

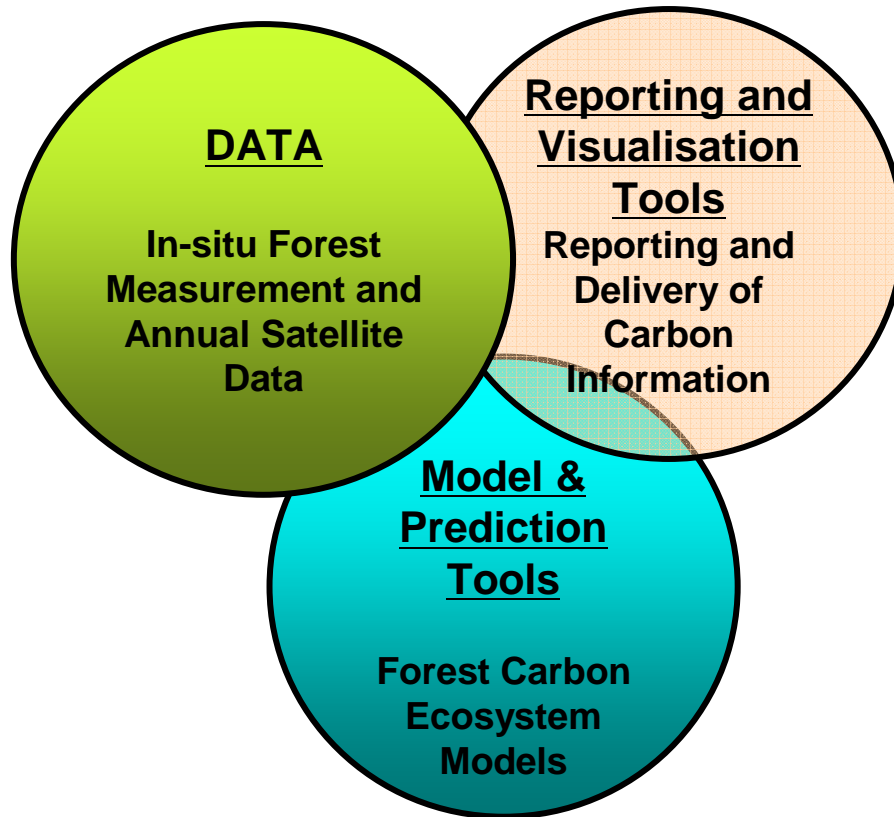
Technical Standards and Interoperability (“complimentarily”): GEO FCT Approach

Alex Held – CSIRO





Possible Elements of National Forest Carbon Monitoring Systems



The core elements of sovereign national forest monitoring systems are likely to include:

1. Earth observing (satellite) data to monitor areas of forest, deforestation and forest degradation as well as afforestation and reforestation;
2. Land use mapping to determine post deforestation land use;
3. Ground measurements for model calibration, validation and verification;
4. Models to estimate carbon stocks and greenhouse gas emissions from trees, forest floor litter and soils; and
5. GIS systems to hold and present maps, and to produce reports according to prescribed UNFCCC accounting and reporting rules.

The emphasis on each element will change according to national circumstances

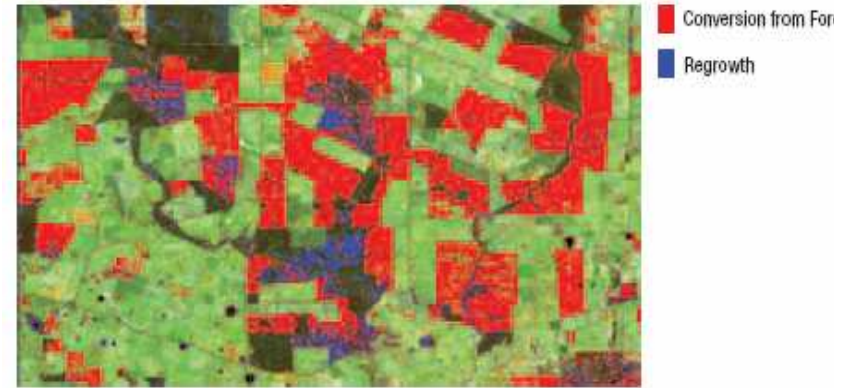


SAMPLE CARBON ACCOUNTING OUTPUT (NCAS)

Table 3. Land Use Change Emissions (Mt CO₂-e)⁹ National and by Australian State and Territory, 1998-2003.

Year	National	New South Wales	Northern Territory	Queensland	South Australia	Tasmania	Victoria	Western Australia
1988	114.9	23.3	1.0	62.4	4.1	6.4	5.9	11.7
1989	119.1	26.5	0.8	68.1	0.4	6.9	6.3	10.1
1990	126.2	22.7	0.6	79.2	1.1	7.8	4.7	10.1
1991	101.3	21.8	0.6	59.7	0.6	7.0	3.9	7.6
1992	84.5	19.0	0.8	48.0	0.4	6.0	5.1	5.2
1993	71.1	14.0	0.4	43.1	-0.7	6.1	3.8	4.3
1994	68.0	12.3	0.4	43.5	0.0	5.6	2.9	3.2
1995	64.4	12.6	0.5	38.2	-0.1	6.1	3.0	4.1
1996	61.5	10.7	0.8	36.2	0.0	7.0	2.5	4.3
1997	57.7	9.5	0.7	36.1	-0.4	6.3	2.4	3.1
1998	71.3	12.5	0.5	45.9	-0.3	6.3	2.5	3.9
1999	57.8							
2000	59.6							
2001	53.4							
2002	60.6							
2003	38.7							

(a) An Example Land Cover Change Image (1972-2000 composite).



An Example Carbon Output (Emissions in 1998).

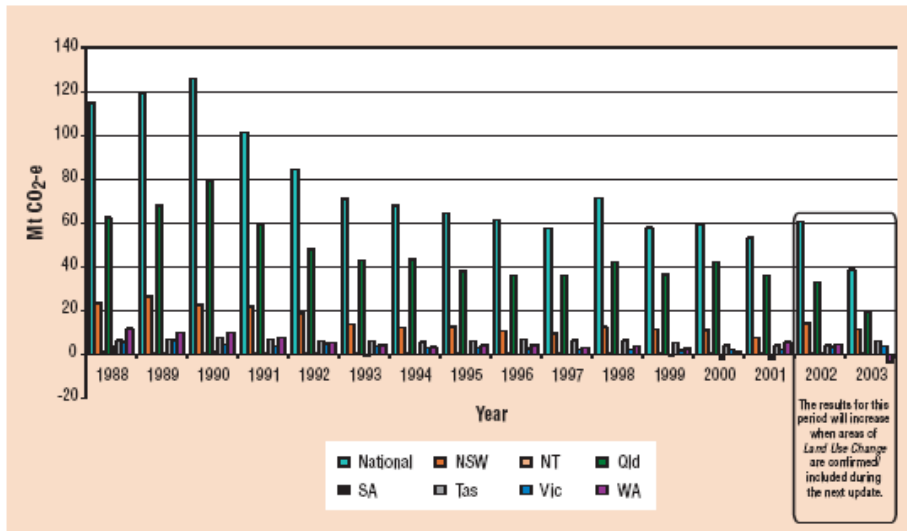
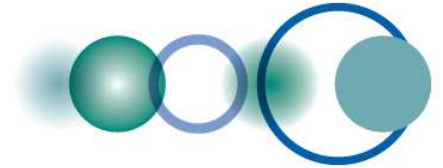


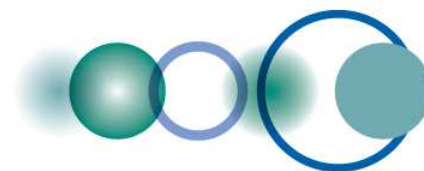
Figure 12. Emissions (Mt CO₂-e) Over Time by Australian State and Territory.

Spatially Explicit Accounts



Task Outputs/Deliverables

1. Regional reference test-sites established in consultation with national governments, NGO's and expert teams
2. Optical + SAR data acquisition strategy agreed and established via CEOS agencies
3. Forest change data (Optical + SAR) products agreed and being routinely produced, by national/regional programs
4. Establish guidelines for annual, mid-resolution global forest-change monitoring program
5. Satellite data processing, accuracy assessment and correction methods widely agreed and documented
6. Consistent field measurement guidelines and protocols implemented across national demonstrators
7. Provision of in-country access to observations, datasets, tools and expertise and associated capacity building activities.

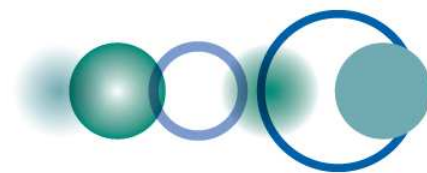


Technical Requirements based on Typical Forest Change & Routine Monitoring Requirements

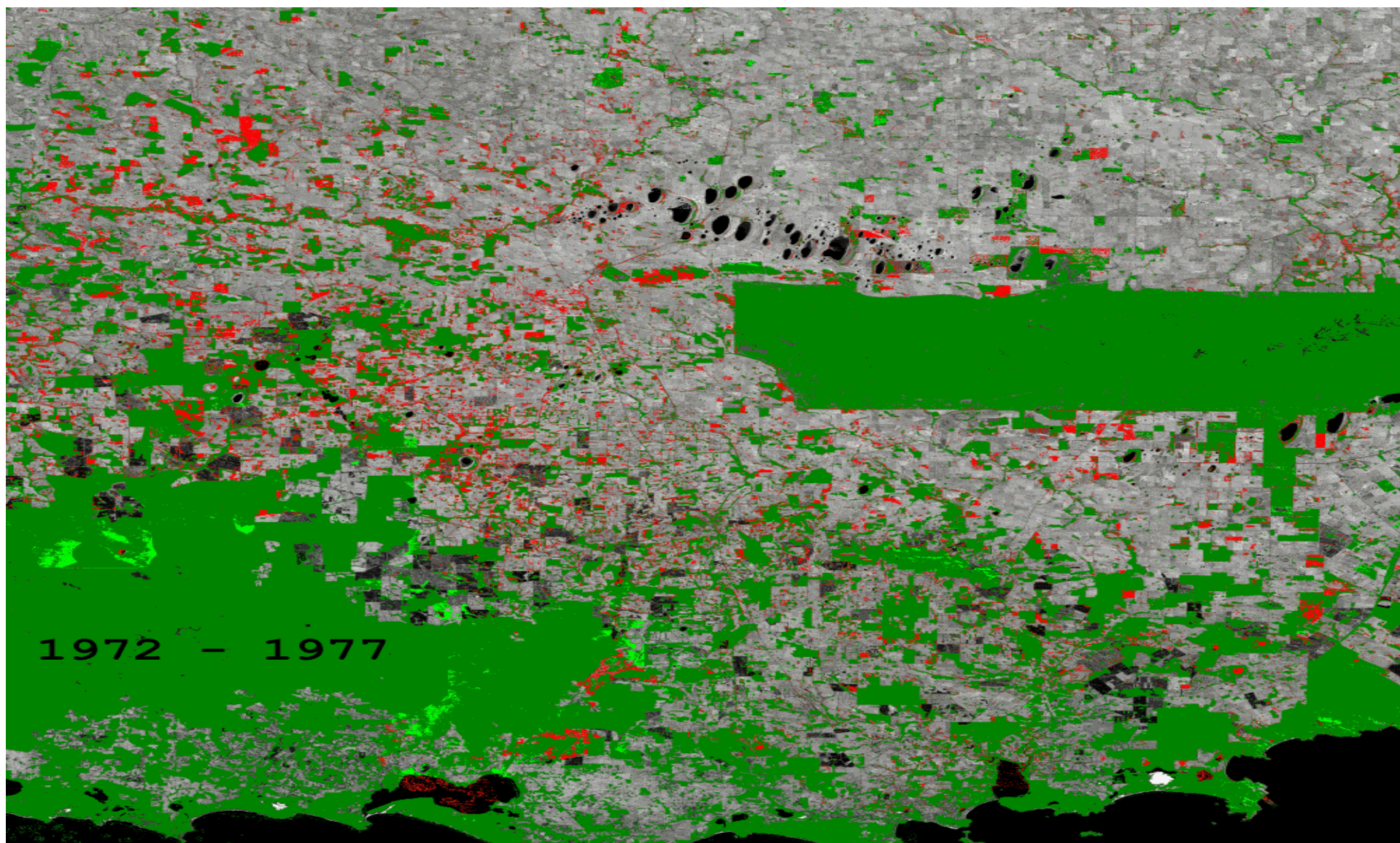


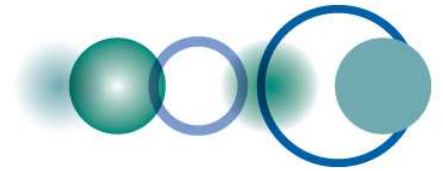
Type of clearing	Characteristic size	Characteristic temporal cycle
Selective logging	Gaps < 30 x 30 m	30-80 yrs
Clear-cut logging	> several ha	80 yrs
Shifting cultivation	Small fields, < 6 ha	5-10 yrs
Small-holder agriculture	Small fields, < 6 ha	Permanent until abandoned
Intensive mechanized agriculture	> 100 ha	Permanent until abandoned
Urban growth, or other uses	Ranging from small settlements to urban expansion	Permanent until abandoned

Source GOF-C-GOLD

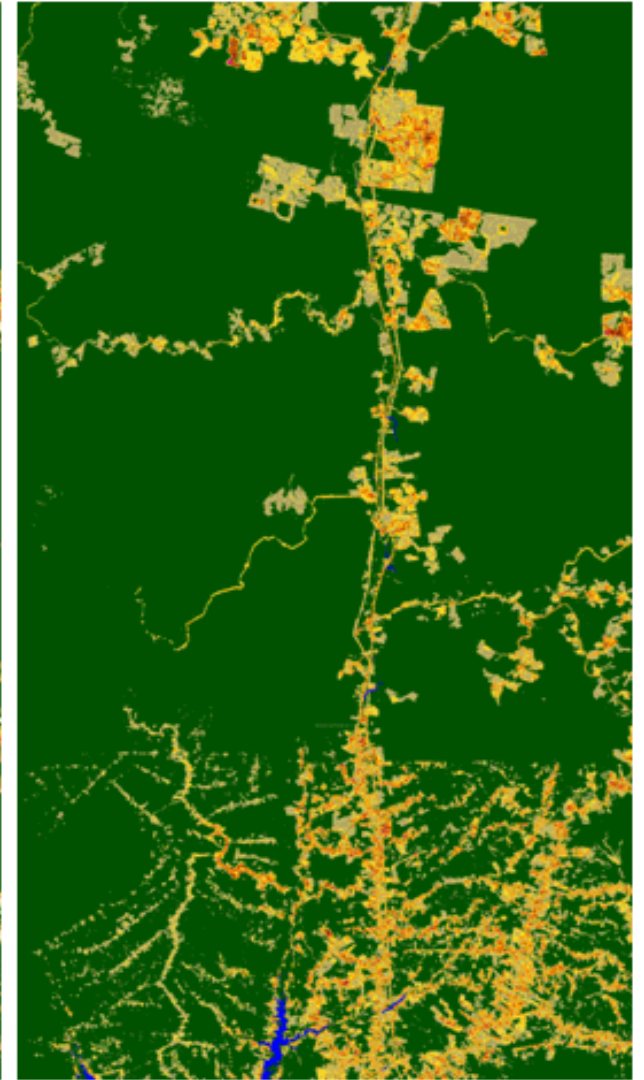
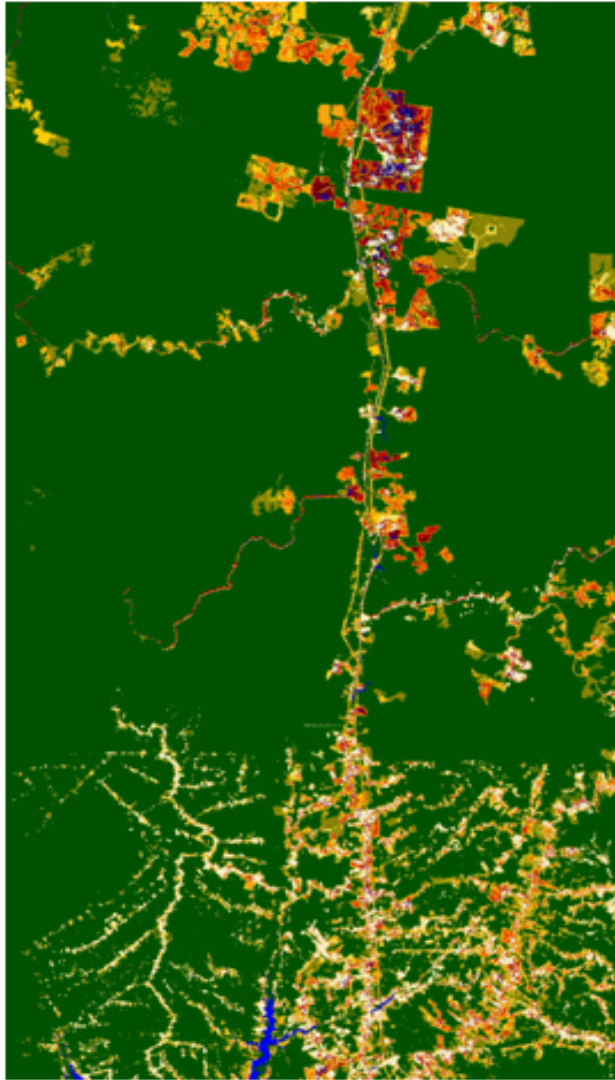
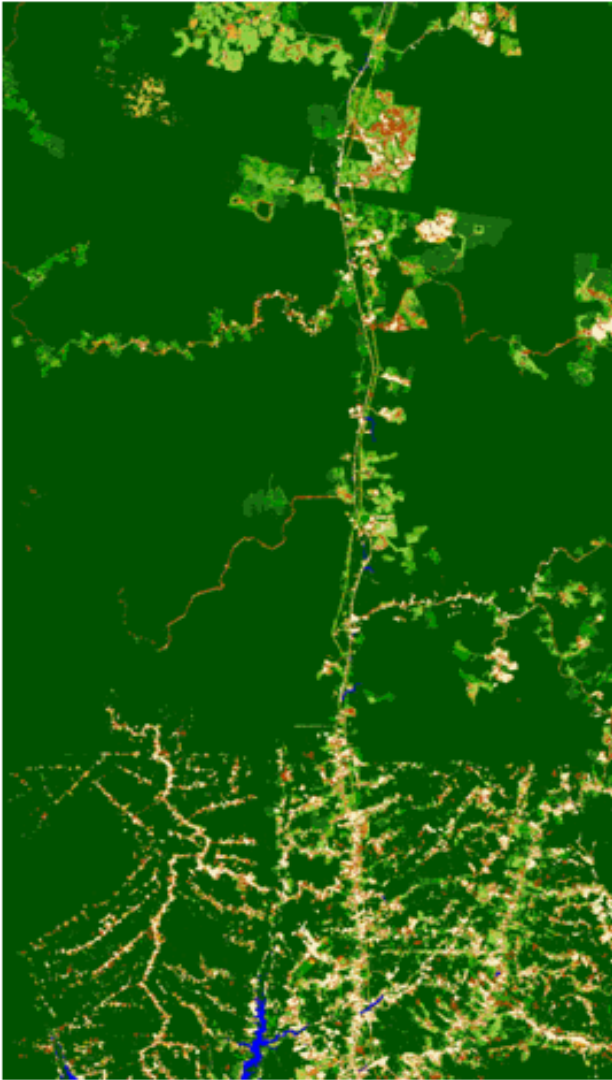


NCAS Land-cover Mapping Methodology

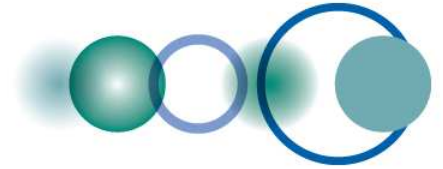




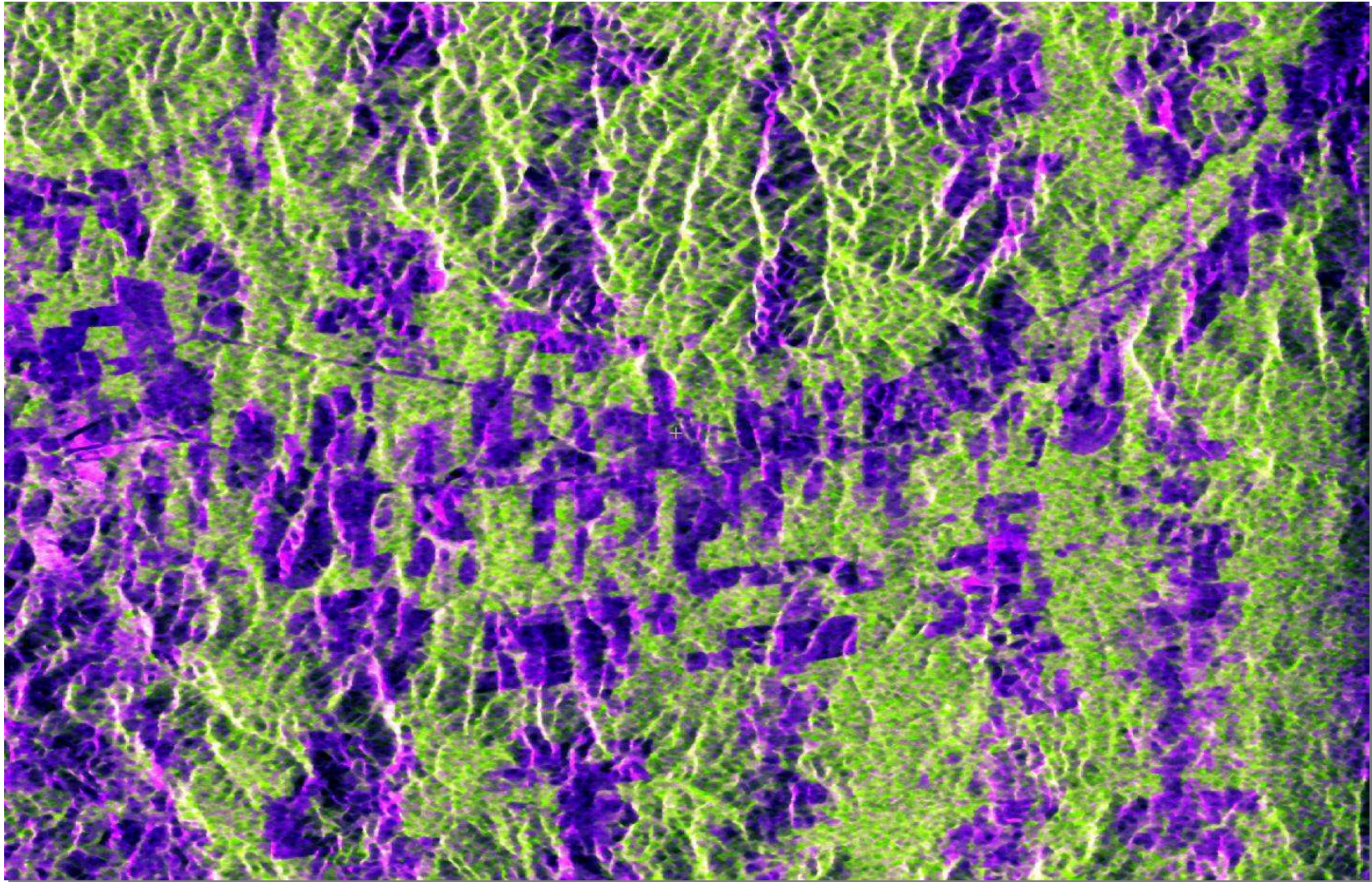
Landsat TM - Time-series Classifications, Manaus, Brazil



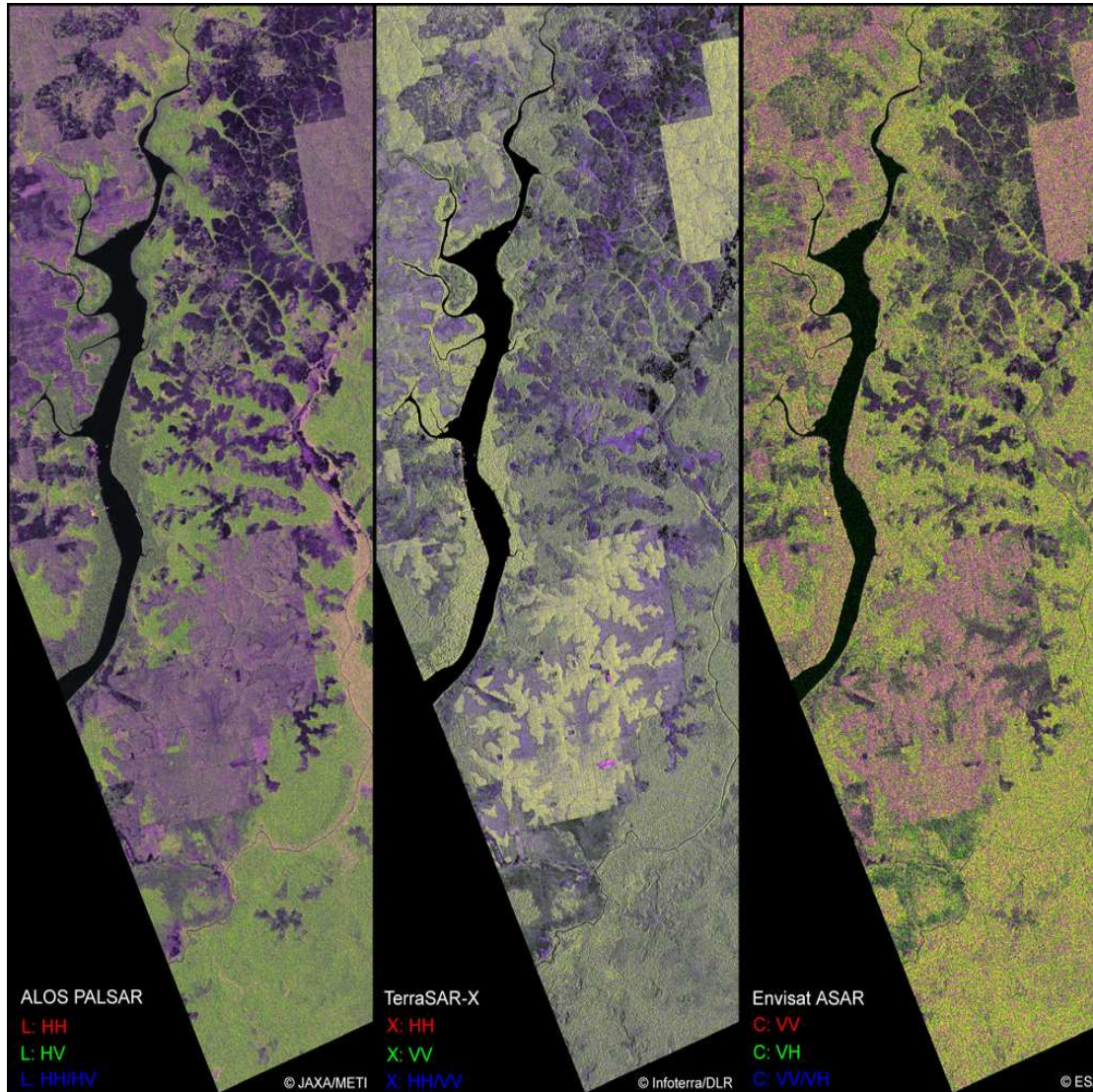
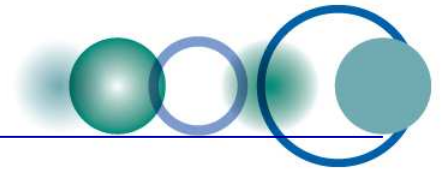
(Source R. Lucas)



L-Band SAR Composite (HH/HV/HH-HV)



Source: J. Kellendorfer)



Kalimantan Tengah,
Indonesia

Source: A. Rosenqvist – JRC-JAXA

L-band
ALOS PALSAR (FBD mode)

HH + HV

C-band
Envisat ASAR (APP mode)
Radarsat-2 (Wide dual pol)

VV + VH
(HH + HV ?)

X-band
COSMO-SkyMed (Ping-pong)
TerraSAR-X

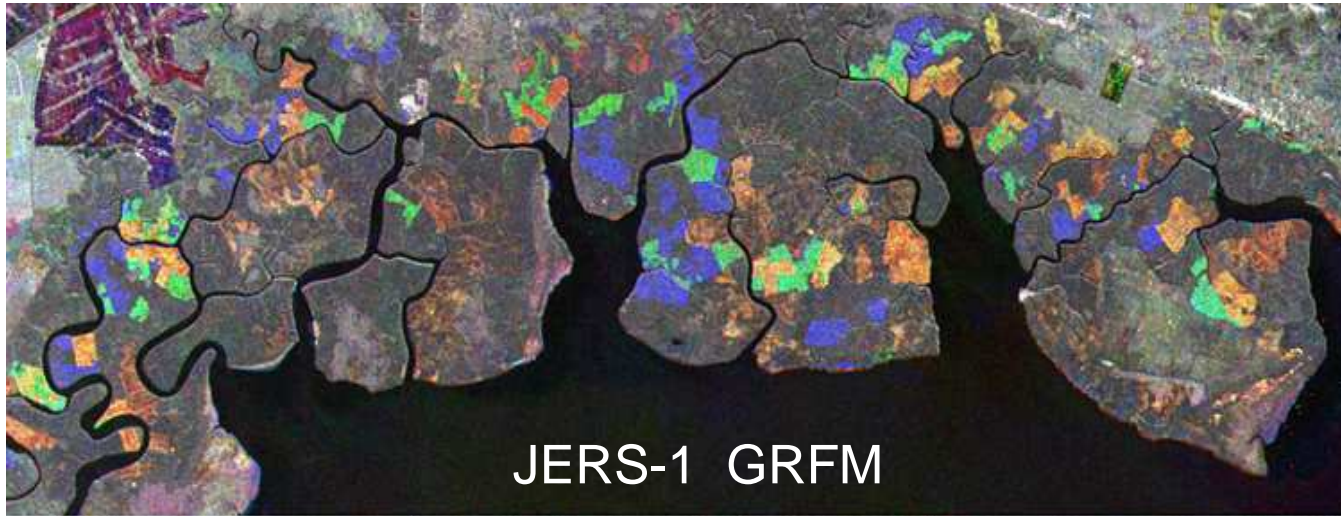
HH + HV
[CESBIO/Wageningen/FRA-SAR]
HH + VV (?)
[InfoTerra sample]

TBD

2006-11-04



Annual/seasonal forest change monitoring - L-band



JERS-1 GRFM

1992

1995

1998



ALOS PALSAR

2006

2007

2008

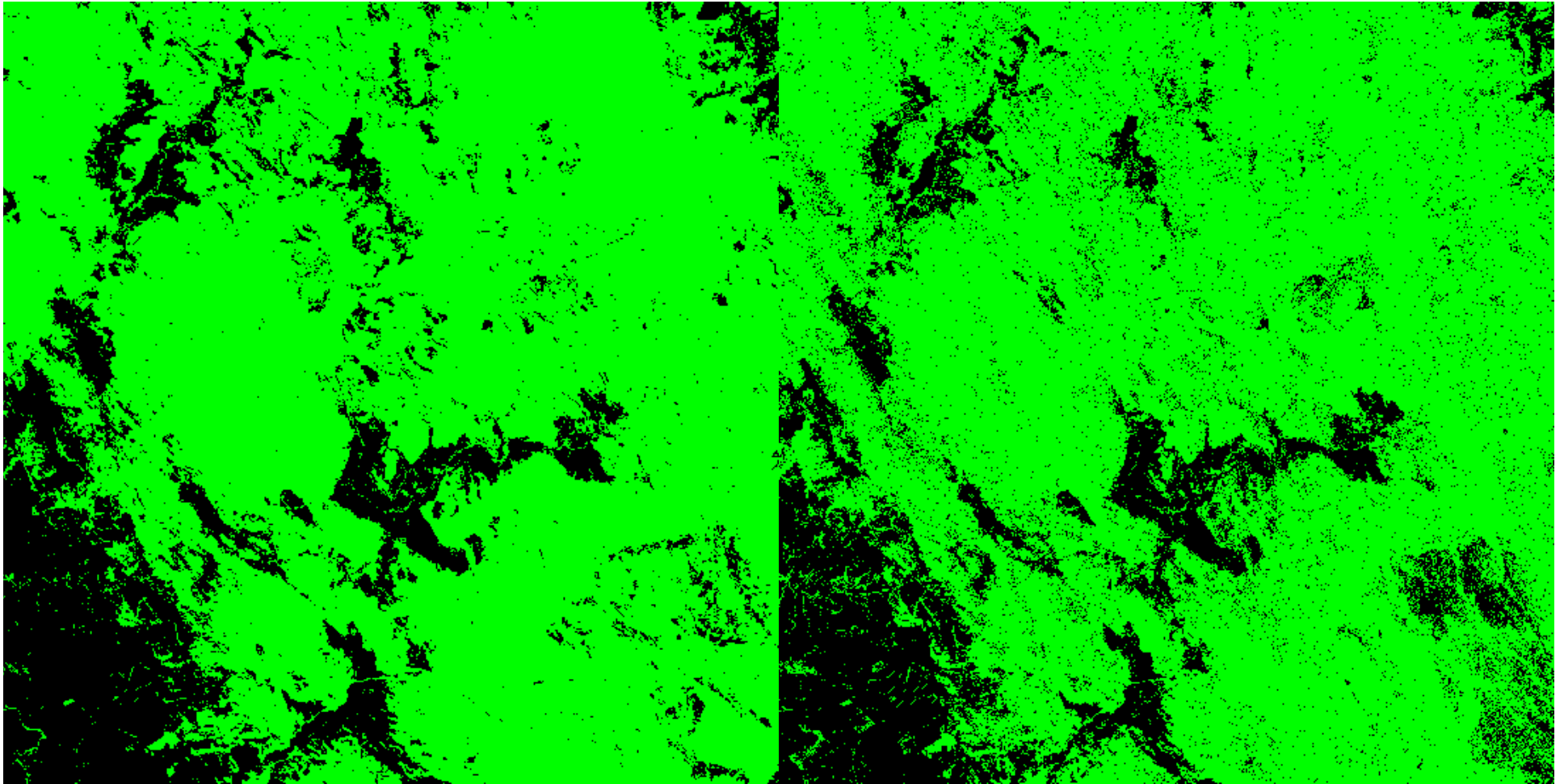
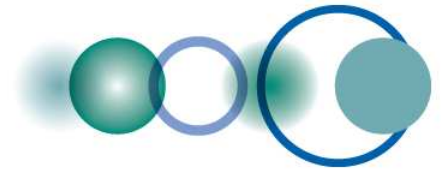
Perak, Malaysia

Source: A. Rosenqvist – JRC-JAXA



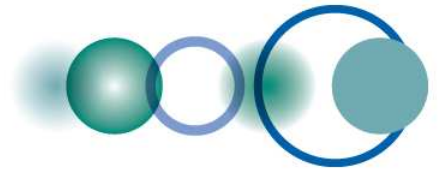
GROUP ON
EARTH OBSERVATIONS

TASMANIA Demonstrator

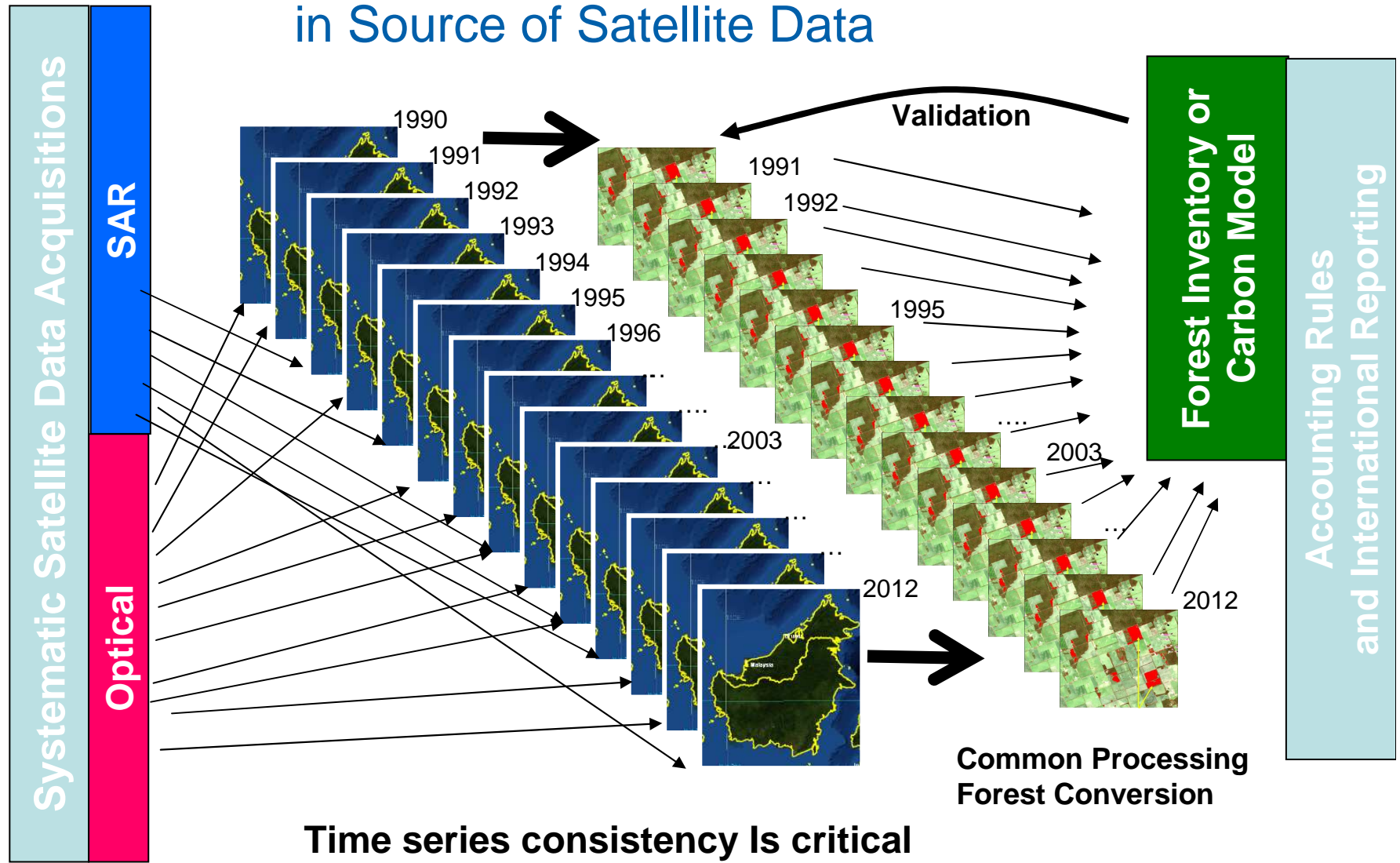


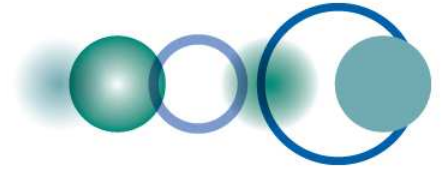
Forest classification derived
from Landsat 2007

Forest classification derived
from PALSAR 2007

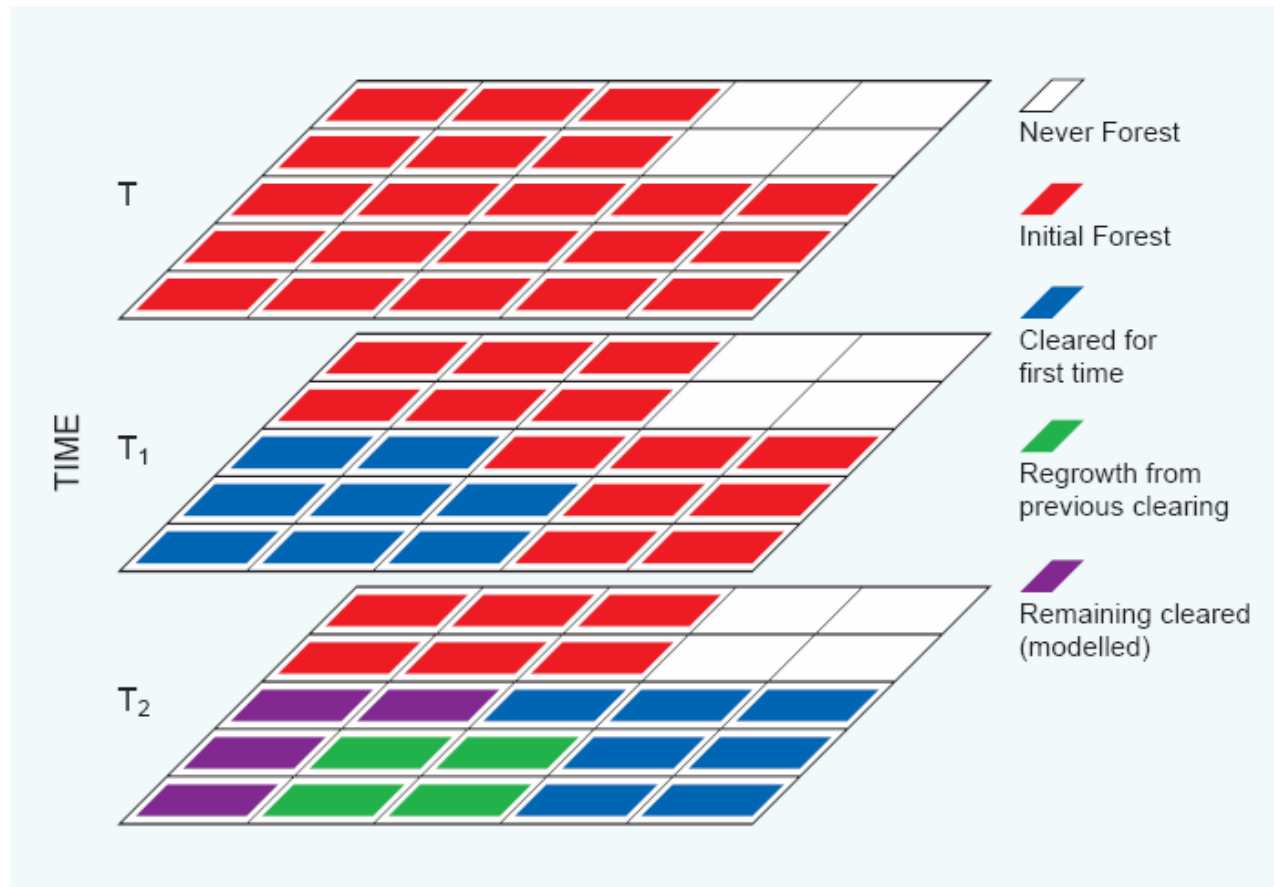


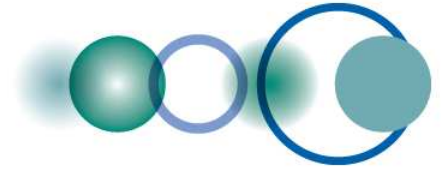
Interoperability/Complementarity in Source of Satellite Data





Pixel based land cover change





Initial Approach

- Task is developing a document outlining initial data analysis principles:
 - Common map projection
 - Ground reference and elevation information
 - Data specifications from space agencies (eg path orientated Images, maximum resolution appropriate for sensor, meta data to include all sensor data available for helping with estimation of geometry between viewer, ground, and source.
- Regional Processing Hubs are being established, including specification of working teams.
- Working teams should produce detailed working systems and specifications based on National Demonstrator requirements.
 - To include reference data sets, set of common control points etc etc
- GEO FCT will coordinate inter Region Processing Hub interoperability workshops
 - a) each region to outline the approach adopted
 - b) lessons learned
 - c) what are the best components out of each system
- Iterate 3 and 4, updating National approaches and best practice as it evolves.

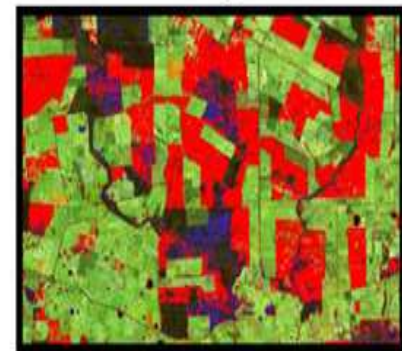
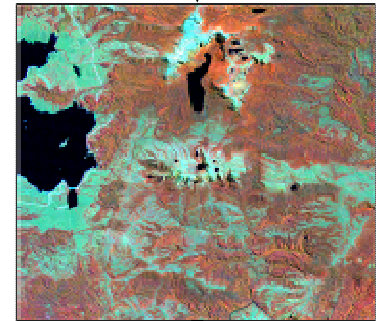
**Key Deliverable: Development of Methods for production of repeatable
Land-Cover Products for Ingestion into Carbon Models**

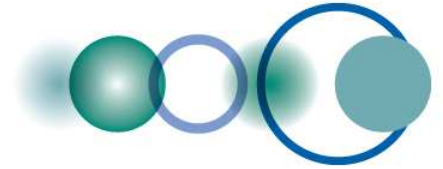


Needs

Expert community agreement on data analysis methods for:

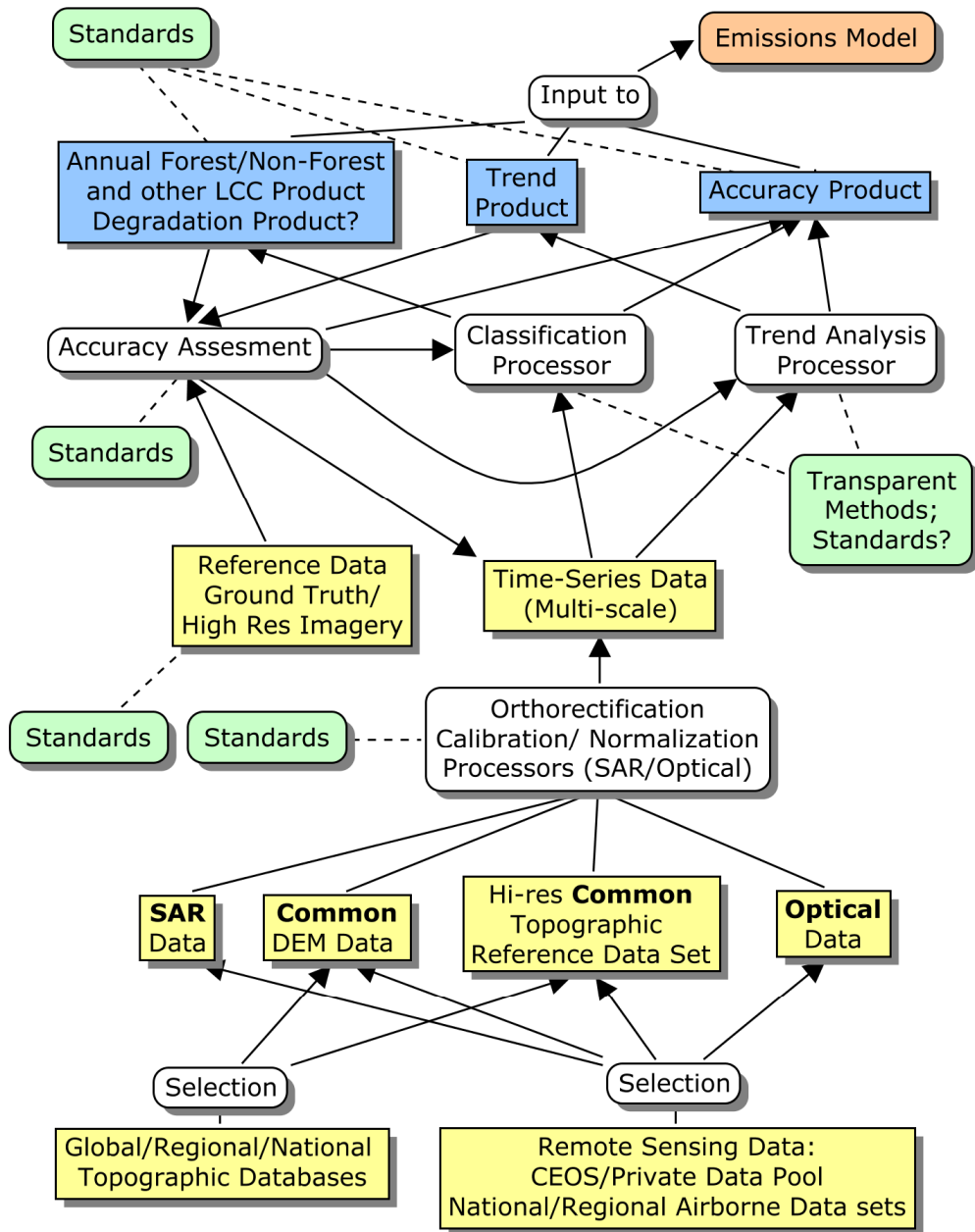
- optical & SAR data integration
- processing into annual, orthorectified, terrain illumination-corrected mosaics
- Methods for production of Information Products on annual forest cover change at medium resolution





GEO FCT Processing Methodologies Document

- Coordinated by Woods Hole (J. Kelndorfer), CSIRO (Held); w. input from Wageningen U, UNSW, GOF-C-GOLD, CSIRO,
- Products include:
 - Horizon-1: Annual Forest, Non-Forest trends and associated accuracy metrics (preferably from a 1990 baseline)
 - Horizon-2:
 - Forest Degradation (& trends)
 - Land-use (e.g. agriculture, shifting cultivation, plantations, native forest), Forest class: secondary forest (eg after fire or after agriculture); Softwood, hardwood, native, Plantation type mapping pre- and post-1990
 - Sparse woody perennial cover
- Draft v1 available for input asap



Q/A

