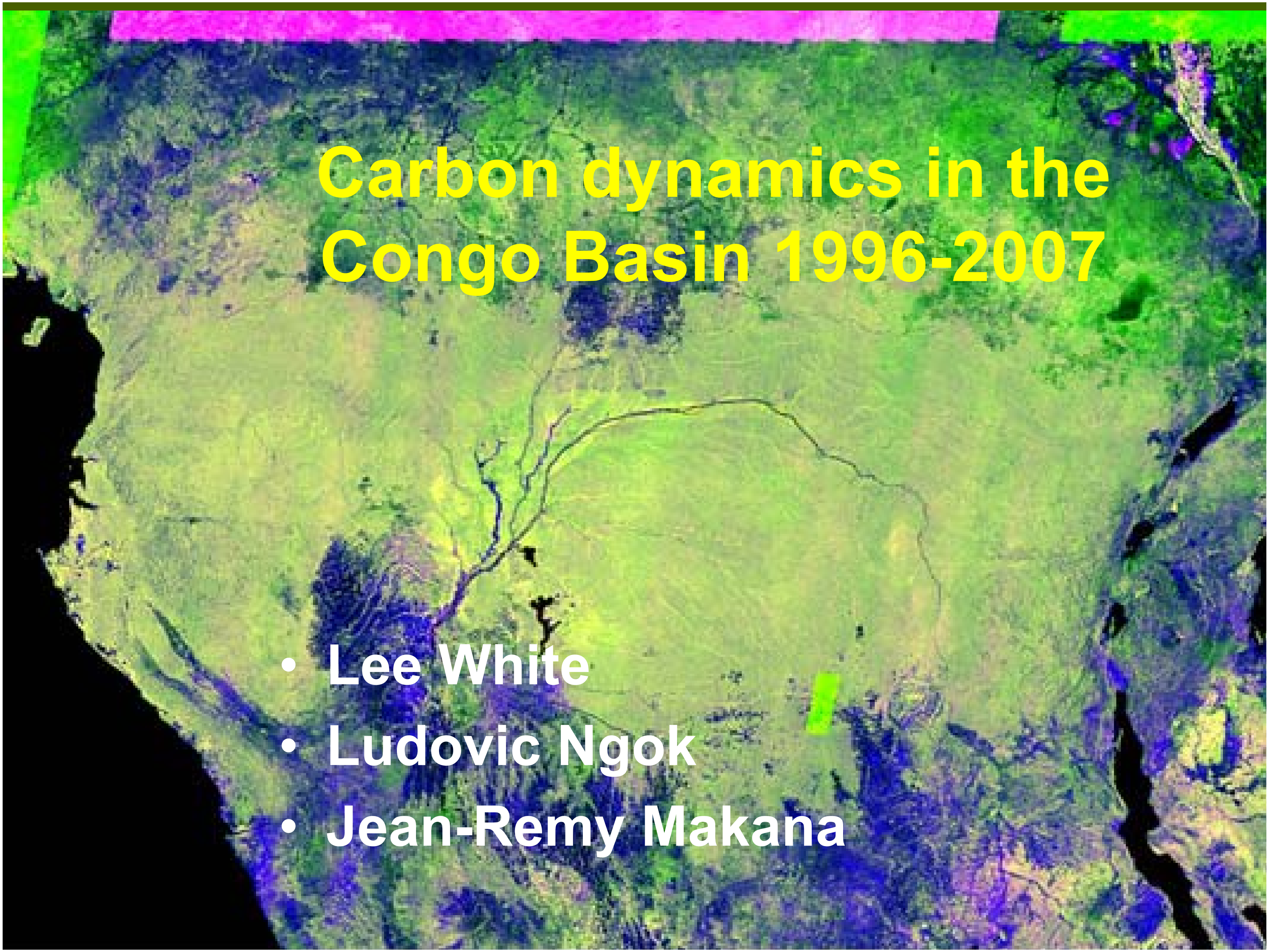
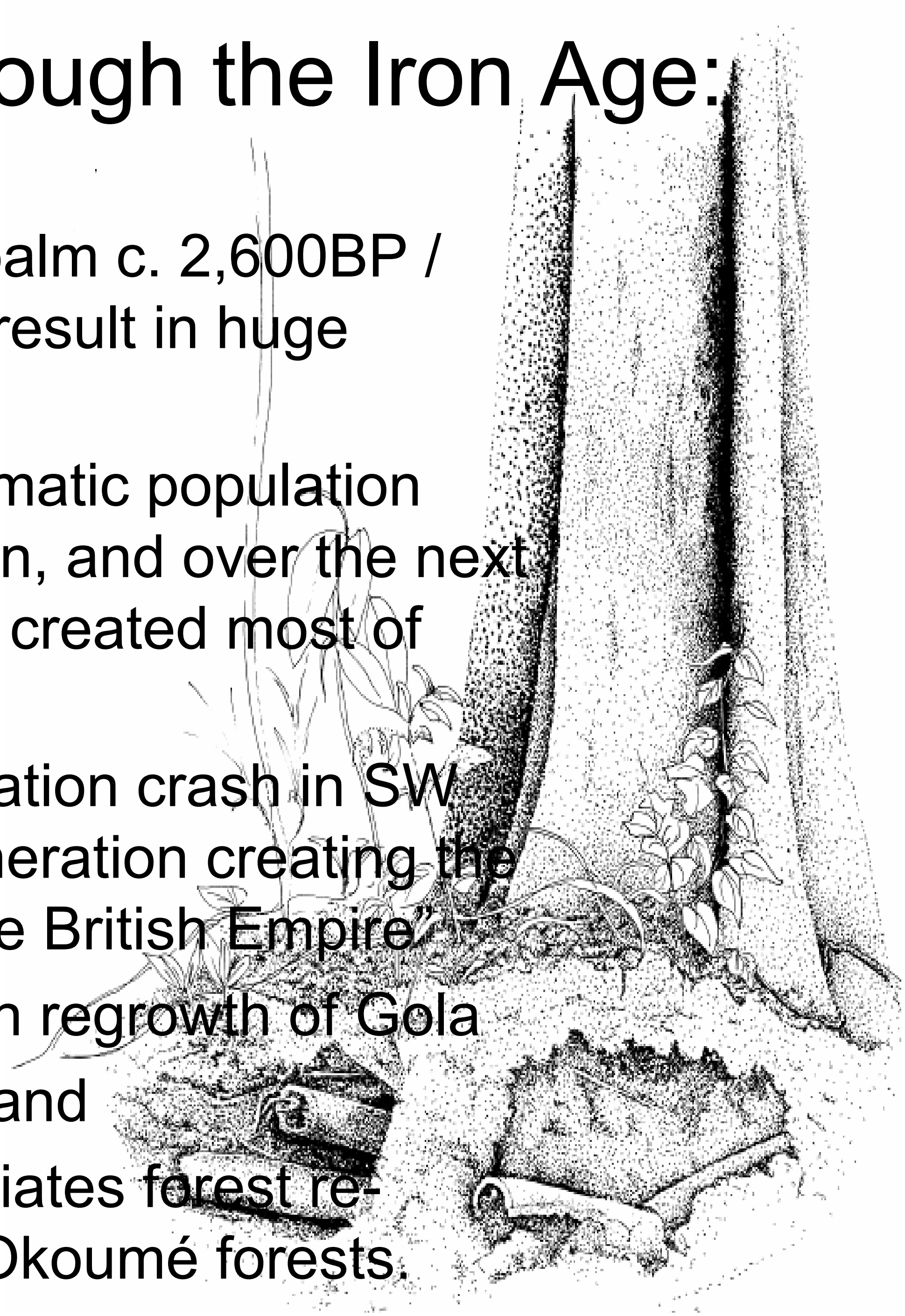


Carbon dynamics in the Congo Basin 1996-2007

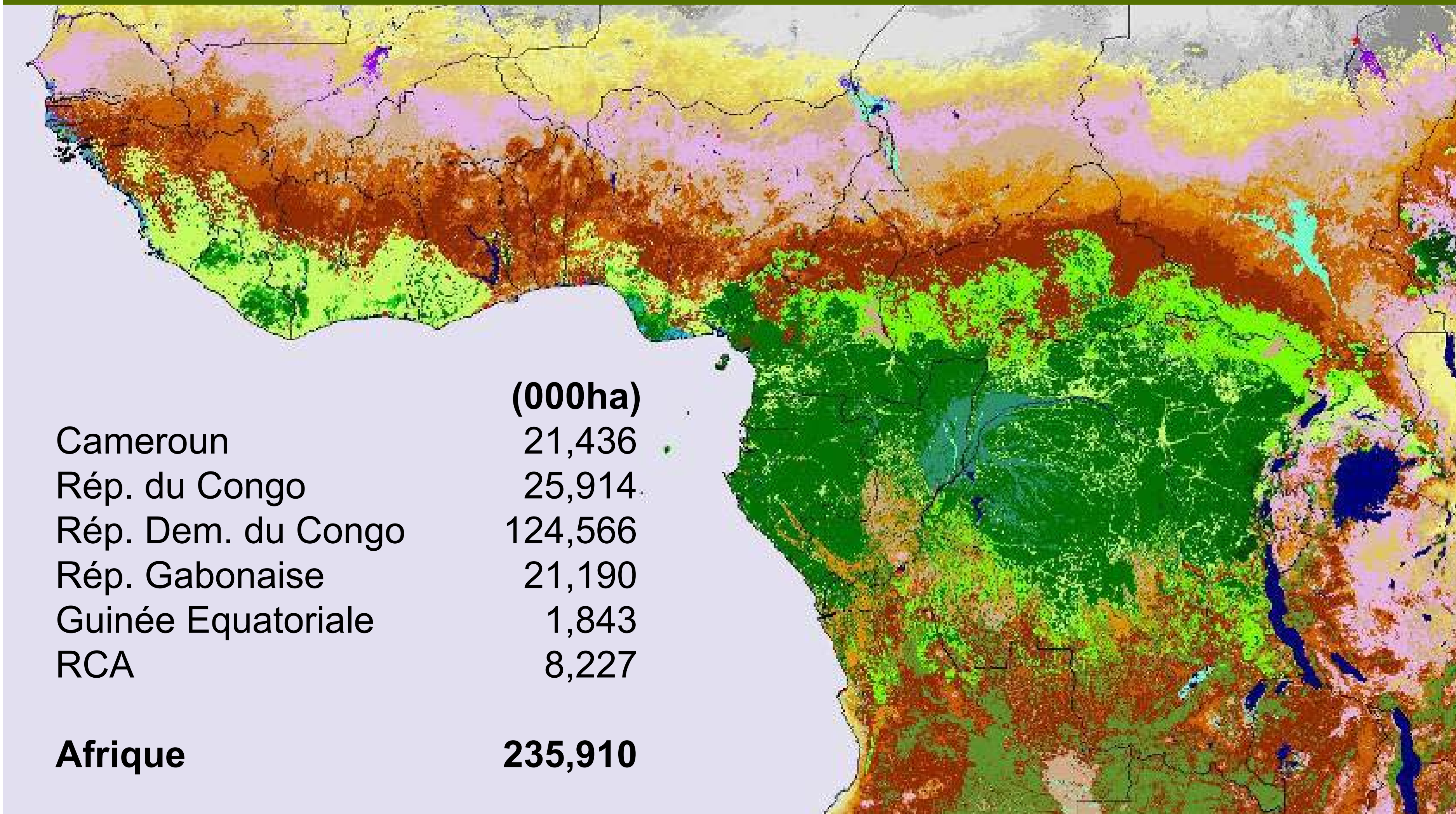
- Lee White
- Ludovic Ngok
- Jean-Remy Makana

Forest change through the Iron Age:



- Arrival of the banana and oil palm c. 2,600BP / development of iron smelting result in huge population growth
- Starting around 550 AD a dramatic population crash affected the entire region, and over the next 5-600 years natural re-growth created most of today's rainforests.
- 1250 - 1300 AD human population crash in SW Nigeria results in forest regeneration creating the "finest mahogany forests in the British Empire"
- c.1850, tribal warfare results in regrowth of Gola
- 1900 – rinderpest (W. Africa) and "regroupement" (C. Africa) initiates forest re-growth – producing Gabon's Okoumé forests.

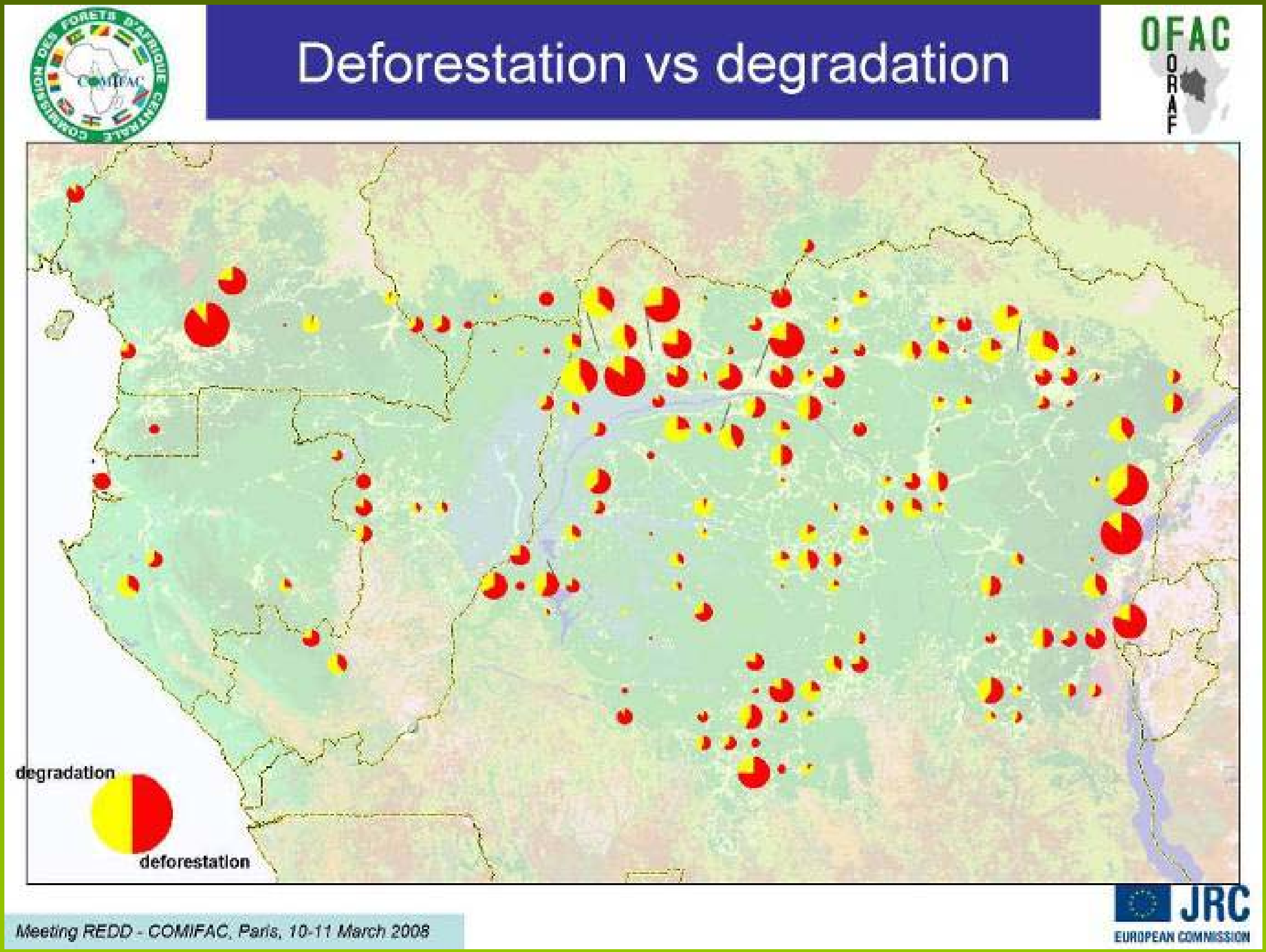
The African rain forests in 2000



	(000ha)
Cameroun	21,436
Rép. du Congo	25,914
Rép. Dem. du Congo	124,566
Rép. Gabonaise	21,190
Guinée Equatoriale	1,843
RCA	8,227
Afrique	**235,910**


Mean Annual $C0_2$ accumulation:
1.8T / ha / year
Some Protected Landscapes ?up
to 14T / ha / year

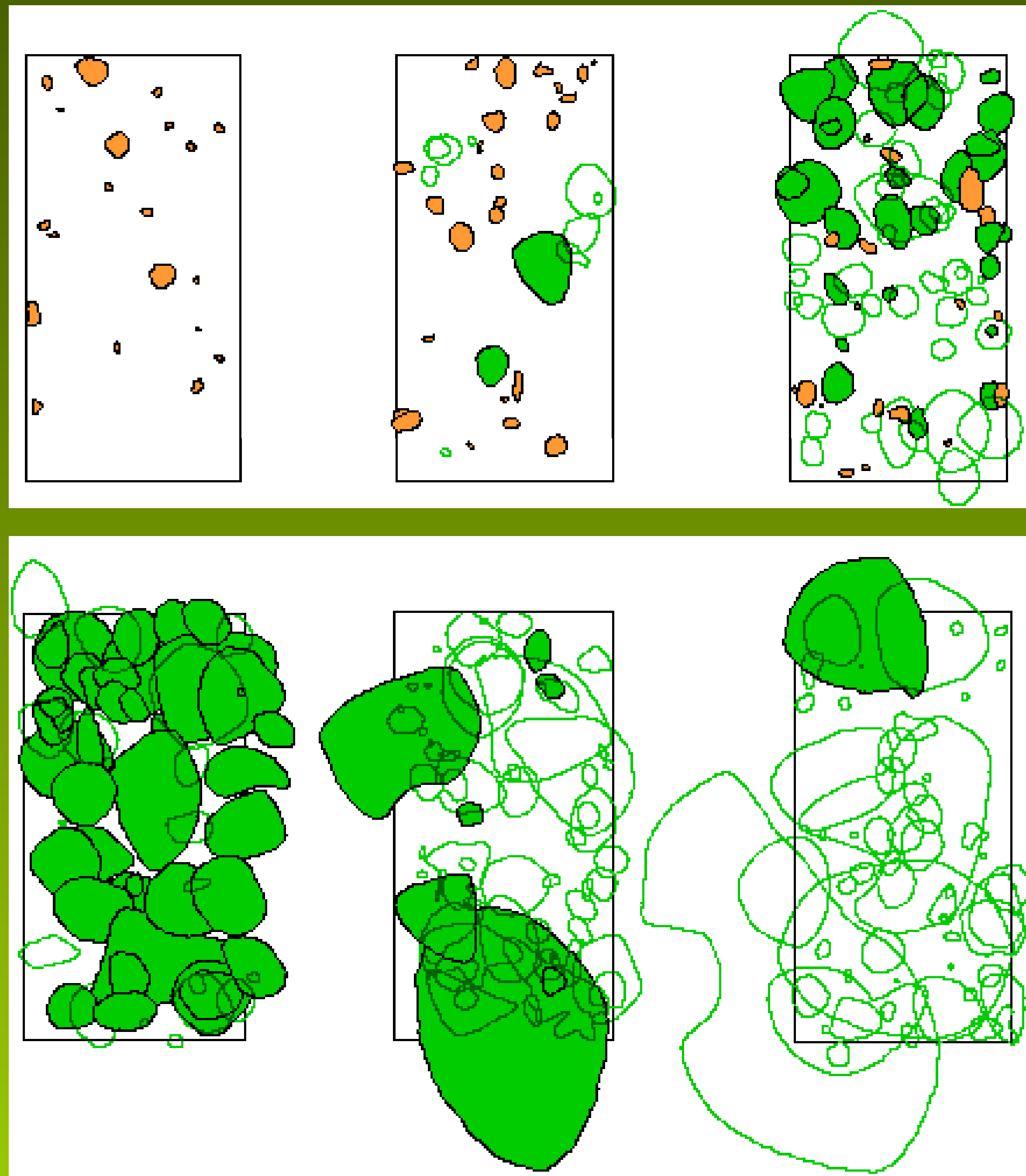
Deforestation in the African rain forests



Savanna colonisation

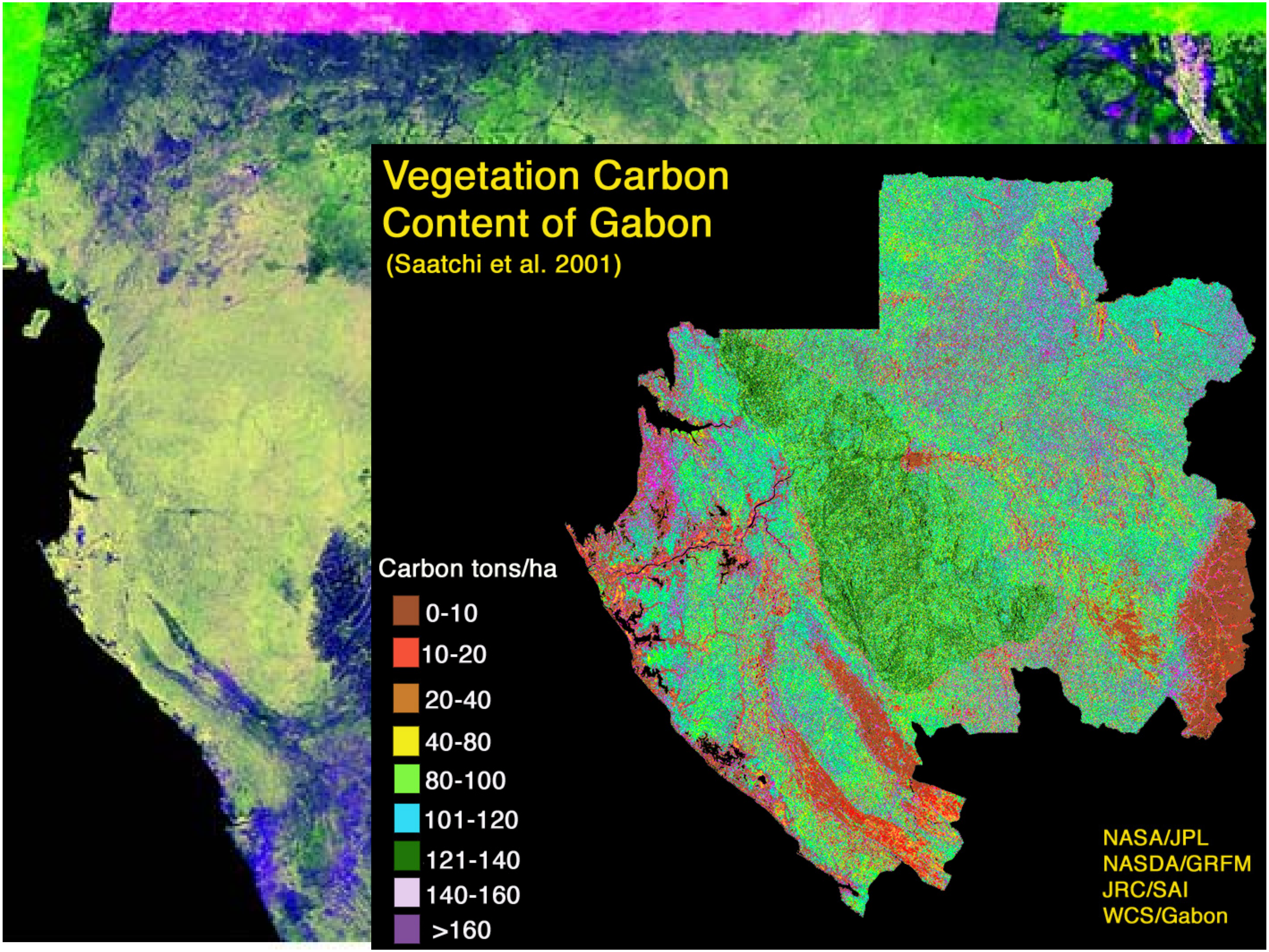
Vertical projections of all canopies of trees and lianes with dbh>5 cm in 40x20m plots in burnt savanna, unburnt savanna, colonising, monodominant, Marantaceae and mixed Marantaceae forest types.

(clockwise from top left)



- 1994

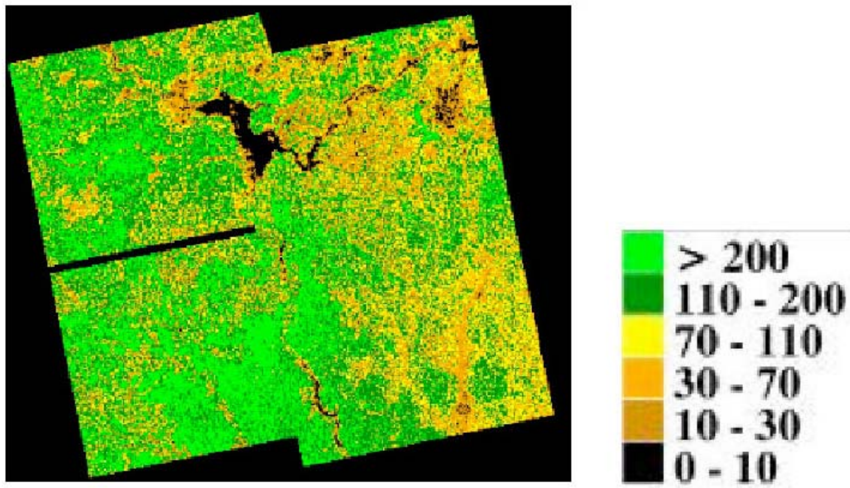
- 2007

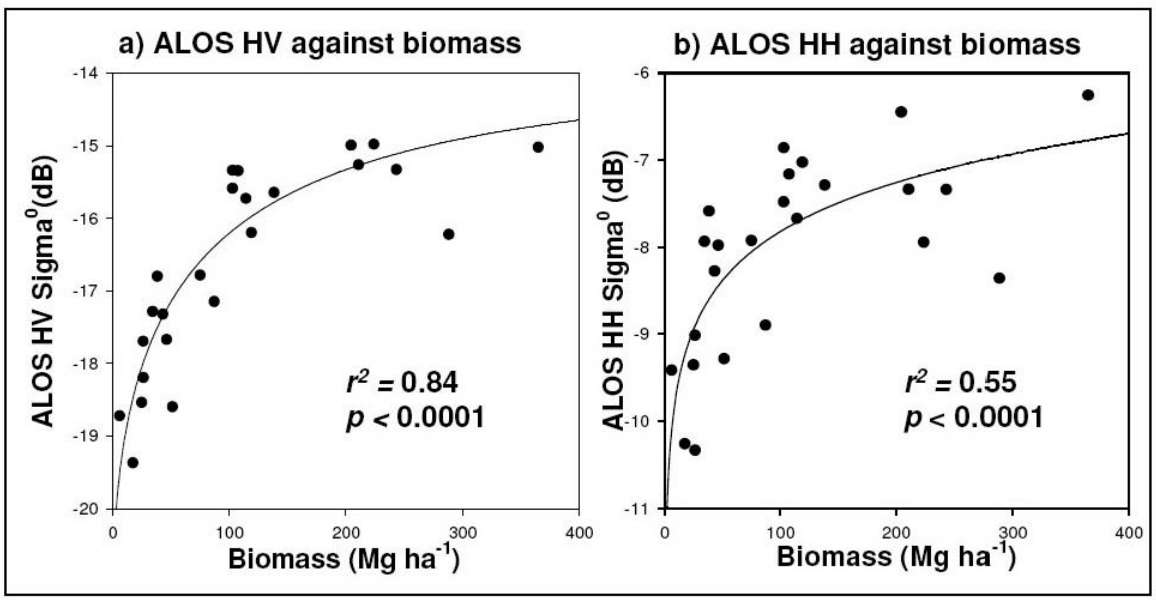


Vegetation Carbon
Content of Gabon
(Saatchi et al. 2001)
Carbon tons/ha
0-10
10-20
20-40
40-80
80-100
101-120
121-140
140-160
>160
NASA/JPL
NASDA/GRFM
JRC/SAI
WCS/Gabon

Radar Backscatter Derived Biomass Tropical Forest (Africa) Mitchard et al. 2008

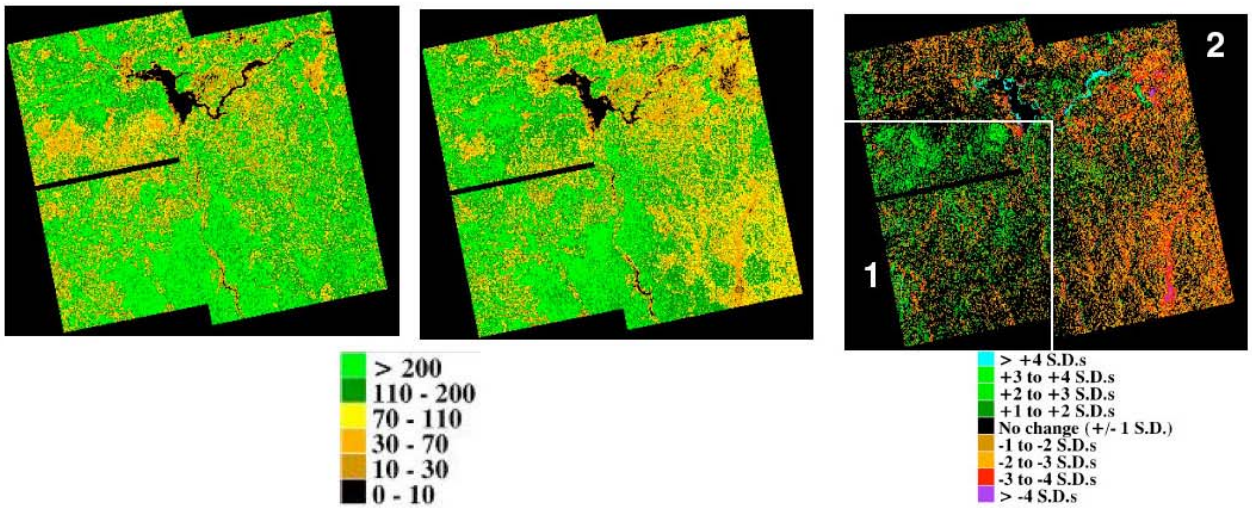
ALOS PALSAR Data





Assessment of Biomass Change Measurement from Disturbance and Recovery (ALOS & JERS-1)

a) JERS 1996 biomass class image b) ALOS 2007 biomass class image c) Change, in standard deviations



	Minimum spatial scale at which change can be detected **annually**			Minimum spatial scale at which change can be detected **decadally**		
Biomass Range	±1 Mg ha^{-1} yr^{-1}	±5 Mg ha^{-1} yr^{-1}	±10 Mg ha^{-1} yr^{-1}	±1 Mg ha^{-1} yr^{-1}	±5 Mg ha^{-1} yr^{-1}	±10 Mg ha^{-1} yr^{-1}
< 100 Mg ha^{-1}	1 km	200 m	100 m	100 m	25 m	12.5 m
100-200 Mg ha^{-1}	2.5 km	500 m	250 m	250 m	50 m	25 m
> 200 Mg ha^{-1}	4 km	800 m	400 m	400 m	100 m	50 m

Saatchi et al., 2008

Results of preliminary change detection using satellite L-band radar data over Lope National Park

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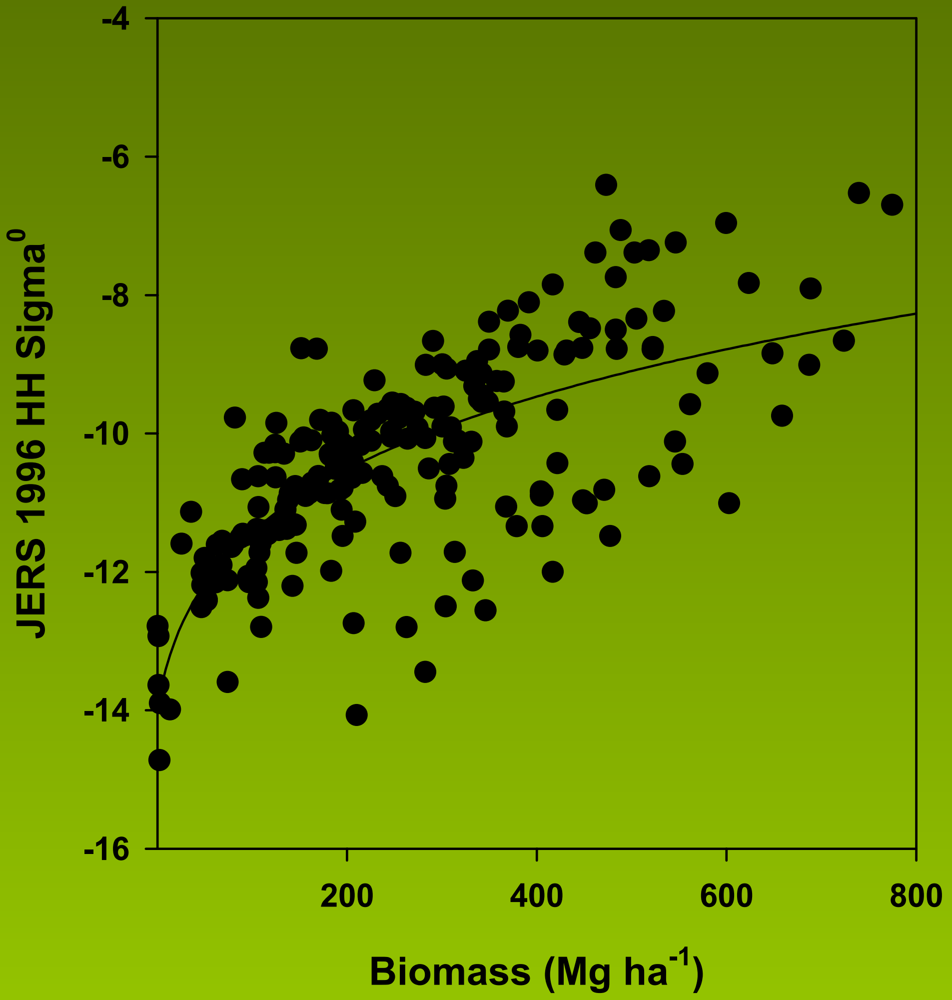
Long-term plot data from SEGC database / Dr. Kath Jeffery

1. JERS 1996 to biomass regression

- Calculated biomass using Chave *et al.* 2005 equation (calculated site-specific DBH-height alometric equations where tree height wasn't measured)
- Used data from:
- 110 plots (20 x 40 m) measured c. 1994
- SEGC transect, 5 km long, cut up into 50 x 50 m sections
- Compared to backscatter from JERS 1996 data taken in 1996 (3 by 3 boxsearch)



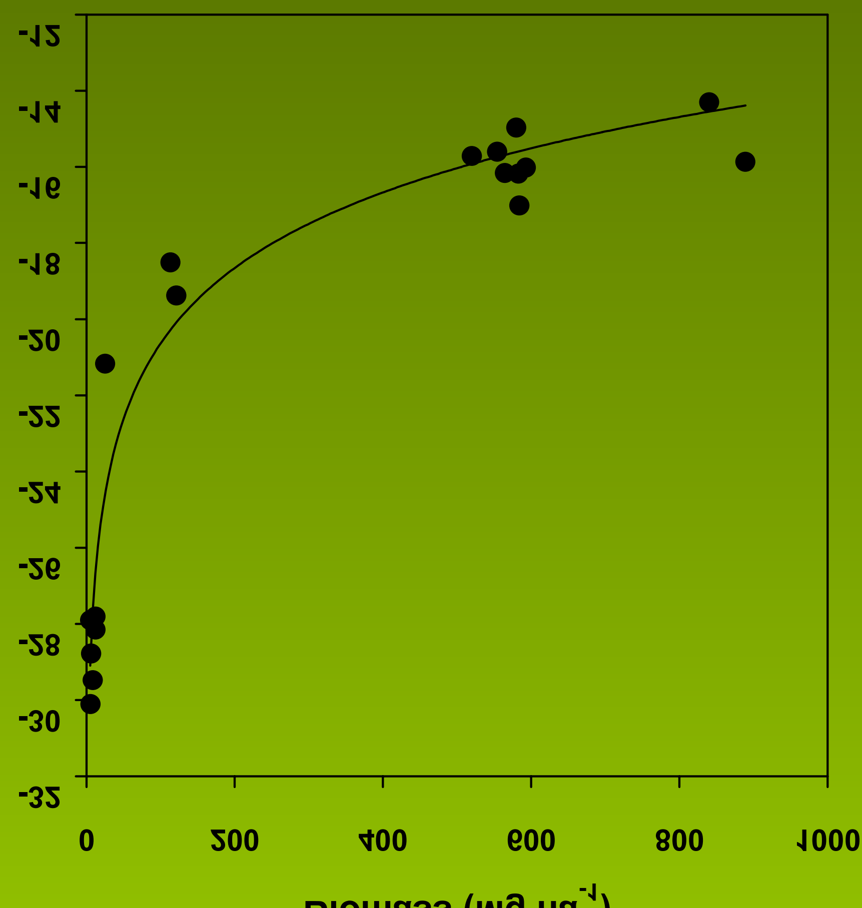
$r^2 = 0.52$

$p < 0.0001$

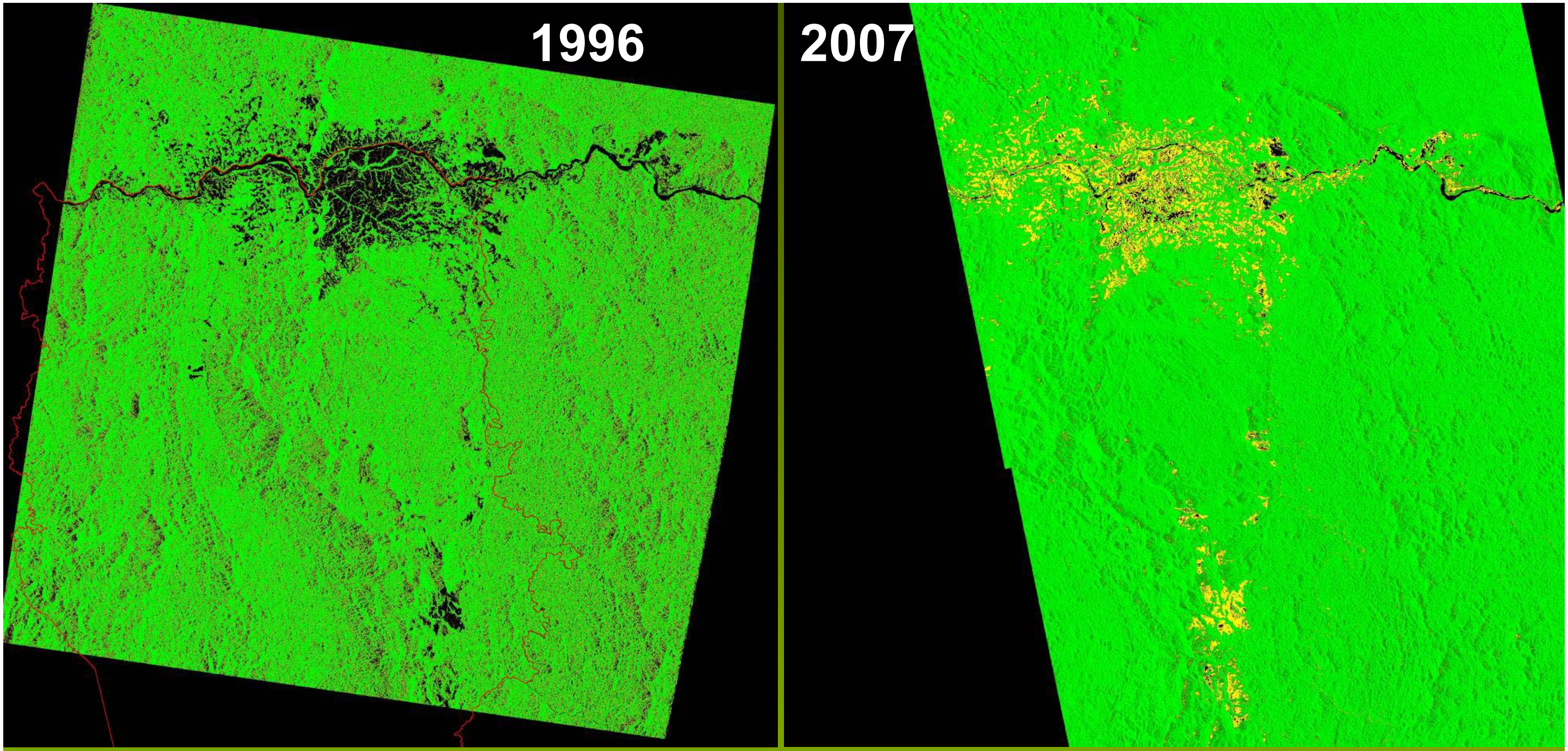
$\text{Sigma}^0 = -13.66 - 0.223(\ln(x)) + 0.1541(\ln(x))^2$

2. ALOS 2007 to biomass regression

- Calculated biomasses as before for 8 plots (20 x 40 m) with re-measures in 2005
- Added data from 12 suspected unchanged area (forest and savanna)
- Regressed against HH and HV, but found strongest relationship using just HV (all HH and the ln(HV) squared terms insignificant)



$r^2 = 0.94$
$p < 0.0001$
$\text{Sigma}^0 = -34.67 + 2.9527(\ln(x))$

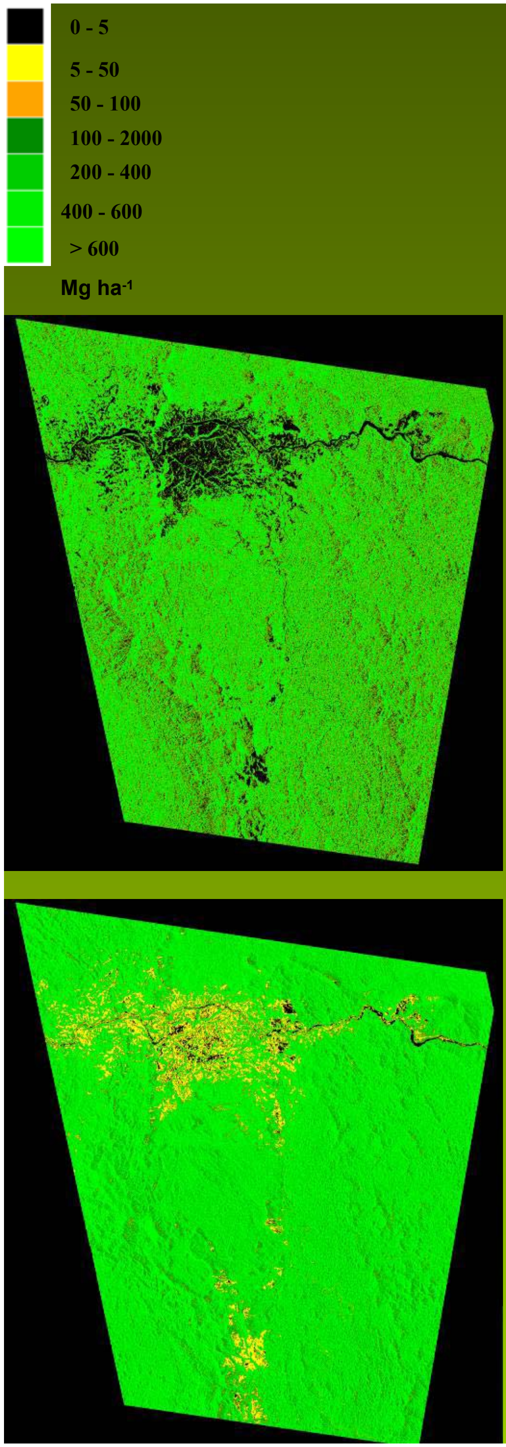


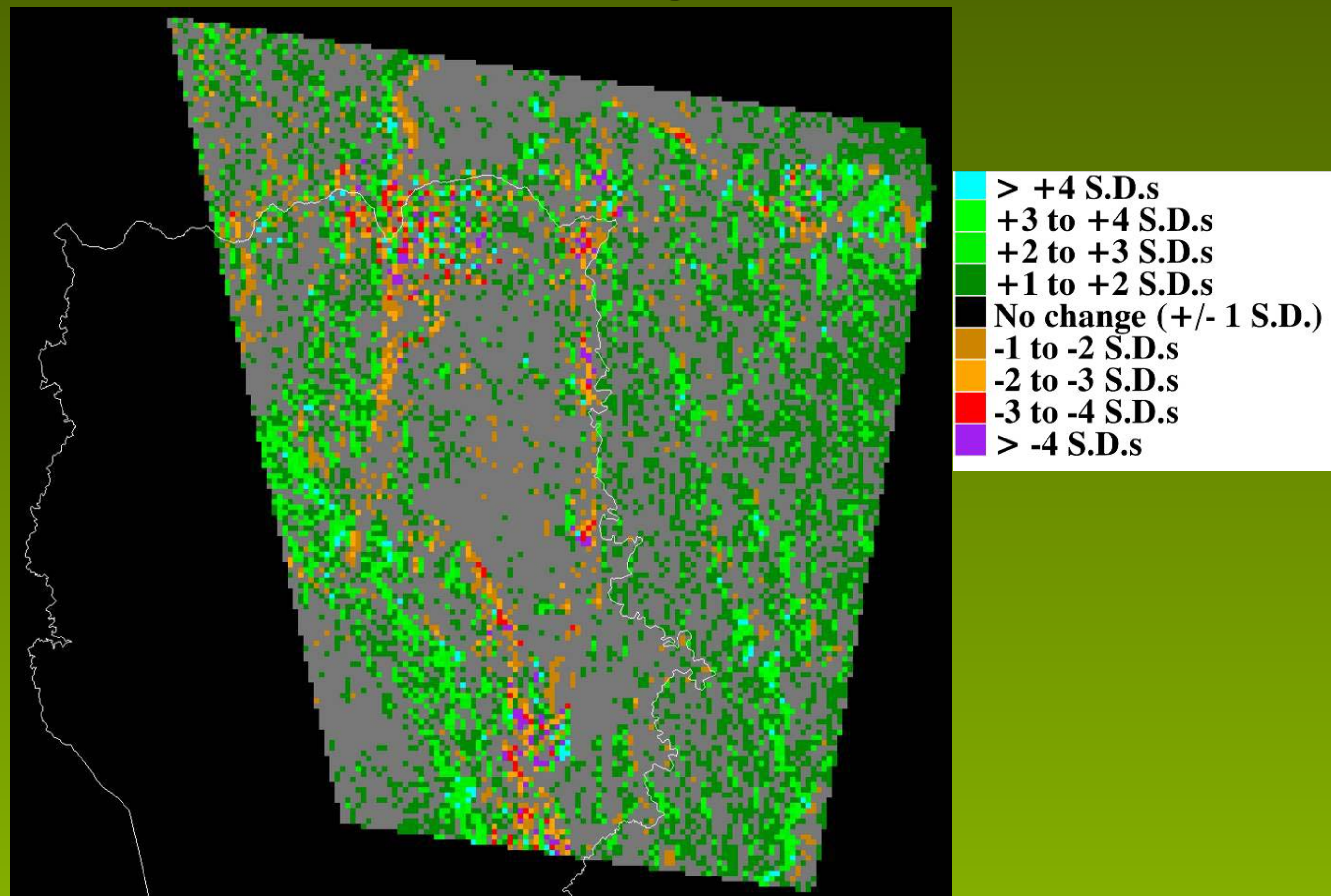
Black	0 - 5
Yellow	5 - 50
Orange	50 - 100
Dark green	100 - 2000
Green	200 - 400
Green	400 - 600
Bright green	> 600

Mg ha^{-1} (biomass, not carbon – approximately divide by two to get carbon)

Ratioed Change

$$\text{Change} = \frac{2007 - 1996}{2007 + 1996}$$

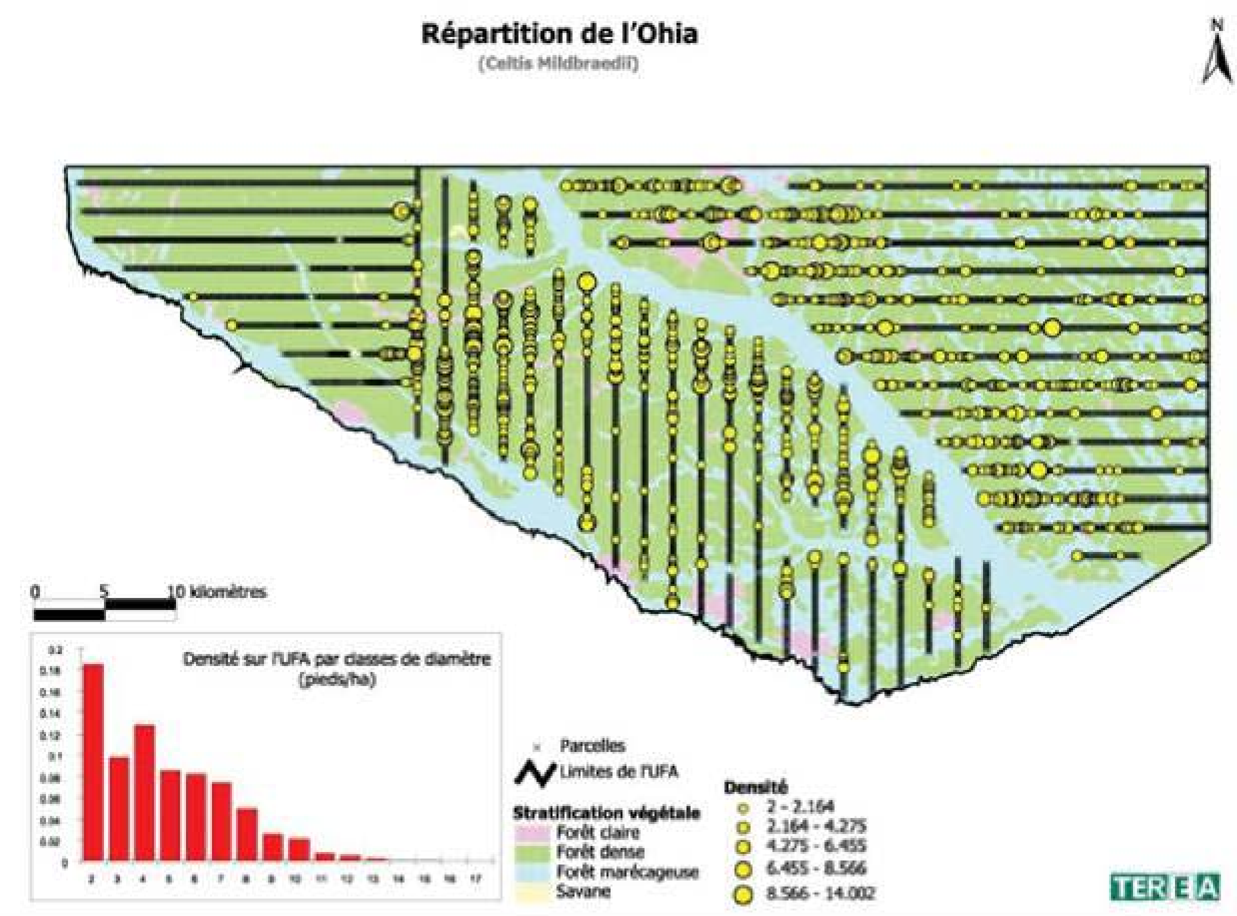


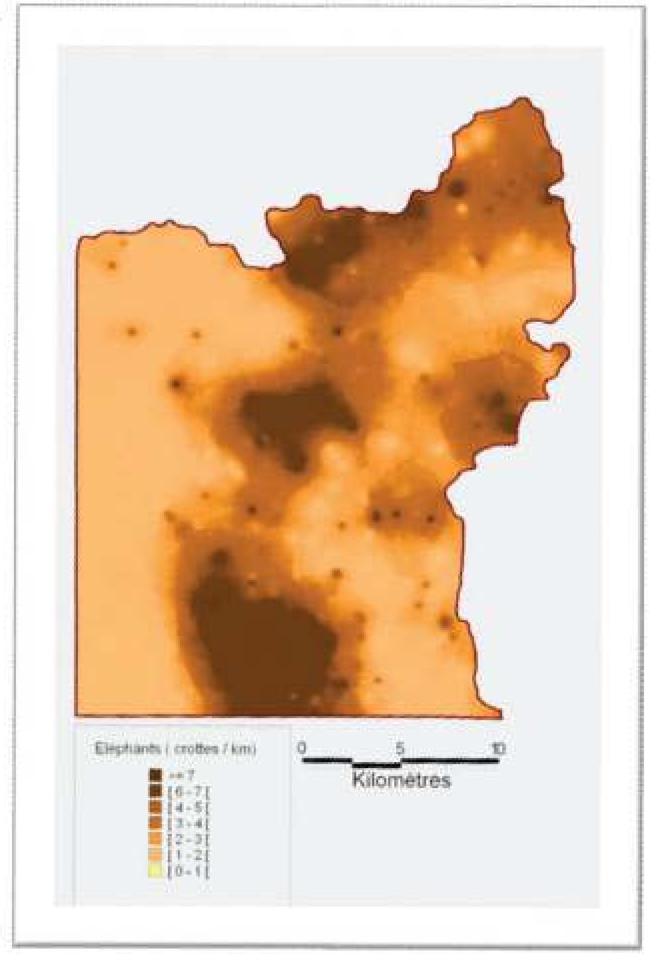


Change ratio produces a normal distribution with values between -1 and 1, where 0 is no change. Subdivide this with standard deviations to produce the above change map. Note done at 1 km squared resolution, to reduce noise and geolocation errors, whereas original biomass maps are both at 25 m resolution.

Inventaires d'aménagement – INTERPRÉTATION

Répartition de la ressource





Réseau COMIFAC . . .

- The UNFCCC focal points in the COMIFAC region plan to establish a regional network including all initiatives to evaluate the carbon balance in the region
- It will include all permanent plots and one-off vegetation studies as well as forestry inventory data
- We plan a 1996-2007 change analysis to be finalised before Copenhagen

Réseau COMIFAC . . . Needs:

- All actors (donors, research institutes, researchers . . .) to pool resources into common analysis
- Wall-to-wall ALOS mosaic for 2007, and ?2008, 2009, 2010
- Detailed analysis of carbon balance in undisturbed forests, different logging scenarios, shifting cultivation mosaic

Lessons from West Africa