Carbon and land cover change in Central Africa : where are we?

Robert Nasi
Center for International Forest Research

Brazzaville, 02 février 2010

Outline

- Information needed
- Available or missing?
- Errors and uncertainties
- Where we are...:
  - Land cover
  - Carbon stocks
  - Land use changes

Information needed

- Carbon pools: soil, dead organic matter, aboveground and belowground biomass
- Land cover and related carbon stocks
- Land use changes and related carbon losses

Available or missing?

- Available:
  - Land cover and land use changes
  - Generic allometric equation for aboveground biomass
- Missing:
  - Agreed vegetation typology
  - Soil and belowground carbon
  - Dead organic matter
  - Specific allometric equations for the region

Errors and uncertainties

	Source of error / uncertainty	Error (of mean, in %)	Parameter

Building a biomass equation	• irregularly shaped and hollow trees
	  ○ if dbh>50cm
	  ○ if dbh >5cm
	• measure of trees (dbh, H, density)
	  ○ if dbh >10cm
	  ○ if dbh <10cm
	• sampling error (5, 100, 300 trees)
	• allometry error
	  ○ if dbh >10cm
	  ○ if dbh <10cm
		+30
		+11
		±17
		±23
		±10, 5, 3
		±31
		±55
			BA stand
			BA stand
			AGB tree
			AGB tree
			AGB stand
			AGB tree
			AGB tree

Estimating biomass using a set of permanent sample plots	• tree-level AGB estimate
	  ○ if dbh >10cm
	  ○ if dbh <10cm
	• allometric model (with/without corrections)
	• PSP size (0.1, 0.25, 1 ha)
	• landscape representativity of set of PSP
		±47
		±78
		±22 to 11
		±16, 10, 5
		±11
			AGB PSP
			AGB PSP
			AGB PSP
			AGB PSP
			AGB landscape

Estimating biomass using an existing forest management inventory	• minimum diameter limits for census
	  ○ 30cm
	  ○ 45cm
		-30
		-55
			VOB FMU
			VOB FMU

So where are we?

Area estimation by forest land cover classes (km²) in Central Africa (1)

Land cover class	Area (km²)	% Sub Region
Closed evergreen lowland forest	1 421 834	35
Submontane forest (900-1500m)	63 100	2
Montane forest (> 1500 m)	9 754	0
Swamp forest	123 264	3
Mangrove	1 926	0
Total humid forest	**1 619 879**	**40**
Mosaic forest/croplands	370 123	9
Mosaic forest/Savannah	588 011	15
Closed deciduous forest	304 808	8
Deciduous woodland	630 890	16
Open deciduous shrub land, sparse trees	301 220	7
Others	233 540	6
TOTAL Sub region (Congo Basin)	**4 048 470**	**100**

Carbon stock estimation in the Congo Basin

Land cover(LC)	Total Carbon (millions tonnes)	% C Total
1. Closed evergreen lowland forests	27 299	59.3
2. Swamp forests	1 761	3.8
3. Sub-mountain forests (900-1500m)	770	1.7
4. Mountain forests (>1500m)	119	0.3
Humid dense Forest (1-4)	**29 949**	**65.1**
Closed deciduous forests	2 791	6.1
Mosaic forest/croplands	3 955	8.6
Mosaic forest/savannas	3 403	7.4
Deciduous woodland	4 149	9.0
Grassland, shrub land, sparse trees	1 770	3.8
Congo basin sub-region (TSR)	**46 016**	**100.0**

Main categories of land uses in Central Africa

- Logging (concessions): 595 380 km²
- Conservation (Protected area): 444 970 km²
- Slash and Burn Agriculture: 438 801 km²

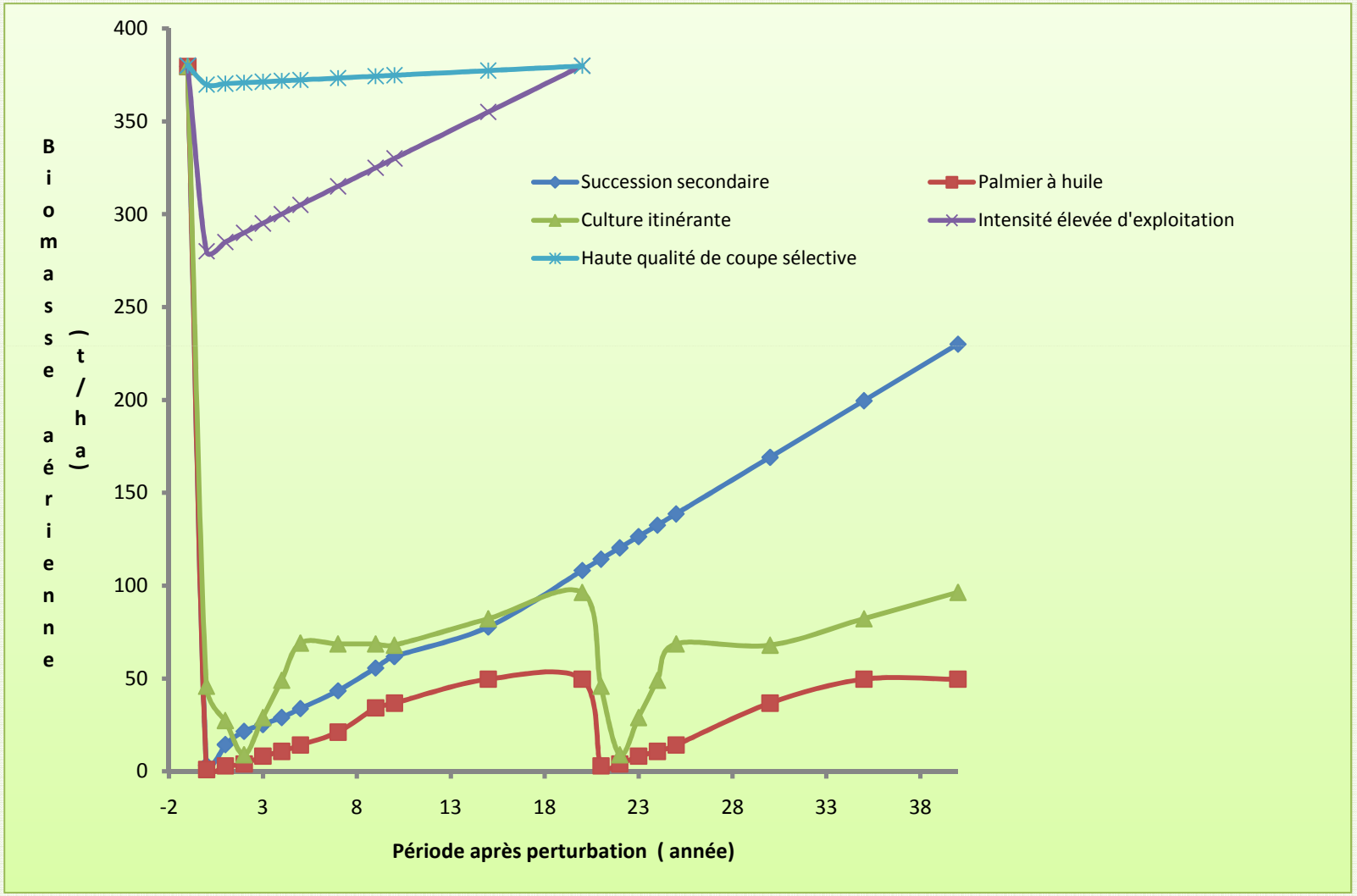
Main land uses changes process in Central Africa

- Deforestation: Conversion of forest land to long-term or permanent non forest uses/stand
  - Anthropogenic origin
  - Canopy cover reduction under certain threshold (ex: 30%)
  - Examples: conversion of forest land to agricultural land, meadows and villages
- Degradation: Carbon stock reduction « Forest land remaining forest land »
  - Phenomenon both quantitative (Carbone) and qualitative (biodiversity)
  - Example: selective logging

Changes between 1990 and 2000 in Central Africa

Pays	Annual Deforestation(%)	Annual net degradation(%)
Cameroun	0,14	0,02
Gabon	0,09	0,07
Congo	0,02	0,01
RCA	0,06	0,02
DRC	0,20	0,12
Central Africa	**0,16**	**0,09**

Impact of land uses changes on above ground biomass



Impacts of land uses changes on the above ground biomass

- Selective logging: stock reconstitution after 25 years
- Secondary succession: biomass > 100 t/ha after 20 years; reconstitution in 100-150 years
- Plantations (oil palm) slash and burn agriculture: definitive lost of 70 to 90% the initial biomass

Thank You

Brazzaville, 02 février 2010