Global Mangroves: Mapping and Monitoring
4tH Science Advisory

Global Mangroves

- Overall project objective
  - Development and validation of a system for:
    - Mapping the global extent of mangroves (tropical, subtropical and temperate).
    - Providing descriptors for baseline establishment.
      - Extent
      - Biomass
      - Density
      - Species/community composition

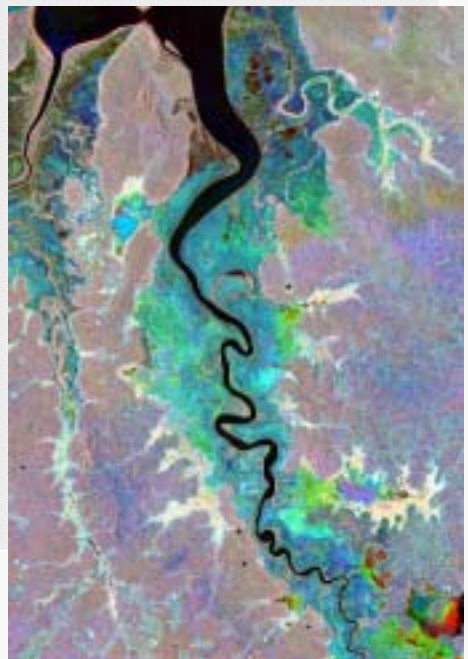
Rationale

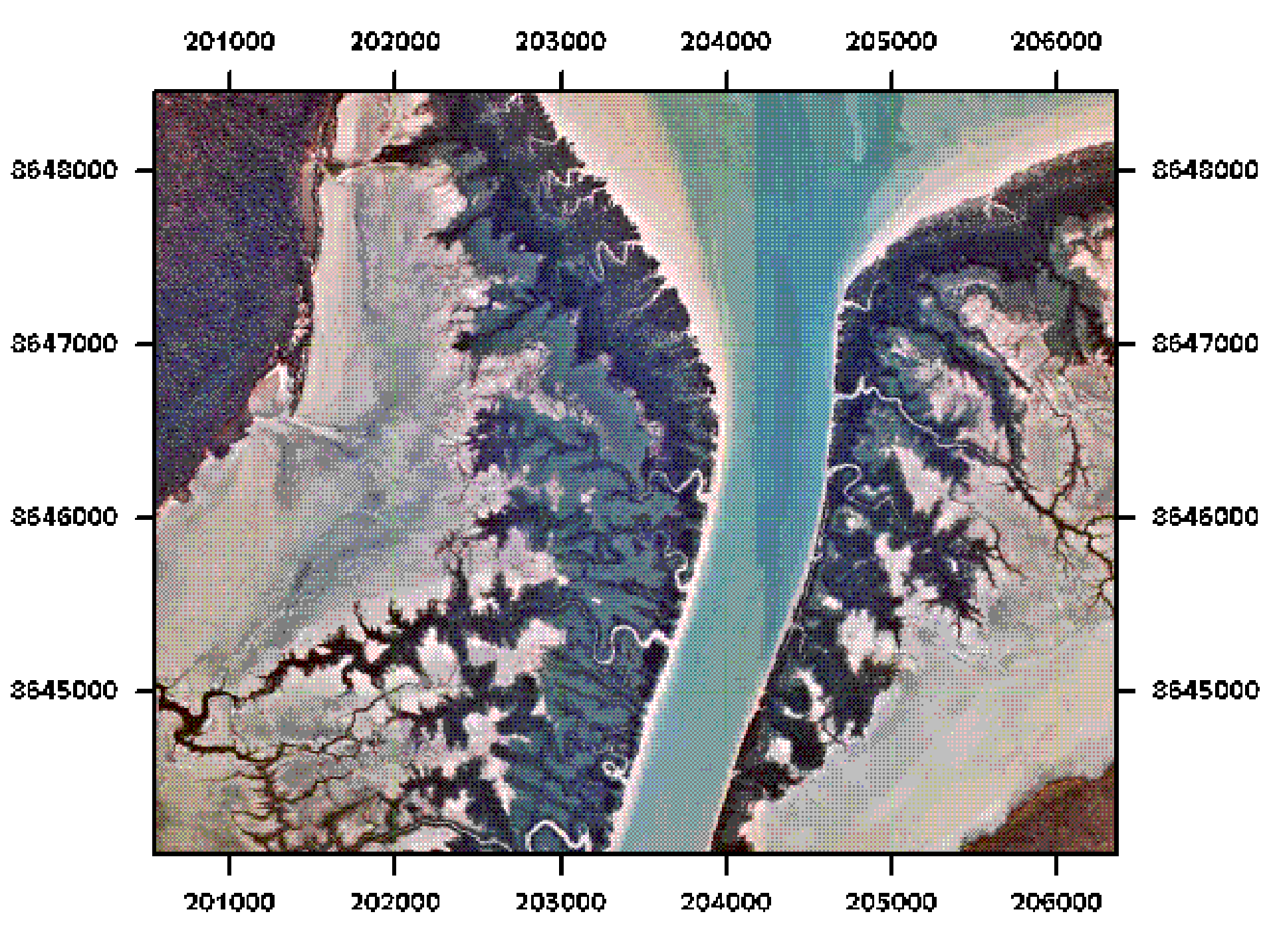
- Requirement for an up-to-date global map of tropical, subtropical and temperate mangroves.
- Required to:
  - Establish a baseline dataset against which to assess change (i.e. within a monitoring framework).
    - Sea level rise, climate change (e.g., increased cyclonic activity)
    - Anthropogenic clearance and degradation
  - Evaluate impacts of change on fisheries, coastal protection etc.
  - Estimate greenhouse gas emissions

STUDY SITES

West Alligator River, Kakadu N.P. Australia. (1998 RADARSAT Scansar Composite/ Change Image)

February (Blue)
WET SEASON
May (Green)
EARLY DRY SEASON
September (Red)
LATE DRY SEASON

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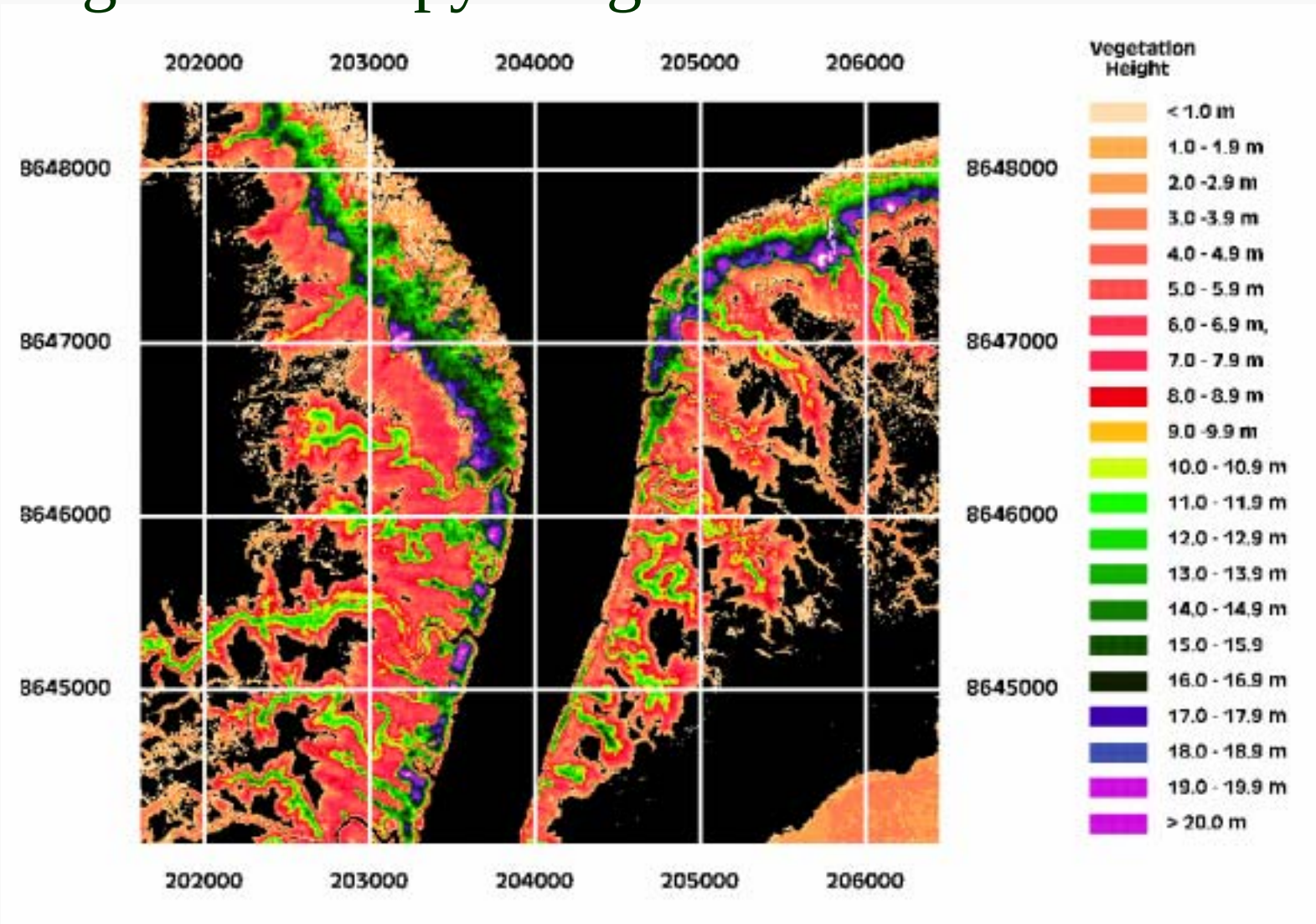
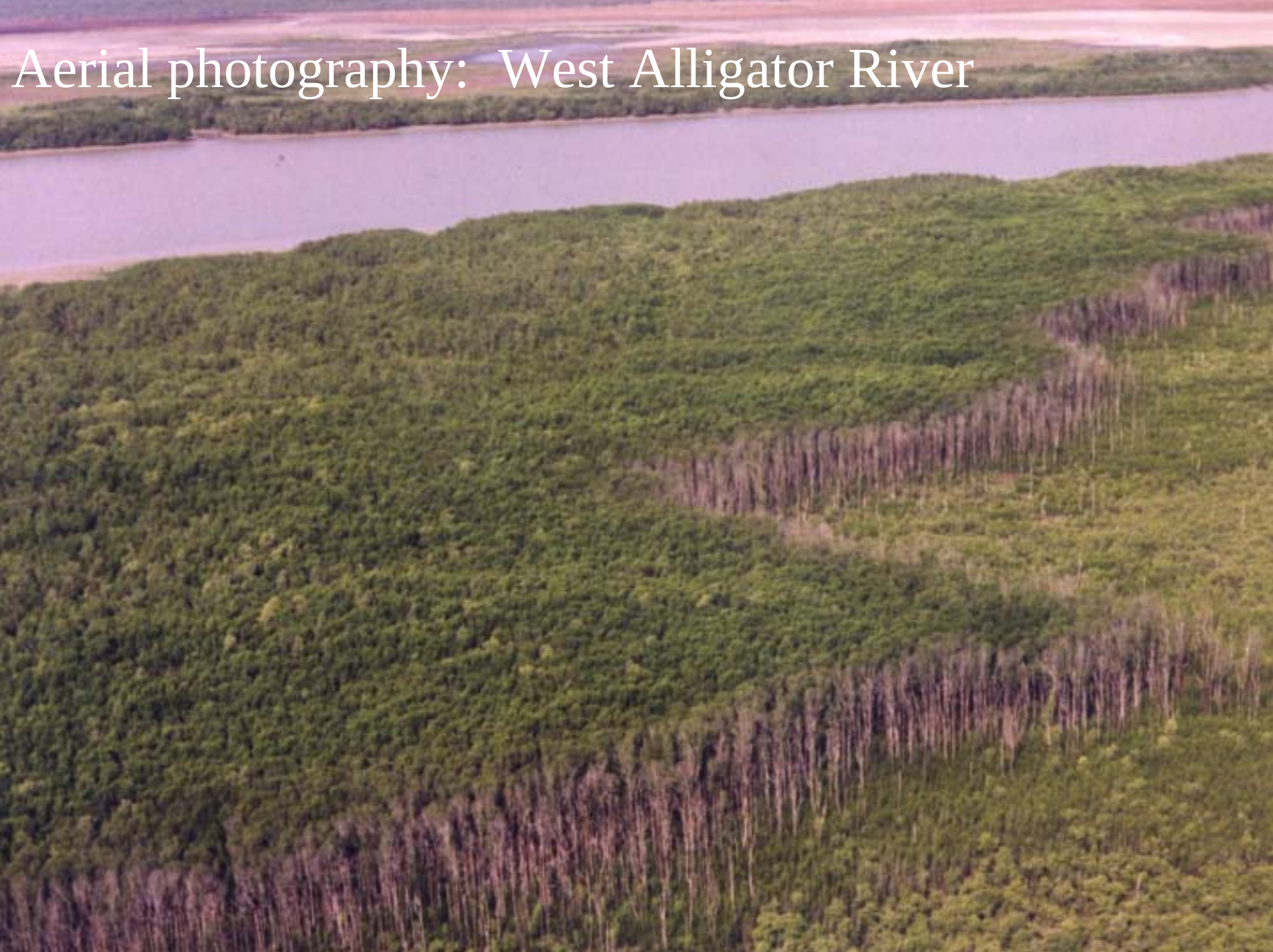
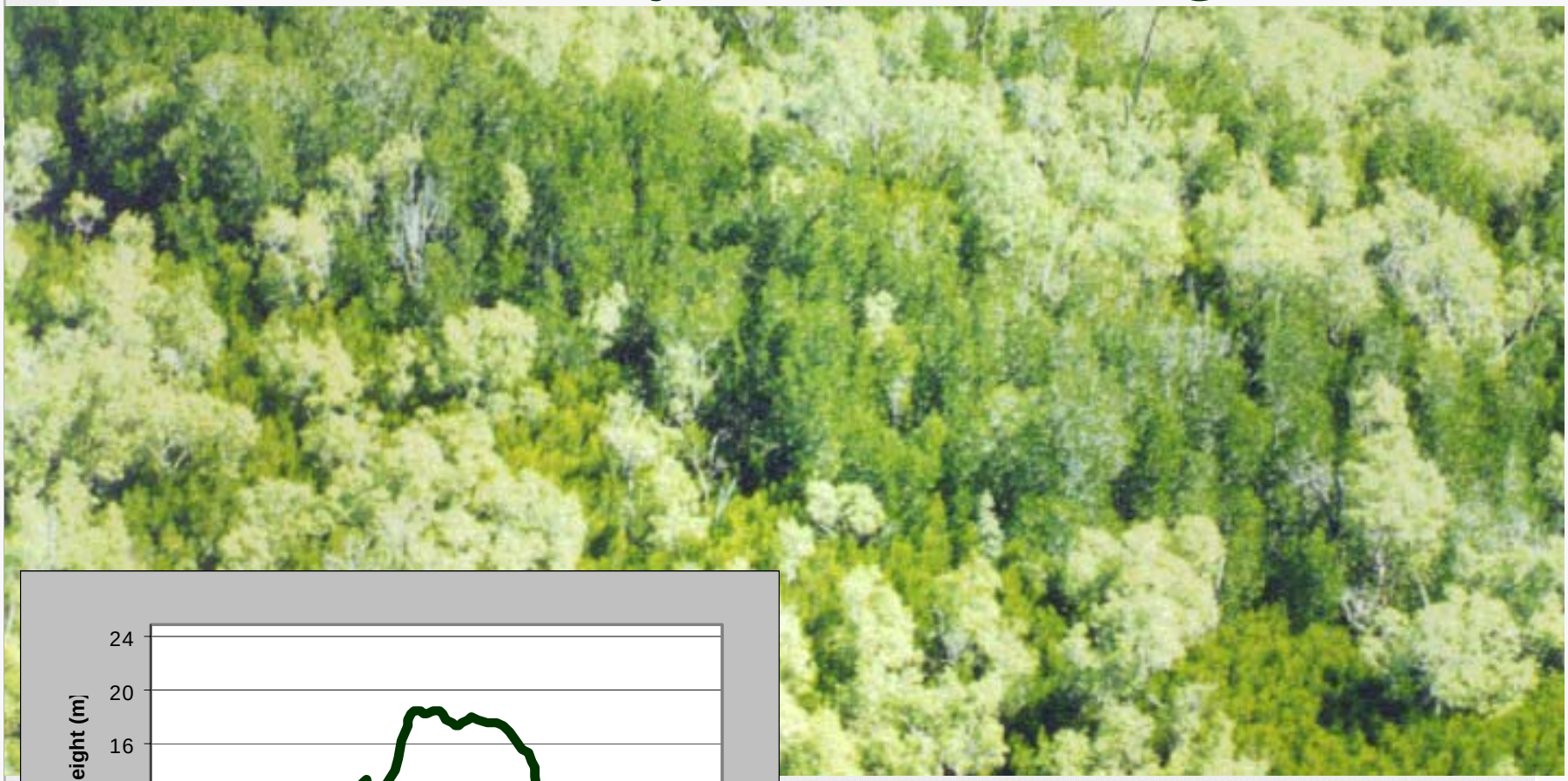
Mangrove Canopy Height

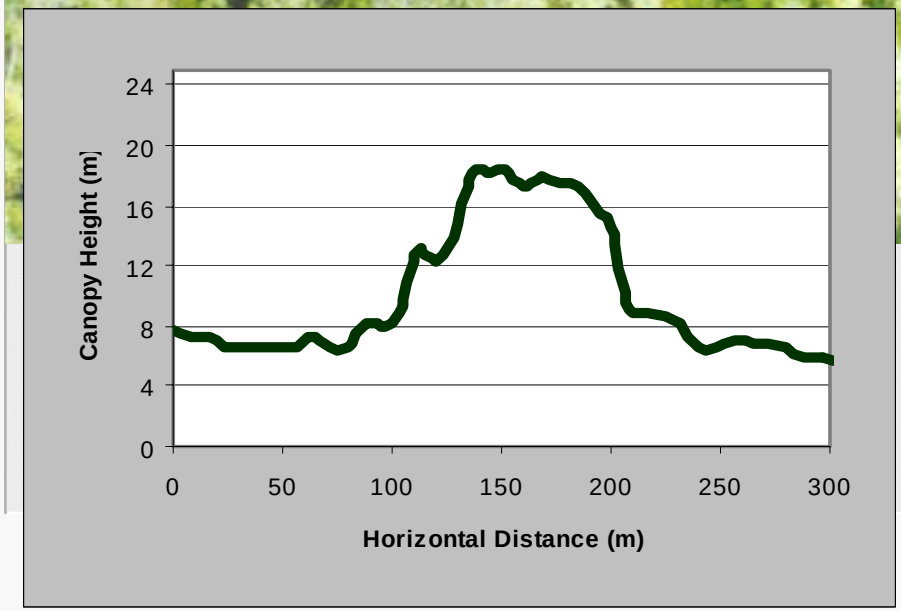


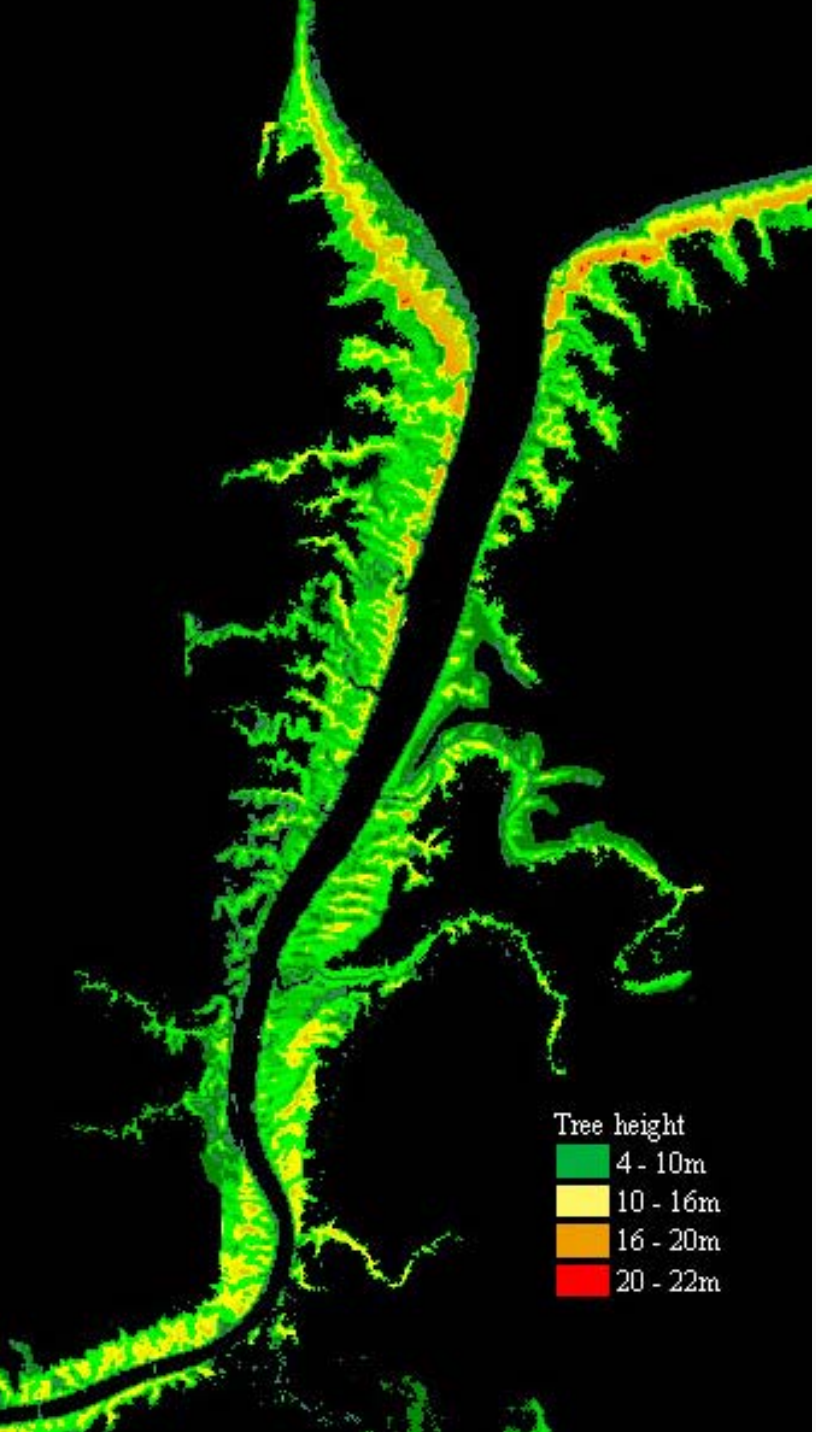
Lucas, R.M., Ellison, J.C., Mitchell, A., Donnelly, B., Finlayson, M. and Milne, A.K. 2002.
Use of stereo aerial photography for quantifying changes in the extent and height of mangroves in tropical Australia.
Wetlands Ecology and Management 10: 161-175.


Aerial photography: West Alligator River

Transect across tributary of the West Alligator



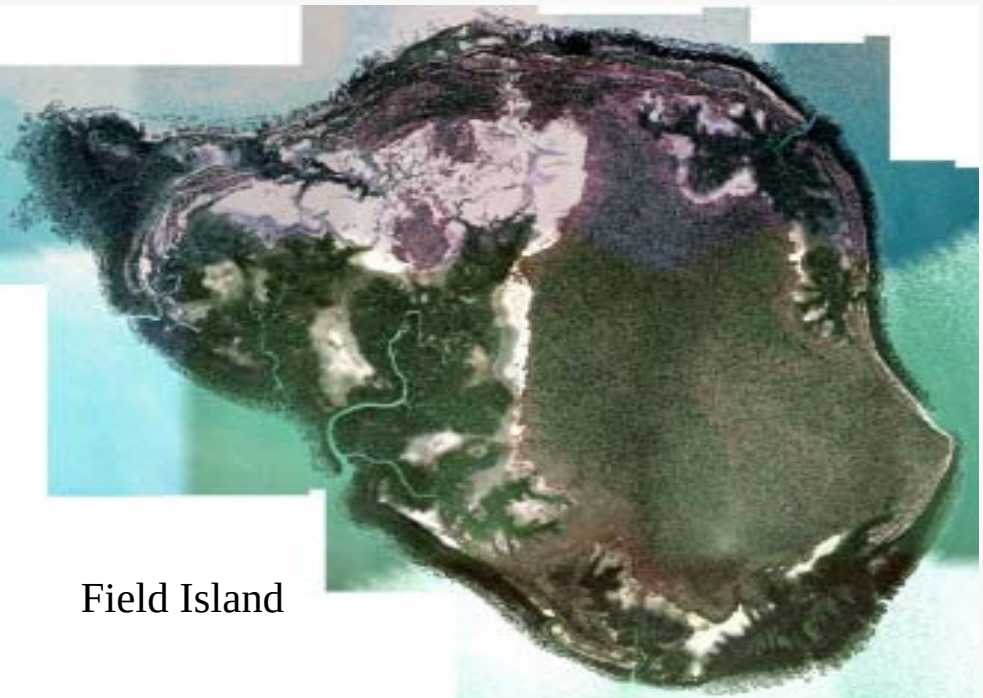




DEM: West Alligator River

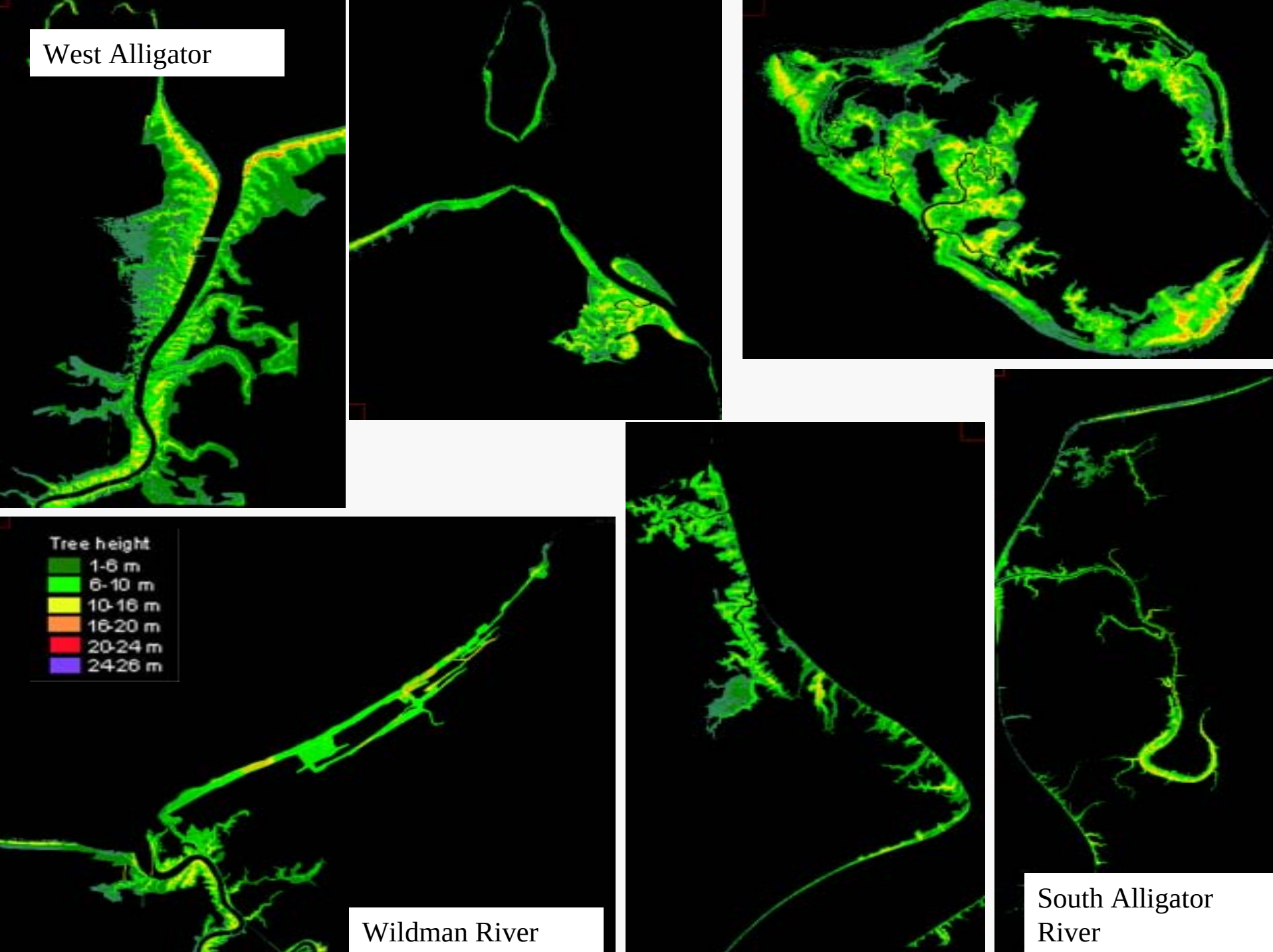
Mangroves of the ARR, Kakadu NP

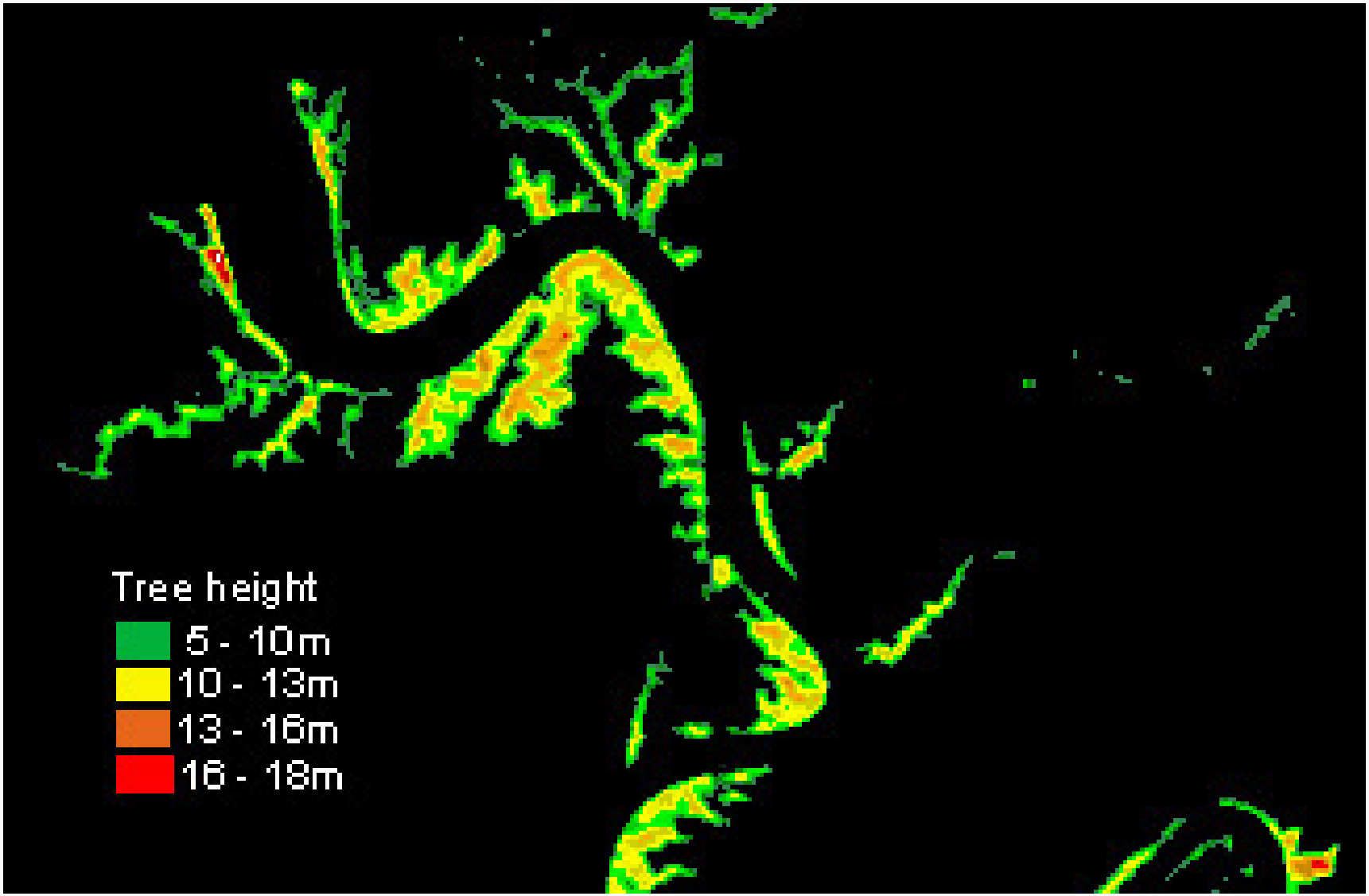
West Alligator River



Field Island

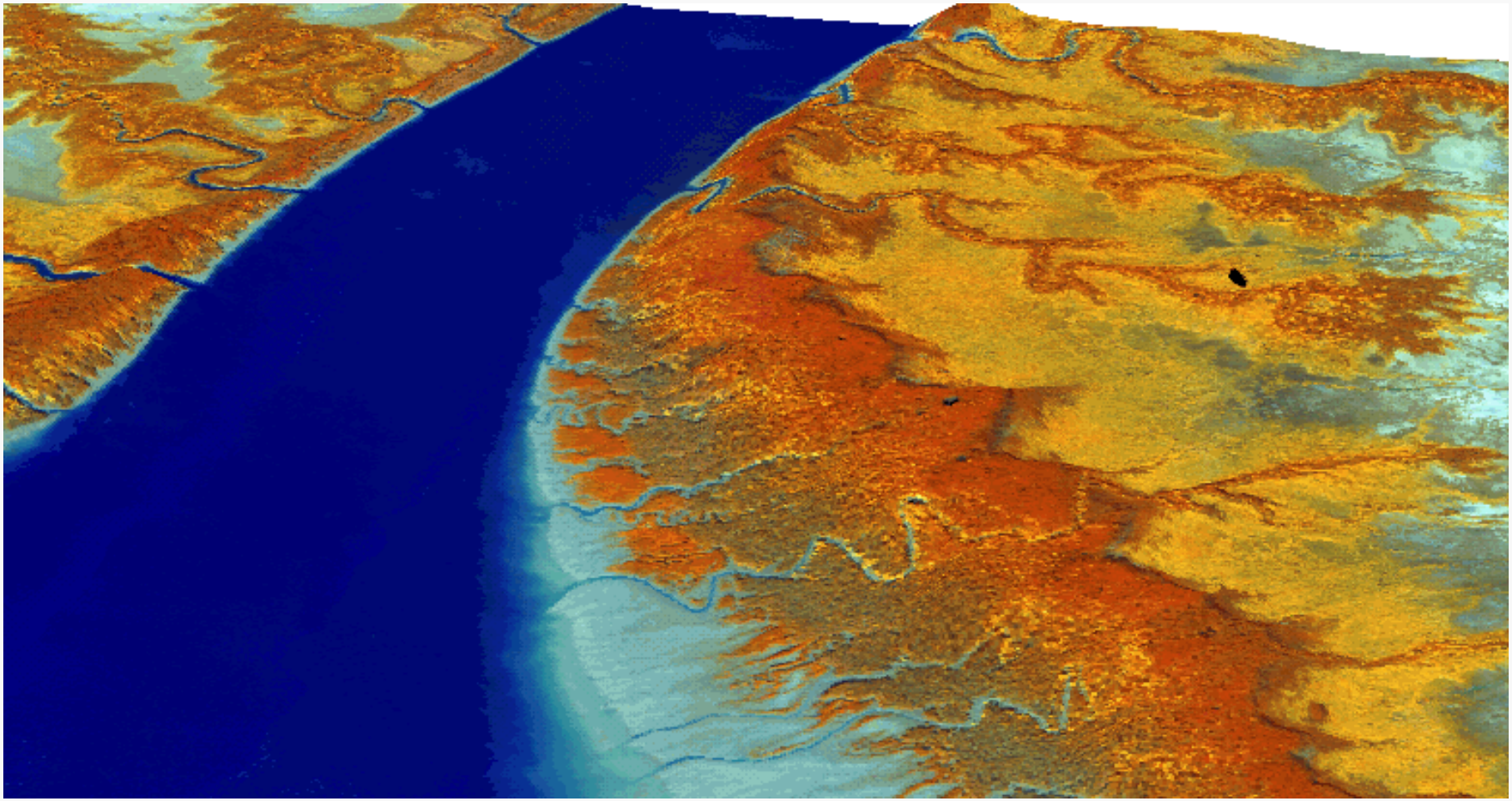
East bank, South Alligator River

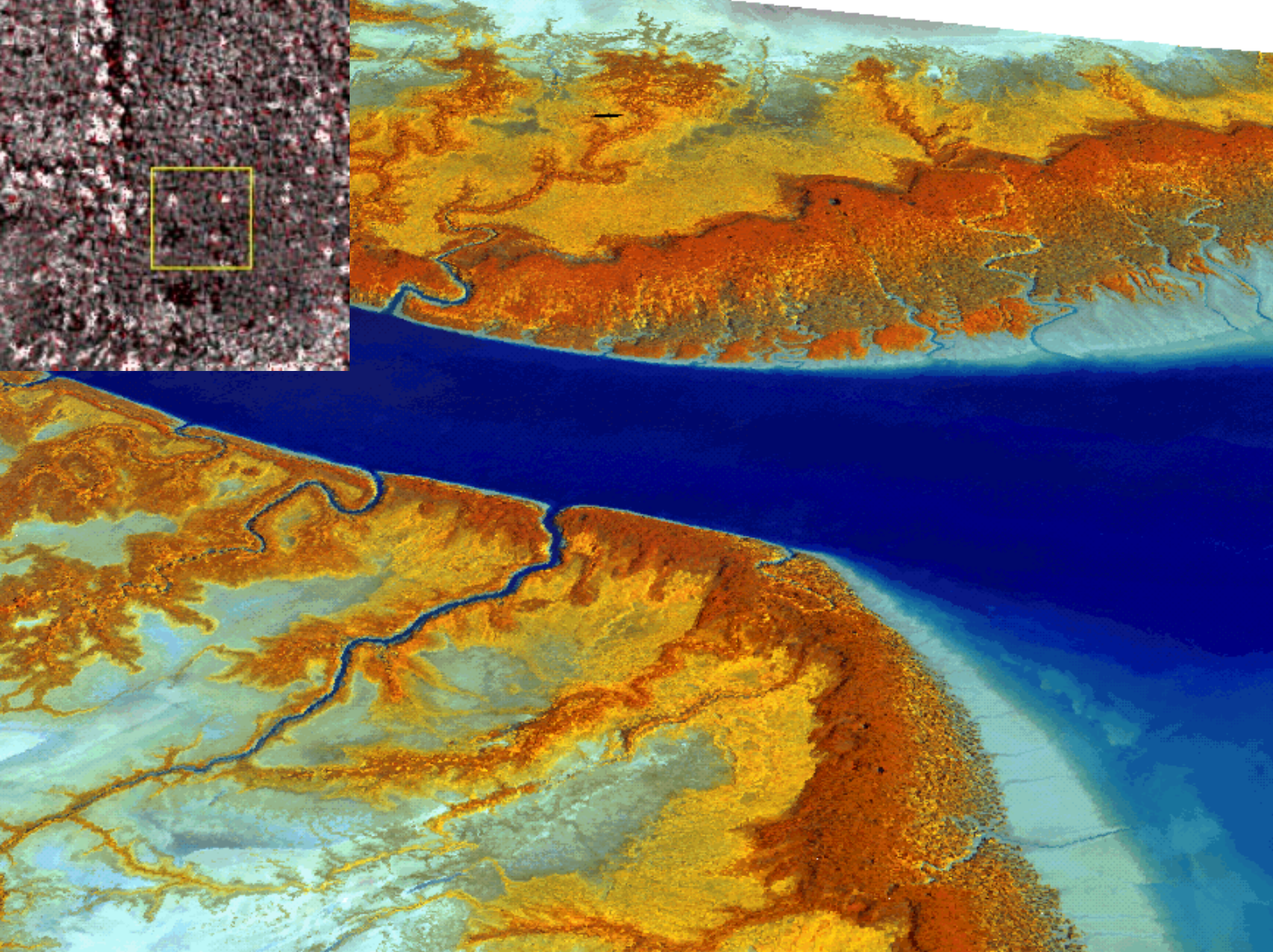

West Alligator
Tree height
1-6 m
6-10 m
10-16 m
16-20 m
20-24 m
24-26 m
Wildman River
South Alligator River


Tree height
5 - 10m
10 - 13m
13 - 16m
16 - 18m

SPECIES DISCRIMINATION.

West Bank: Perspective view combining species information from CASI data and canopy height from stereo photography





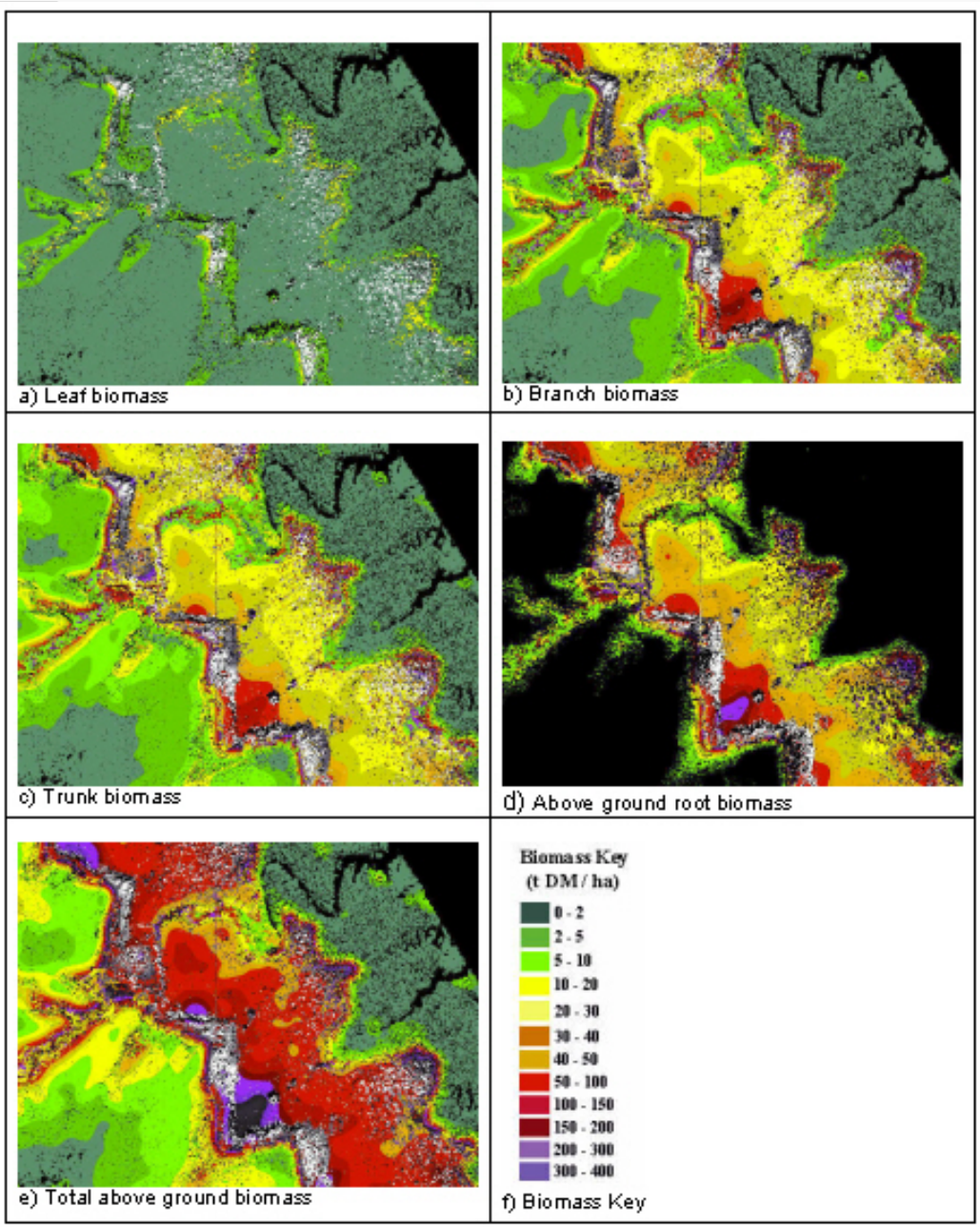
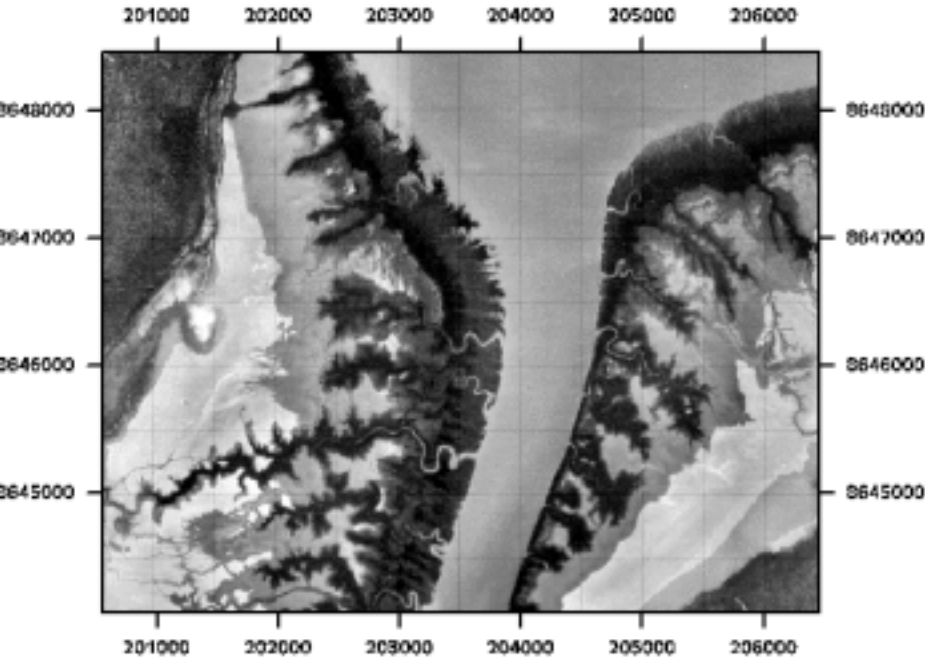


Figure 7. Spatial datasets of total above ground and component biomass (t dry matter (DM) ha-1).

Estimation of Total and Component Biomass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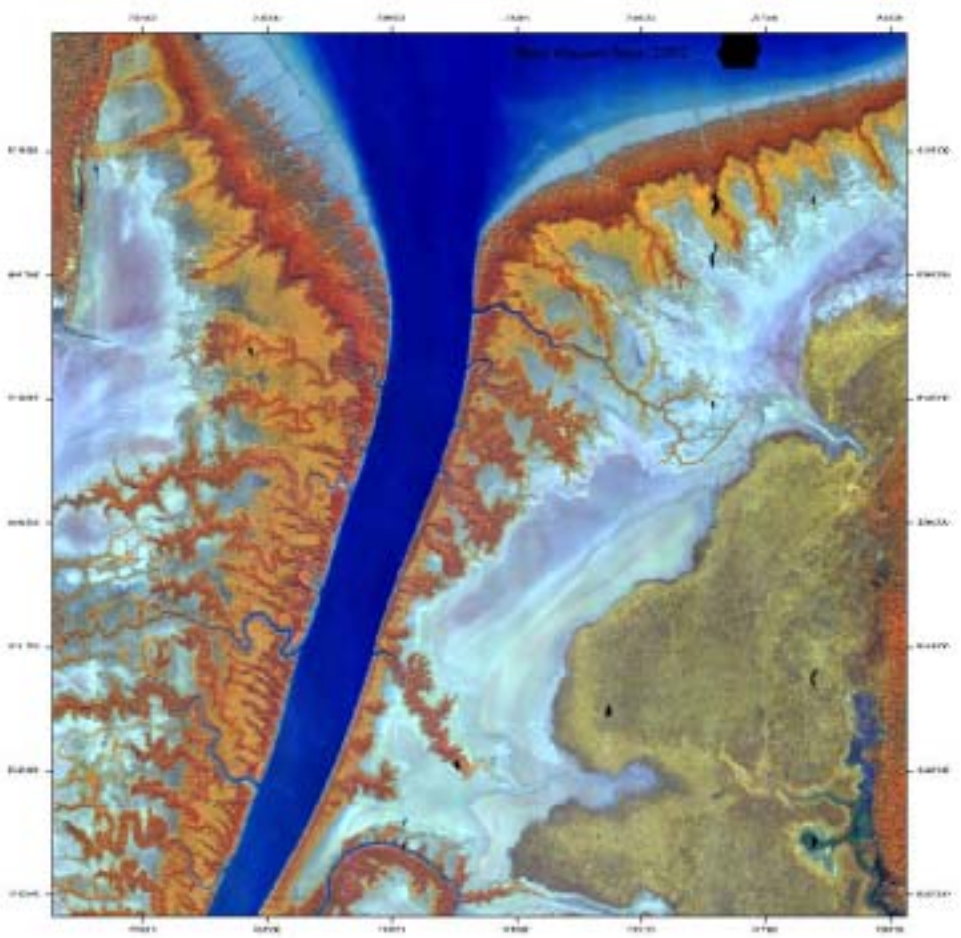

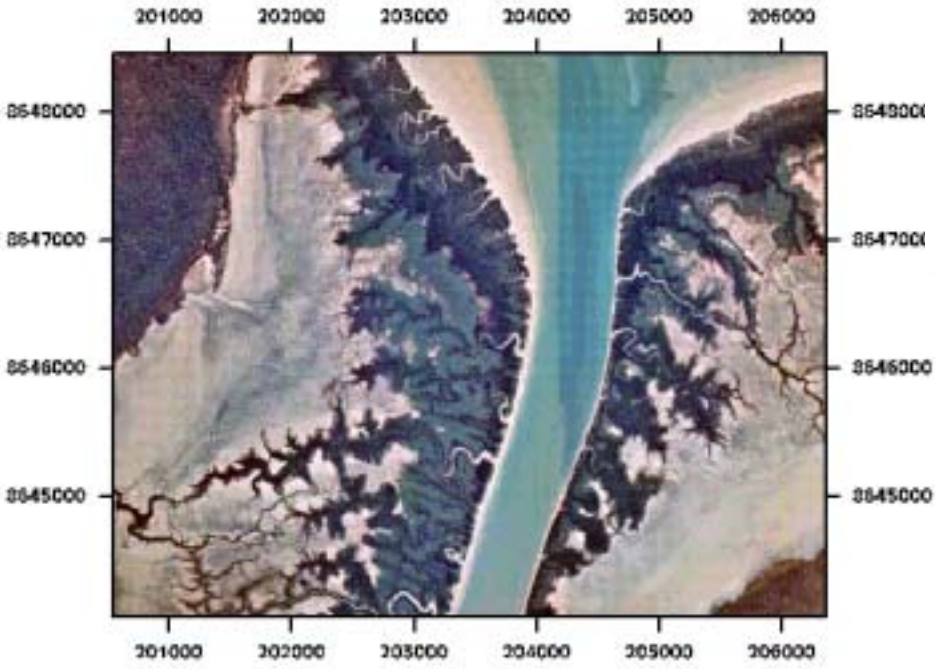
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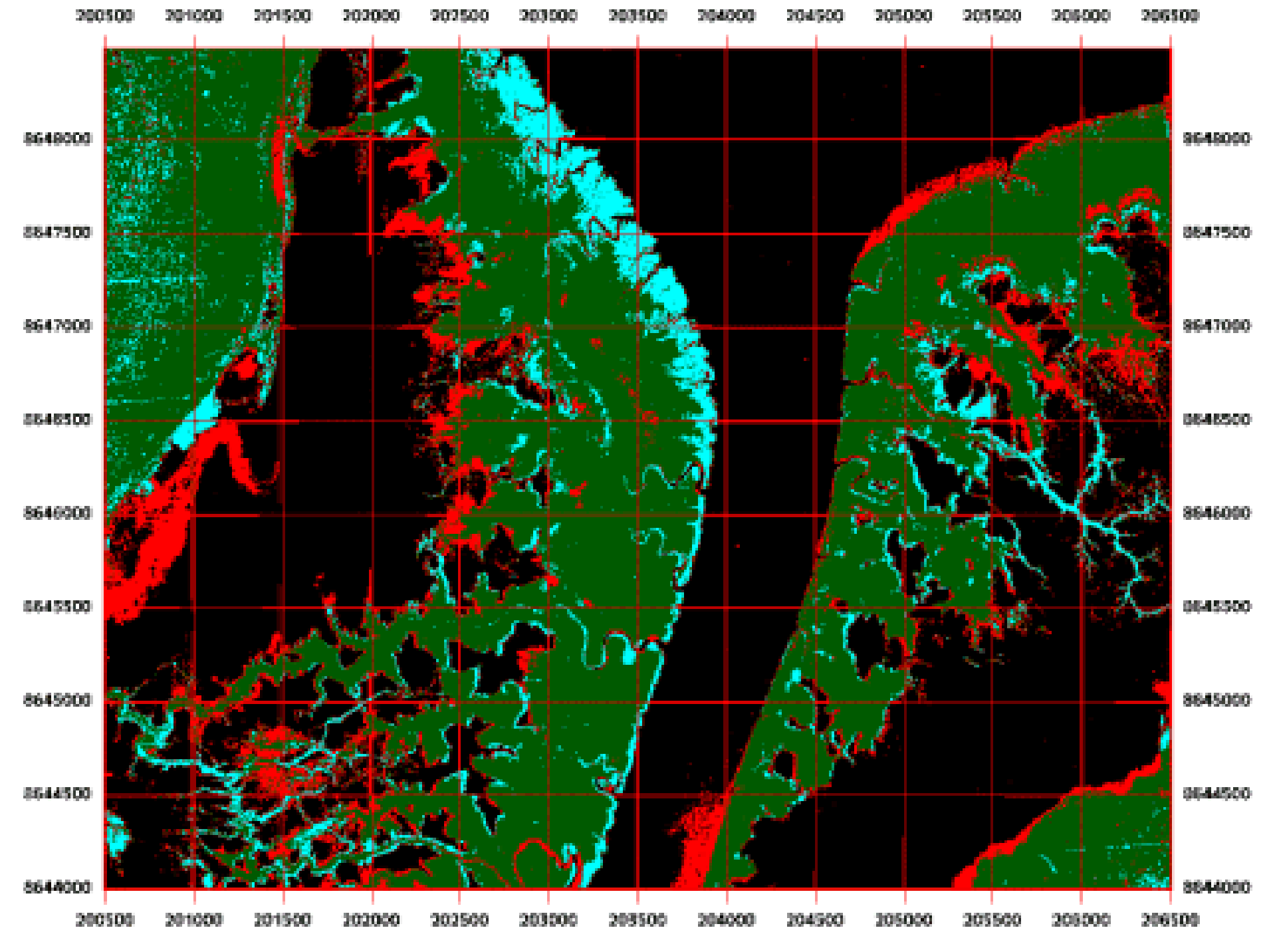
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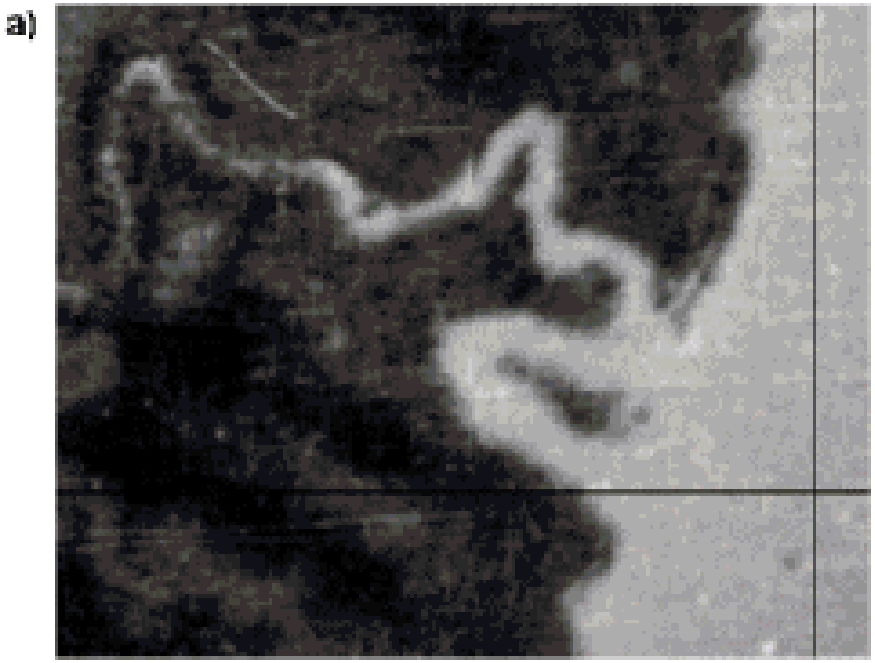
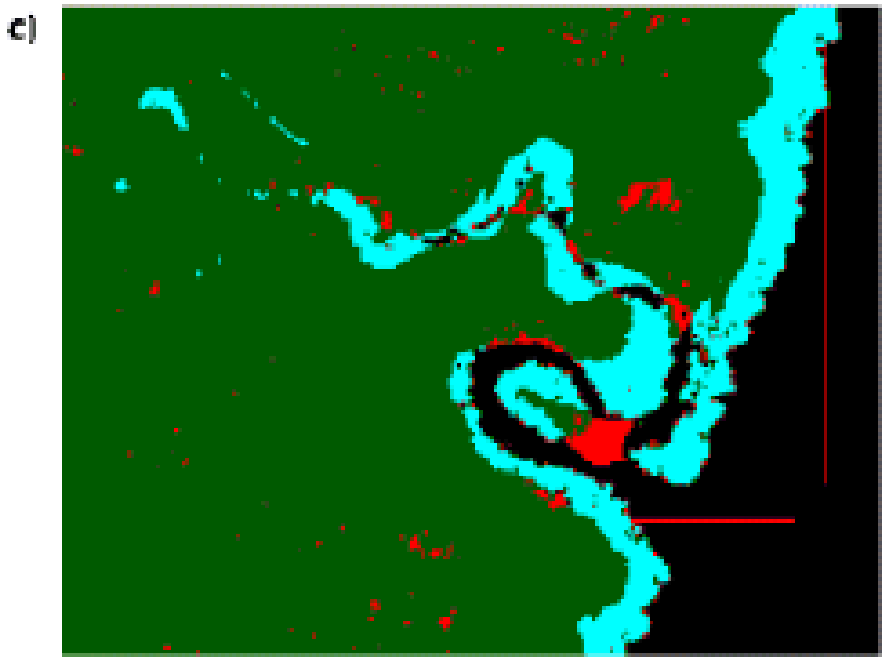
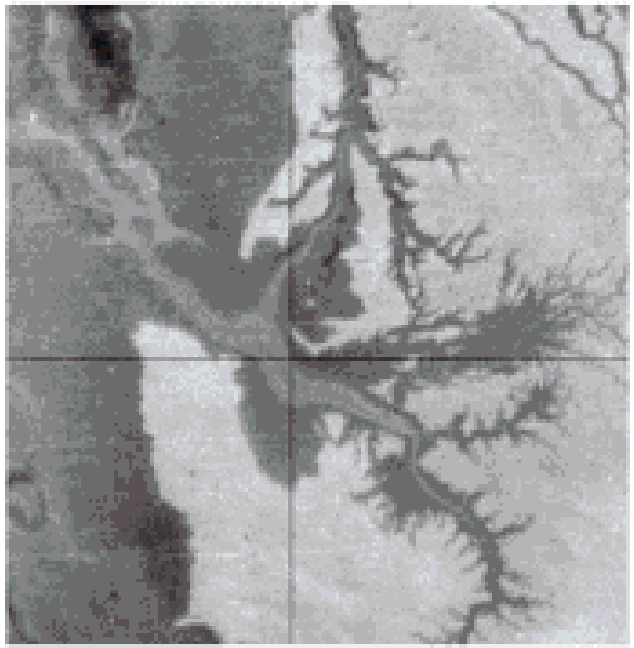




Changes in the extent of mangroves (1950-1991), Kakadu National Park

a)



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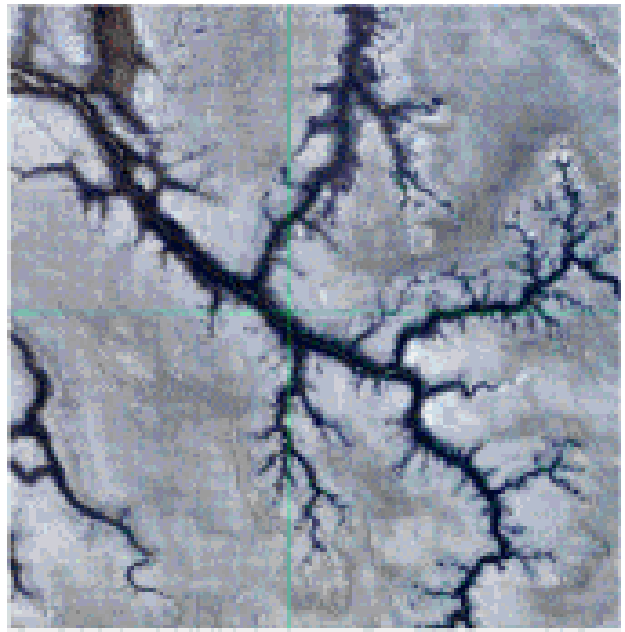
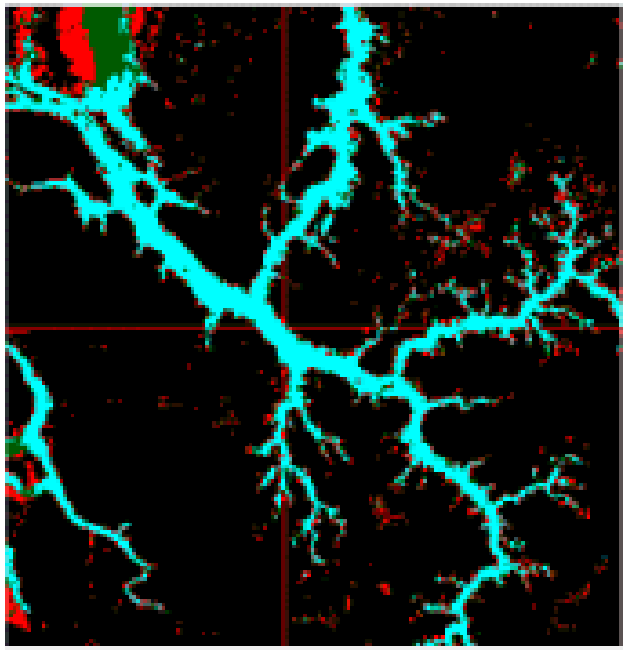
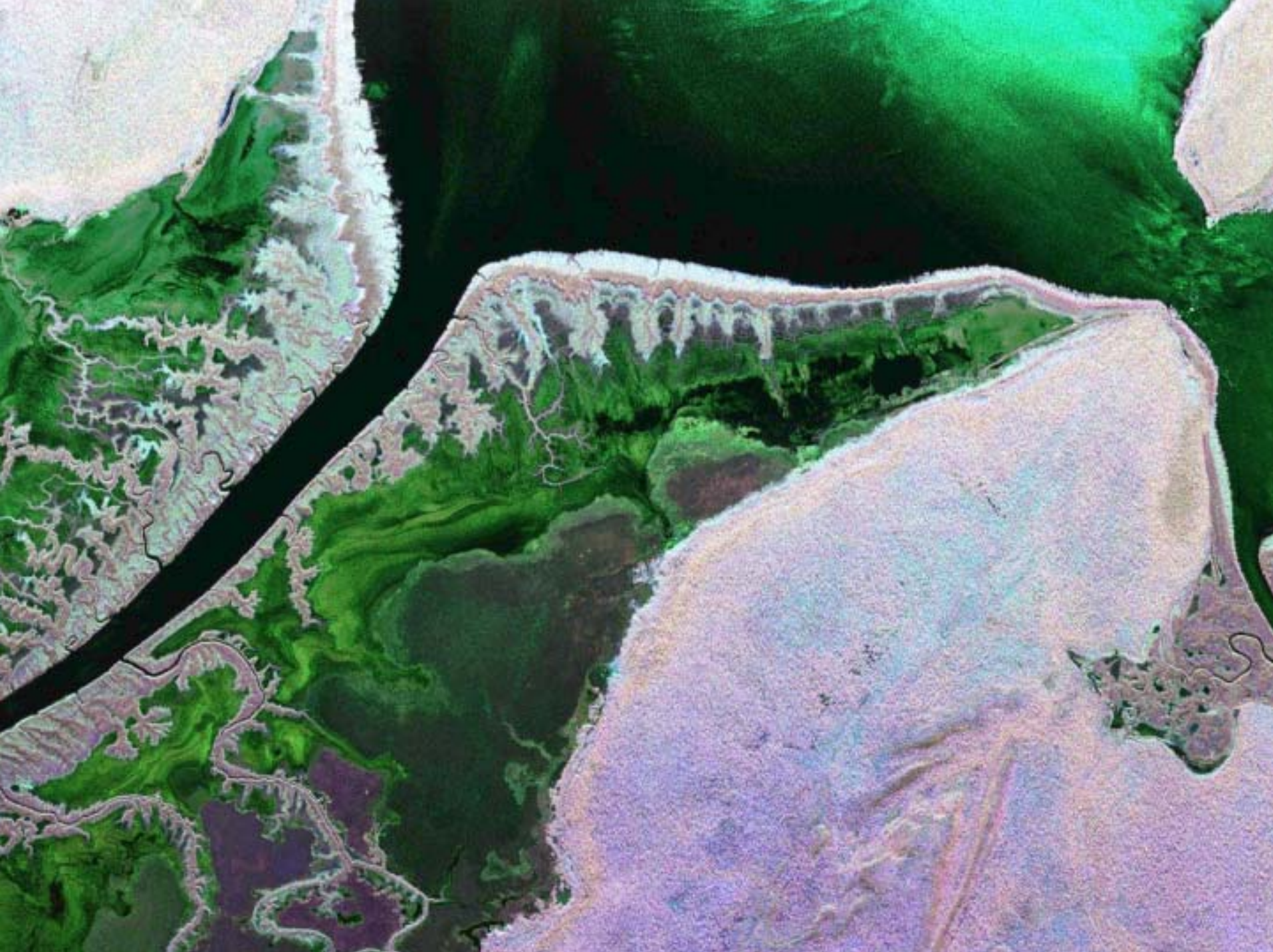


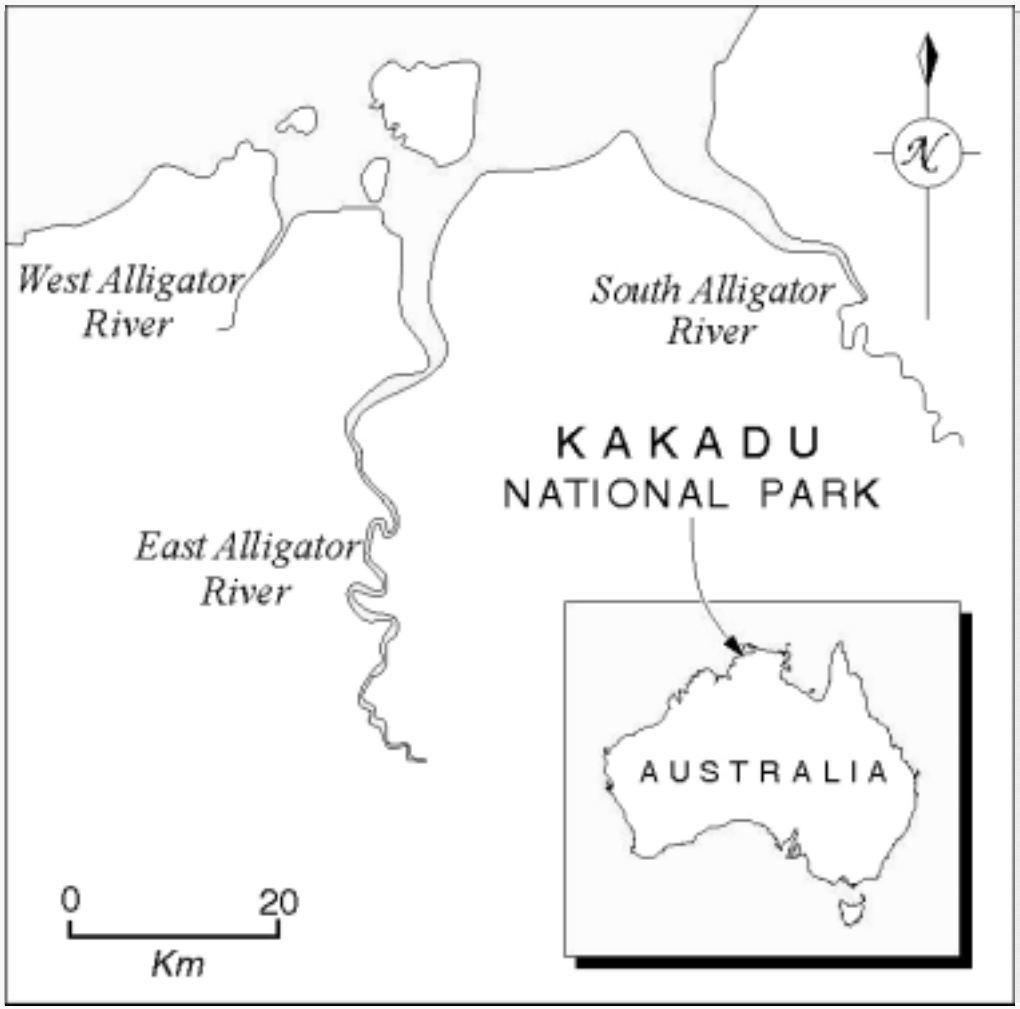
Saltwater Intrusion and Headwater Extension

c)

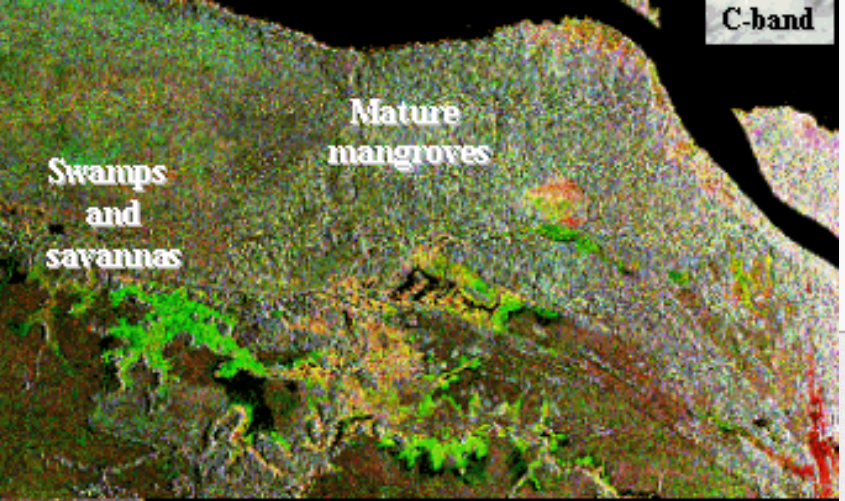


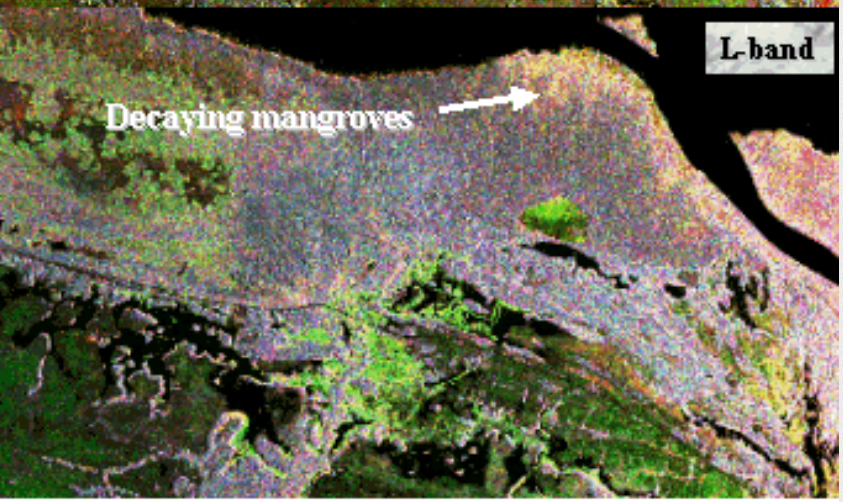


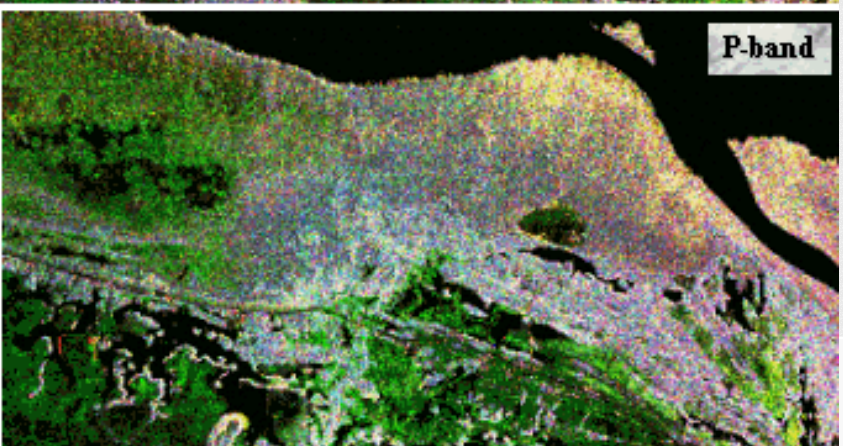
Alligator Rivers Region (ARR), Kakadu NP

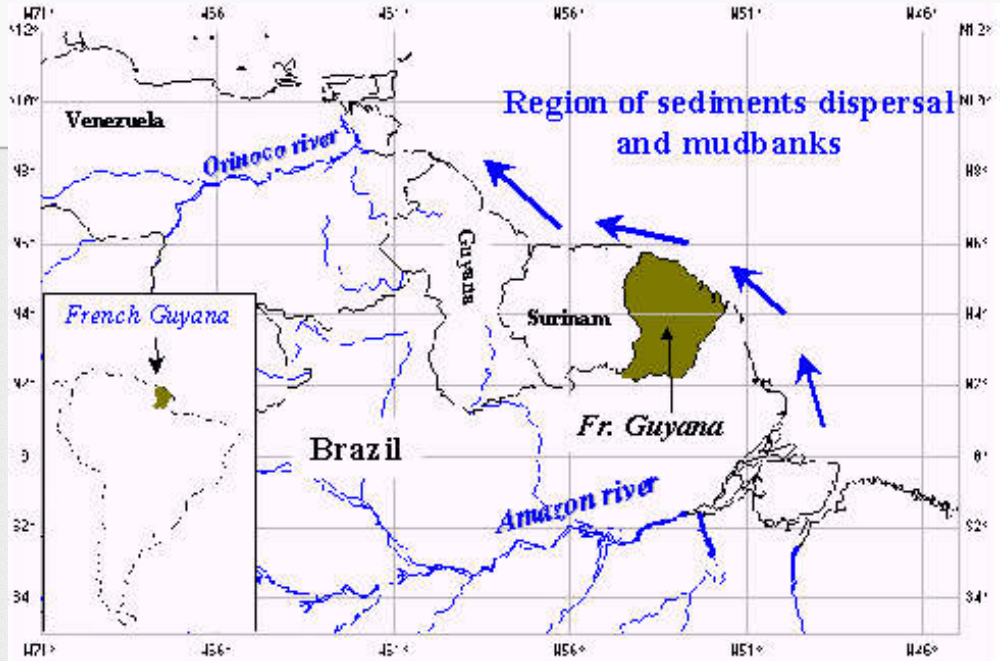


Study Sites





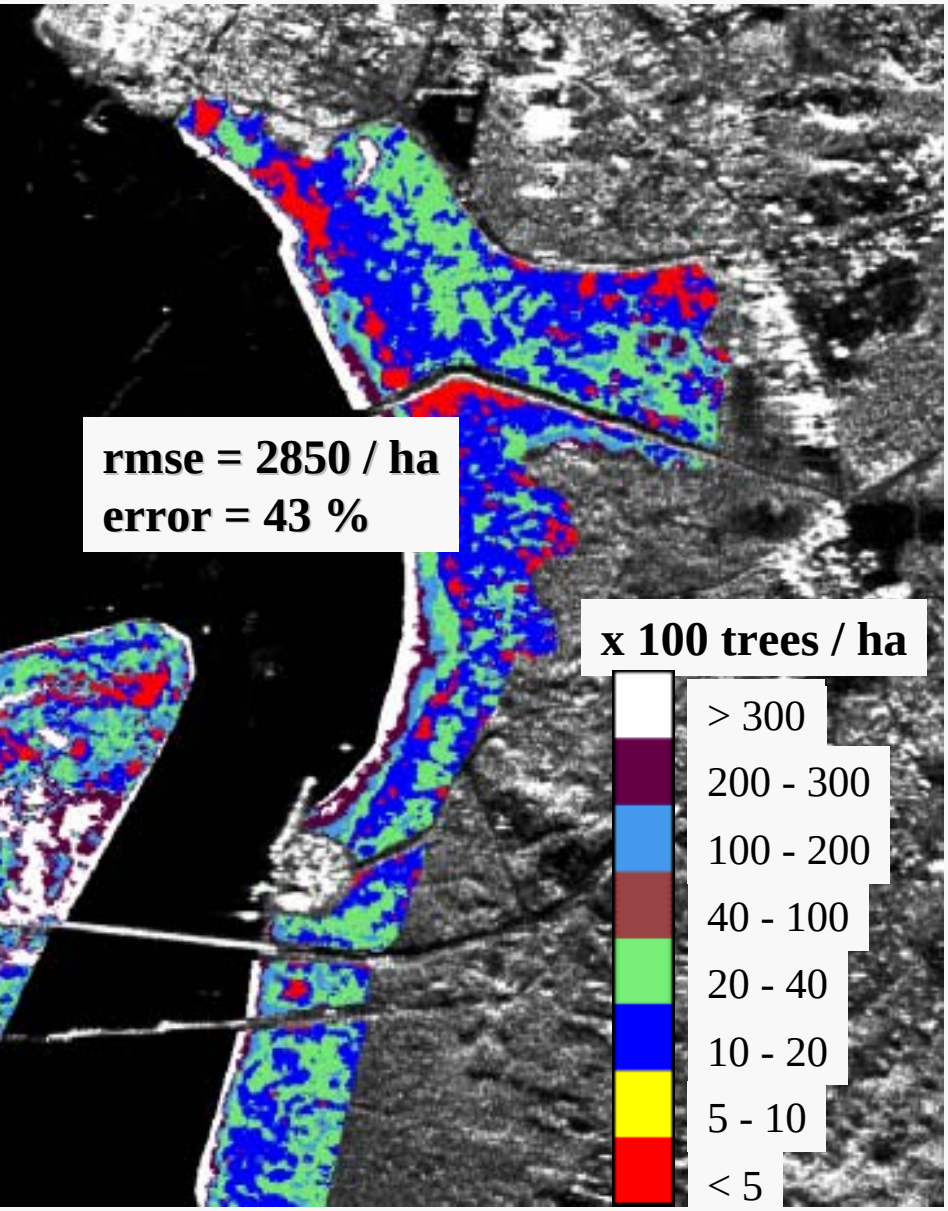




Crique Fouillée, French Guyana

Mangrove Response to Coastal Environmental Change

- AIRSAR data acquired for many sites worldwide:
  - Crique Fouillée, French Guyana
  - Kakadu N.P., Australia
  - Ajuwa River, Irian Jaya
  - Daintree N.P., Australia
  - Guinea, central Africa (SIR-C SAR)
  - Sungai Wain and Sambaliung, Indonesia
- Several areas have multiple acquisitions
  - Kakadu N.P. (1993, 1996, 2000).
- Potential for establishing changes in internal structure and biomass as well as extent.


rmse = 2850 / ha
error = 43 %
x 100 trees / ha
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5 - 10
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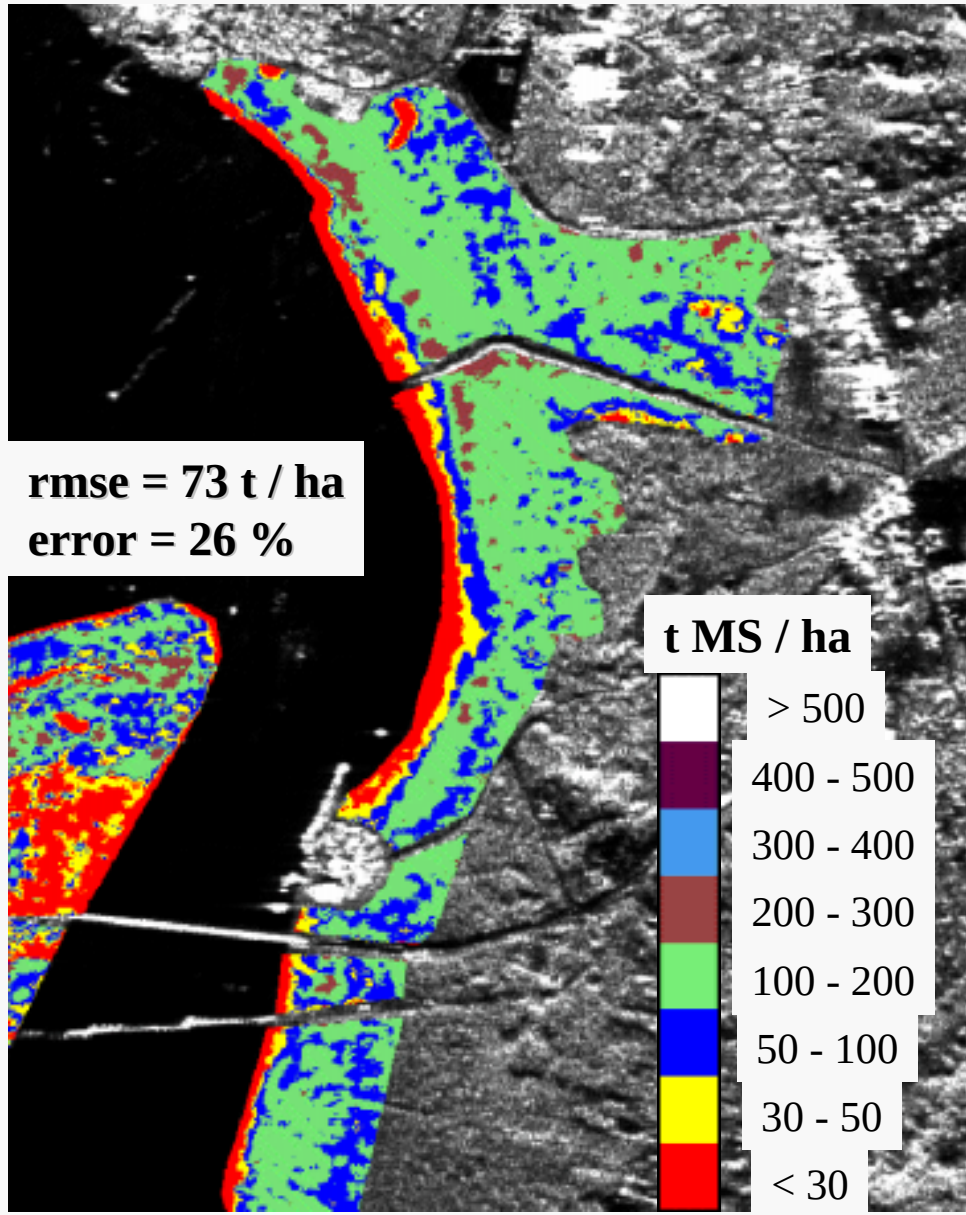
rmse = 73 t / ha
error = 26 %
t MS / ha
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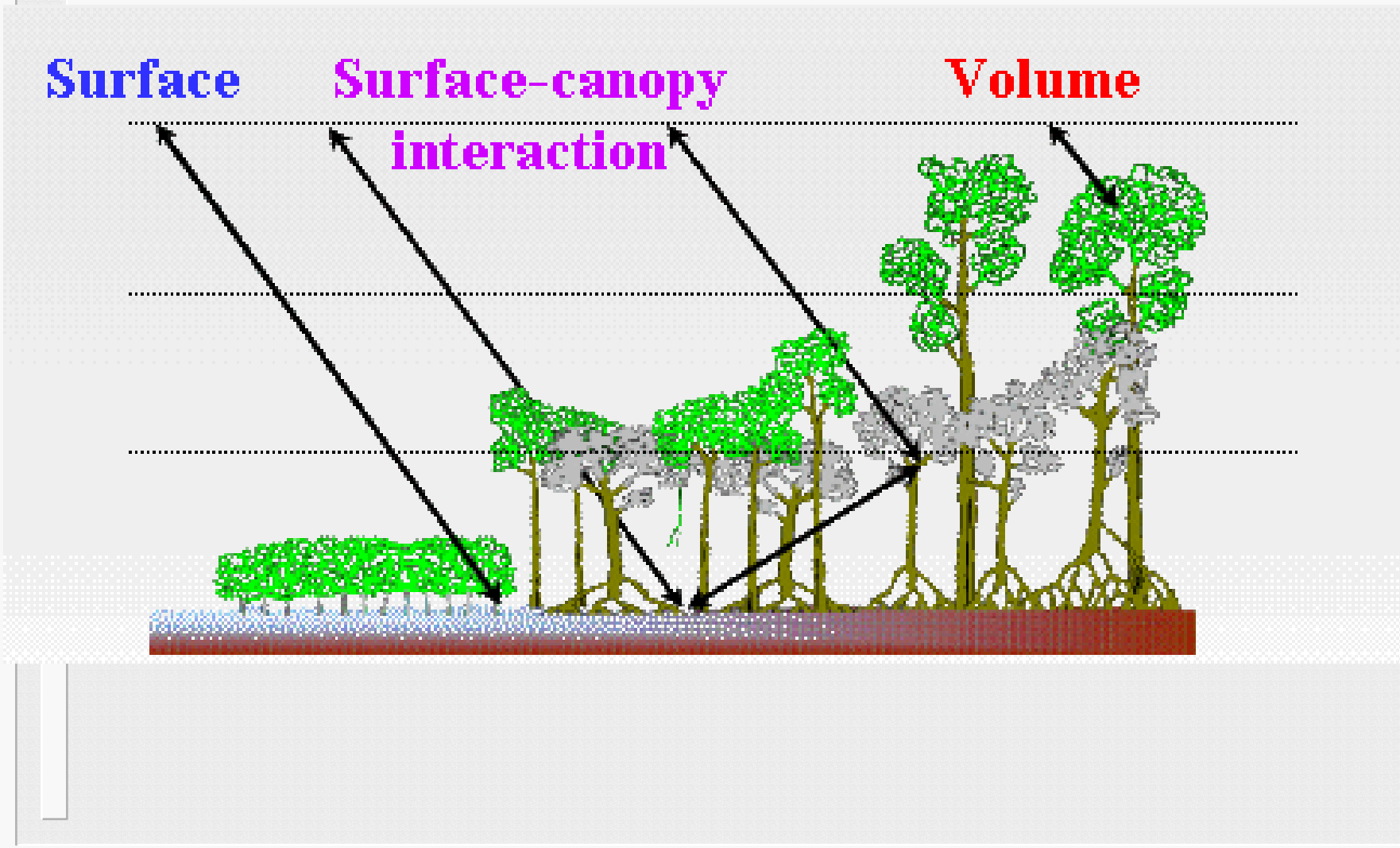
< 30

Mangroves: Scattering Mechanisms



Role of ALOS PALSAR

- Better estimation of mangrove extent and potentially biomass (albeit relative) and density.
- Integration with data from optical/hyperspectral sensors essential for classifying species, communities and hence zonations.
  - E.g., Landsat ETM+ derived maps for northern Australia.
- Integration with data from other SAR sensors (e.g., ENVISAT ASAR)

Product Deliverables

- For sites worldwide, finer spatial resolution datasets/models for:
  - Understanding
    - SAR response of mangroves (role of C and L band SAR)
  - Validation
    - Tree height (e.g., from ALOS PALSAR interferometry)
    - Extent
    - Biomass, density and species/community composition
- Basic tools to support and give confidence to mangrove mapping.
- Global map of mangrove extent
- For selected regions, validated mangrove maps (e.g., northern Australia, Amazon estuary, Indonesia).

Collaboration

- UNSW/UWA (Australia, UK)
- ERISS (Australia)
- CSIRO Land and Water (Australia)
- Queensland Department of Natural Resources/Northern Territory Government (Australia)
- NASA JPL, US (South East Asia and Africa)
- IRD (South America including French Guyana)
- University of Wageningen (Indonesia)
- University of California, Santa Barbara (South America)
- CENPES PIATAMAR, Brazil.

Milestones

- Finalisation of mosaics for Kakadu National Park and establishment of baseline datasets from photography, CASI and AIRSAR (July/August, 2003).
- Finalisation of review paper (July, 2003)
- Collaborate to produce consistent supportive datasets for other regions.
- Consolidation of partners (developers and users) and submission for funding (end 2003)
- Acquisition of ALOS PALSAR data and associated (e.g., ENVISAT ASAR) data.
- Application of algorithms for mangrove characterisation at selected sites worldwide and validation
- Development of products (i.e., methods)
- Promotion of uptake by agencies charged with mangrove mapping.
- Completion of mangrove maps for remaining areas (e.g., Mozambique)