserved
- Any source of pollution has to be prevented



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Regulating services

##### *Climate and air regulation, protection against natural hazards:*

- The forest is really important in the regulation of the local and global climate
- There is a current climate change, mainly caused by deforestation (itself caused by logging, agricultural and mining activities):
  - Seasons are more unstable
  - Temperatures rise
  - Pluviometry decreases
  - Potential impacts on crops, such as cocoa
- Local climate around large cities of the country has radically changed since deforestation
- Ecological roles of the forest in natural cycles were identified:
  - Carbon, nitrogen and phosphorus cycle
  - Photosynthesis and respiration mechanisms
- Ecological filter limiting the atmospheric pollution and improving the air quality (dirt filtration, absorption of toxic gases and vapour, provision of oxygen)
- Really important protection against natural hazards: flooding, drought, bush fire, soil erosion, strong winds, storms, spread of diseases >< some tree species create some hazards (e.g. harmful insects)

**« You do not realise what you have until you lose it »:**

Only 9 respondents did not believe in the role of the forest in climate regulation. They live in the zone which is the less deforested of the whole study area.



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Regulating services

##### *Soil quality:*

- Fertility: forest soils are better than elsewhere
- But additional labour is necessary to advantage of this upper fertility
- The best crops can grow with high yields after the cutting of an old forest stand: plantain, cocoa

##### **Logging concession :**

Are the logging operations impacting the soil quality?

- ➔ Extremely strict rules (FSC certification)
- ➔ Impacts of logging operations are not seen as highly damaging on soil quality
- ➔ Only tracks and logyards can cause compaction effects  
= marginal surface compared to the whole forest concession



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Cultural services

##### *Heritage:*

- Both intrinsic value and utilitarian value
- Symbolic and emotional value, rich cultural heritage
- Precious heritage from the ancestors: necessary to conserve and sustain over generations!

*« We are nothing without the forest! »*

##### **Protected area:**

- Dja Biosphere is part of the UNESCO World Heritage
- Local populations are well aware that the Reserve is part of the international heritage
  - ➔ The international community has to bring financial support to uphold it, as the entire world receives the benefits of this global heritage!
- Many tourists and researchers = proof of this internationally recognized heritage value
- Local populations do not understand why they would be the only ones to take care about the protected area, while they are under poverty conditions



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Cultural services

##### *Tourism:*

##### **Logging concession :**

- No tourism, but high potential (with some constraints)

##### **Protected area:**

- Some tourists, but the flow is greatly reduced since the attacks of Boko Haram in the north (2014)
- +- 40 tourists in 2016, and more than 200/year before Boko Haram
- Project in development with the African Wildlife Foundation

##### **Community forests:**

- No tourism, but high potential mentioned in the management plans
- Implementation is much more complicated and needs investment capital



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Cultural services

##### **Education:**

- Overall concensus on the importance of environmental education!
- Numerous scientific research projects in Cameroonian forests
- At school:
  - Teaching programme about the protection of the environment
  - Deforestation, reforestation, climate change, endangered animals
  - A large proportion of respondents are not aware of the sensitization of children at school
- At home:
  - Baka Pygmies: how to find and use forest products
  - Mindful parents: avoid squandering of bushmeat and other forest resources
  - Rarely seen in practice, mainly due to poverty constraints...

##### **Protected area:**

- Nature Conservation Service: awareness raising
- ECO-CLUB project: educational activities

##### **Logging concession :**

- Raising population awareness about sustainable exploitation practices: workers, villages, schools

##### **Community forests:**

- Local NGOs involved in local development projects



## ② Perceptions of ecosystem services

### b) Qualitative perceptions (justifications):

#### Cultural services

##### *Relaxation and recreation:*

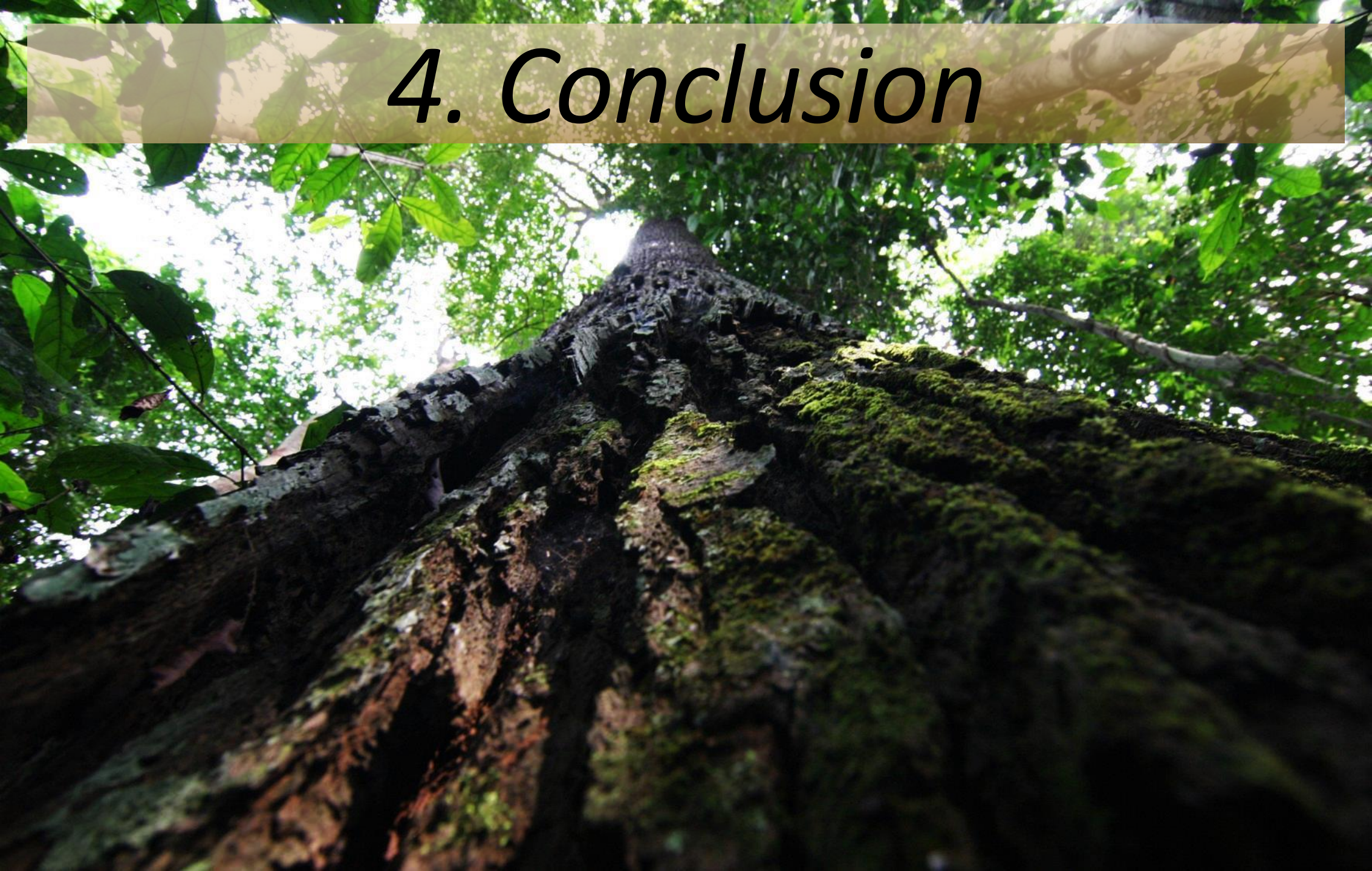
##### 3 different profiles:

- 1) **« This is a real constraint to go inside the forest »:**  
Fear of animals, utter drudgery to carry any forest products, more comfort and ambiance in the village, preference to go in other cities for their distraction
- 2) **« I never go in the forest only to relax, but it is pleasant to work in »:**  
Gathering of forest products, hunting and fishing to avoid the bustle of the village
- 3) **« I regularly go in the forest just for relaxing »:**  
Observe and discover the nature, avoid stifling heat of the village, enjoy fresh and pure air and to stroll as a sport activity

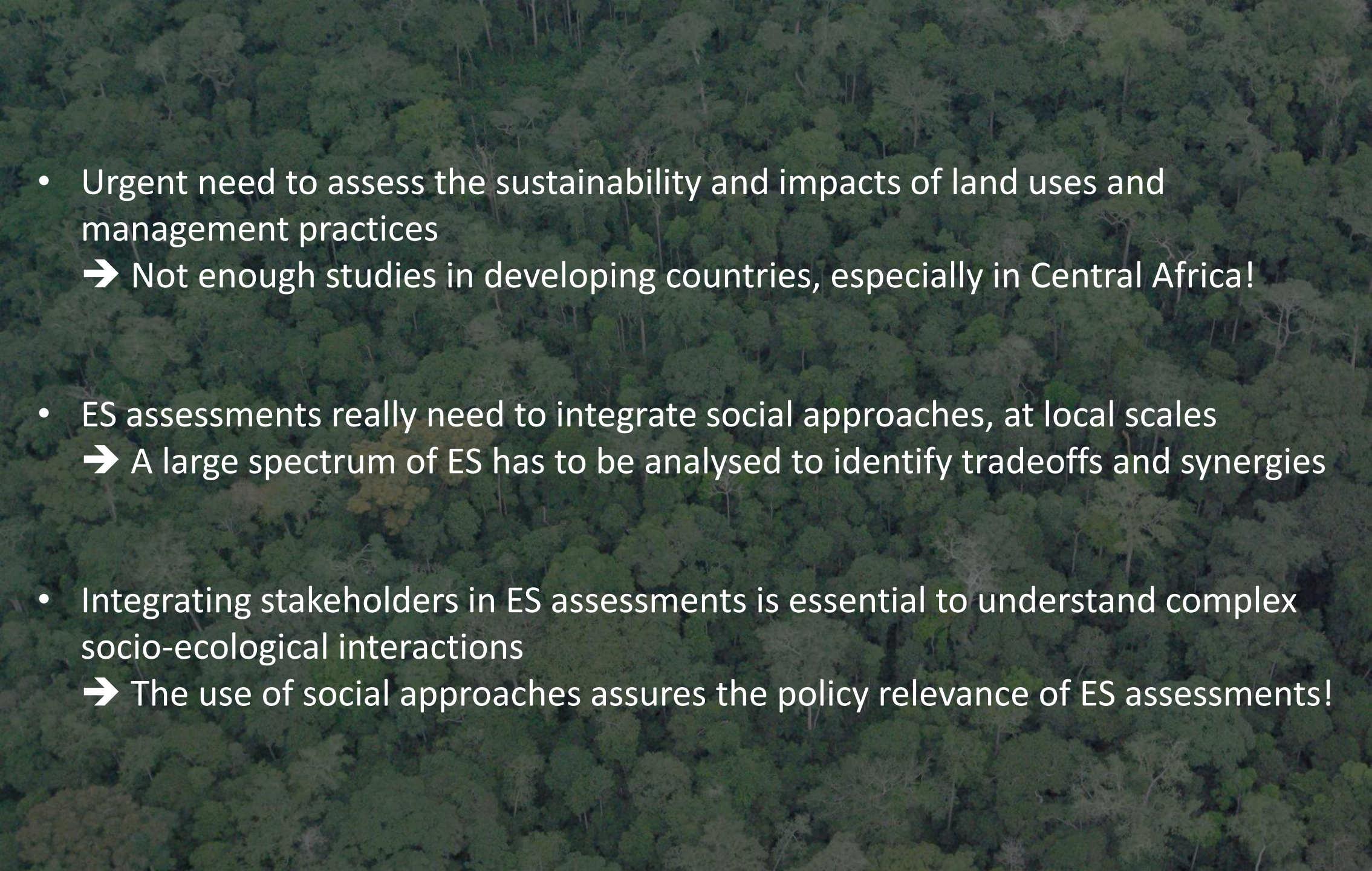
➔ Marked dualism: utilitarian use only VS relaxing



# 4. *Conclusion*





- 
- Urgent need to assess the sustainability and impacts of land uses and management practices
    - ➔ Not enough studies in developing countries, especially in Central Africa!
  - ES assessments really need to integrate social approaches, at local scales
    - ➔ A large spectrum of ES has to be analysed to identify tradeoffs and synergies
  - Integrating stakeholders in ES assessments is essential to understand complex socio-ecological interactions
    - ➔ The use of social approaches assures the policy relevance of ES assessments!





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**Thanks for your attention,  
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