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Using multi-temporal ALOS PALSAR to investigate flood dynamics in semi-arid wetlands: Murray Darling Basin, Australia.

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and
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Project Objectives

- The establishment of baseline data for rivers and wetlands in the MDB to identify priorities for conservation action and rehabilitation under the International RAMSAR Convention
- To improve estimates of habitat availability for wetland dependent species and to identify species or habitats that require conservation.
- To evaluate the carrying capacity of the land for agriculture and potential carbon storage
- To perform flood risk mapping for flood mitigation and Government emergency response

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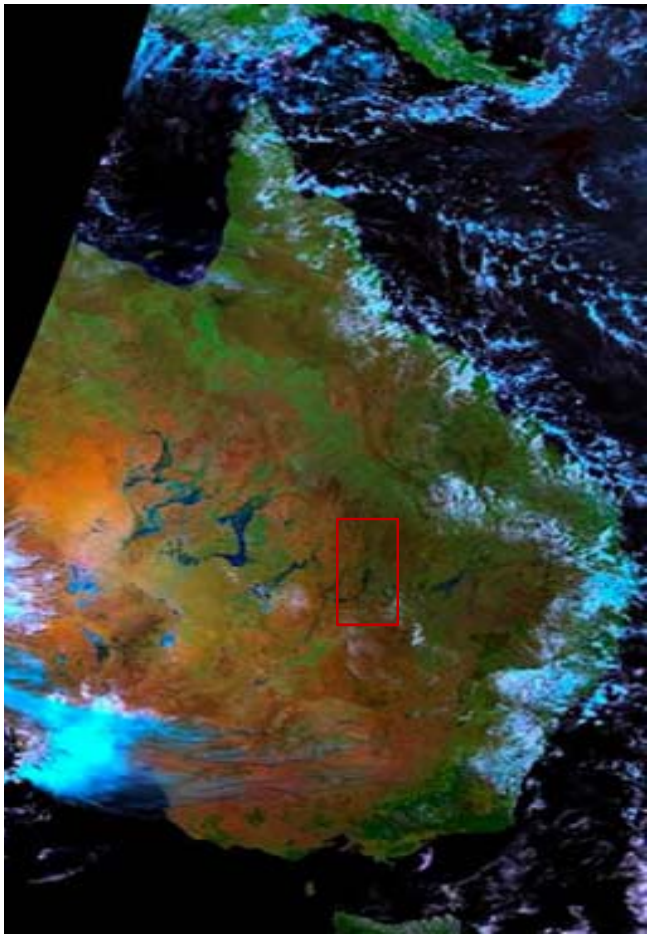
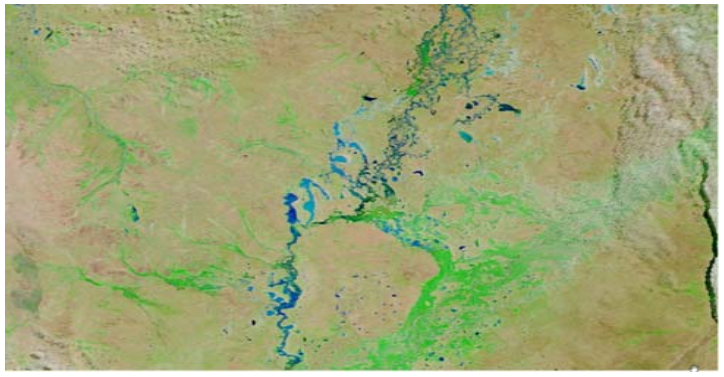


Water flowing down the Warburton Groove



Flooding MODIS Channel Country and Paroo River Catchment March 14,2010

Study Area: The Paroo and Warrego Rivers

700km

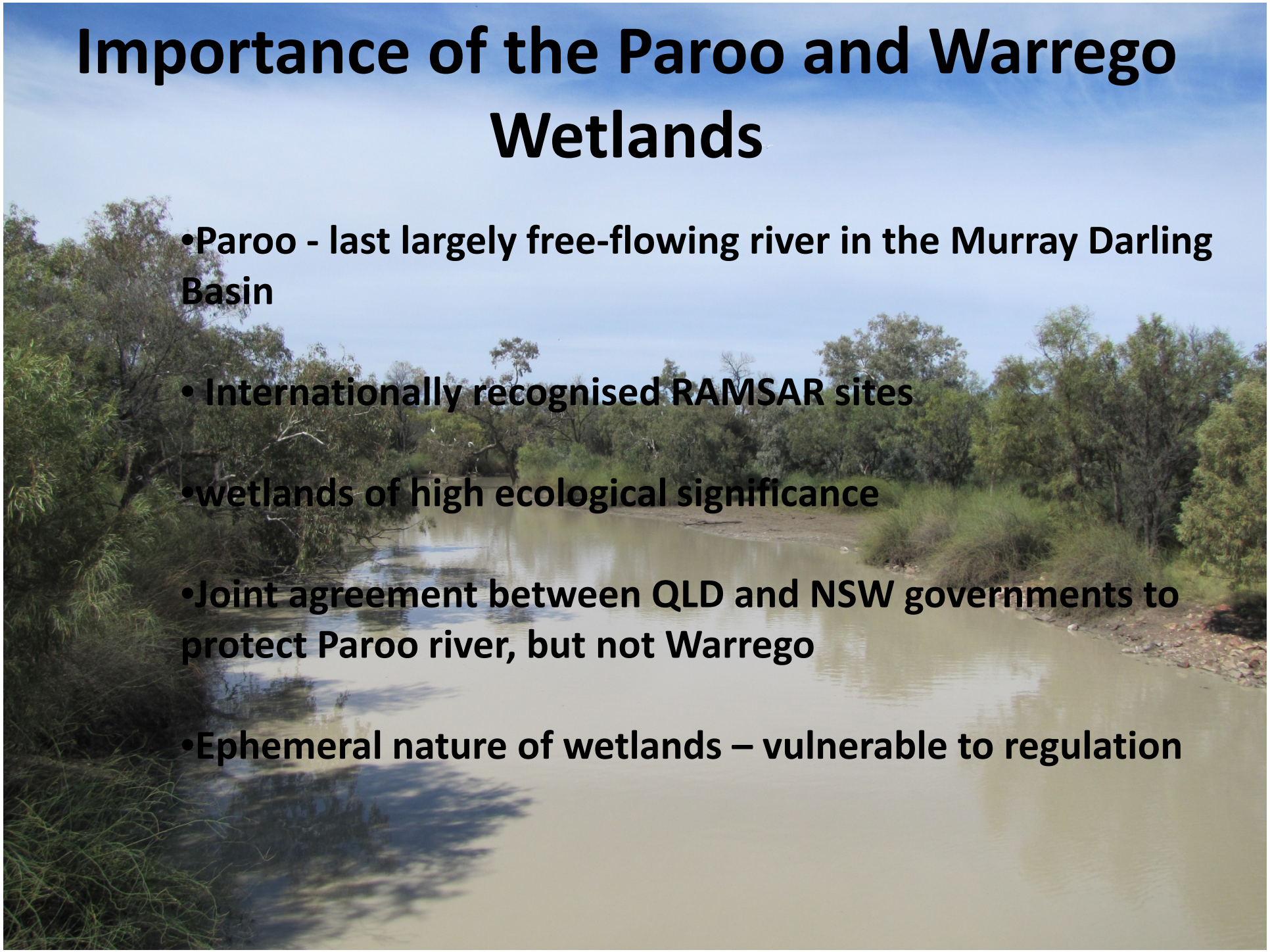
Headwaters in QLD

•Interconnected during flooding

Semi-arid wetlands:

- •Waterholes
- •Freshwater lakes
- •Salt Lakes
- •Swamps
- •Claypans

Importance of the Paroo and Warrego Wetlands



- Paroo - last largely free-flowing river in the Murray Darling Basin
- Internationally recognised RAMSAR sites
- wetlands of high ecological significance
- Joint agreement between QLD and NSW governments to protect Paroo river, but not Warrego
- Ephemeral nature of wetlands – vulnerable to regulation

Research Schedule

2012

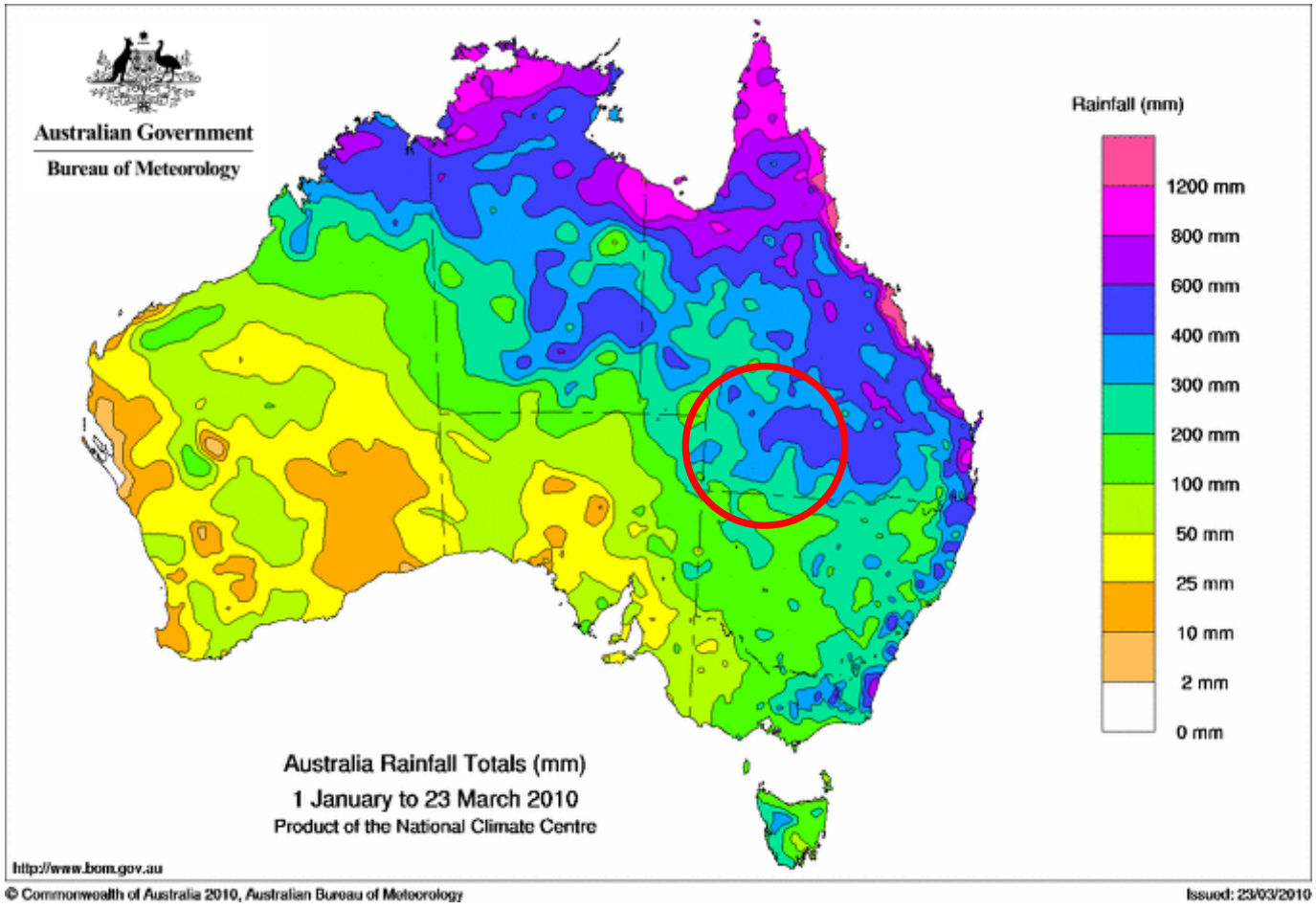
- Develop optimum methods for mapping inundation and wetland types in the arid zone using remote sensing
- Investigate use of L-band Radar satellite data

2013

- Determine the effectiveness of L-band Radar for detecting changes over time in the spreading and recession of floodwaters.
- Evaluate the interoperability of radar and optical
- Evaluate relative differences and benefits of the different satellite platforms

Support International Conventions, Environmental Conservation

Flooding in the Paroo and Warrego Rivers



Rainfall 2010

January-March

300-600mm

SW QLD

Equal or above annual average


Paroo and Warrego Rivers in Western Murray Darling Basin
Flight over the floods – 600km - April 2010
Flooded river channels, water spreading out across the landscape.

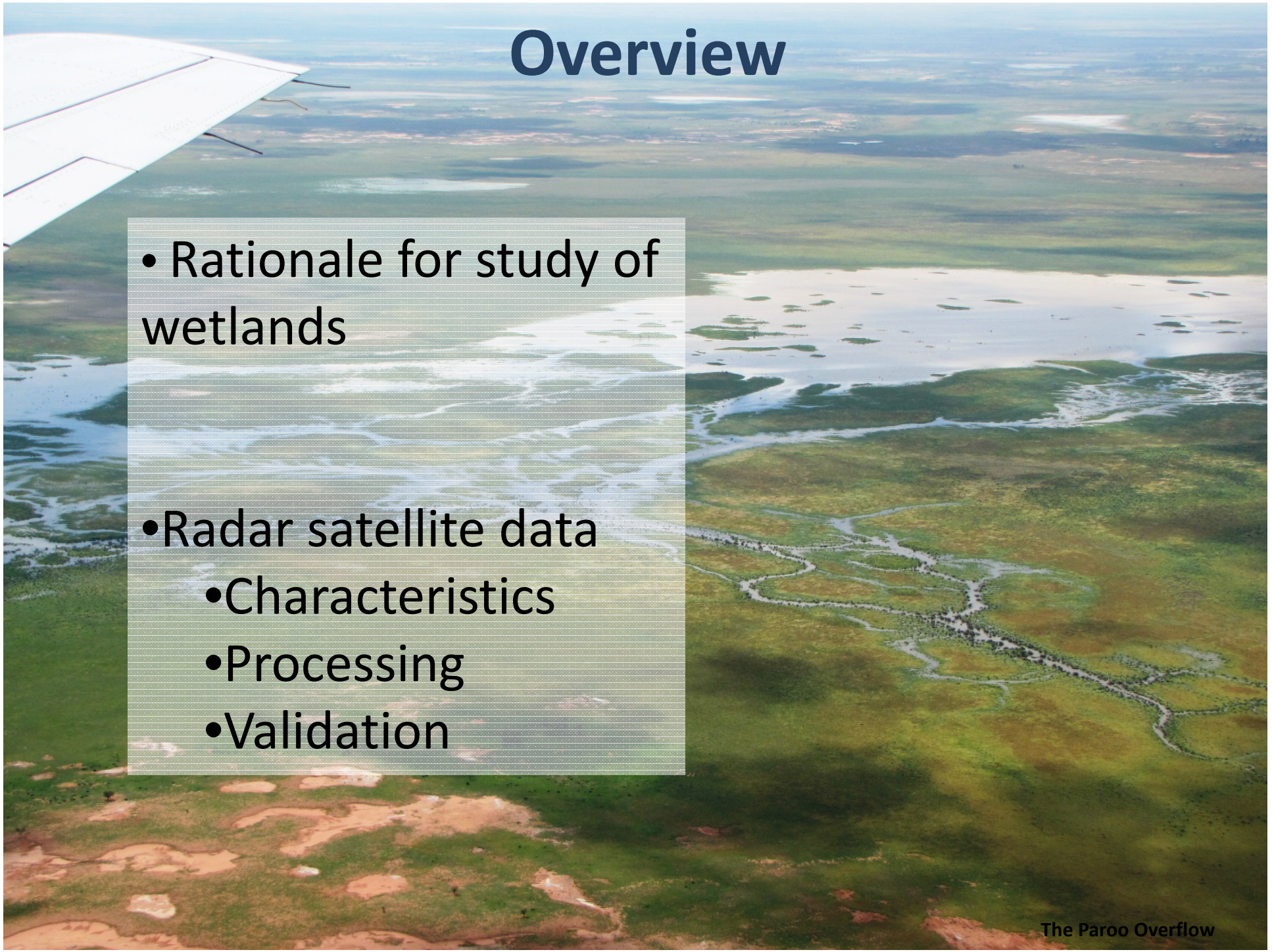

How can these vast flooded areas be mapped and monitored over time?
The Paroo Overflow

Wetland Types

Overview

- Rationale for study of wetlands

- Radar satellite data
  - Characteristics
  - Processing
  - Validation



Importance of mapping wetlands

- A vital ecological component in the landscape

Pastoral country

Wetlands feed livestock

- catchment condition monitoring
- sustainable grazing
- flood risk mapping
- Identification of high conservation value aquatic ecosystems

Food and breeding areas for fauna

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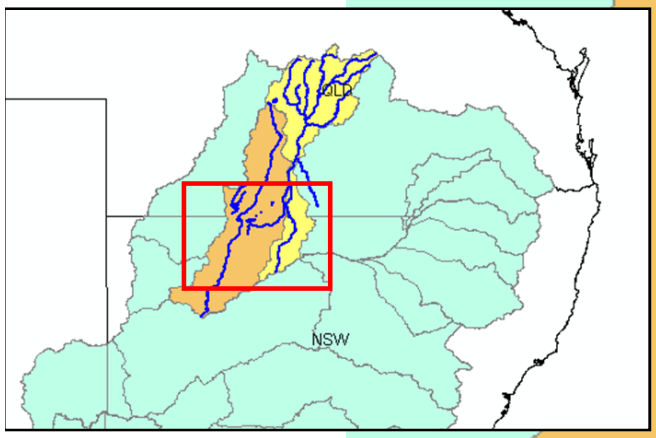


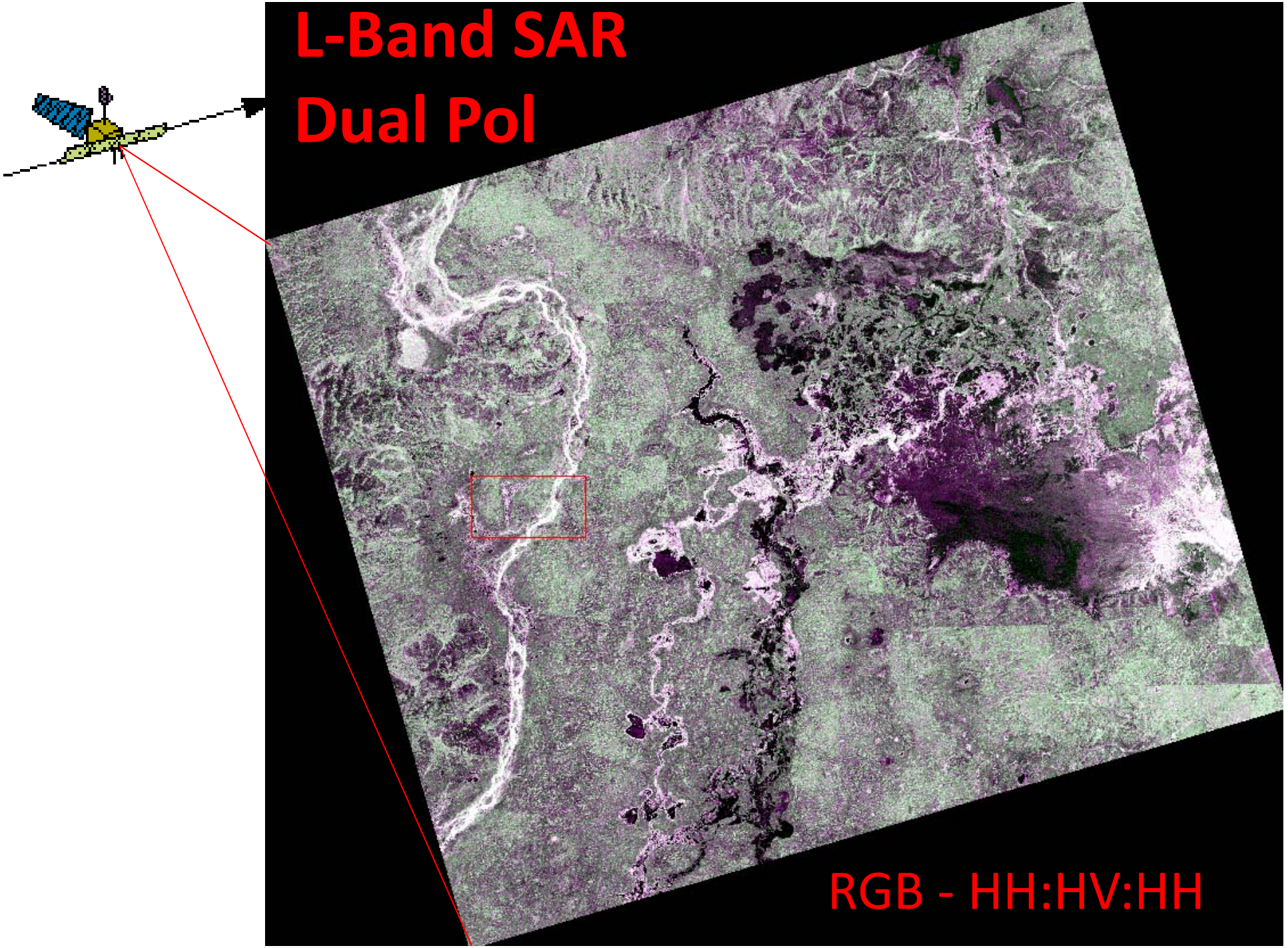
QLD

NSW

8 time-series images

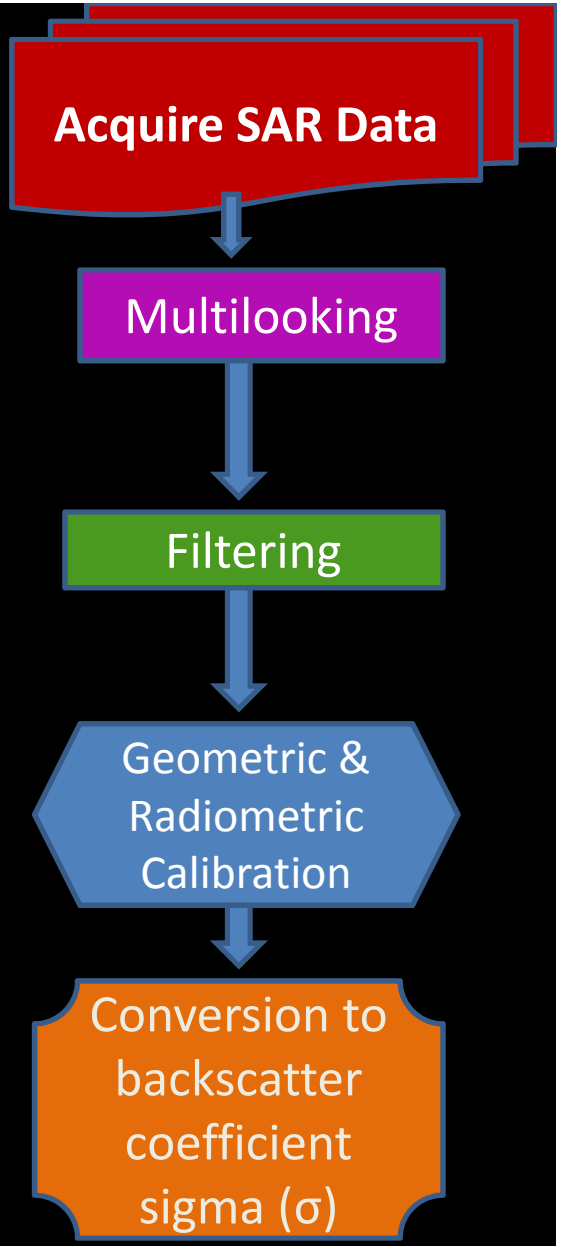
6 mosaic images

3 Polarmetric

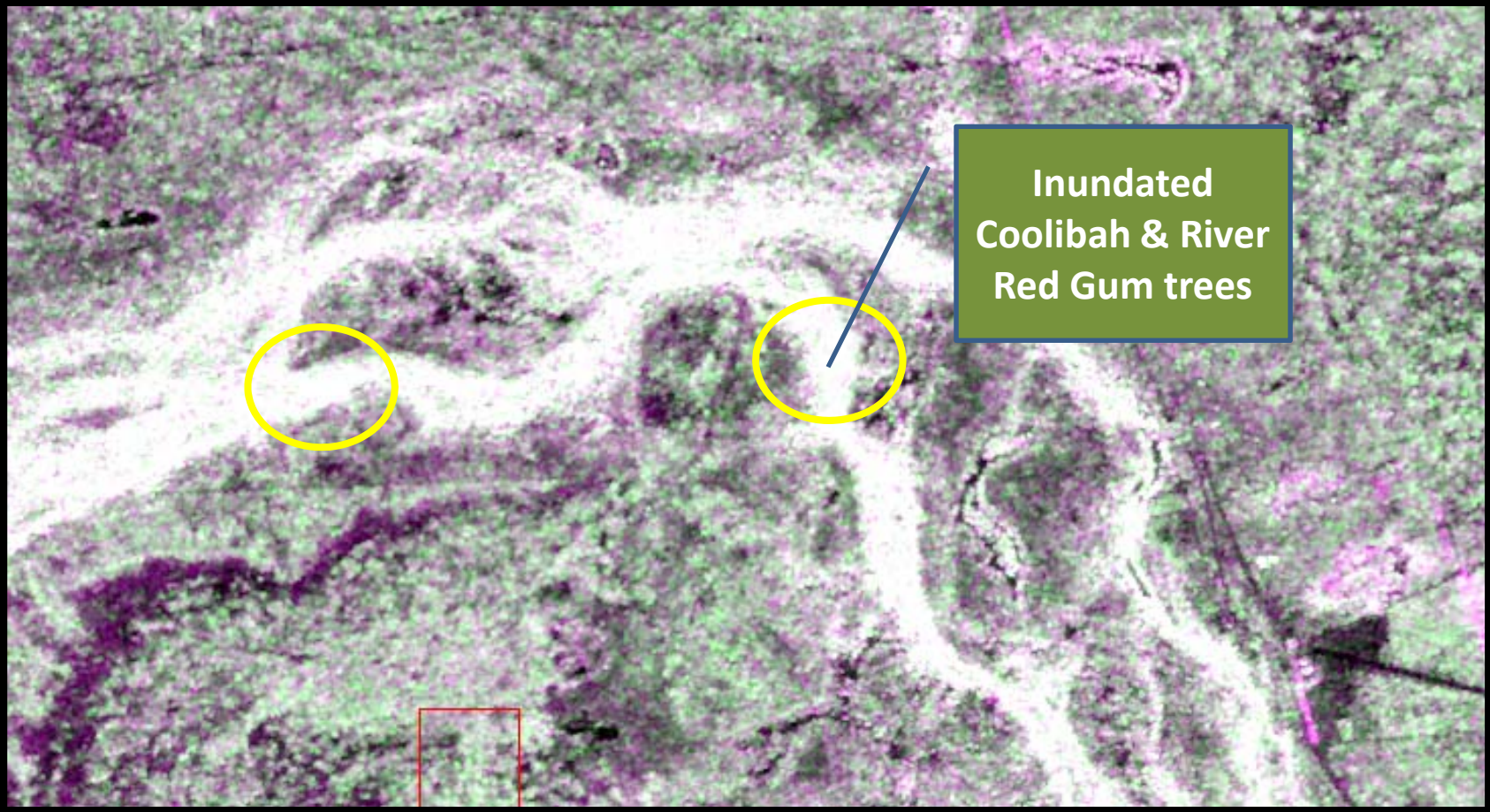

L-Band SAR
Dual Pol
RGB - HH:HV:HH

SAR data processing

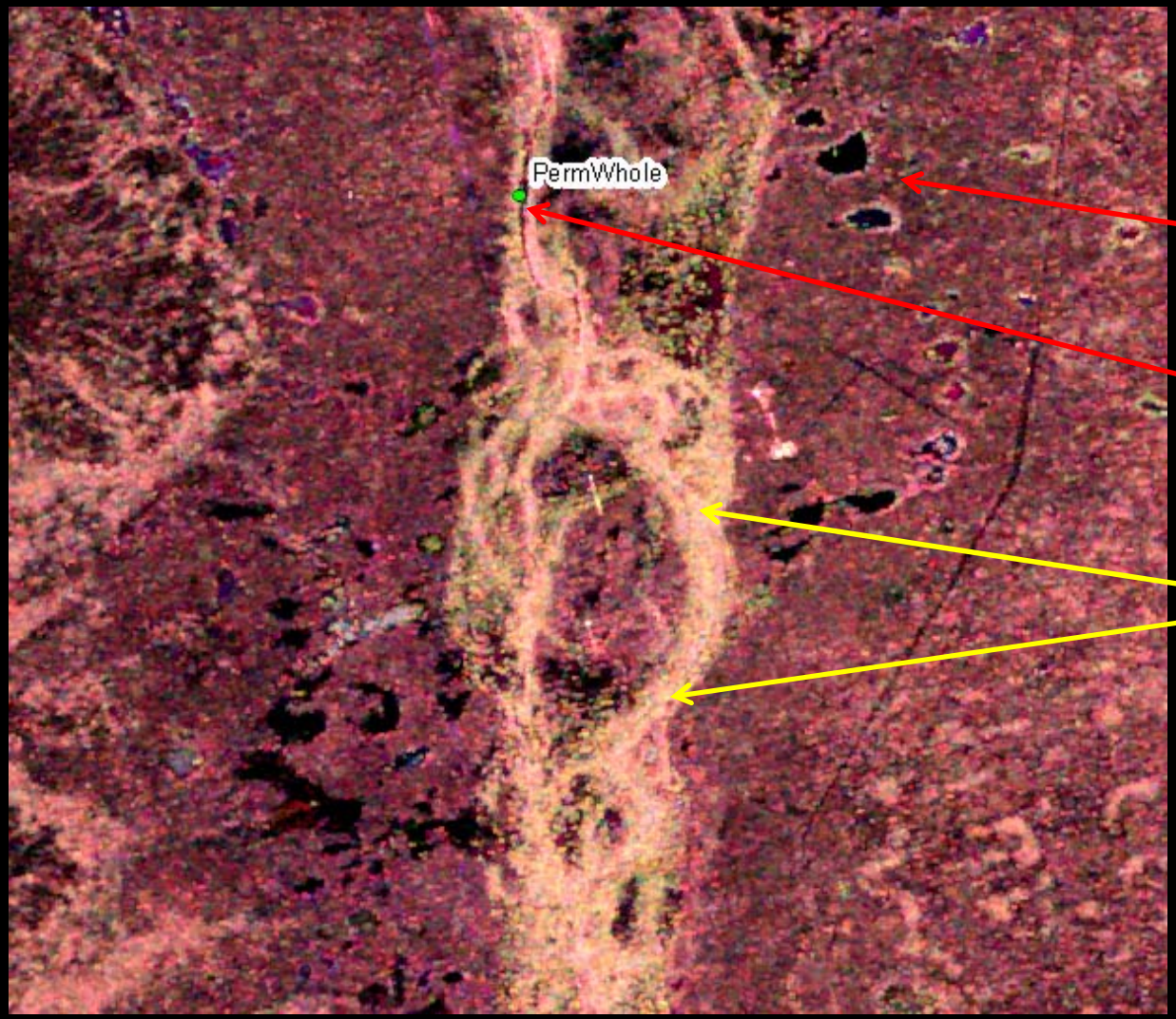
- Filtering: trial different filters – retain edges, reduction of noise
- Geometric: assigning each pixel a spatial reference (geographic coordinates)
- Radiometric: modify values – removal of noise from SAR sensor
- Backscatter sigma – measure of dielectric properties of surface features



SAR double-bounce effect:
High backscatter along flooded channels



SAR characteristics

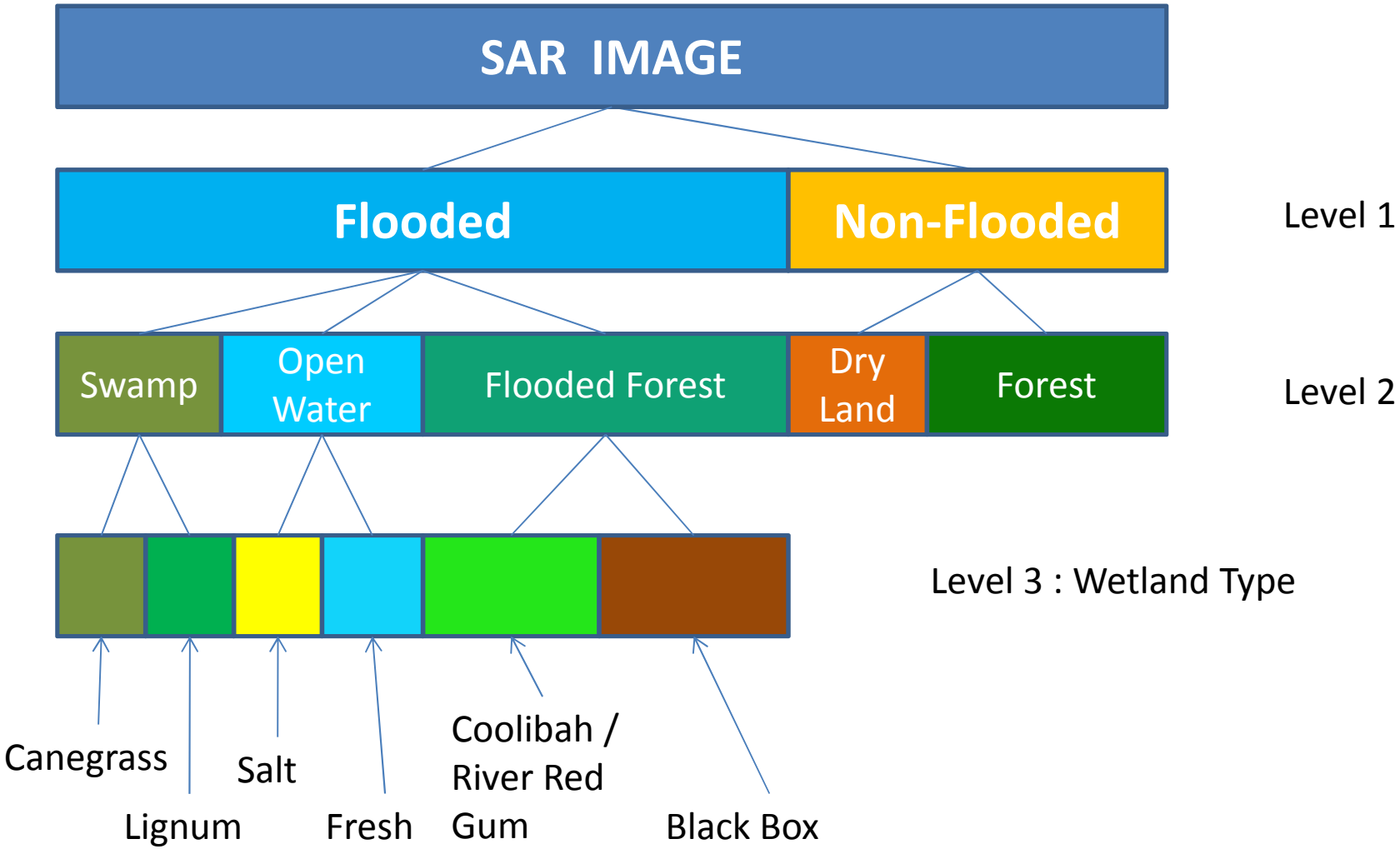


•Open water is dark:
- Claypans
- Lakes
- Billabongs

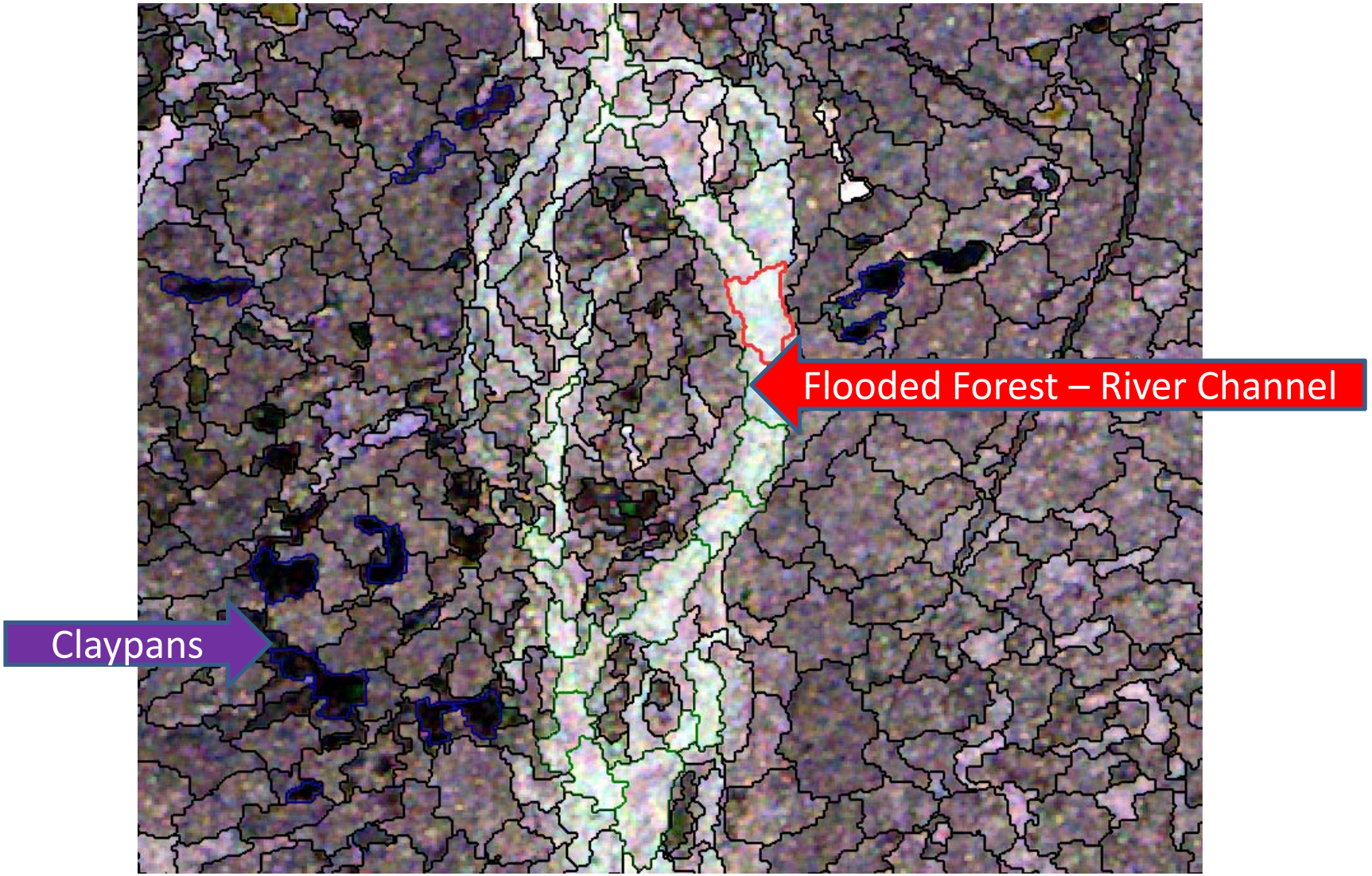
•Flooded channels covered in vegetation are bright

Segmentation

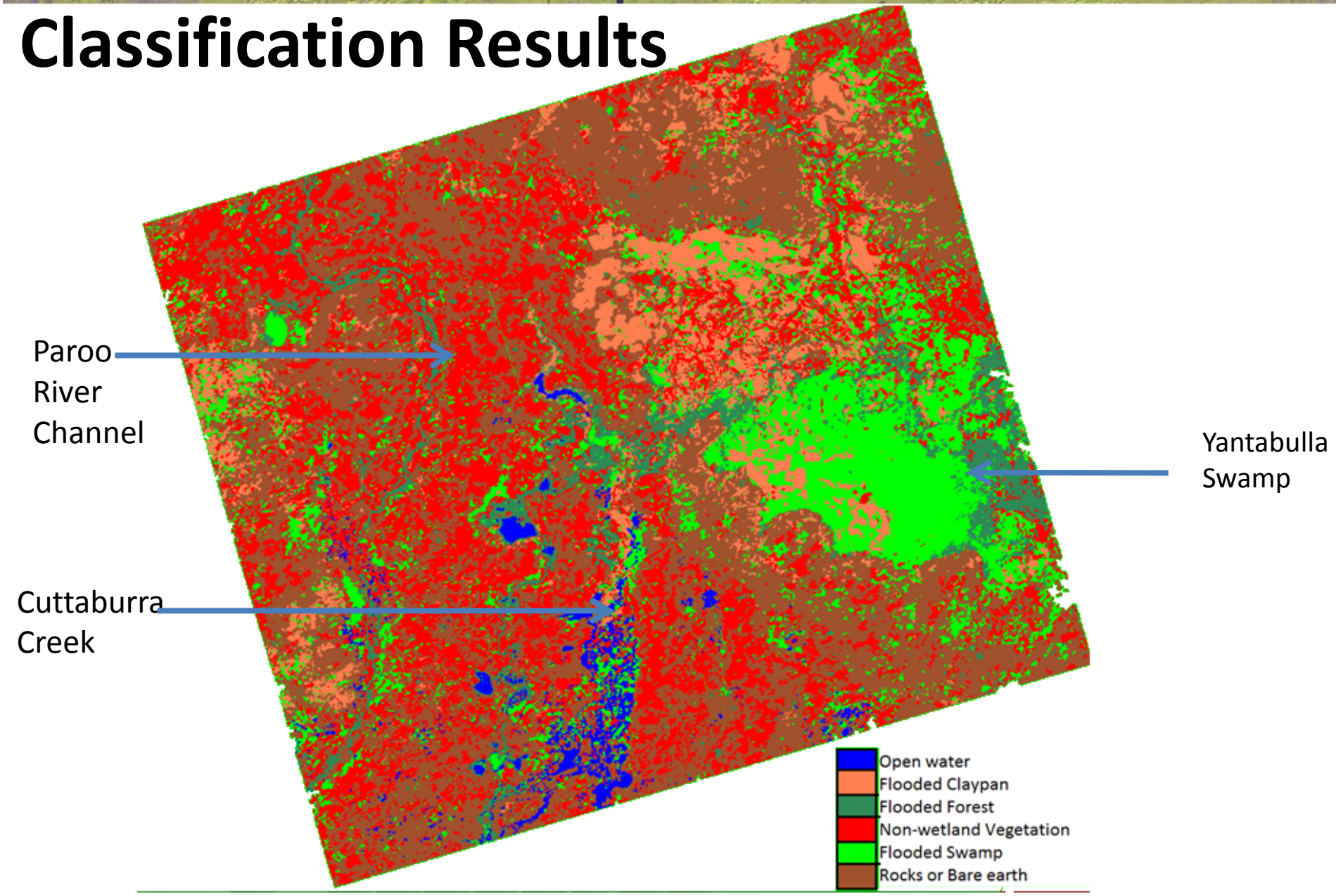
- Partition image into homogenous groups.
- Hierarchical ‘multiresolution’ approach
- Objects identified at different scales



Segmented Floodplain



Classification Results



Classification and Field Validation

Segmentation rule sets decision rules classify segments

- Spectral thresholds

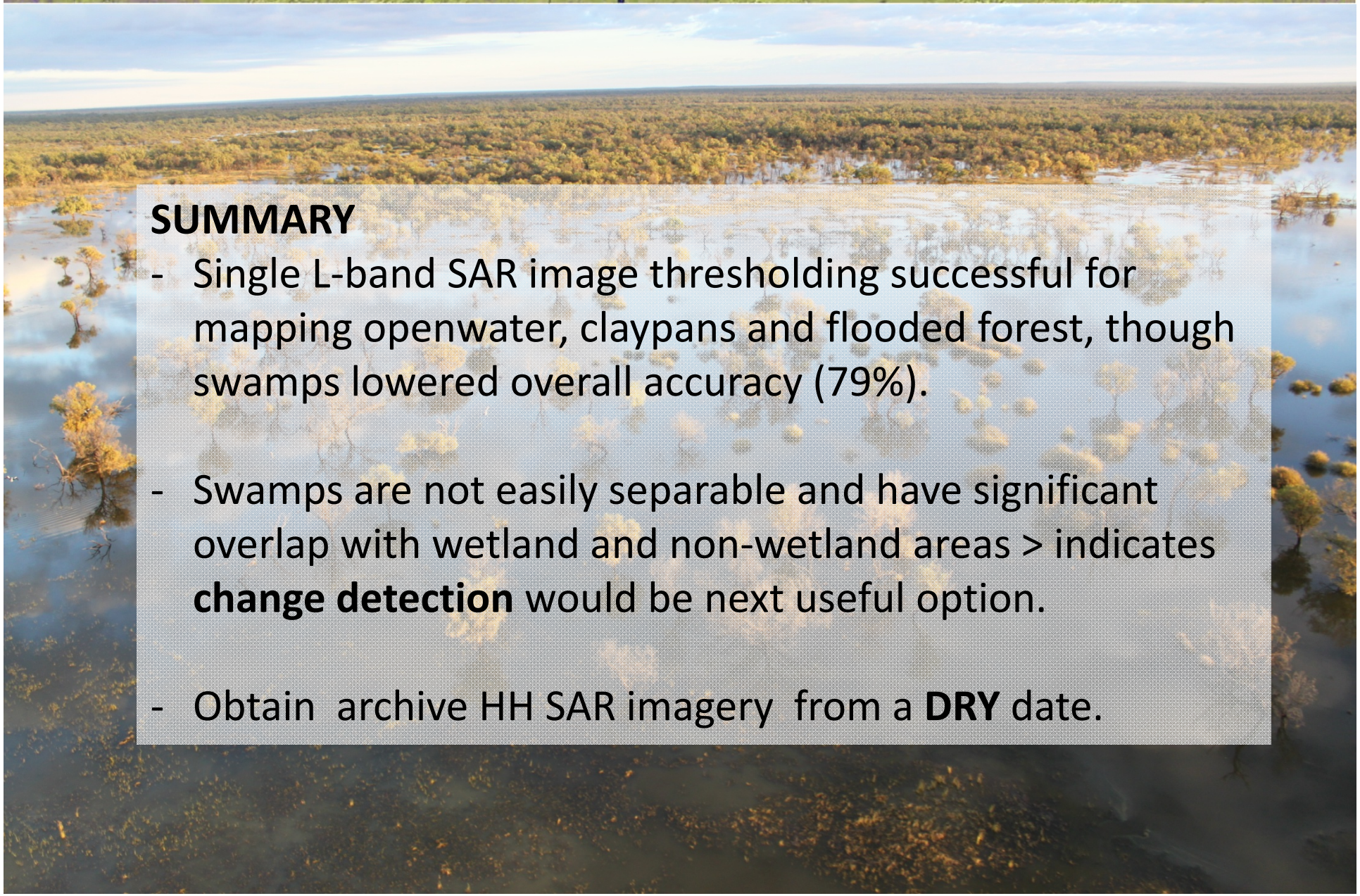
-Object characteristics such as **size, shape, texture, context, hierarchy and colour statistics (GIS)**

Classification accuracy quantified with:

- **Coincident imagery** from aerial photos and SPOT imagery

- **Information** (verbal and photographic) from landholders

- **Field data** (vegetation community type and inundation extent) collected.

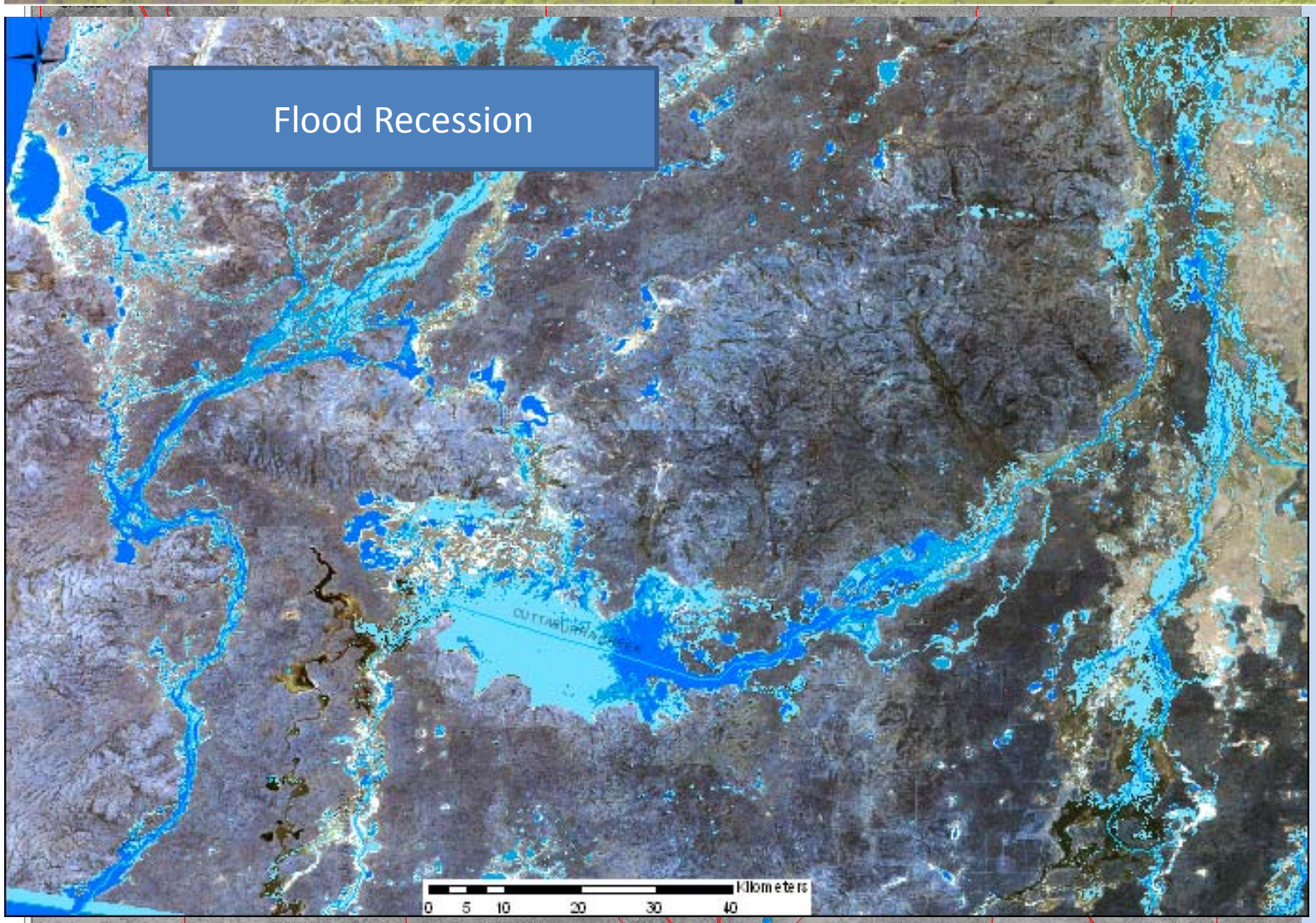


SUMMARY

- Single L-band SAR image thresholding successful for mapping openwater, claypans and flooded forest, though swamps lowered overall accuracy (79%).

- Swamps are not easily separable and have significant overlap with wetland and non-wetland areas > indicates **change detection** would be next useful option.

- Obtain archive HH SAR imagery from a **DRY** date.



snapshot: water flow cuttaburra creek.

Continuing for 14 band time series:
-duration
-permanence

Flow modelling Potential, low relief :Need DEM

Deliverables

- **Change detection of inundation between July 2009 and May 2010. Due June2012.**
- **Identification of high conservation value areas for the protection of critical aquatic habitat in terms of refuges (perennially flooded areas.). Due June 2012**
- **Operational methods for monitoring the expansion and recession of floodwaters using ALOS PALSAR; Due Dec 2012.**
- **Inundation maps of flood extent across the Paroo and Warrego Rivers for 2009-2011 with extensive field data for accuracy assessment; a prototype for emergency response applications. Due March 2013.**

Deliverables contd.,

- Identification of key vegetation indicators to measure during field surveys, for classification of community type and structure, using SAR imagery. Due December 2012
- Vegetation maps to community level for RAMSAR sites along the rivers showing the utility of ALOS PALSAR for characterization. This will include an accuracy assessment using the Statewide Landcover and Trees Study that measures Woody Forest and Non-Woody Vegetation across the state using LANDSAT and SPOT imagery as well as extensive field assessments. Due June 2013.
- Identification of ecologically significant wetland sites, in terms of the flood regime (timing, duration, extent of flooding) and vegetation characteristics, identified for their conservation value. Due 2013.

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Acknowledgments

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Western Catchment Management Authority

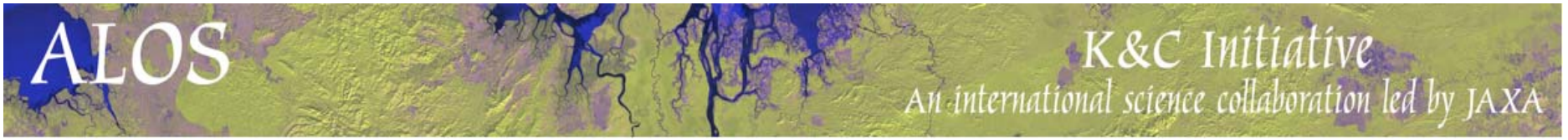
Dr Anthea Mitchell, Dr Adrian Fisher, Dr Geoff Horn

Geoscience Australia, MDBA, NSW OEHand

JAXA K &C Initiative

AWRC
Australian Wetlands and Rivers Centre

WESTERN
Catchment Management Authority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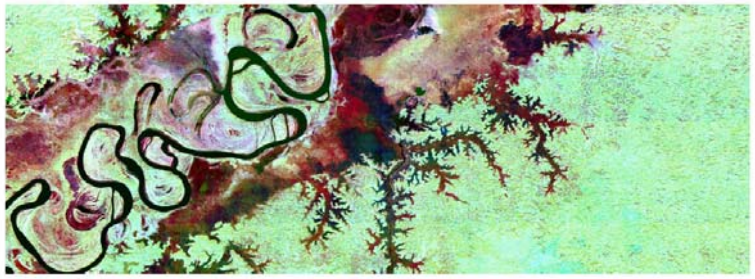
Interoperability: - PNG

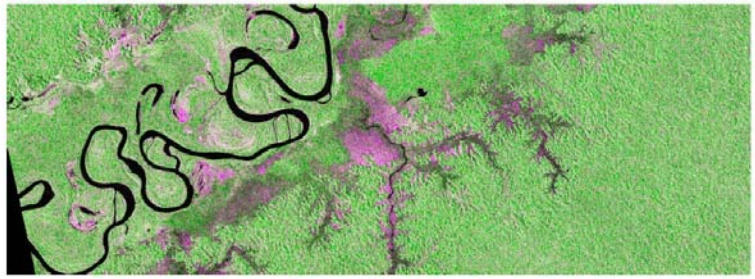
Airborne (Baseline Mapping) Satellite (Monitoring)

WP4 GeoSAR Forest / Non-Forest, 2006



- False colour composite of GeoSAR data for a region East of Lake Murray.
- XVV, HXP, PHH
- Orthorectified forest / non-forest mapping at 5m posted pixels.
- Can provide a report of forest cover on the mainland in 2006.

WP4, PALSAR Forest / Non-Forest, 2007



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- LHH, LHV, LVV
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- Can provide reports of forest cover over entire country for 2007 - 2010.

confidential

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- Three classes, over 99% overall accuracy.

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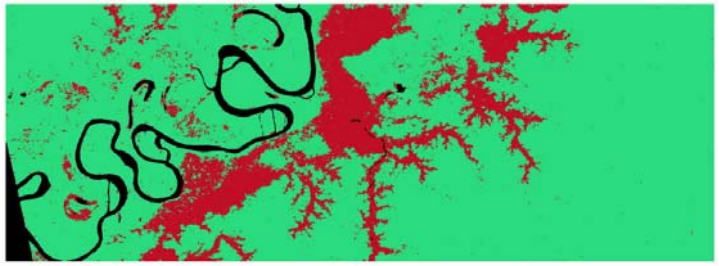

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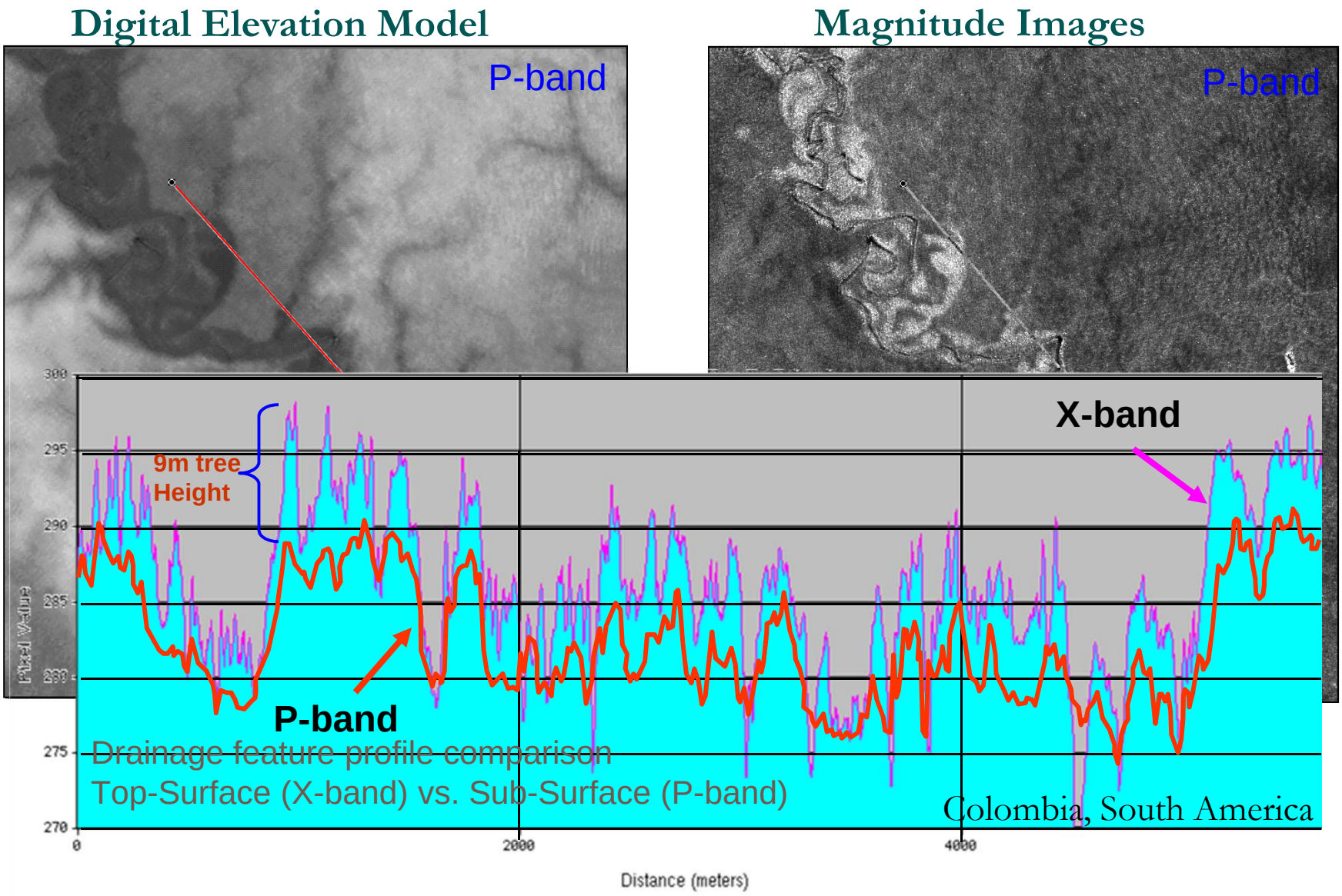
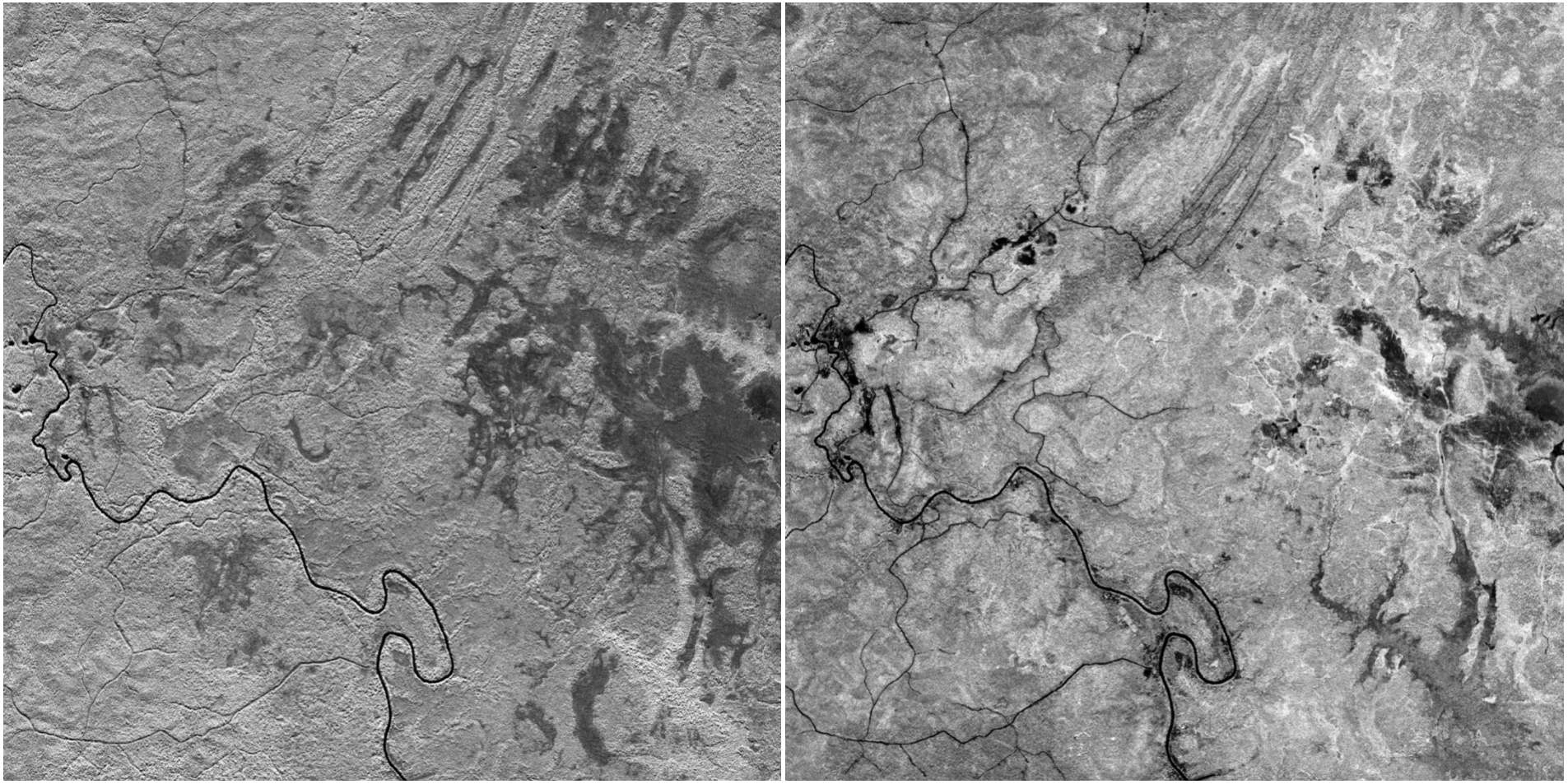
Airborne GeoSAR X and P band

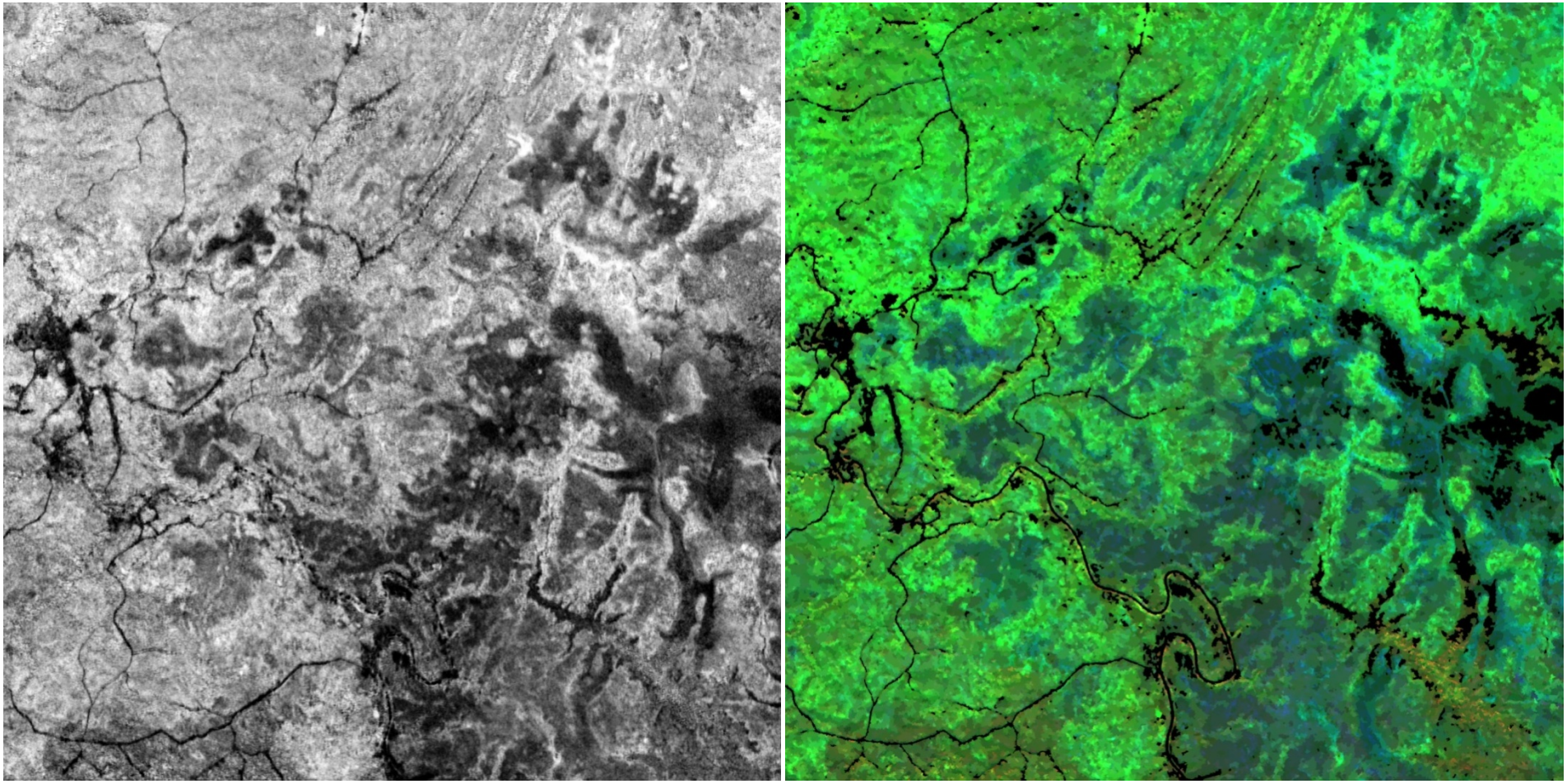


An Example of GeoSAR Biomass Estimation



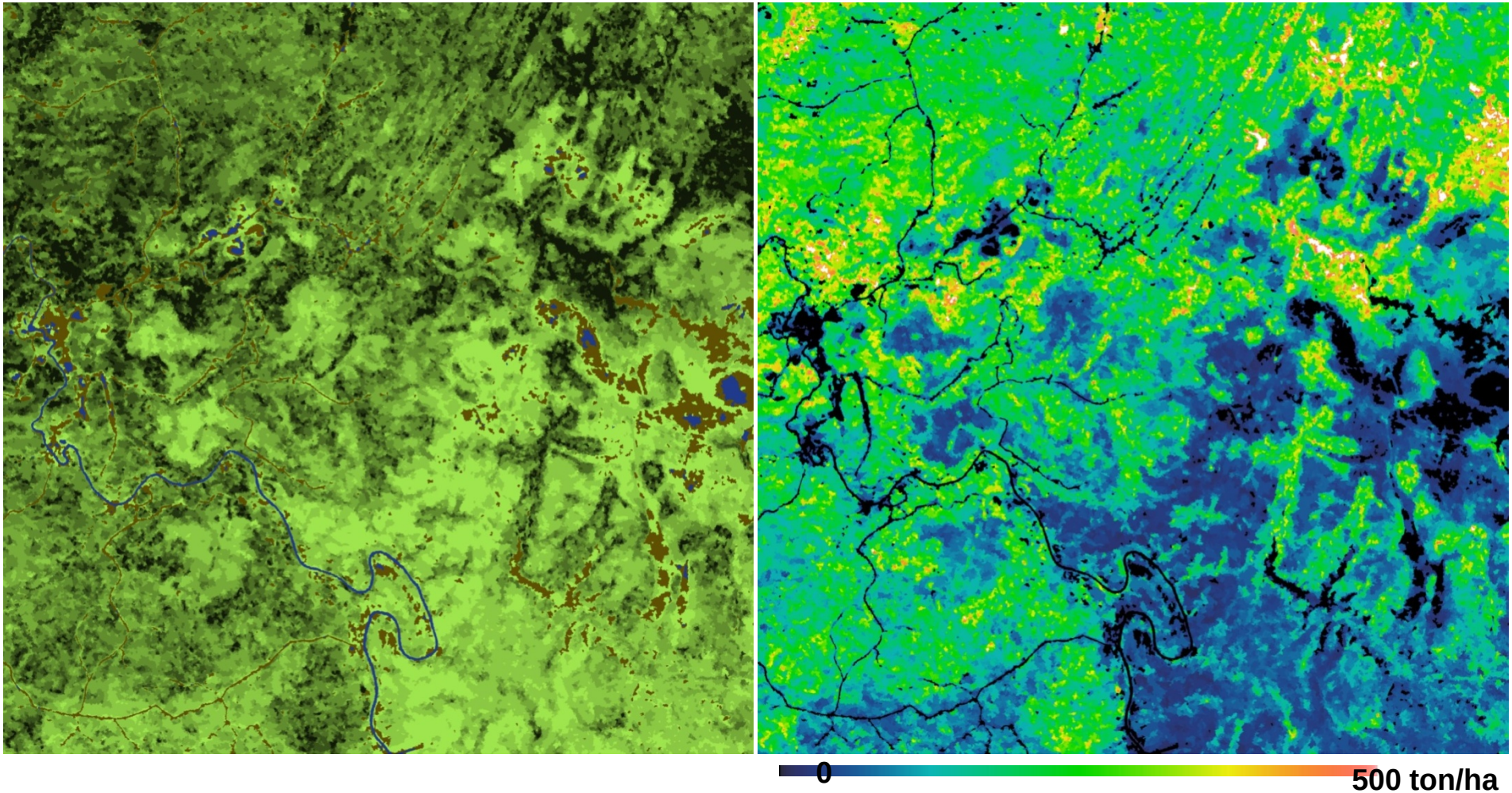
- Left: X-band magnitude, right: P-band magnitude. The area is ~25,000ha. Data from Papua New Guinea collection

An Example of GeoSAR Biomass Estimation



- Left: X-band - P-band interferometric height, h_{int}, is a surrogate vegetation height.
- Right: (R:X, G:h_{int}, B:P) for forested areas.

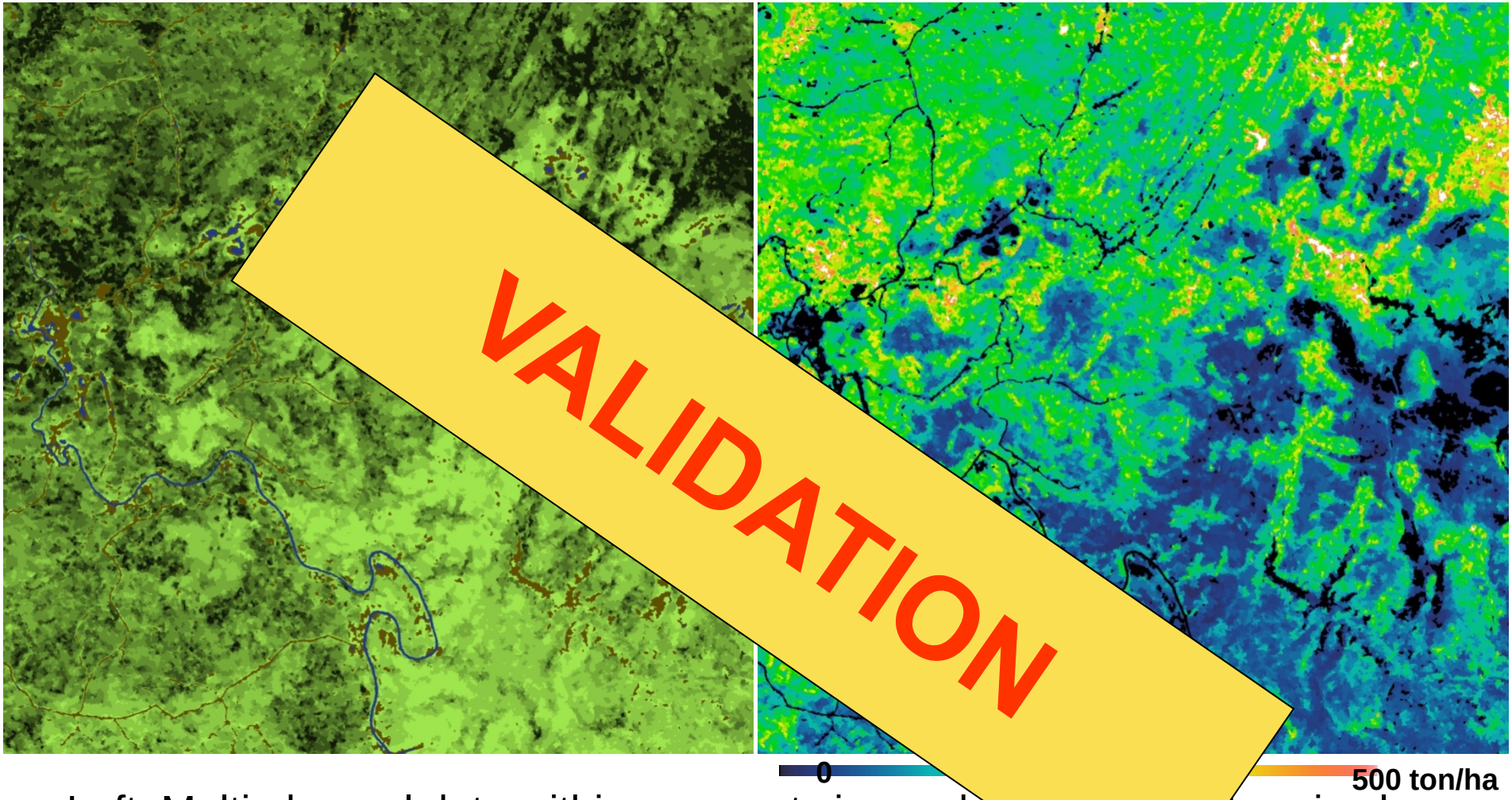
An Example of GeoSAR Biomass Estimation



- Left: Multi-channel data within segments is used to produce a terrain class map (dark green is high-biomass forest).
- Right: Multi-channel data within segments is used to produce a quantitative biomass estimate at high resolution.

(Mark L. Williams,)

An Example of GeoSAR Biomass Estimation



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