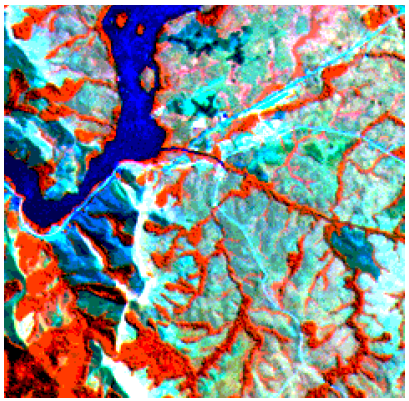
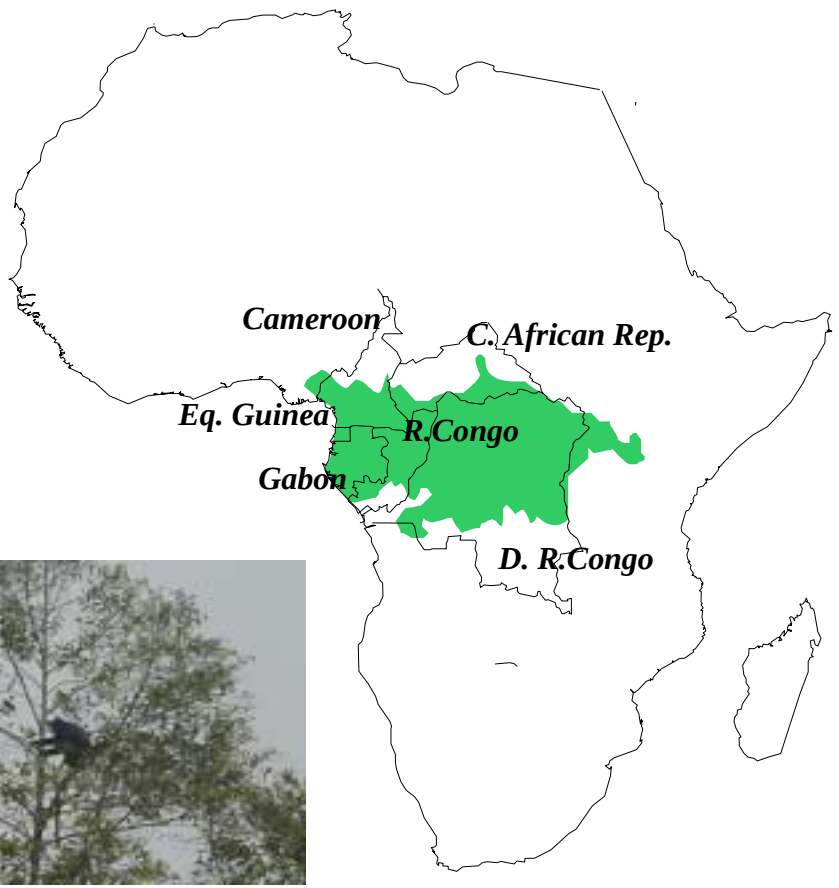
An Integrated Forest Monitoring System for Central Africa

Nadine Laporte, Dept Geog, UMD





LCLUC-Science Team Meeting on GOFC and Disturbance
20-22 Sept 2000, Rockville, MD

Partners

An interdisciplinary team:

- **Nadine Laporte (UMD) - P. I., Manager, Land cover classification**
- **Guoquing Sun (UMD/NASA)- Radar biomass assessment**
- **Jacqueline Lemoigne (NASA)/ Miro Honzack (UMD)- Fusion methods**
- **Ralph Dubayah (UMD) - VCL biomass estimation**
- **Philippe Mayaux (TREES/JRC, Italy) - Regional radar land cover mapping**
- **Lee White (WCS) - Field data collection & validation**
- **Mike Fay (WCS) - Aerial digital video acquisition & validation**

Collaborators:

- **CARPE and GOFC networks**
  (Univ. Kinshasa DRC, in-country Forest Services, WWF Minkebe Project, etc.)
- **WCS/MIKE project (John Hart and René Breyer)**
- **CIRAD-Forêt France (Michelle Pain Orcet)**
- **Zoological Society of Milwaukee (Gay Reinartz).**
- **Jim Tilton (NASA) - Land cover classification algorithms**

Objectives

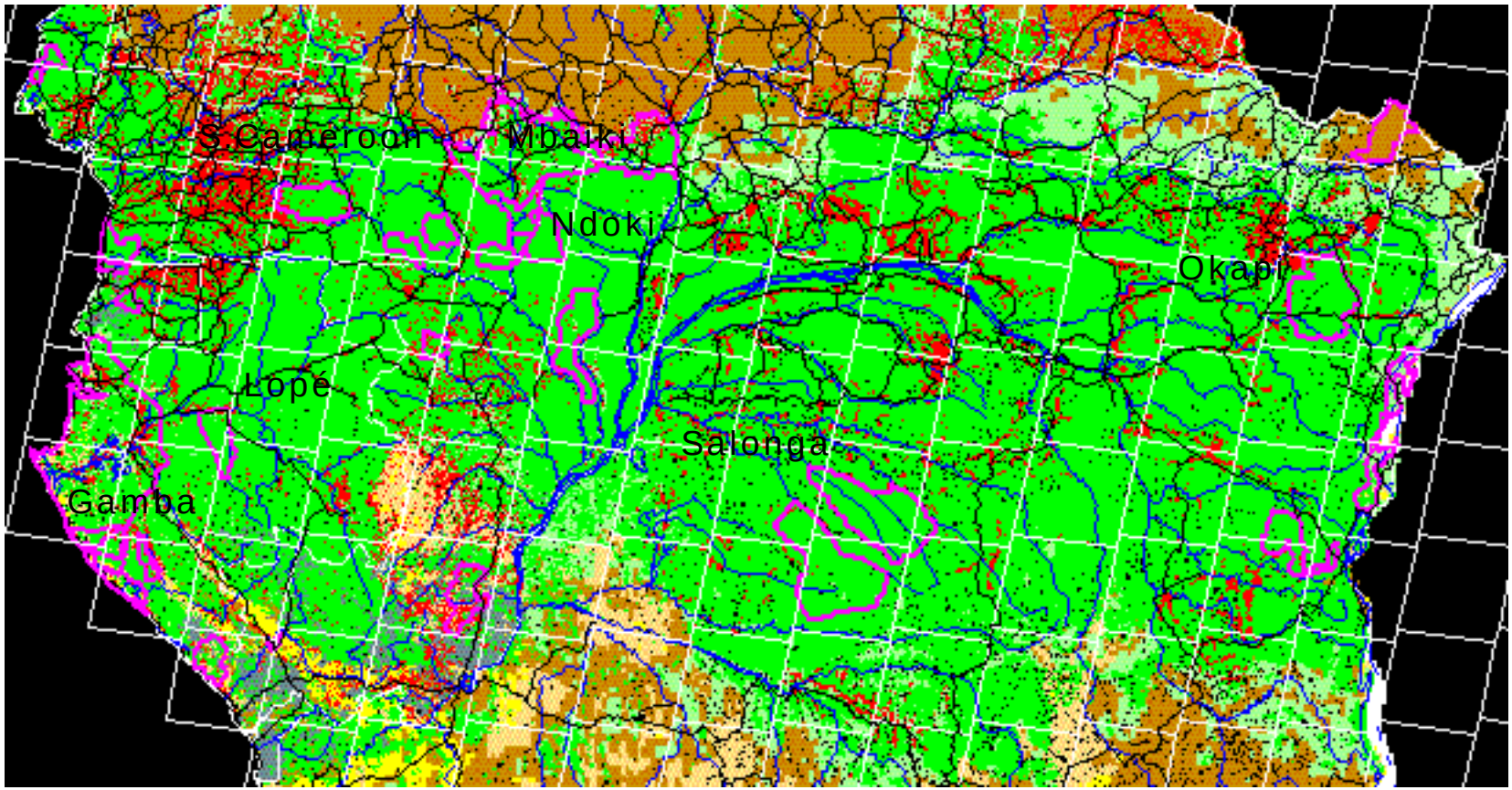
- Develop methods to map Central Africa forest types, and biomass using a multi-sensor multi-scale approach (AVHRR, MODIS, JERS, ERS)
- Develop validation protocols for regional land cover products (Field, Video, Ikonos, Landsat)
- Reinforce collaboration between National Forest Services, ecologists and conservationists to develop an operational forest monitoring system

Science Implications

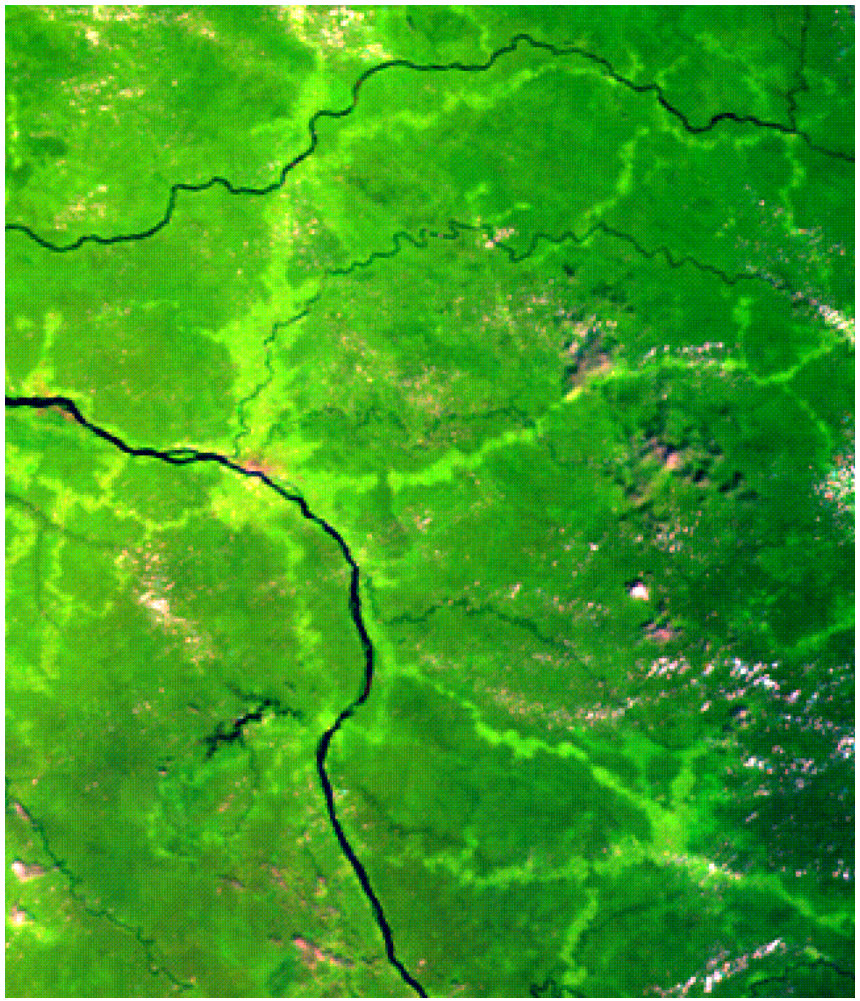
- Better characterisation of tropical forest land surfaces and processes
- Multi-scale multi-sensor data integration methods and appropriate validation tools
- Integrate central African research scentists in regional sciences activities (e.g. GOFC)

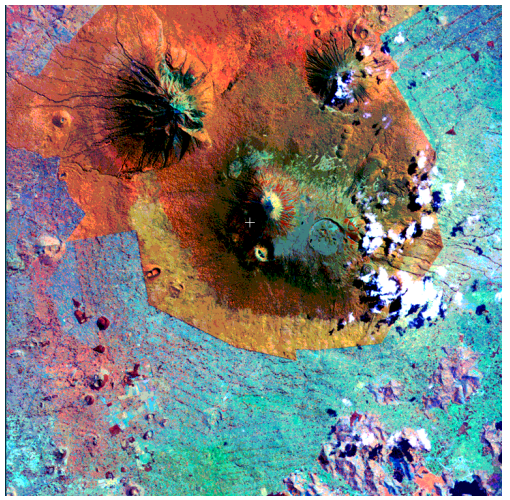
Study sites

Primary sites: Lopé - Ndoki - South Cameroon
Secondary sites: Salonga, Okapi, Gamba, Mbaiki



Remotely sensed image data

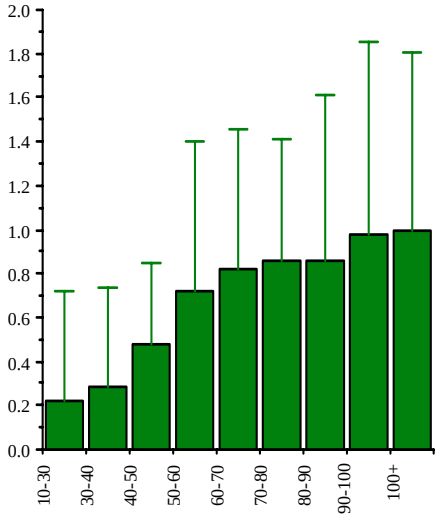




- Landsat ETM+
- IKONOS
- Aerial Digital Videos
- MODIS 1km, 500 m
- SPOT vegetation
- JERS1, ERS, SIR-C
- SAR 6m

Field data acquisition and collection of existing data for GIS integration

Lopé site, July 2000



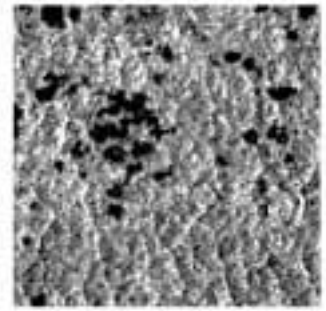
Growth rates Okoumé

Field Work Challenges !

Land cover mapping

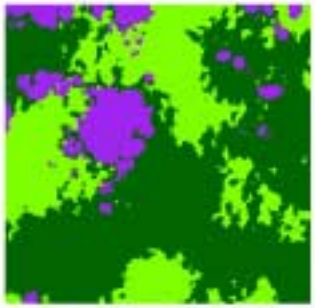
- Integration of multi-resolution multi-sensor information (radar-optical) UMD/NASA
  - Fusion and classification using a neural network
  - Data fusion using a wavelet approach
  - Classification using segmentation techniques
- Integration of multi-resolution multi-sensor radar (JRC)
  - Classification of JERS-ERS central Africa mosaics

Fusion of AVHRR and JERS

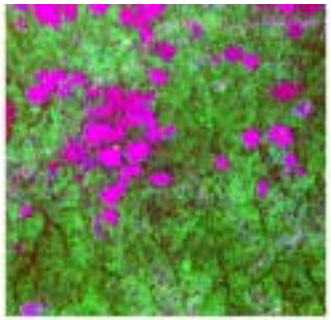


fine spatial and
texture information
from JERS-1 image

coarse spatial and
spectral information
from NOAA AVHRR image

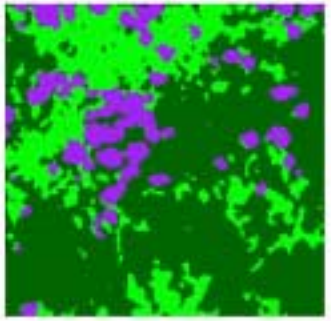


Forest
Non-forest
Regrowth



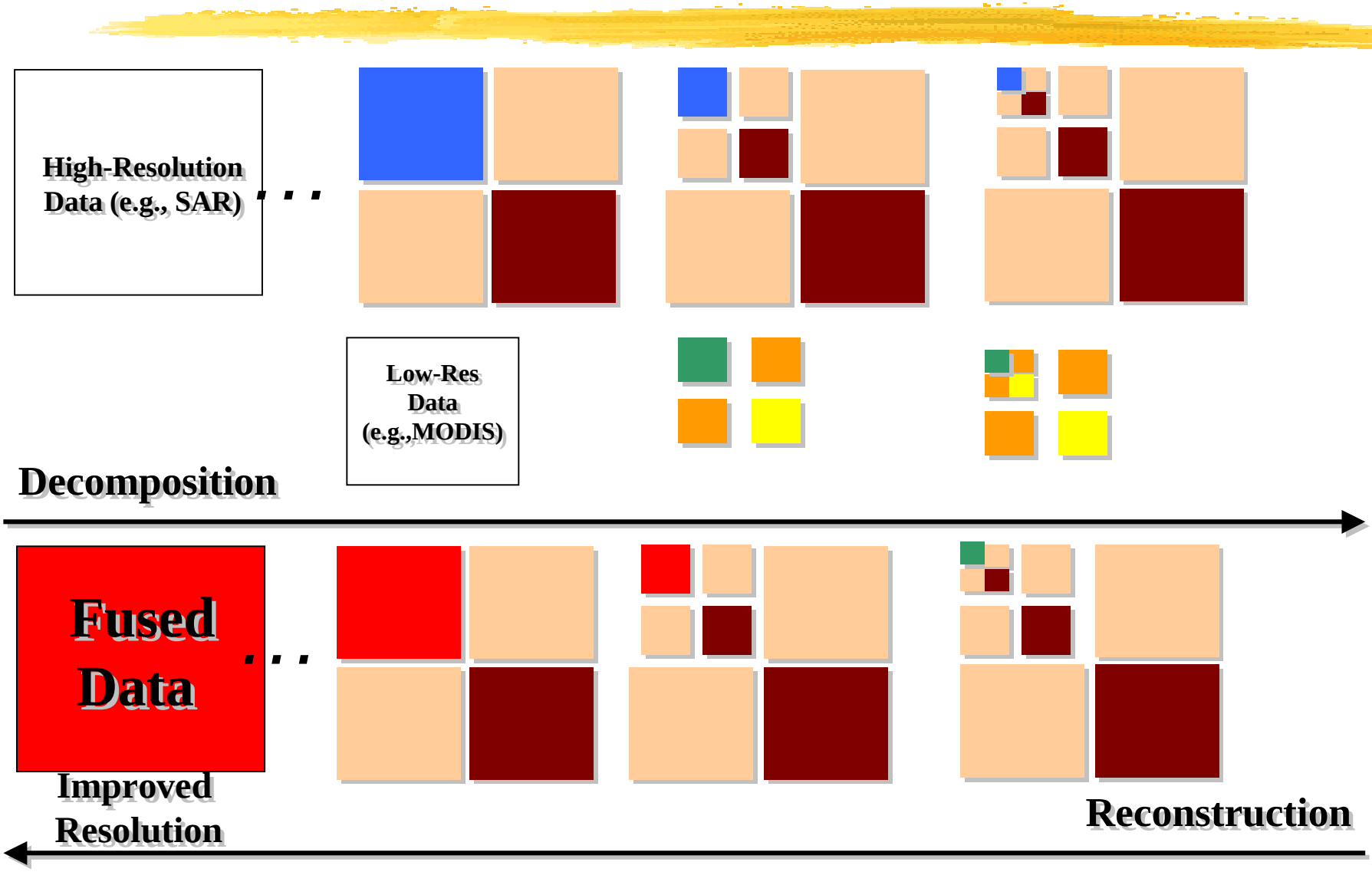
Landsat TM
fine spatial,
spectral

and
texture
information



Forest
Non-forest
Regrowth

Wavelet-Based Fusion

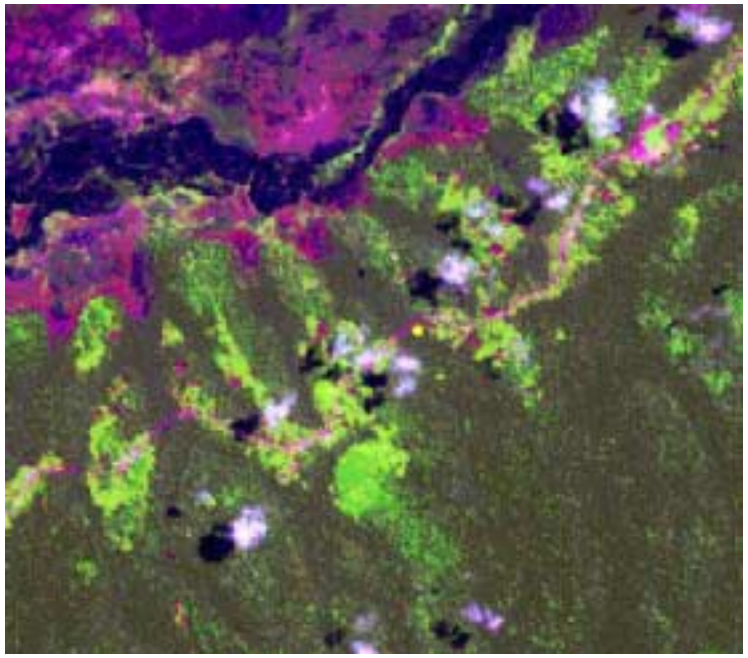


Biomass assessment & mapping

- Phase 1:
  - Develop **direct** and **indirect** methods of biomass assessment at site level for **South Cameroon** and **Lopé** (Gabon)
- Phase 2
  - **Test applicability** of methods derived from sites to improve regional level estimates
- Phase 3:
  - Test the use of VCL data to improve biomass estimation at the **site and region scales**

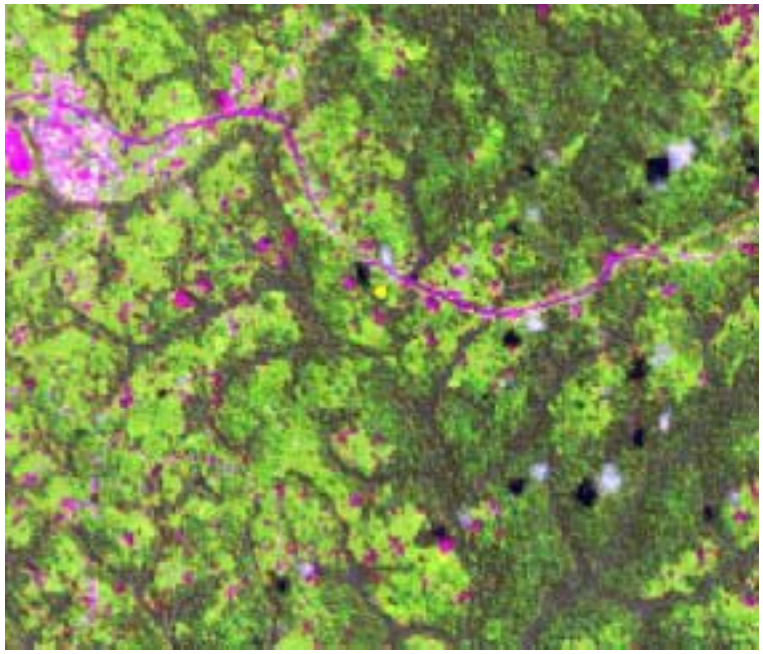
Biomass estimation at field sites

Landsat ETM+



Plot 29 - Total biomass 86 Mg/ha
Mixed forest
Far from capital

Landsat ETM+

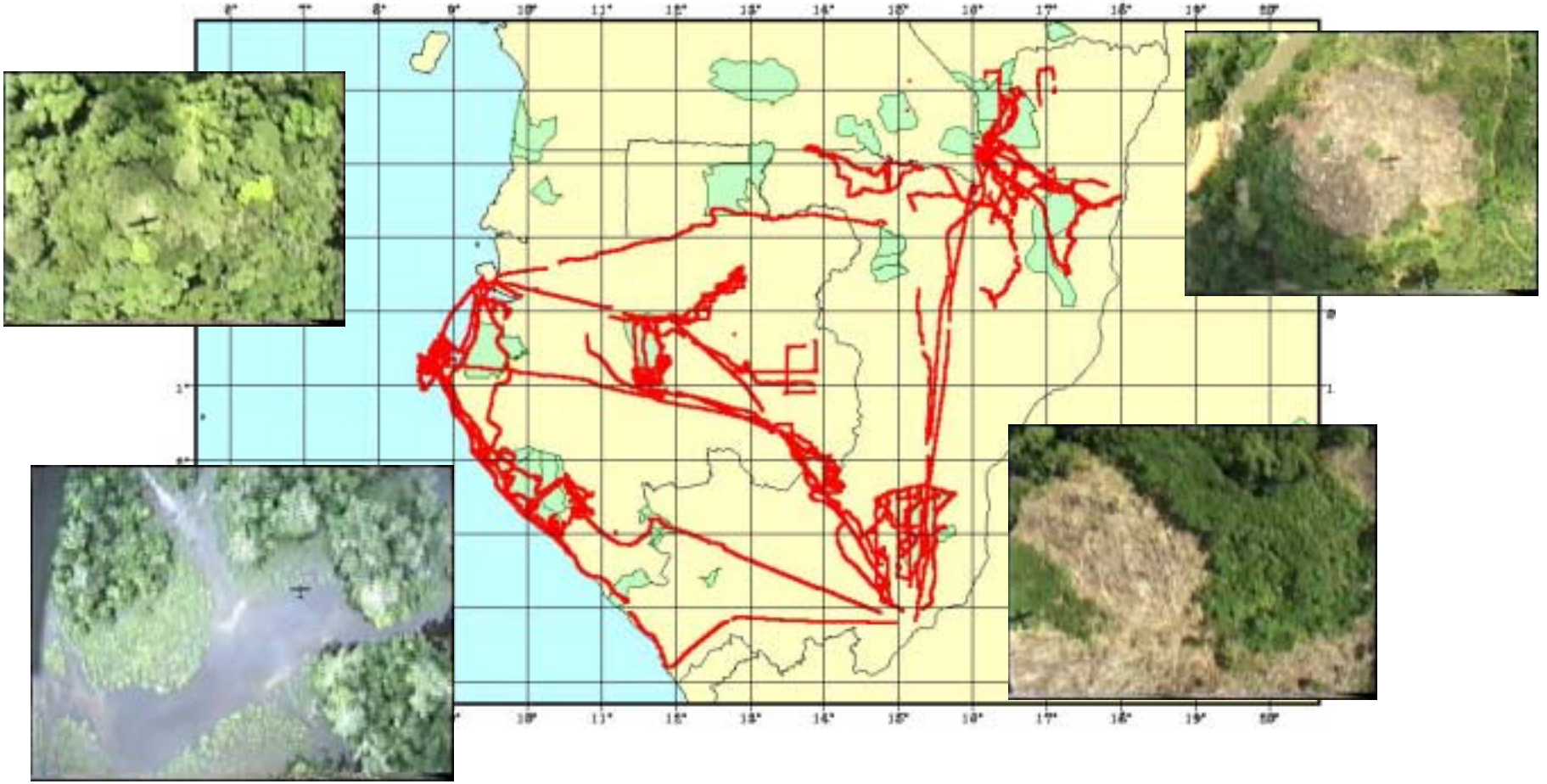


Plot 21 - Total biomass 60 Mg/ha
Swamp forest
Short distance from capital

Validation

- Site level
  - Local collaborators
  - Existing data and limited new field measurements
- Region
  - Aerial videos (WCS / Mike Fay)
  - MIKE network (Hart, Beyers, Walsh)
  - Salonga survey (MZS)
  - Okapi (Hart)

Aerial Video Analysis for LC validation



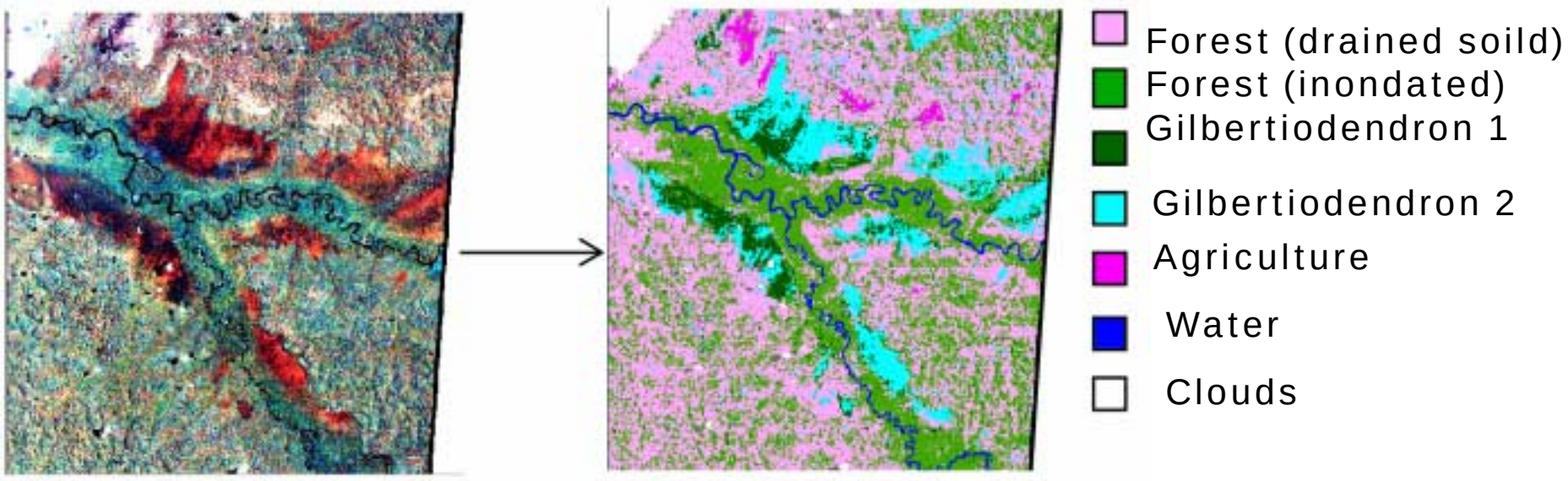
Expected Results

- Better characterisation of tropical forest land surfaces and processes
  - New regional and local land cover maps supporting research activities, in-country Forest Services and conservation efforts
  - Biomass maps at site and regional levels
  - Better characterisation of forest-savanna interfaces
- Standardised field validation data sets for regional land cover maps

Expected Results

- Network of forest managers, ecologists and remote sensing specialists
- Facilitate exchange and distribution of satellite RS products in the region
  (WWW & CDs)
- Increased participation of Central African scientists in GOFC and NASA/LCLUC goals
  (e.g. Forest monitoring, carbon, etc.)

Share image data, methodology and products with in-country collaborators



TM - Salonga- 550 sqm
(C.C. 4,5,7)

Classification provided to field crew

Participation in the organization of a CARPE-GOFC regional forest monitoring workshop

LOPE Workshop 4 July- 20 July 2000

Integrated Forest Monitoring

- Distribution of final products to national forest services and conservation organizations
- FM activities follow up & mentoring through C ARPE and GOFC network (Training)
- Convene a Regional workshop on Forest Monitoring with local and international players (Development of Research Agenda)