INFORMATION SYSTEMS

Deforestation Monitoring Using RADARSAT-2 New Beam Mode

presented by Flavio Wasniewski

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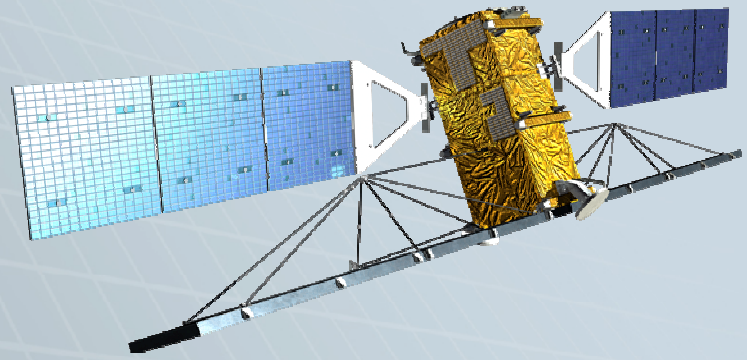
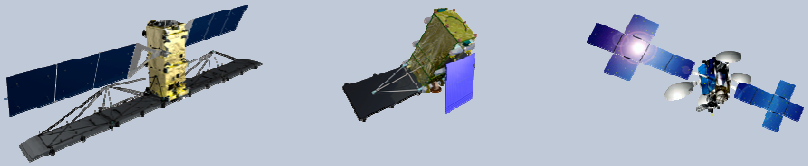
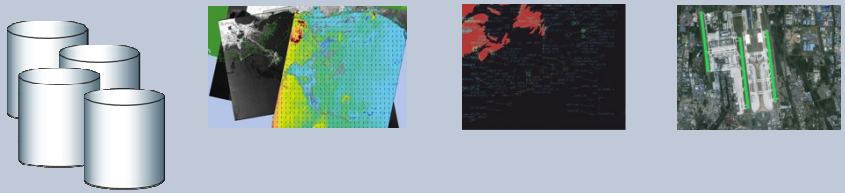
Summary

- About MDA
- RADARSAT-2 New Beam Mode
- Forest Management Challenges
- MDA ForestWatch for Deforestation Monitoring
- Stack-based Change Detection
- Case Studies



Corporate Overview

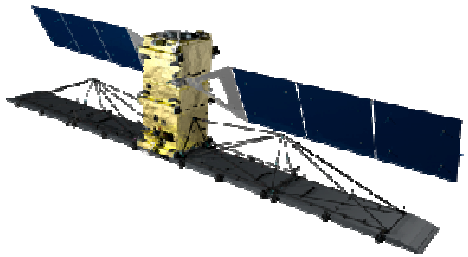
Business	Offering
Space-based Missions 	• Space-based information, communication, and robotic missions • Space-based subsystems
Ground-based Integrated Information Solutions 	• Ground-based and Airborne information systems
Geospatial Services 	• Land/ocean-related information services

MDA – A History in Space

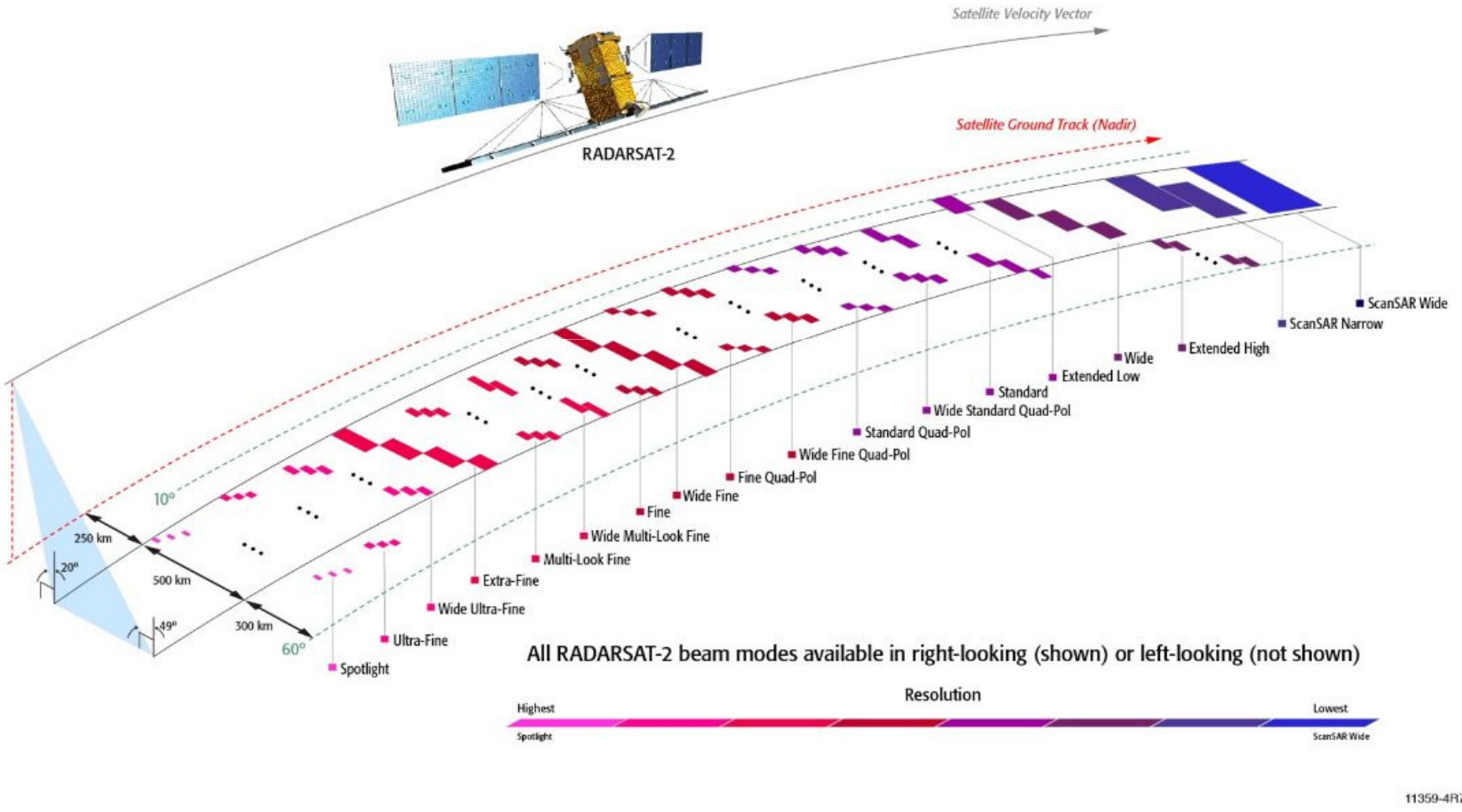
- **A history of building and operating systems designed for operationally-focused customers**

- **MDA Geospatial Services benefits from MDA's 50-year space legacy**
  - Launched RADARSAT-1 in 1995; RADARSAT-2 in 2007
  - Future: RADARSAT Constellation Mission (RCM) in 2018

- **Strong partnership with the Canadian Space Agency**
  - Canadarm, ISS Robotics, RADARSAT-1, RADARSAT-2 , RCM

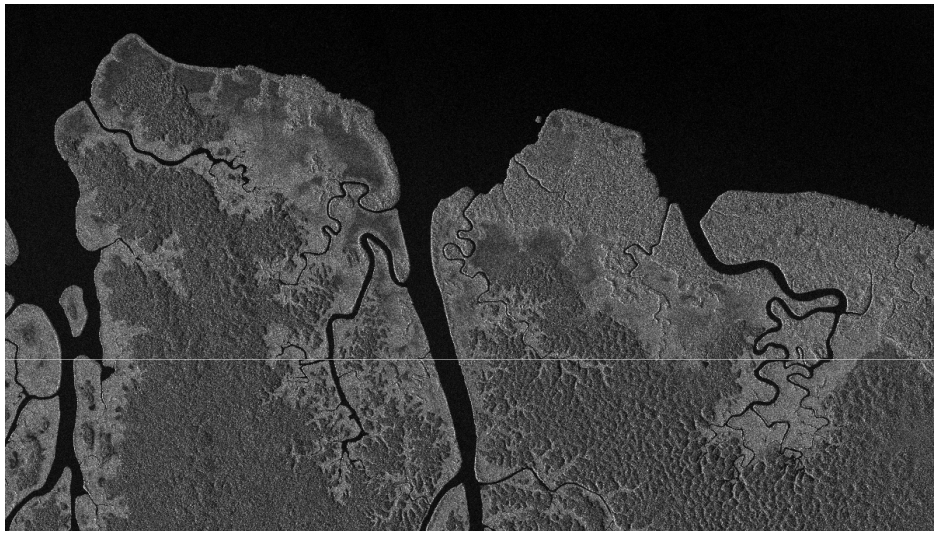


RADARSAT-2



New RADARSAT-2 Mode: Extra-Fine

- 2013 – New Extra-Fine beam developed to address high resolution, wide area applications.
- 2013/2014 – MDA change detection algorithms successfully applied to deforestation areas over multiple countries using Extra-Fine data. Local institutions partner for validation.
- 2014 – Extra-Fine images available commercially.
- 2014 – Canadian Space Agency awards MDA a RADARSAT-2 forest change application development project.



125 km swath, 5m resolution

MDA ForestWatch

Space-based, automated forest change detection solution that provides a cost-effective option for routine, reliable, high resolution monitoring of large forest areas

Forest Management

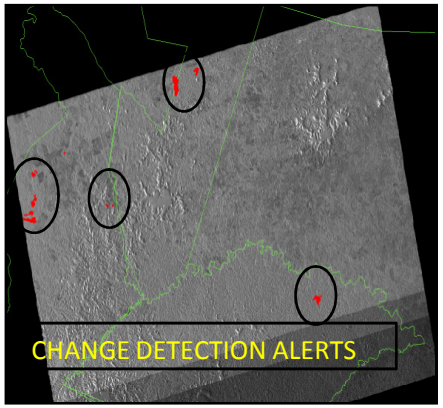
- Forests cover roughly one-third of the Earth's land mass, and contain almost three quarters of the carbon present in living things
- Forests are the lungs of the planet, with tropical rainforests alone providing 40% of the earth’s oxygen
- Global economic contribution
  - ~2% of the world’s gross domestic product
  - ~3% international merchandise trade
- Effective forest monitoring has always presented a challenge

Key Challenges for Forest Management

- Forest areas are large and often difficult to access
- Current methods for monitoring are time consuming and expensive
  - Aerial solutions are expensive and have limited range
  - Optical Satellite solutions are affected by cloud cover and weather
- Monitoring doesn't happen frequently enough
- Forest degradation and illegal selective logging difficult to detect using conventional methods

MDA ForestWatch Characteristics

- Reliable, High Resolution Forest Change Detection
  - Unique RADARSAT-2 beam modes provide coverage of vast areas at high resolution
    - Resolution from 3-8 m, depending on the size of the area of interest
    - RADARSAT-2 has the widest image swath width of any available radar satellite
  - MDA ForestWatch change map products deliver information quickly
  - Operationally-focused, responsive production and customer support teams
    - 24x7 availability
  - Detection of small features including selective logging
  - Weather independent



Detect Changes with High Accuracy

MDA Change Detection Process

Create Baseline

- Multiple background images are acquired over time
- Provides a baseline for comparison

Monitor Regularly

- Frequent, repeated collection of new radar imagery
- Monthly, quarterly or annual basis

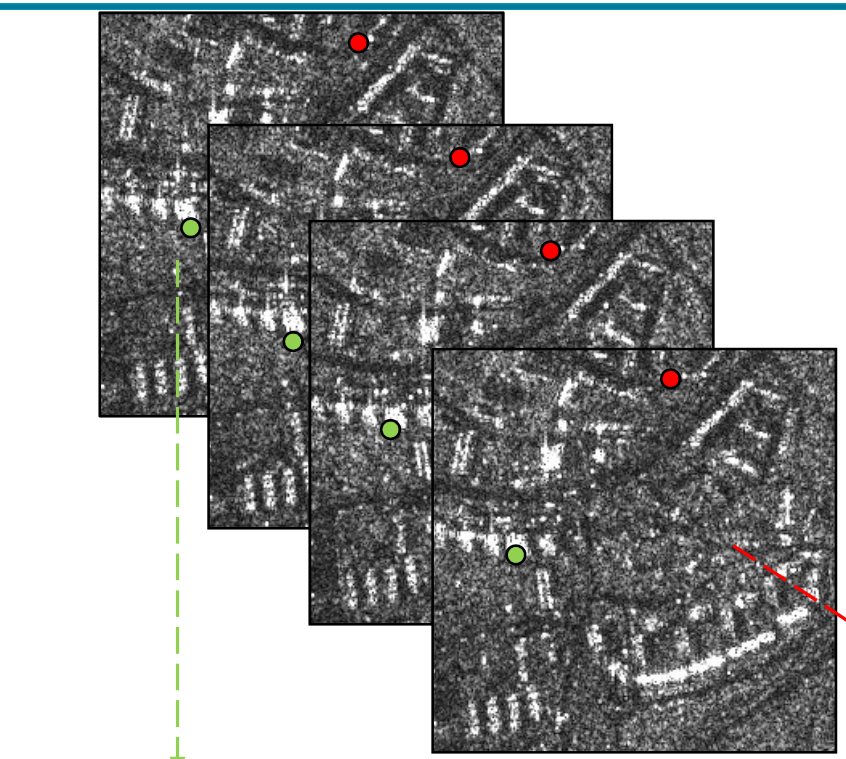
Detect Changes

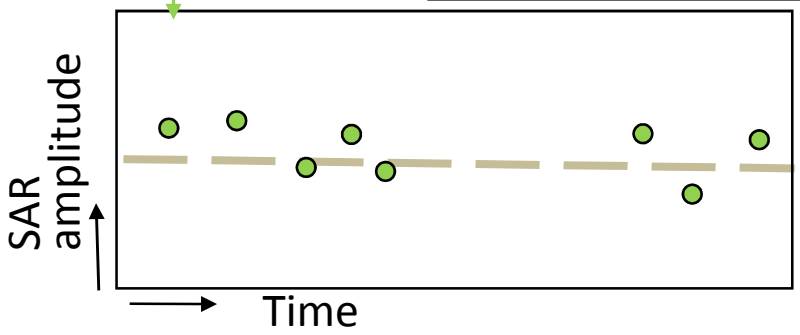
- MDA algorithms detect forest land cover changes during each repeat cycle

Report Changes

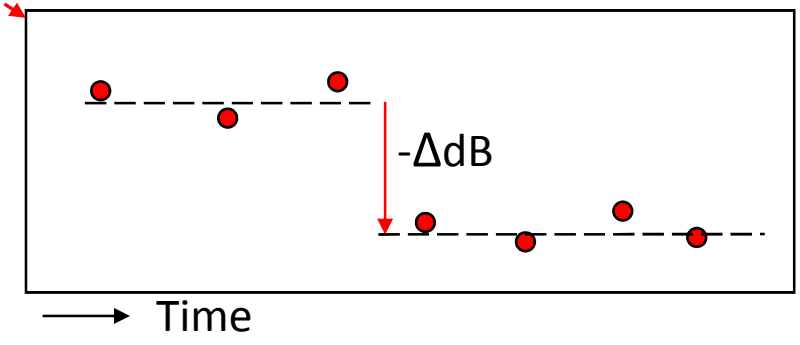
- Regular reports show the exact location, size and timeframe of changes due to deforestation

Stack-based Change Detection in Detail

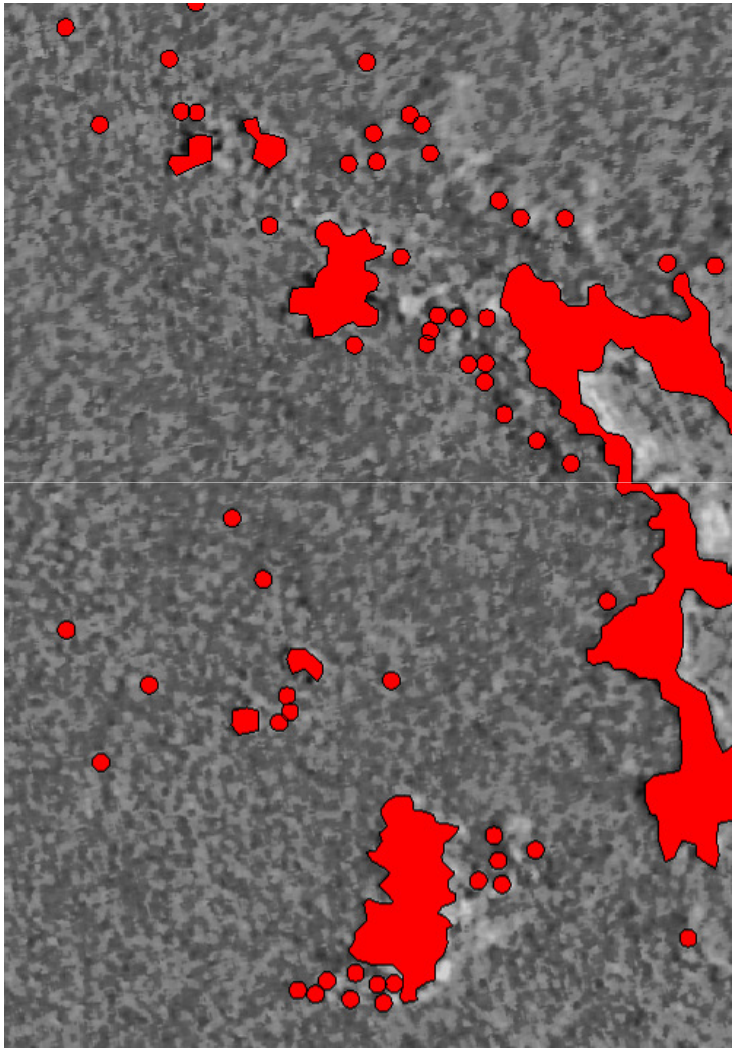


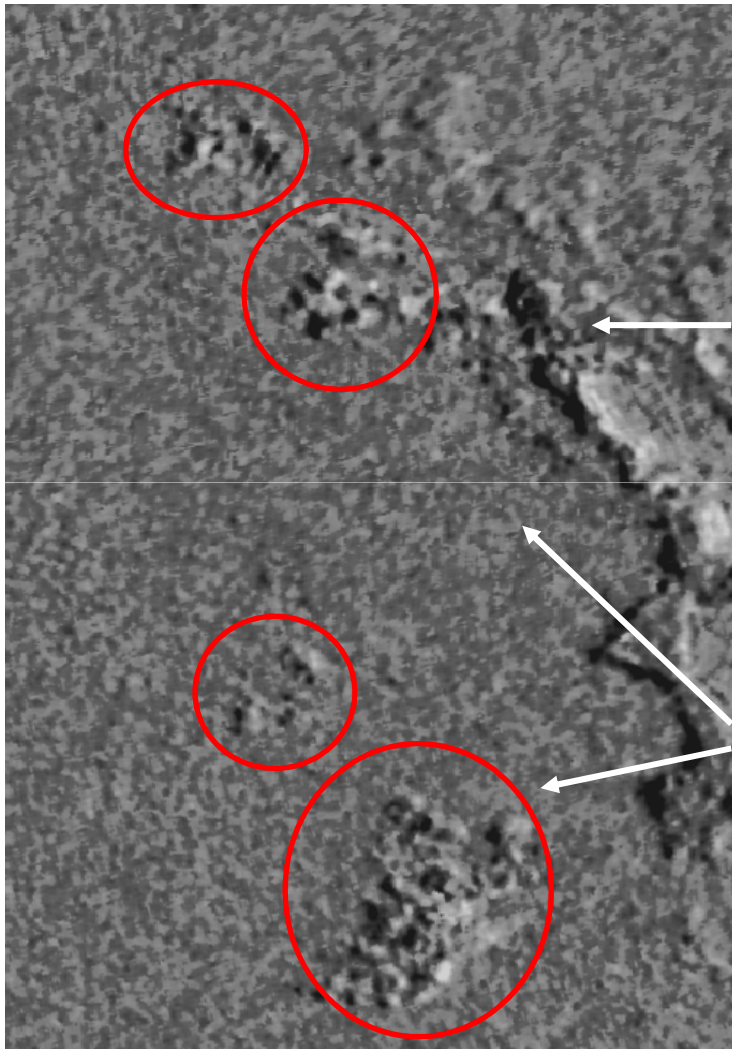


- A Stack is a set of images having identical geometry
- Stack-based approach allows
  - Filtering of speckle noise from individual acquisitions
  - Improvements in accuracy



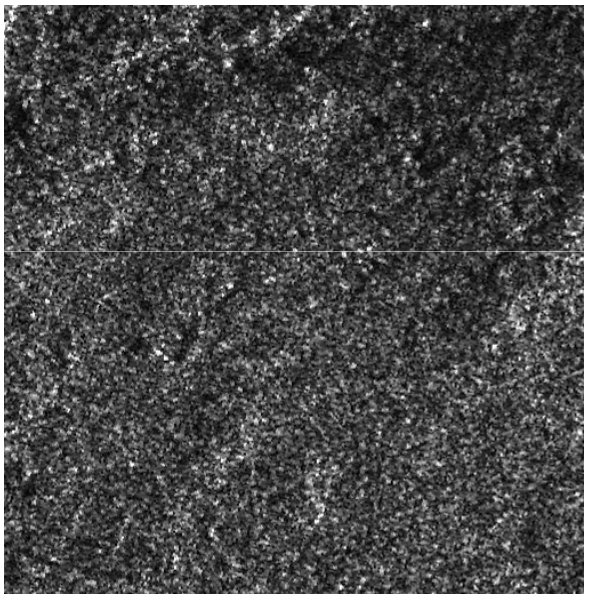
Spotlight Change Image Example





Filtering Speckle Noise Using a Stack

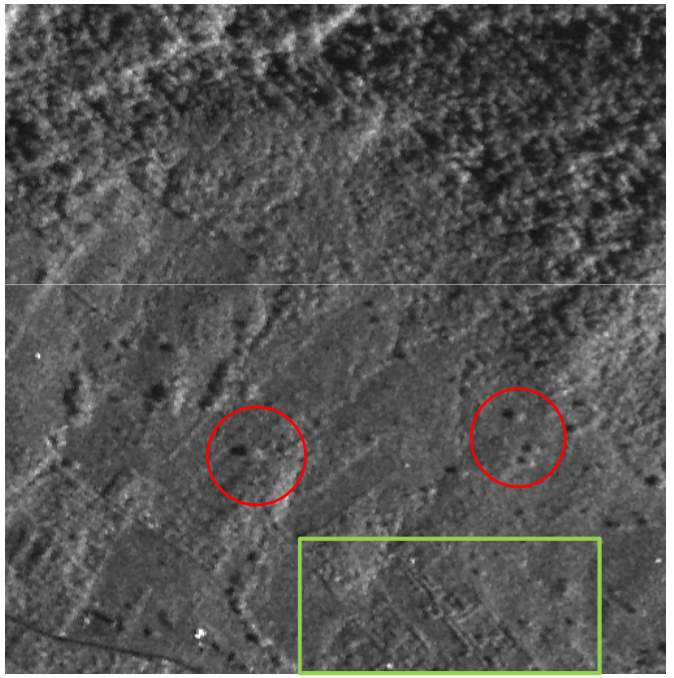
Single SAR Image



~ 1 x 1 km of typical forested terrain

Stack-Based SAR Image

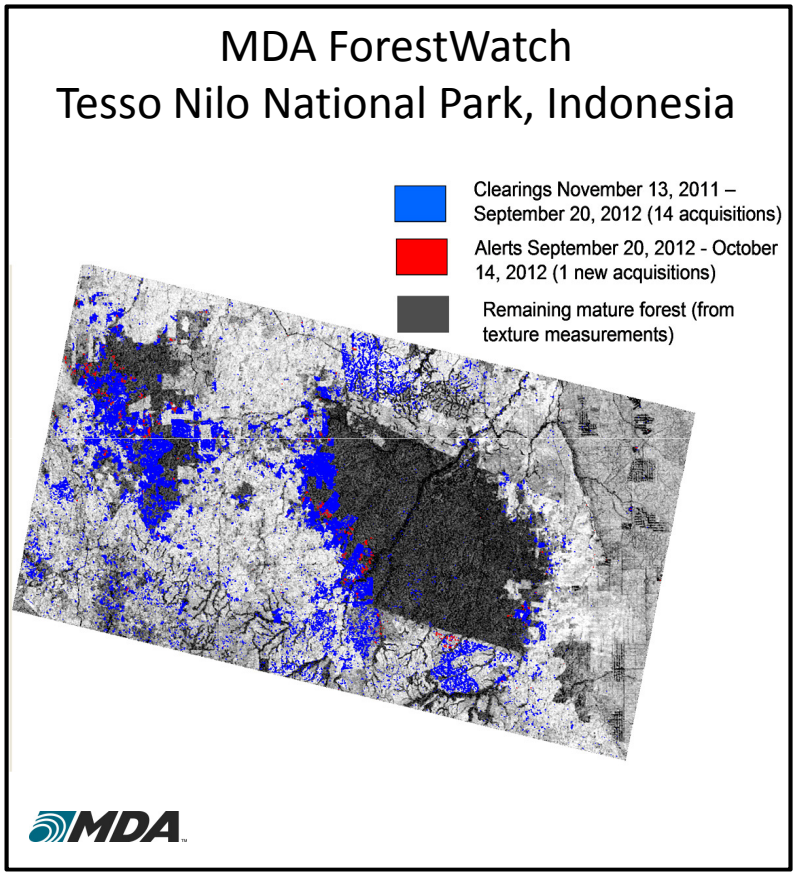
(20 MF Scenes, 5-m resolution)



Individual trees, agricultural fields, and variations in the texture of the vegetation can be identified in stack-based SAR Images

MDA ForestWatch Deliverables

- Forest Change Vectors
  - Standard ESRI shape file
  - With associated attribute table
    - Latitude/Longitude
    - Area
- Forest Change Report
  - PDF or JPG
  - Graphical representation of the SAR image and change results
  - Overlaid on a basemap image of the area of interest



WC2

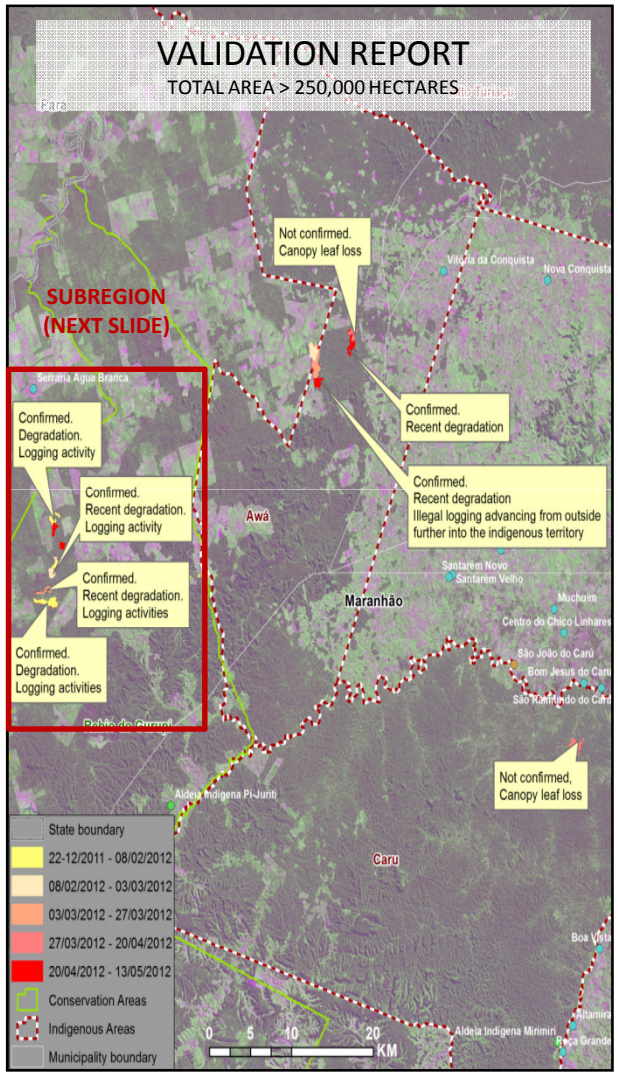
Slide 16

WC2 We need to mock up a ForestWatch "product"

Warren Cartwright, 09-08-2013

Case Study 1: Maranhão, Brazil

- An external organization performed an evaluation of MDA's deforestation monitoring solution
- MDA detected multiple deforestation changes
- Validation of the results was performed with low-level flights and visual inspection by experts
  - 100% of locations tested by the external team had experienced forest changes
  - 6 of 8 locations were classified as changes due to recent logging (logs still on the ground)
  - Remaining 2 locations were classified as changes due to other reasons (canopy loss)
- No undetected changes were found



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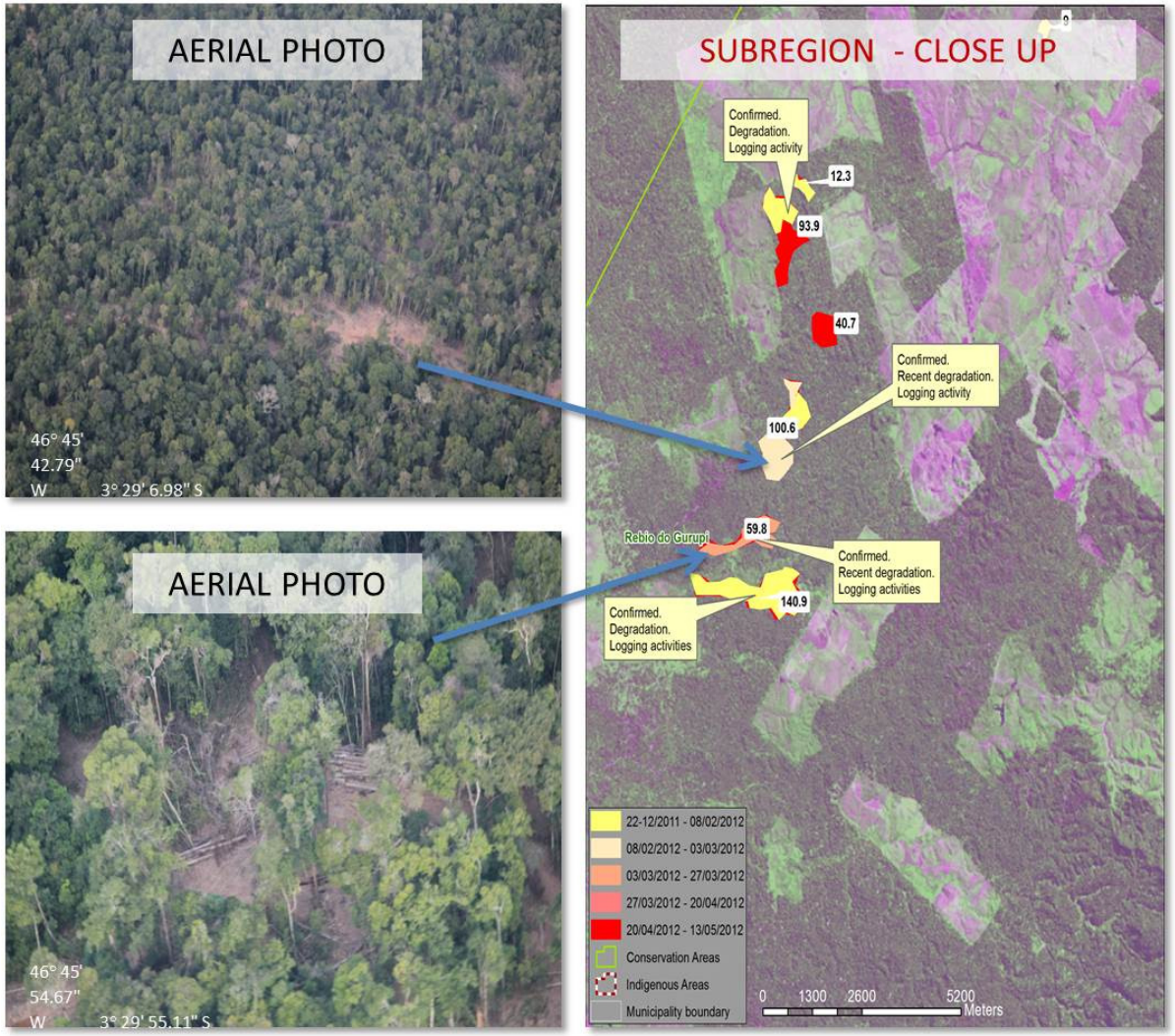
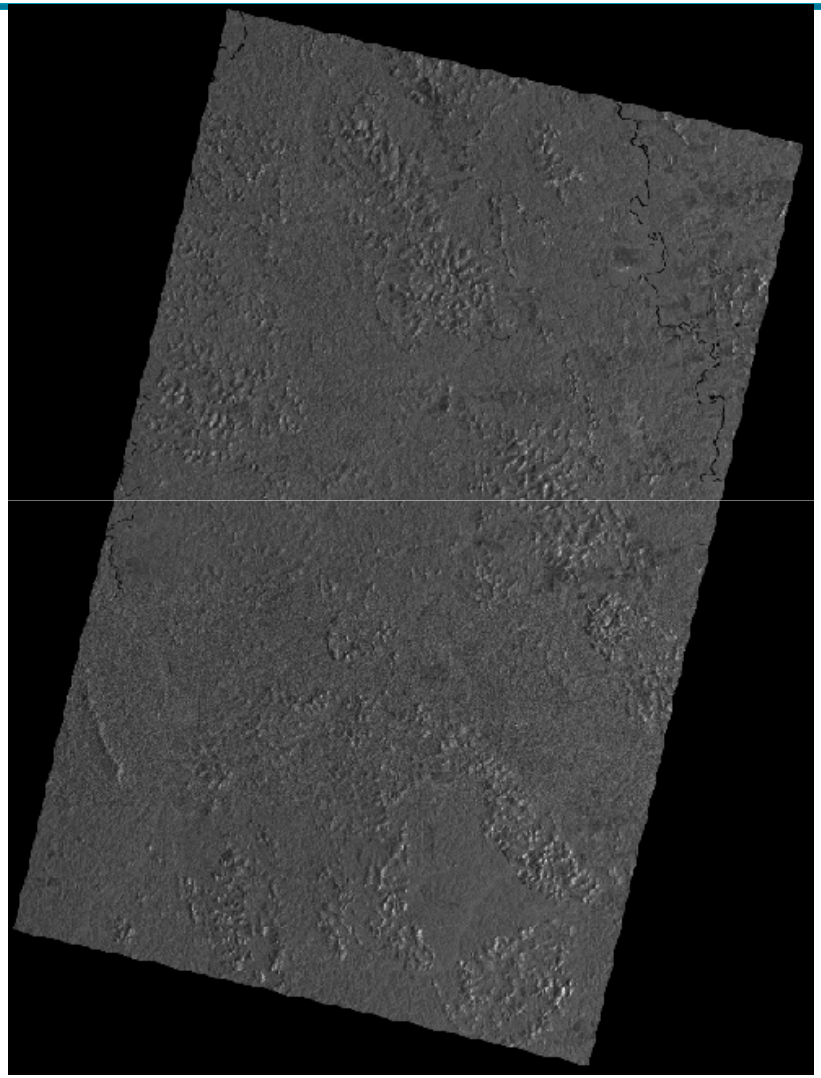
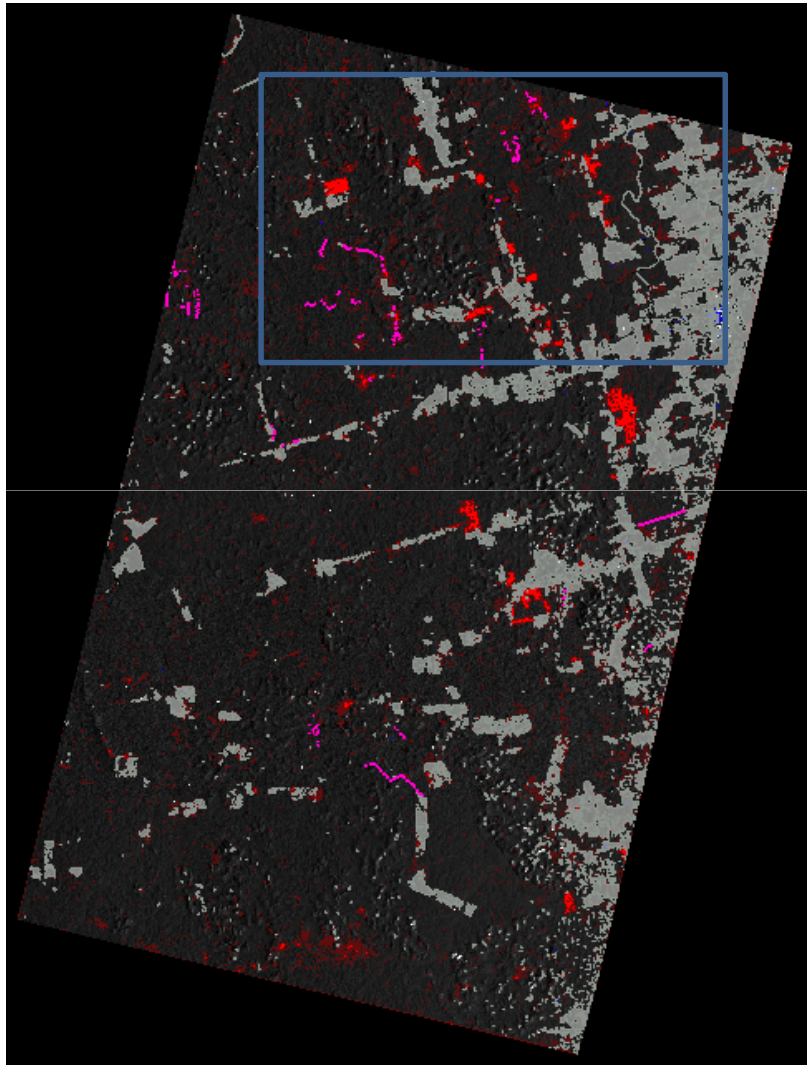
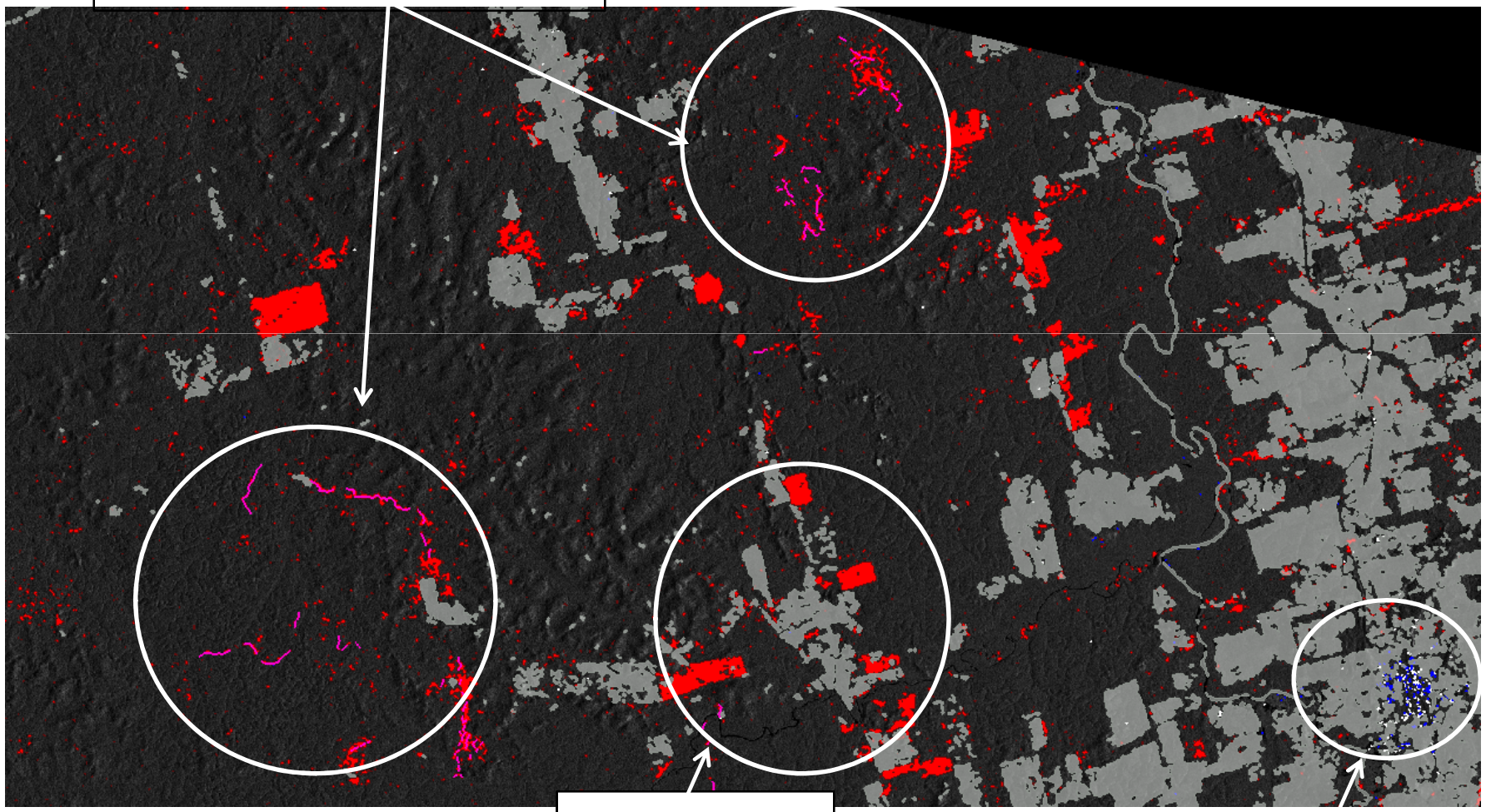


Case Study 2: Pará, Brazil

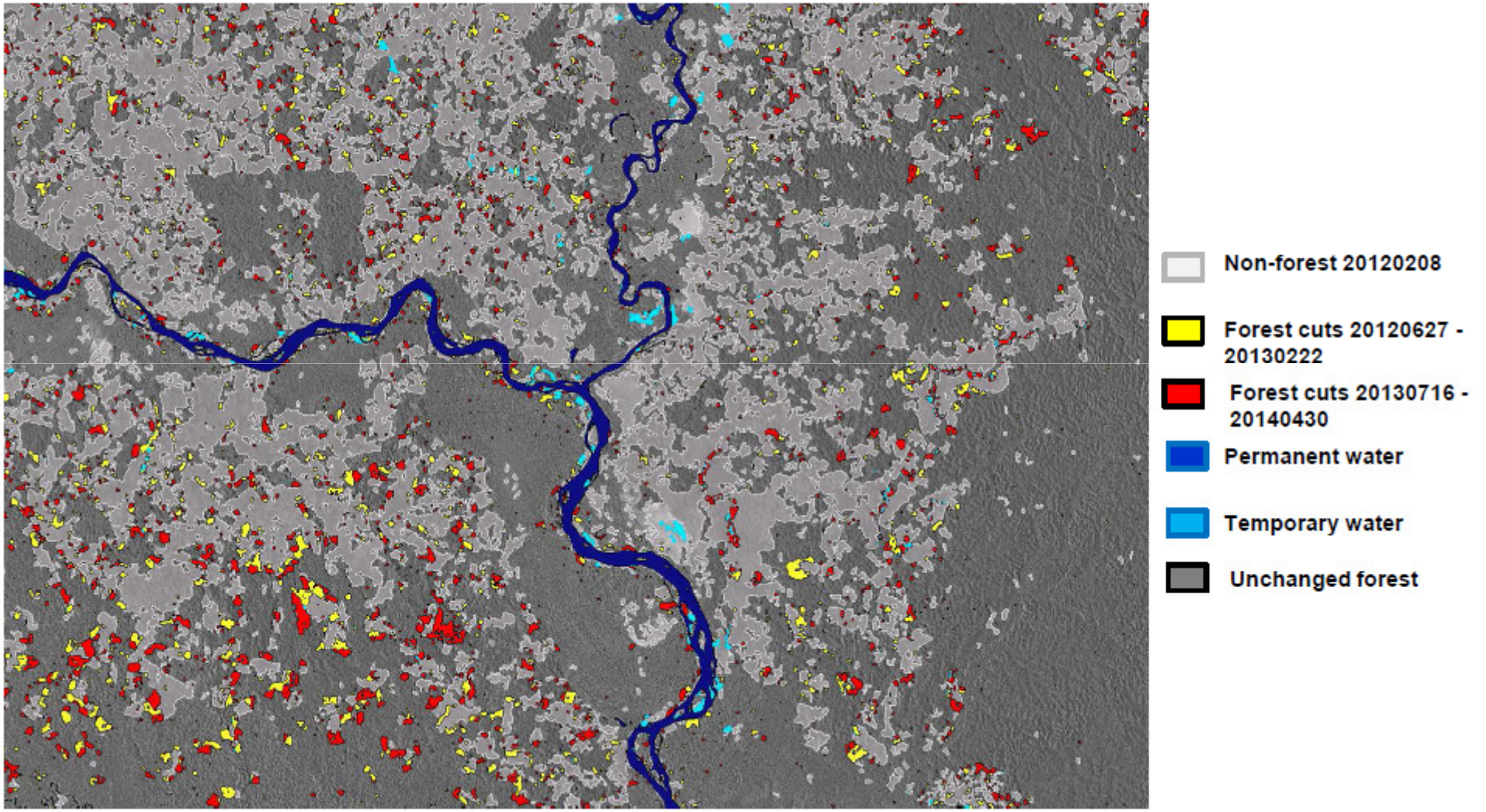




Case Study 2: Pará, Brazil- Zoom-in



Case Study 3: Tres Esquinas, Colombia – 2014



Summary

- RADARSAT-2's Extra Fine beam mode provides high resolution, wide area and weather independent coverage
- MDA ForestWatch change detection method allows for detection of deforestation in early stages
- Independent, frequent monitoring
- Easy-to-use, customizable reports that clearly show the location and extent of deforestation
- Can quickly issue deforestation alerts over areas from thousands to hundreds of thousands of square kilometers in size

Thank You

MDA Geospatial Services Inc.