CARBOVEG-GB

Quantifying the carbon stocks and sink effects in the forests of Guinea - Bissau

A baseline for clean development mechanism projects

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Overall Goals

- Getting the forest sector of Guinea-Bissau ready for accessing the carbon market
- Monitoring tropical deforestation and land use change

Overall Goals

Monitoring forests – Why?

- Biodiversity and ecological conservation
- Natural resources and livelihoods of local populations – Sustainability
- Deforestation a major source of C emissions – Climate change
- Avoided deforestation, an important market opportunity for development – Management and policy issues, CDM, REDD

Overall Goals

Issues to address

- Are there data available to support the monitoring?
- Are there methodological standards?
- Are there institutional capabilities to support the functioning of monitoring systems?

DeFries *et al*. 2005

Objectives

1. Quantification of historical land cover changes and deforestation rates – *baseline*

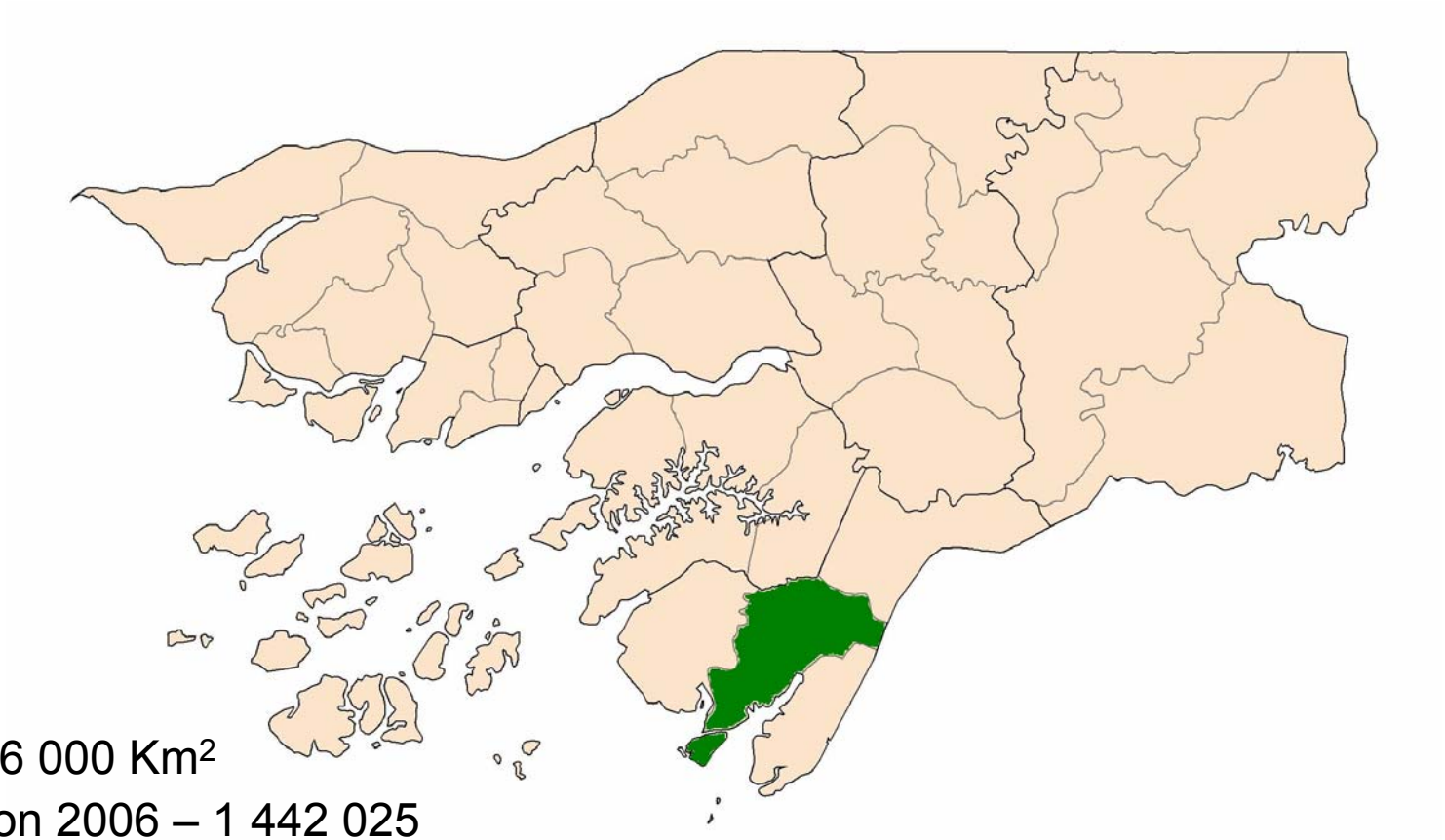
2. Quantification of the carbon stock contained in above ground forest biomass and assessment of carbon sinks

3. Set up a forest vegetation monitoring system and characterization of farming systems and fire practices

4. Capacity building

On going work in Guinea-Bissau

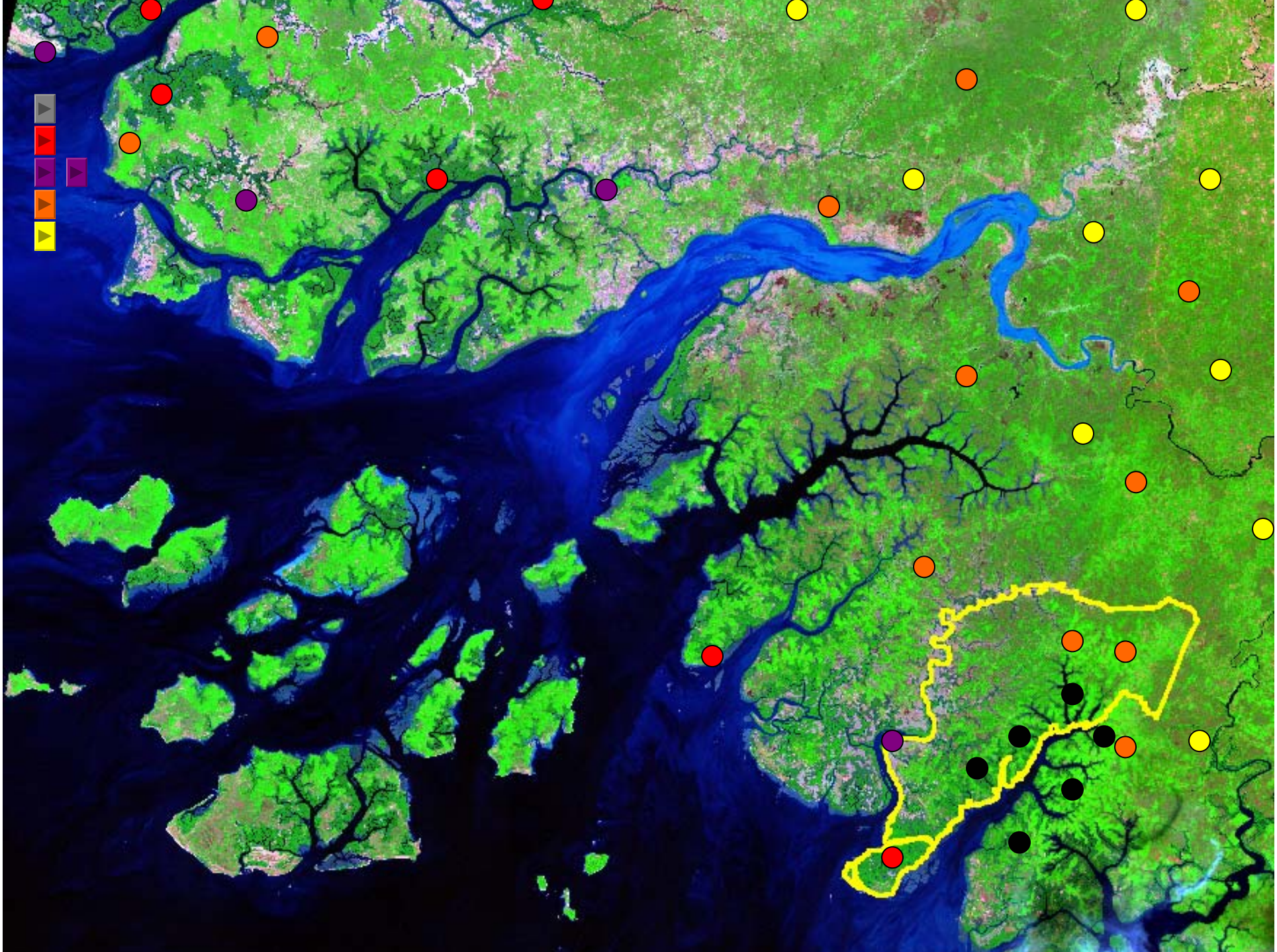
On going work in Guinea-Bissau



Area – 36 000 Km^2

Population 2006 – 1 442 025

Population density – 40 cit/Km^2



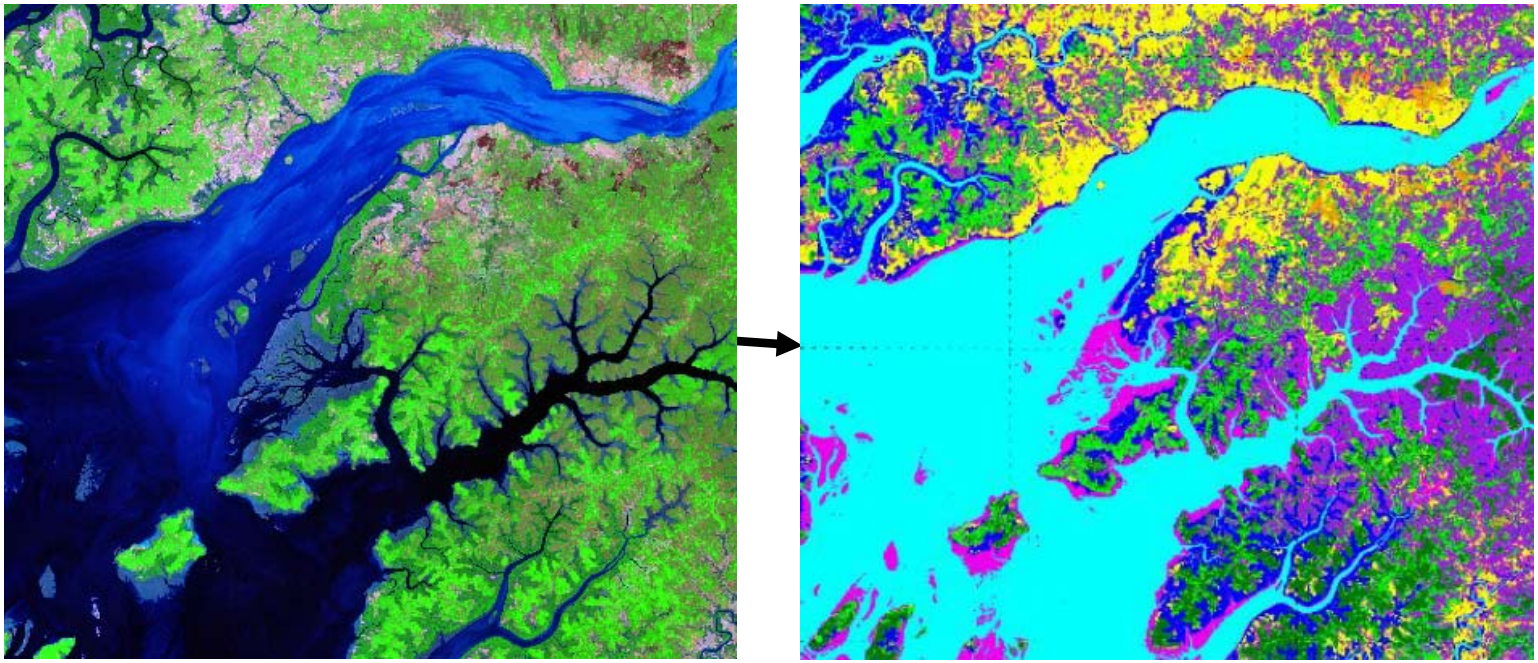
Methodologies

- Image processing and mapping for several dates
- Map algebra for quantification of land cover change
- National forest inventory for assessment of biomass and C stocks[(a)(b)]
- Estimation of vegetation biophysical parameters by remote sensing/field data analysis and modeling for calculation of C sink effect
- Remote sensing and semi-structured interviews for characterization and quantification of forest use and burning practices

(a) Good Practice Guidance for LU and LU Change and forestry

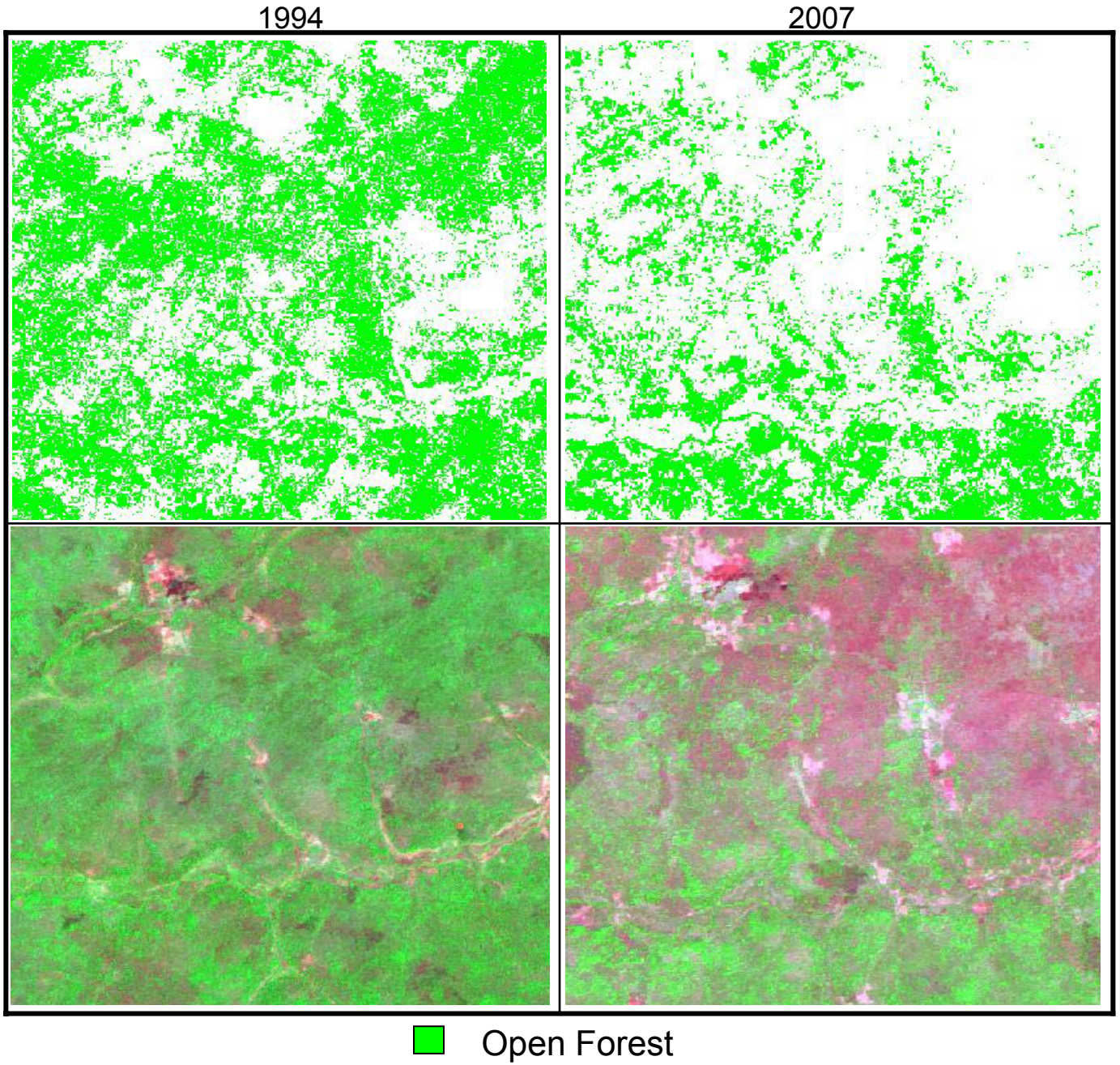
(b) A Source book for land use, land-use change and forestry projects

Methodologies

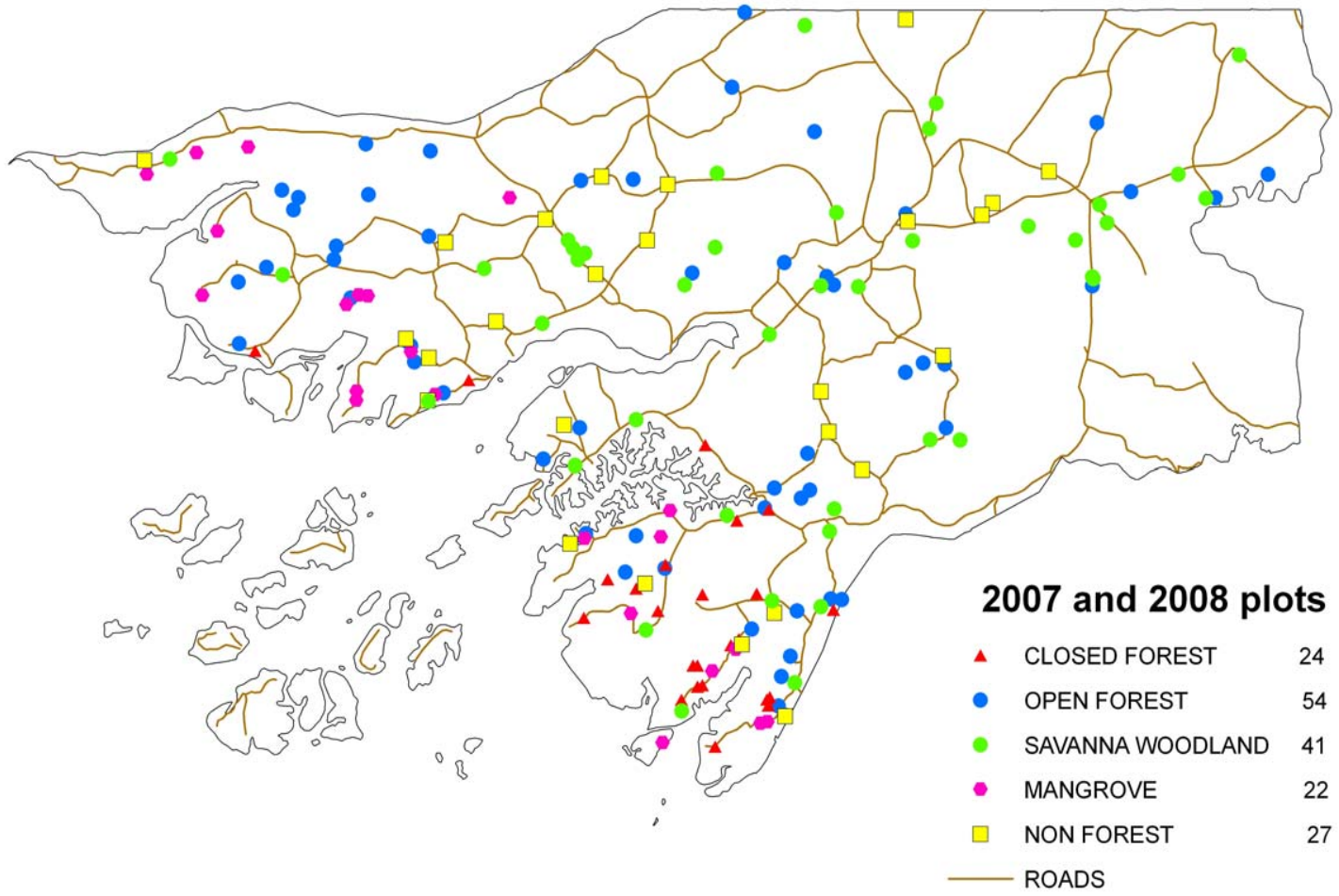


Pre-processing and classification of satellite imagery 1986, 1990, 1994, 1998, 2002, 2006, 2008.

Methodologies



Methodologies



Collecting field data – forest inventory with sampling strategy and measurement protocol

Methodologies

Plot Quantity - Aboveground biomass

Enter values into the green cells. Use the "Tab" or "Enter" key to jump to the next green cell.

REQUIRED ERROR AND CONFIDENCE LEVEL		
e - level of error (%)	10.0%	
Error level (decimal)	0.1	
Z(1-a) - Confidence level	95.0%	
Sample statistic Z(1-a)	1.96	
Total project area size	2525900	hectares

If no cost information exists, then leave Ch

SIZE AND VARIANCE OF EACH STRATA							INTERMEDIATE CALCULATIONS						
Stratum	Stratum Name	Area (ha)	Mean C/ha (tonnes)	Standard Deviation (tonnes C/ha)	Plot size (ha)	Cost C_h If no cost, put C_h =1	W_h	$W_h * s_h$ * sqrt C_h	$(W_h * s_h)$ /sqrt C_h	$N_h * s$	$N_h * s^2$	Variance (tonnes C/ha)	Coefficient of Variation
stratum 1	fd	339420	79.085	48.2	0.08	1	0.1343759	6.4769	6.47692	2.05E+08	9.86E+09	2323.24	61%
stratum 2	fa	1124230	56	29.7	0.08	1	0.445081	13.219	13.2189	4.17E+08	1.24E+10	882.09	53%
stratum 3	sa	775250	22.35	20.07	0.08	1	0.3069203	6.1599	6.15989	1.94E+08	3.9E+09	402.8049	90%
stratum 4	man	287000	23.625	18.56	0.08	1	0.1136229	2.1088	2.10884	66584000	1.24E+09	344.4736	79%
stratum 5					0.08	1	0	0	0	0	0	0	
stratum 6					0.08	1	0	0	0	0	0	0	
stratum 7					0.08	1	0	0	0	0	0	0	
stratum 8					0.08	1	0	0	0	0	0	0	
stratum 9					0.08	1	0	0	0	0	0	0	
stratum 10					0.08	1	0	0	0	0	0	0	

INTERMEDIATE CALCULATIONS		
N = sum N_h	31573750	
Total Area	2525900	hectares
Weighted Mean C	45.095658	tonnes/ha
Weighted Plot Size	0.08	ha
Weighted SD	27.964552	
Weighted Total Variance	867.55793	

GoTo Next

TOTAL PLOT QUANTITY - ABOVEGROUND BIOMASS					
		Number of Plots using AR-AM0001 Equations		Number of Plots using Winrock Methods Manual equation	
Stratum	Stratum Name	Plot Quantity	Rounded Plot Quantity	Plot Quantity	Rounded Plot Quantity
Total Sample Size		147.73		147.73	
stratum 1	fd	34.22	**35**	34.22	**35**
stratum 2	fa	69.83	**70**	69.83	**70**
stratum 3	sa	32.54	**33**	32.54	**33**
stratum 4	man	11.14	**12**	11.14	**12**
stratum 5		0.00	**0**	0.00	**0**
stratum 6		0.00	**0**	0.00	**0**
stratum 7		0.00	**0**	0.00	**0**
stratum 8		0.00	**0**	0.00	**0**
stratum 9		0.00	**0**	0.00	**0**
stratum 10		0.00	**0**	0.00	**0**
TOTAL NUMBER OF PLOTS			**150**		**150**

AR-AM001 Equations[a]:

$$n = \left(\frac{t}{E}\right)^2 \left[\sum_{h=1}^{L} W_h \cdot s_h \cdot \sqrt{C_h}\right] \cdot \left[\sum_{h=1}^{L} W_h \cdot s_h / \sqrt{C_h} \cdot\right]$$

$$n_h = n \cdot \frac{W_h \cdot s_h / \sqrt{C_h}}{\sum_{h=1}^{L} W_h \cdot s_h / \sqrt{C_h}}$$

Winrock Methods Manual and Sourcebook for LULUCF Equations[b]:

$$n = \frac{\left(\sum_{h=1}^{L} N_h * s_h\right)^2}{\frac{N^2 * E^2}{t^2} + \left(\sum_{h=1}^{L} N_h * s_h^2\right)}$$

$$n_h = n * \frac{N_h * s_h}{\sum_{h=1}^{L} N_h * s_h}$$

E = allowable error or the desired half-width of the confidence interval. Calculated by multiplying the mean carbon stock by the desired precision (i.e. mean carbon stock * 0.1 (for 10 % precision) or 0.2 (for 20 %

C_h = Cost to select a plot of the stratum h

t = the sample statistic from the t-distribution for the 95 % confidence level.

WINROCK

Methodologies

Parameters collected in forest plots

- Site characterization and type classification four forest classes
- Structure characterization canopy cover, vertical and horizontal vegetation structure, litter depth
- Forest degradation soil erosion, burning practices, reported logging and agriculture expansion
- Tree measurements species id, vitality, DBH, height, diameter of dead trees, small tree count
- Downed dead wood measurements in two 40 meter transects per plot
- Collection of wood samples for specific gravity estimation
- Collection and weighting of litter

Methodologies

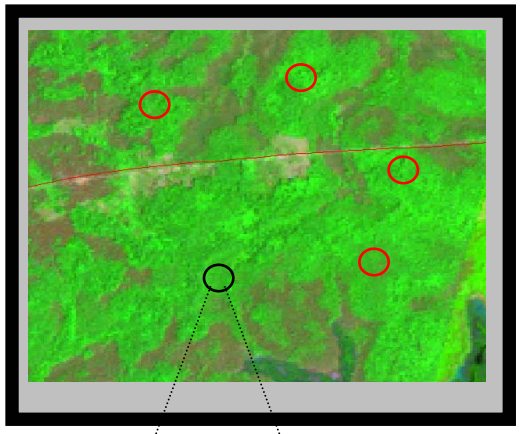


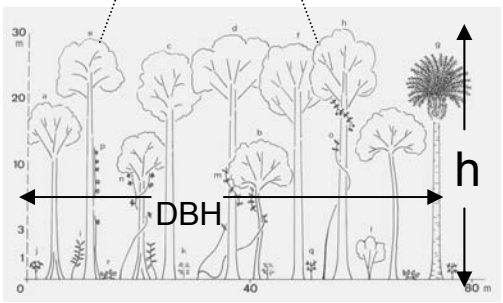


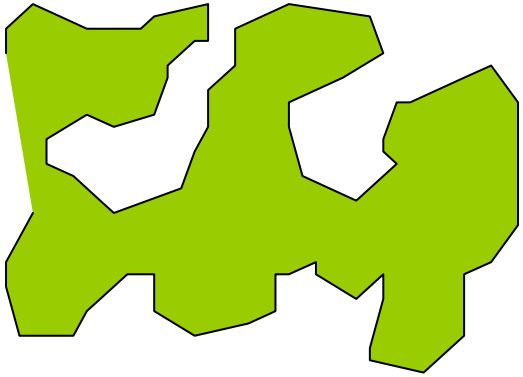





Methodologies







Area (ha)

AGB = f(DBH, H, Specific gravity)

(ton/ha)

AGB ton

C

ton

Methodologies

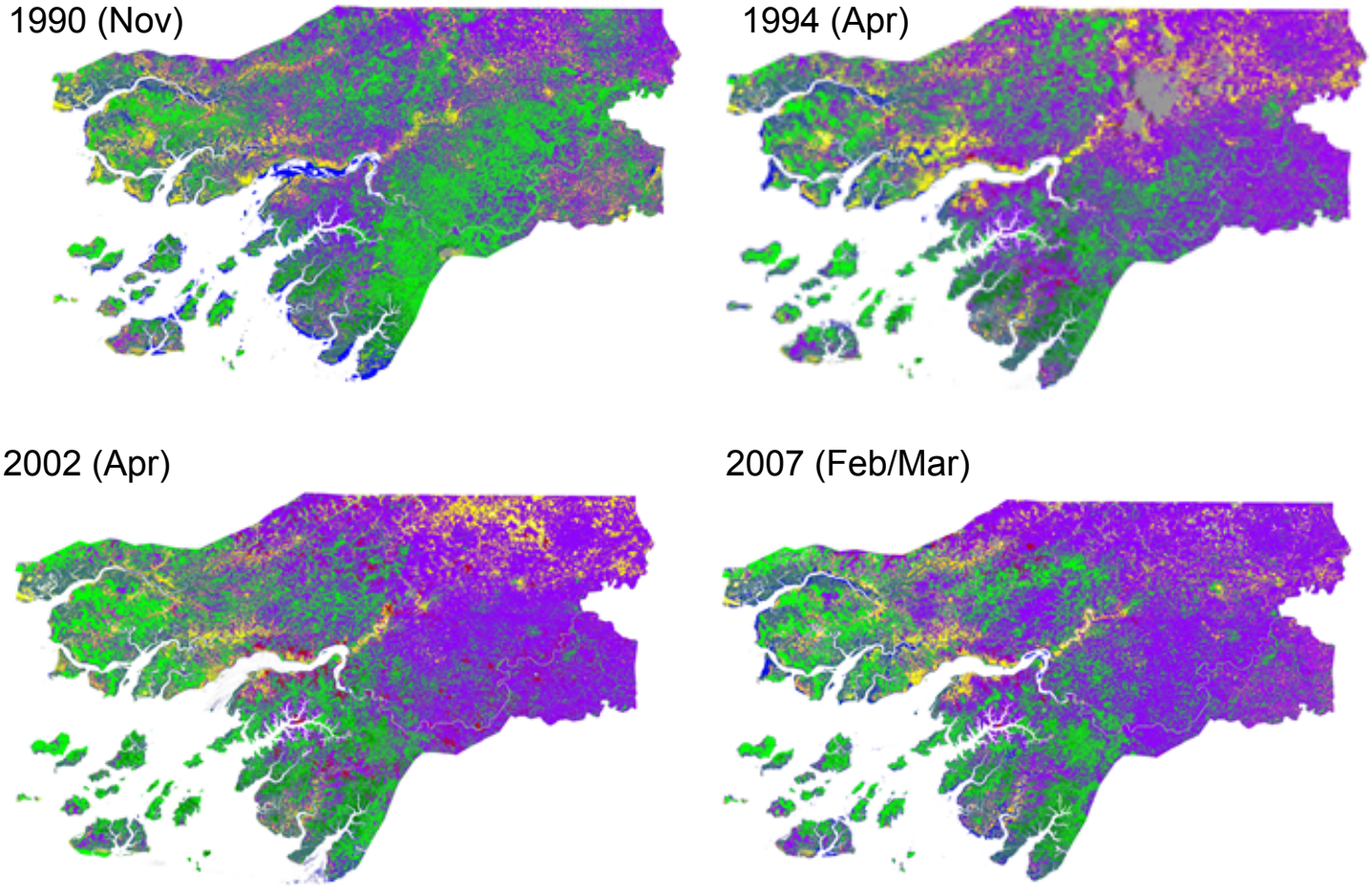
Shifting cultivation and burning practices characterization

- Direct and participant observation, group interviews with key-informants and semi-structured interviews

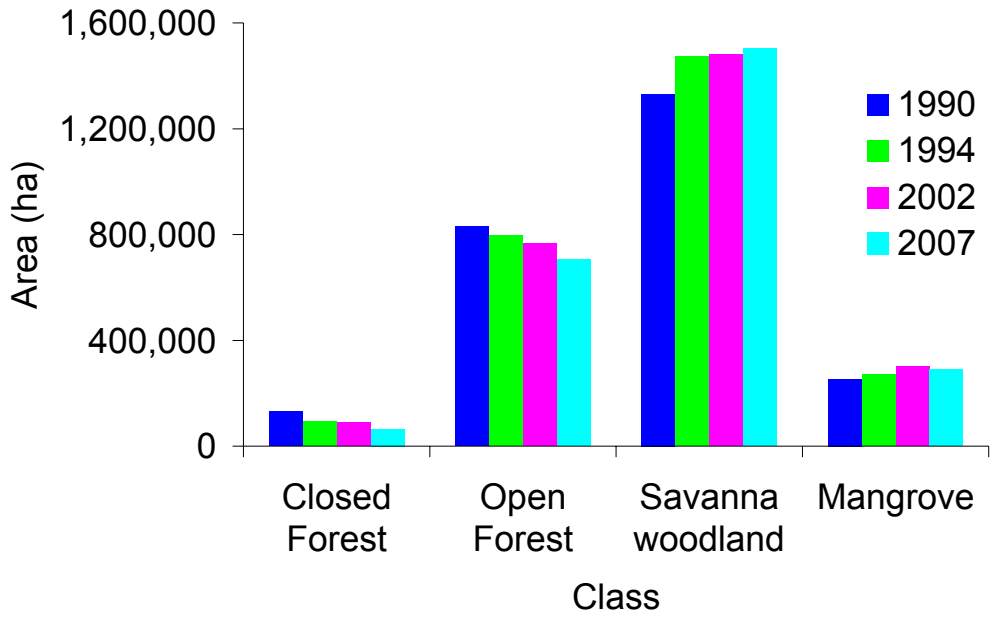
Fire pattern characterization

- MODIS Fire Product at 1km resolution was used to assess fire distribution and density per administrative division
- Fire distribution and density maps were used as guidelines to ethno-agronomic field research on the characterization of farmers' burning practices

Preliminary Results

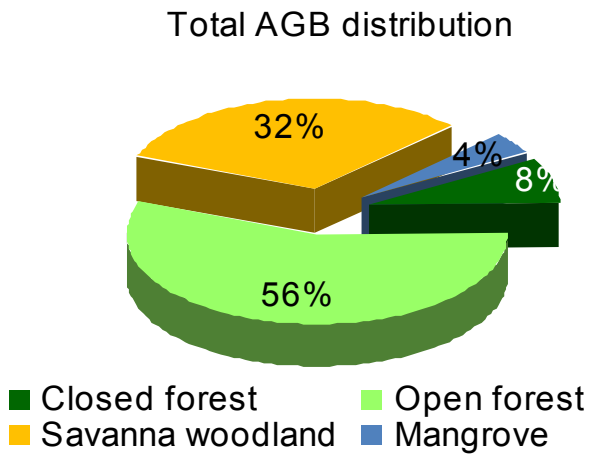


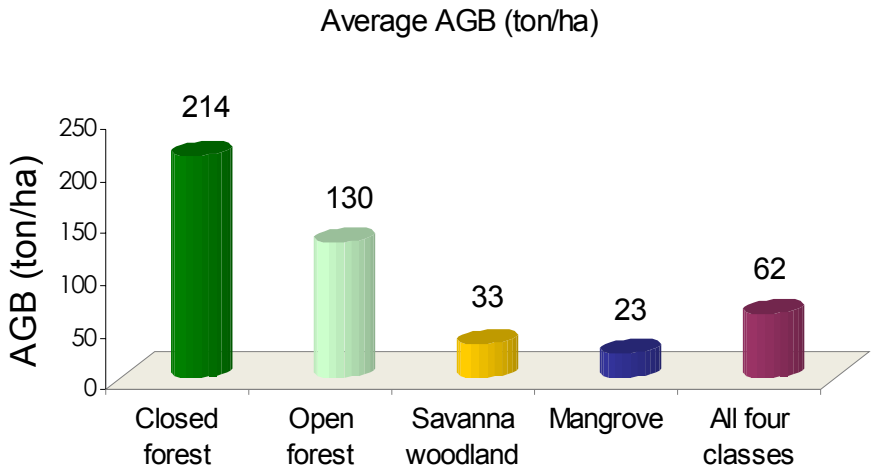
Preliminary Results



	1990	Change %	1994	Change %	2002	Change %	2007	Change % 1990-2007
Closed forest	132196	-30	92847	-4	88783	-26	65775	-50
Open forest	831773	-4	795870	-4	766618	-8	706998	-15
Savanna woodland	1331189	-11	1473991	0	1481004	2	1503534	13
Mangrove	254415	6	269963	11	300171	-3	290482	14

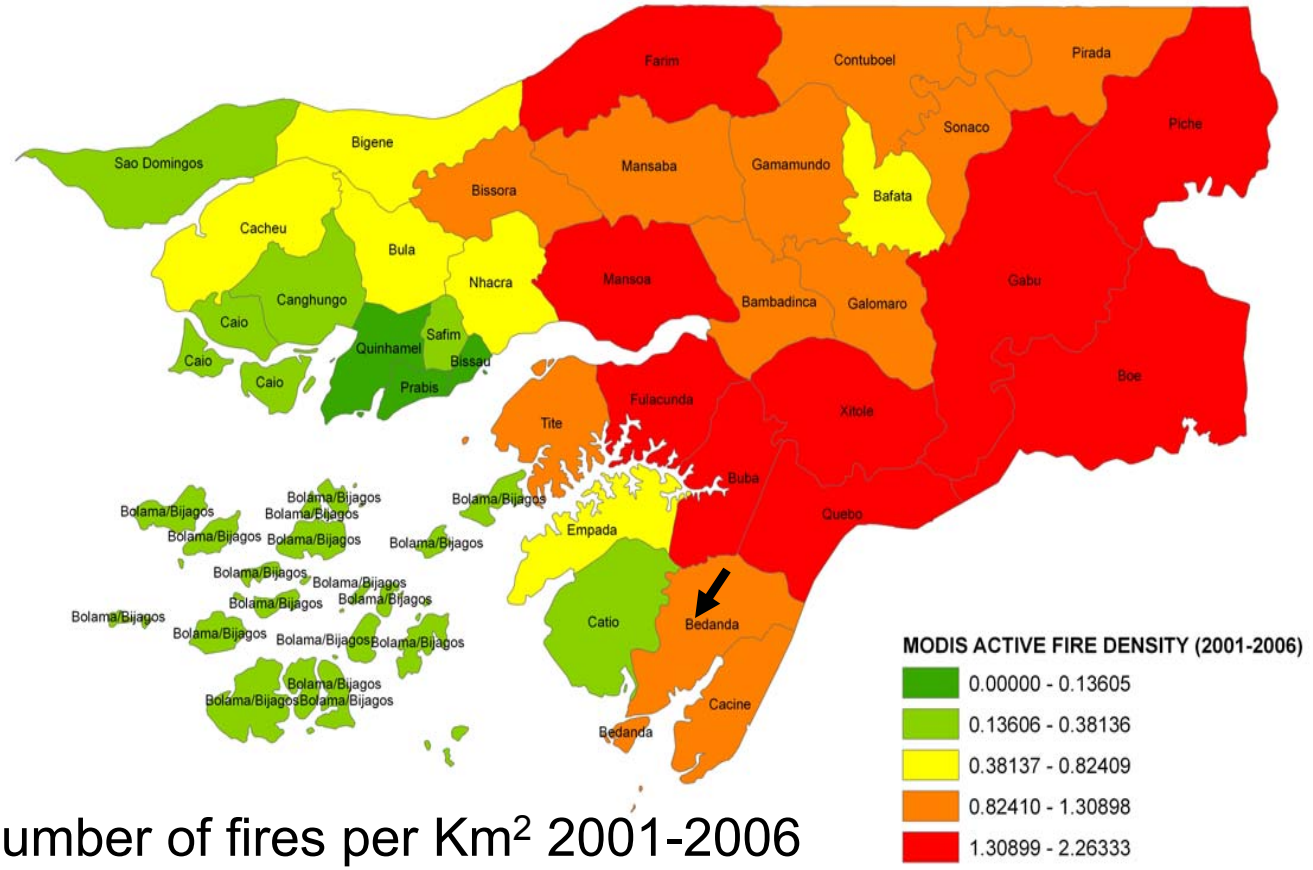
Preliminary Results





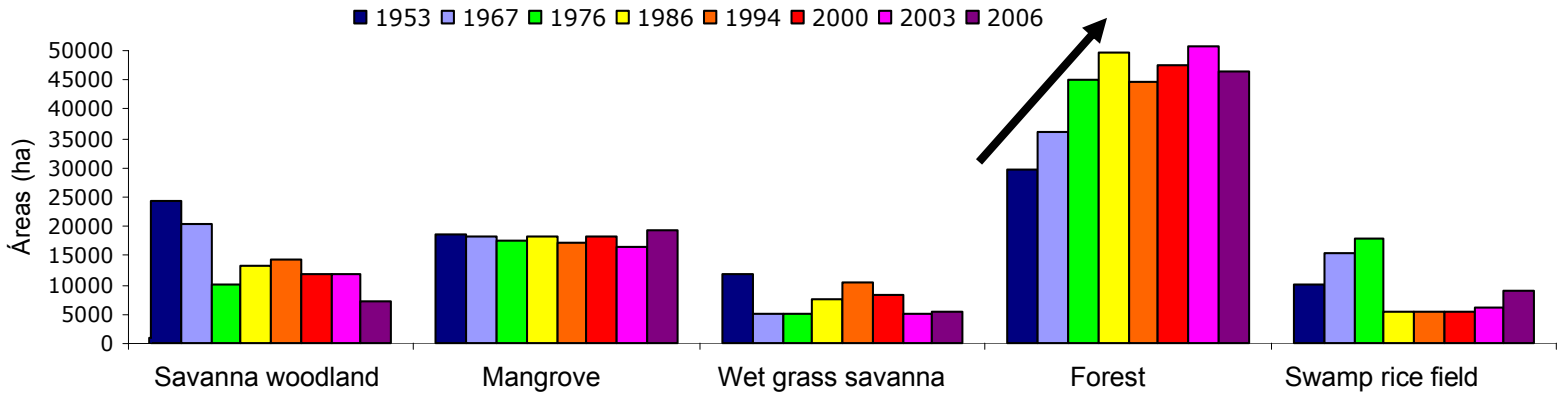
	Above ground biomass of alive trees		Carbon stock on AGB of alive trees and CO_2 equivalent		
Forest type	Average AGB	Total AGB	C	CO_2	%
	Ton/ha	Mton	Mton	Mton	
Closed forest	214	14	7	26	8
Open forest	130	101	50	184	56
Savanna woodland	33	57	29	105	32
Mangrove	23	7	3	13	4
Total forest	62	179	90	329	100

Preliminary Results



Number of fires per Km^2 2001-2006

Preliminary Results Cantanhez

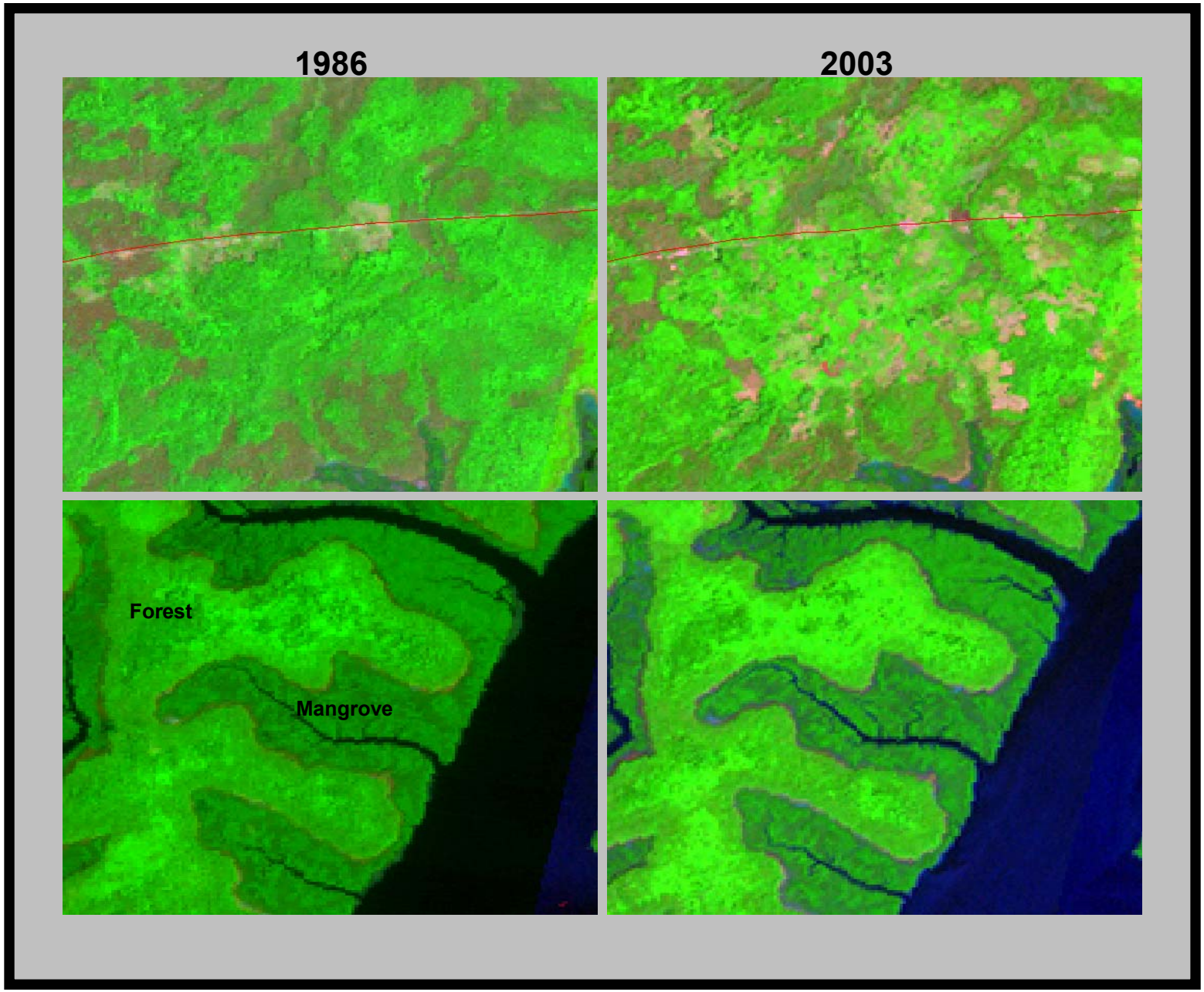


1963-1974: liberation war caused reduction in slash & burn agriculture

1974-1986: post-colonial policy of economic centralization and social changes favored a recovery of secondary forests

1986: structural adjustment favored the opening of markets for fruit production giving rise to deforestation for orchards

Preliminary Results - Cantanhez



Milestone discussion

- Preliminary results allow a guided design of the last campaign
- The calculations done so far indicate a deforestation rate of 1% a year, for the high percent cover vegetation classes
- The average carbon stored in AGB of forests ranges from about 11,5 ton/ha (Mangrove) to 107 ton/ha (Closed Forest)
- Cashew nut plantations must be separated clearly
- Sink effects will be calculated using collected data and modeling

Milestone discussion

So? How is this project responding to the issues identified as crucial to bring GB to the C market?

- Are there data available to support the monitoring?
- Are there methodological standards?
- Are there institutional capabalities for monitoring?

Milestone discussion

Are there data available to support the monitoring? Are there methodological standards? Are there institutional capabalities?

- ✓ A Land Cover map time series to be used and complemented with future dates by DGA – Guinea Bissau
- ✓ Forest and C inventory using standardized methods, manuals and correponding trainning
- ✓ A deforestation baseline
- ✓ Wood density of main forest species
- ✓ Forest species identification field guide
- ✓ Estimation of the C sink effect in the forests
- ✓ Identification of deforestation hot-spots
- ✓ Characterization of agricultural systems and of burning practices

Core team, partners, and funding

The core team **IICT**:

Maria J. Vasconcelos, PhD - Rewable Natural Resource Management/ Forester
Viriato Cassamá, MSc – Environmental Engineer / DNA Guinea-Bissau
Luís Catarino, PhD – Biologist / Vegetation expert
Marina Temudo, PhD – Ethno-agronomist
Duarte Oom, MSc – Forester/ Remote sensing and GIS expert
Ana Cabral, MSc – Geographer/ Remote sensing and GIS expert
Patrícia Lourenço, MSc – Biologist

Partners:

- DGA, Guinea-Bissau
- ISA, UTL Portugal
- FCT, UN Portugal
- METACORTEX Consulting
- WinRock International

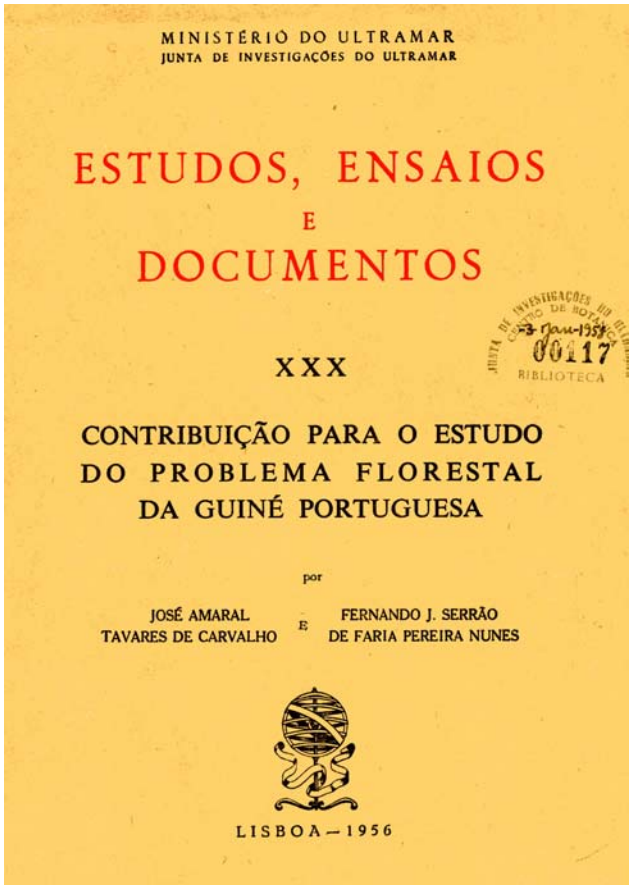
Funding:

- **APA, Ministry of Environment, Portugal**
- FCT, Portugal

Collaboration:

- IBAP, Guinea-Bissau
- INEP, Guinea-Bissau

Contributions to the knowledge-base



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ESTUDOS, ENSAIOS
E
DOCUMENTOS

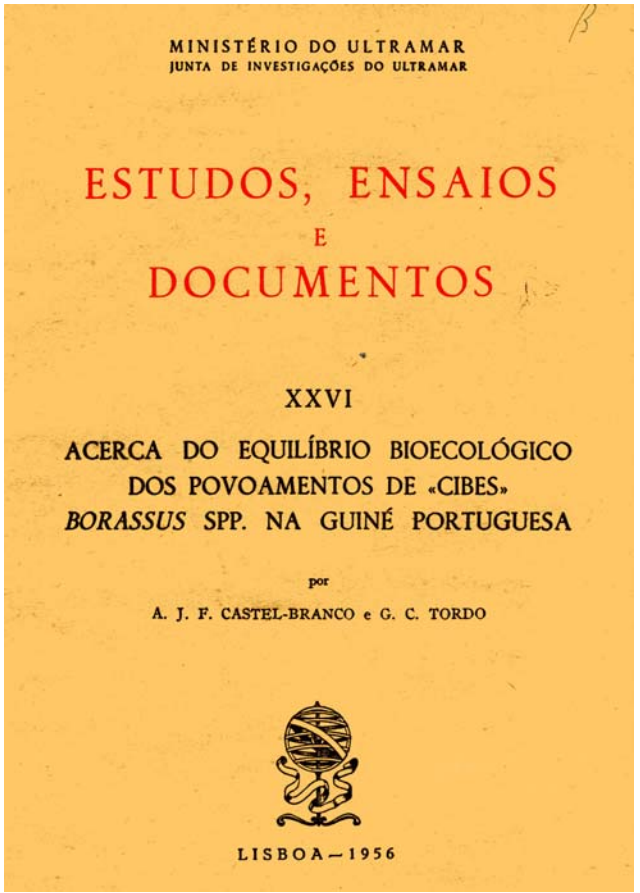
XXX

CONTRIBUIÇÃO PARA O ESTUDO
DO PROBLEMA FLORESTAL
DA GUINÉ PORTUGUESA

por

JOSÉ AMARAL TAVARES DE CARVALHO E FERNANDO J. SERRÃO DE FARIA PEREIRA NUNES

LISBOA — 1956



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ESTUDOS, ENSAIOS
E
DOCUMENTOS

XXVI

ACERCA DO EQUILÍBRIO BIOECOLÓGICO
DOS POVOAMENTOS DE «CIBES»
BORASSUS SPP. NA GUINÉ PORTUGUESA

por

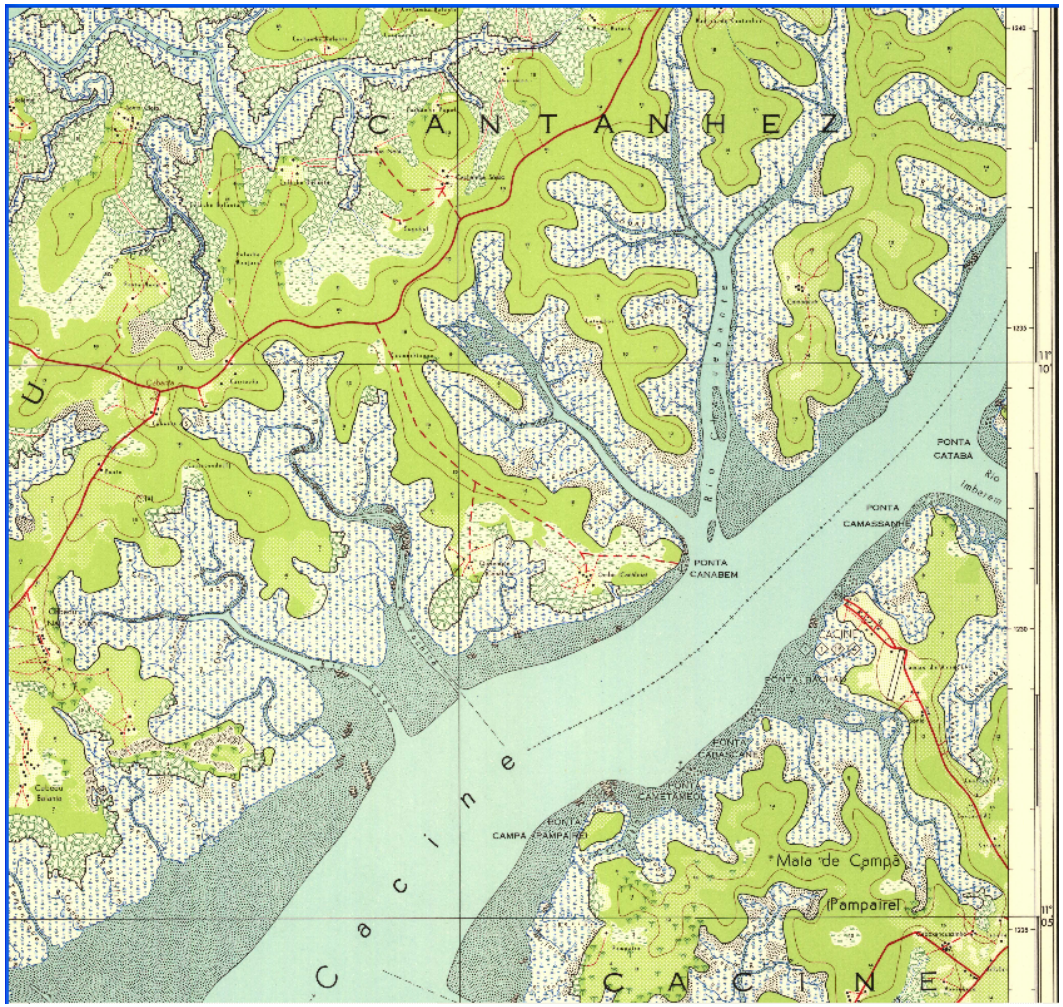
A. J. F. CASTEL-BRANCO e G. C. TORDO

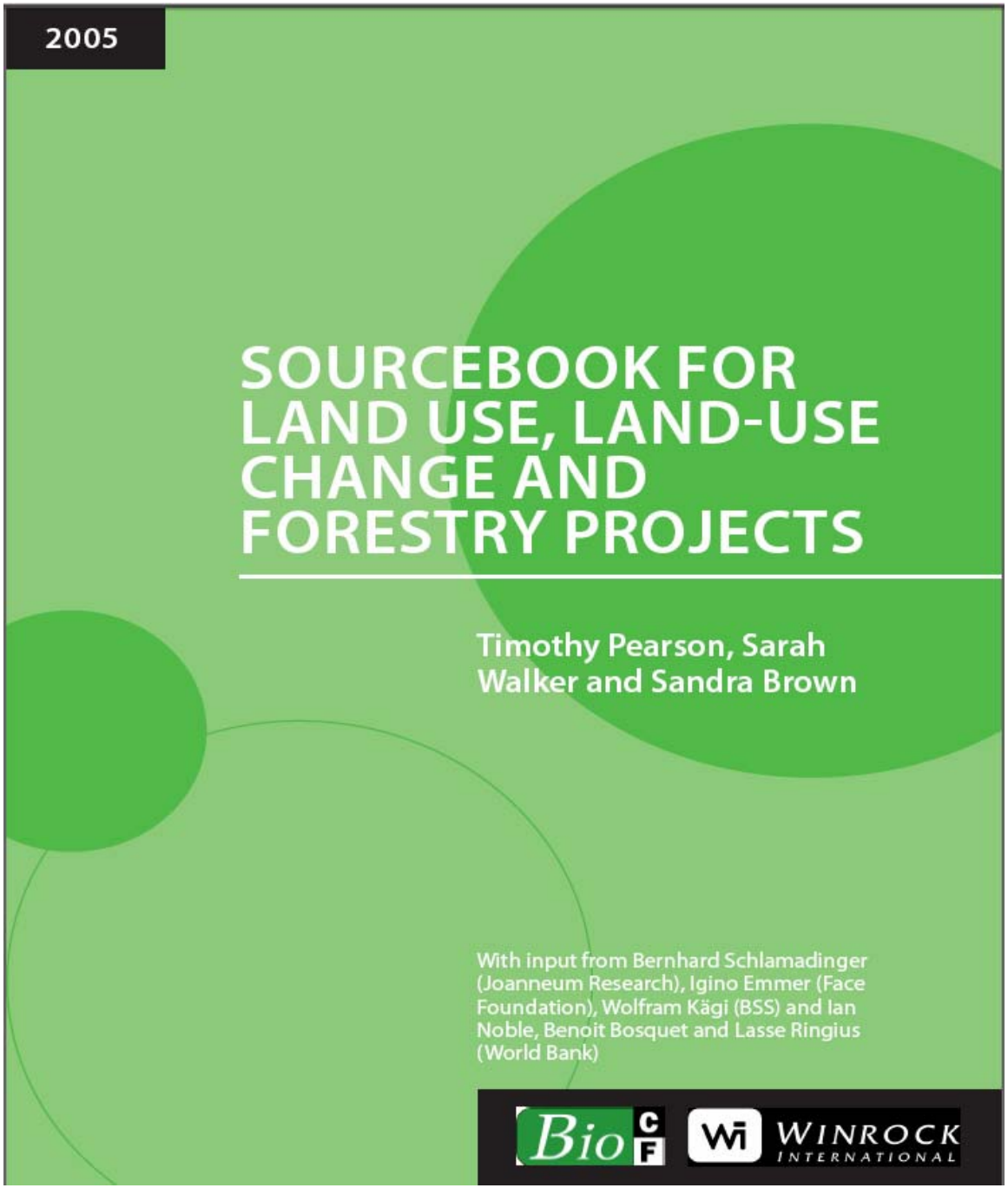
LISBOA — 1956

Contributions to the knowledge-base

Série 1: 50 000

"Carta Topográfica da Guiné-Bissau"




2005
SOURCEBOOK FOR LAND USE, LAND-USE CHANGE AND FORESTRY PROJECTS
Timothy Pearson, Sarah Walker and Sandra Brown
With input from Bernhard Schlamadinger (Joanneum Research), Igino Emmer (Face Foundation), Wolfram Kägi (BSS) and Ian Noble, Benoit Bosquet and Lasse Ringius (World Bank)
BioCF
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Bananas and cola nuts orchard