

Status Report on Forest Carbon Tracking

Alex Held (CSIRO)& GEO FCT Team

November 2009

Modified by Ake R. For KC#13

FCT Team Members: Norway (NSC), Japan (JAXA), Canada (CFS-CSA), FAO, CEOS (ESA), Wageningen University, USGS, USDA, Woods Hole Research Center, INPE, Japan (Restec & NIES), Symbios Communications, GISTDA, GOFC-GOLD, Google, EC/JRC

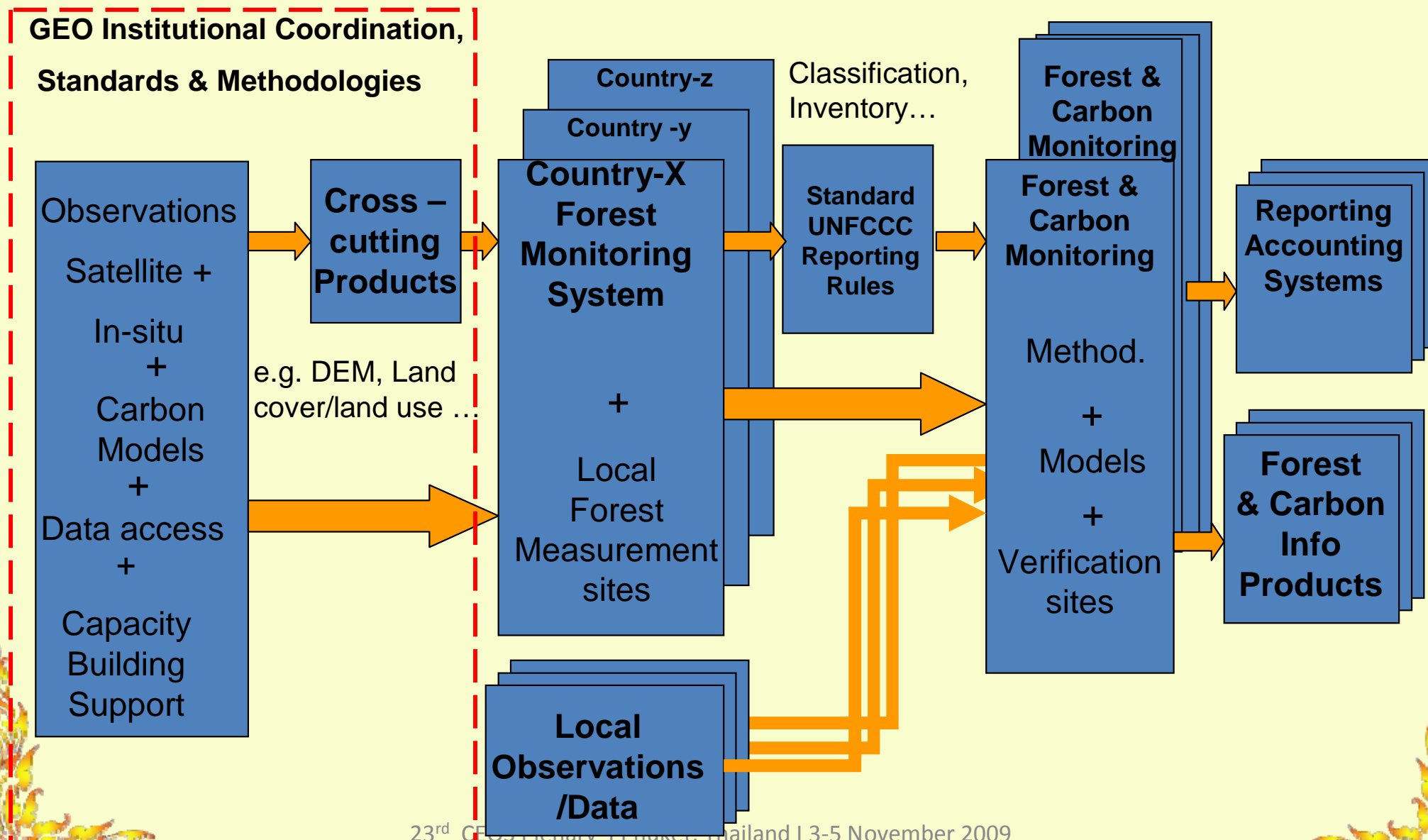
Task Support for National Governments

(Taking Guidance from UNFCCC - IPCC “Good Practice Guidelines” on Lands and Emissions Methods)

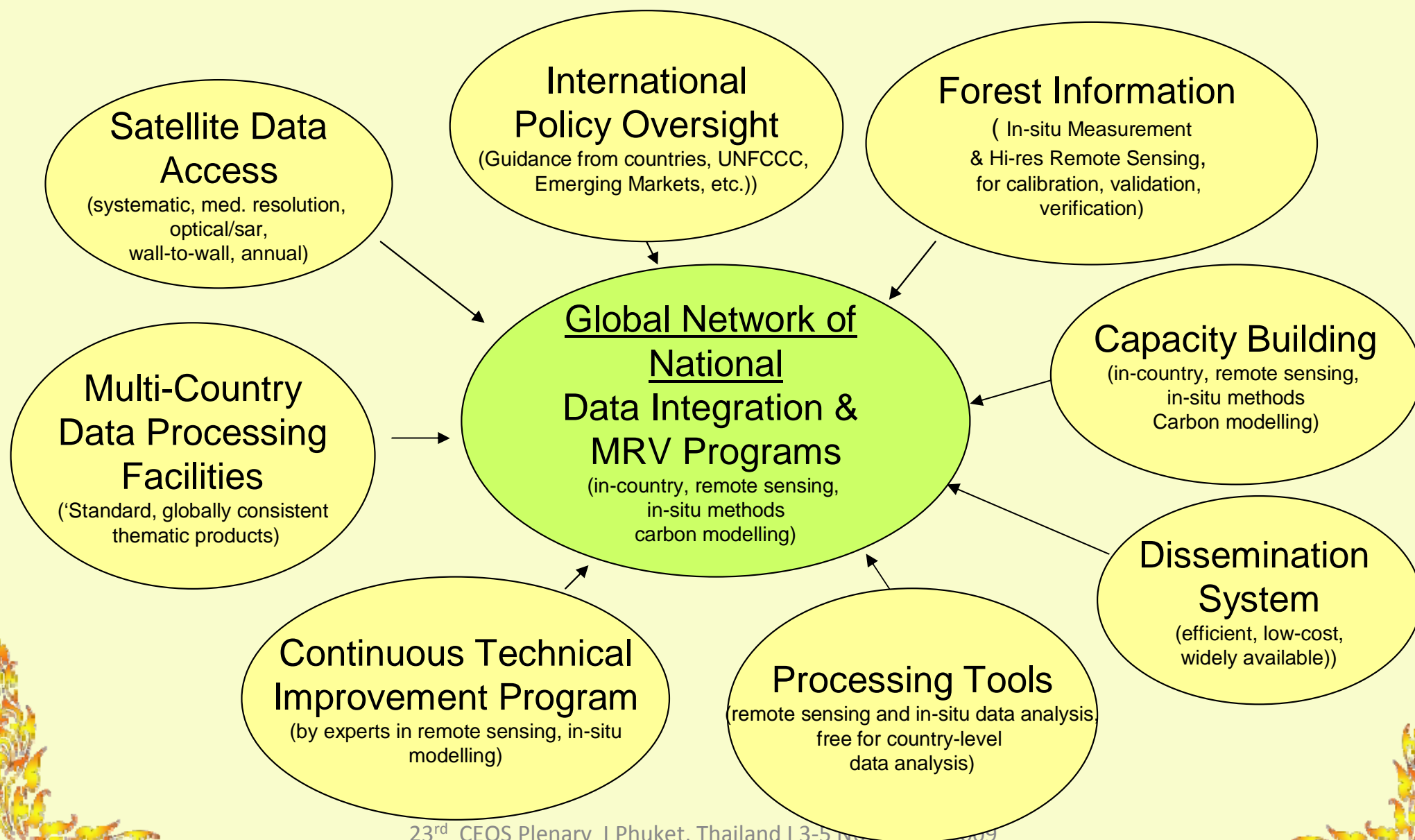
GEO FCT Support

- Lands
 - **Approach 1:** areas of different land use at different times (blind to land substitution and transition)
 - **Approach 2:** a land conversion matrix by area to identify land substitution, but not spatially explicit
 - **Approach 3:** spatially explicit (wall-to-wall time-series monitoring of land use change)
- Emissions
 - **Tier 1:** emissions factors using global defaults
 - **Tier 2:** emissions factors using local defaults
 - **Tier 3:** emissions estimated by direct measurement or model

Network of Forest Monitoring Systems



Components of the Global Forest & Carbon Measurement System (GFCMS)



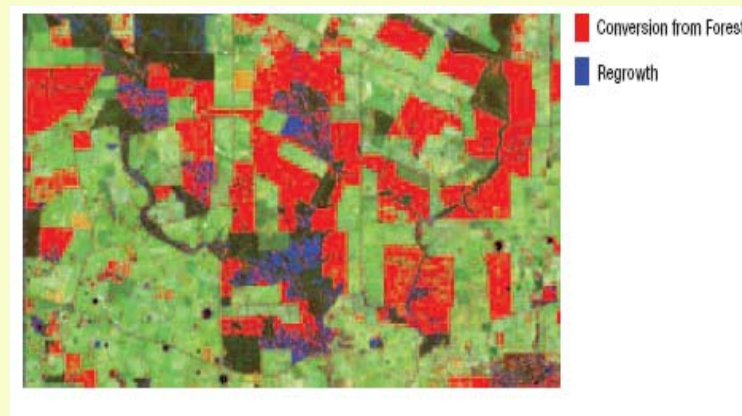
Thematic Product Requirements (as per IPCC-UNFCCC Guidance)

UNFCCC framework definition of forest and deforestation adopted for implementation of Article 3.3 and 3.4 (Kyoto Protocol)

- Minimum forest mapping area: 0.05 to 1 ha max.
- Potential to reach a minimum height at maturity in situ of 2-5 m
- Minimum tree crown cover (or equivalent stocking level): 10 to 20 %

Therefore we need:

- ➔ • National level Forest information (wall-to-wall; border-to-border)
 - To avoid 'leakage'
 - To report at national + sub-national + project levels
- ➔ • Annual Change basis (i.e. time-series)
 - UN/market reporting requirement,
 - Improve accuracy and attribution of changes
- ➔ • Resolution (best operationally available eg 25 m)
 - To report change at sub-hectare basis



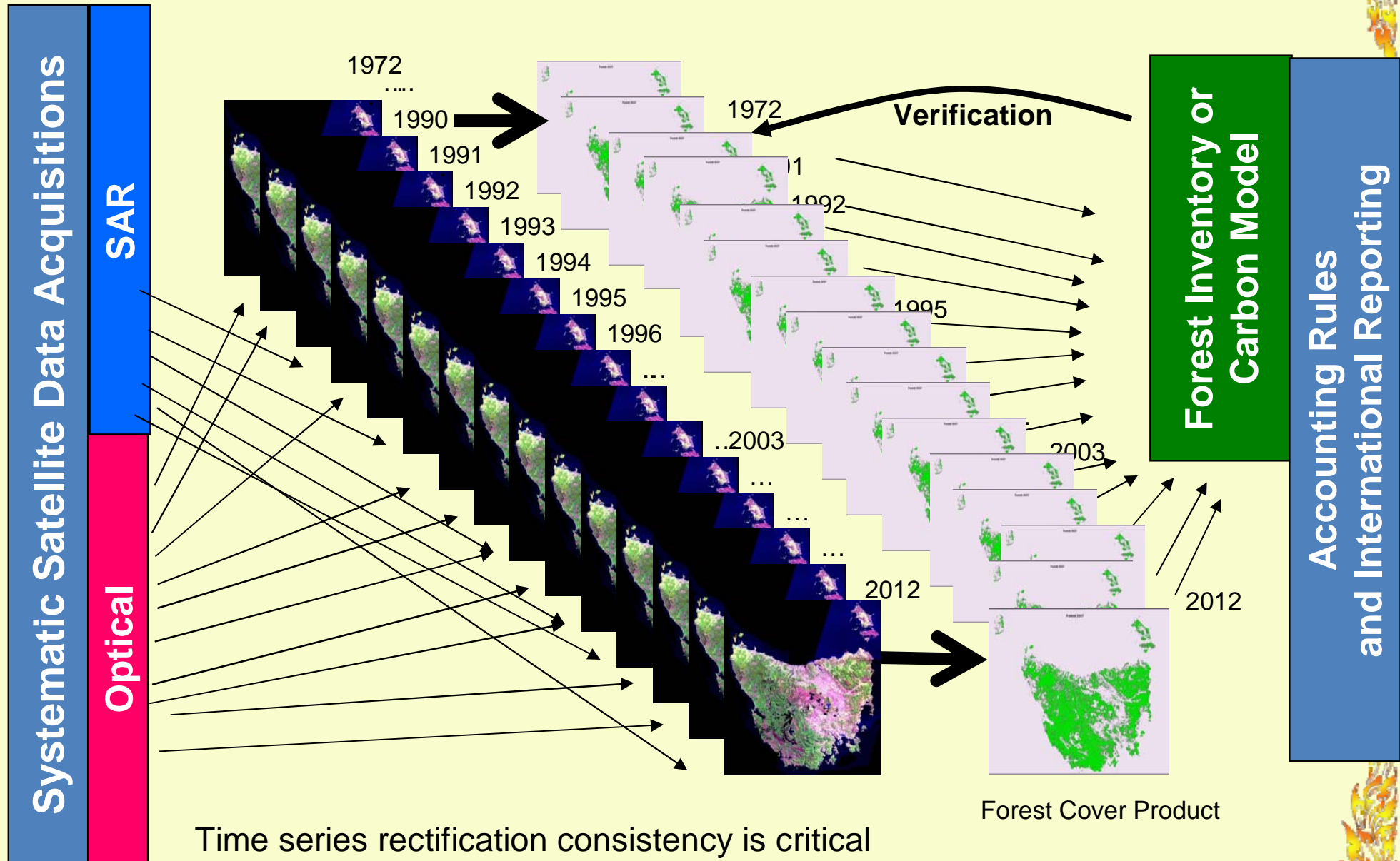
GEO Forest Carbon Tracking Task

(task approved during GEO-V Plenary – Budapest, November 2008)

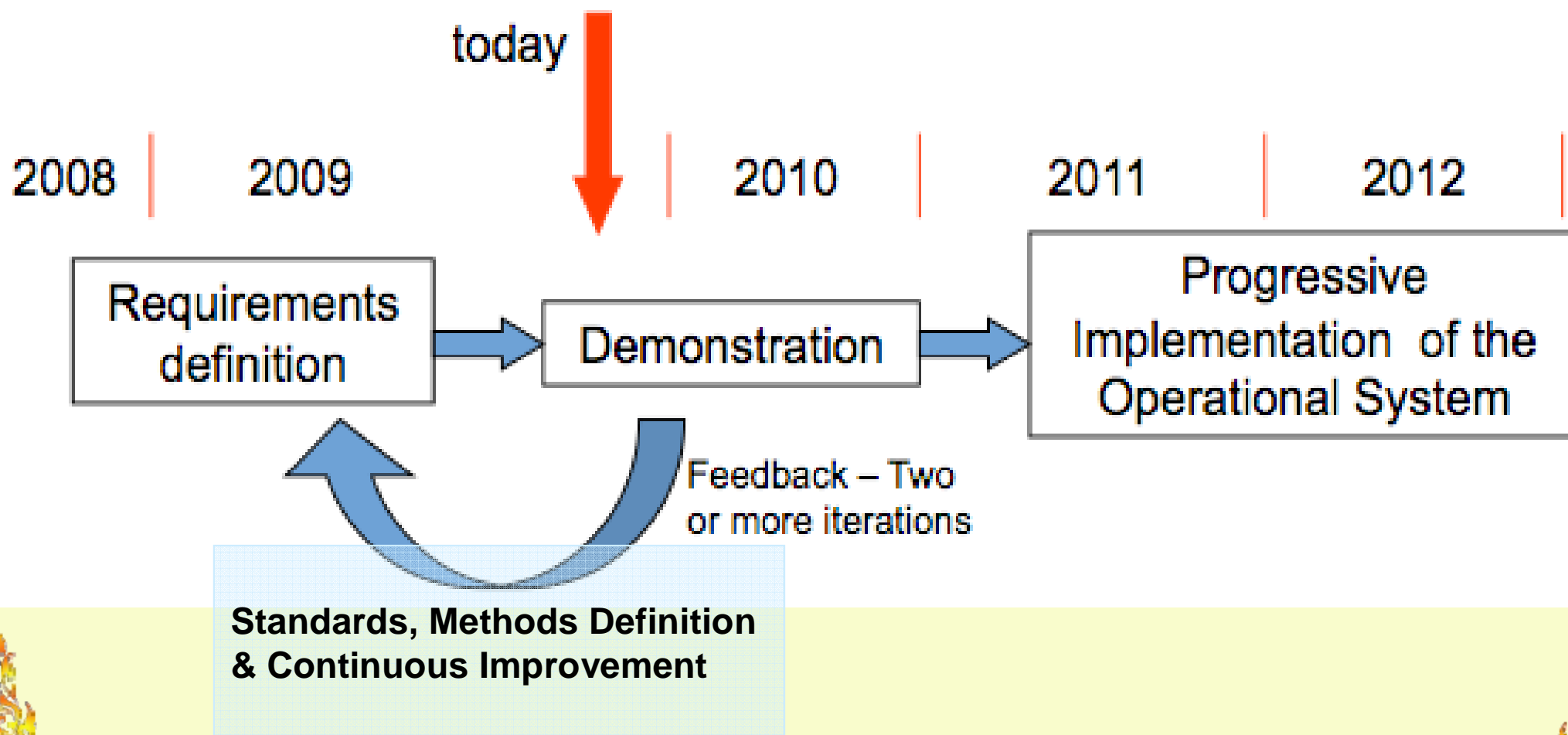
Outputs

- Consolidation of observational requirements and acquisition of annual, mid-resolution global forest-change monitoring information,
- Demonstrate initial capability via several ‘National Demonstrator’ countries and nested verification-sites
- Coordination of protocols for consistent field measurement and validation
- Coordination of data analysis, tools and standard methodologies
- Production of reference documents and datasets
- Improved access to observations, datasets, tools and expertise and associated capacity building activities.

Time-Series & Interoperability in Source of Data



Timeline

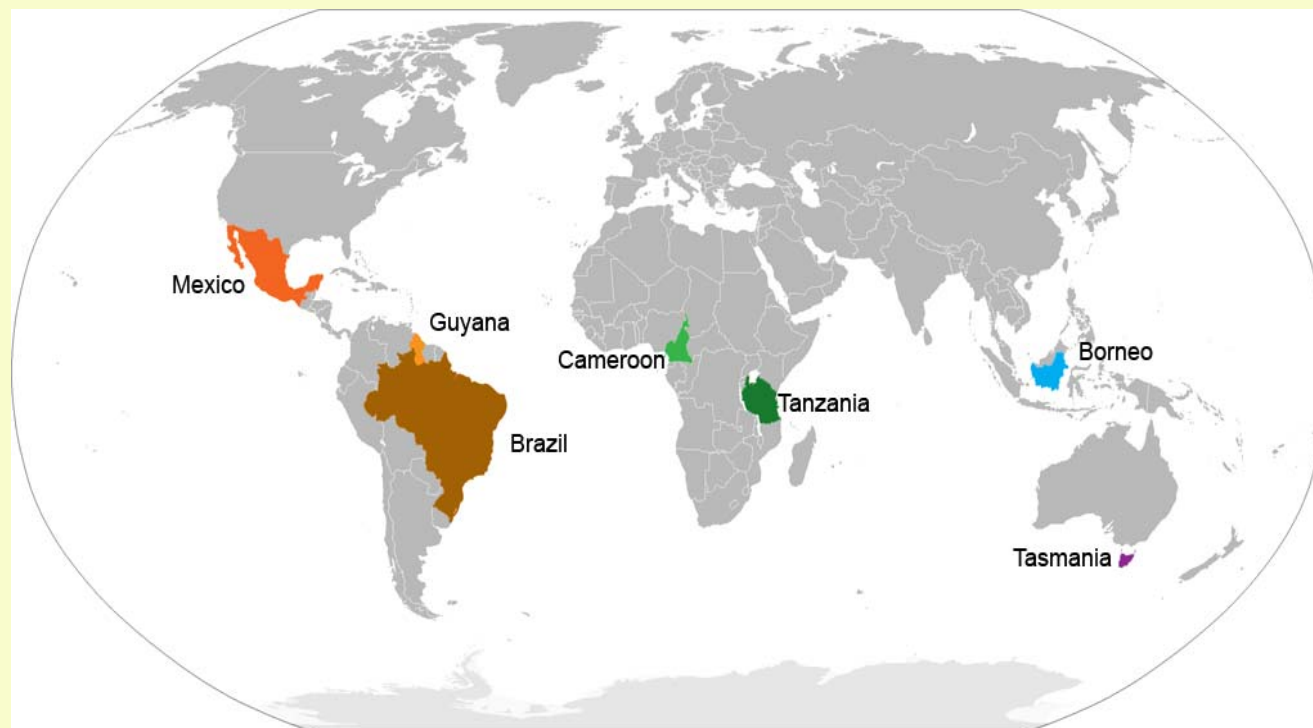


Progress to-Date

- CEOS Communiqué
- Establishment of 'National Demonstrators' and coordination role
- Satellite data requirements document (optical + SAR)
- 2009 CEOS Data Acquisitions and initial products
- Draft forest information product specifications
- GEO FCT Portal (by Google + Australia)

FCT National Demonstrators 2009

- Brazil
- Guyana
- Mexico
- Indonesia (Borneo)
- Australia (Tasmania)
- Cameroon
- Tanzania



- In 2010 we plan to expand this network of national demonstrators and verification sites
- Utilise synergies where possible with CEOS LSI Constellation regional areas, and countries from UN REDD + World-Bank Forest Partnership

Support to FCT: CEOS Organization

- **SAR and Optical data provider Agencies**
 - LSI support for optical data – USGS Leadership
 - SAR co-ordination between CSA, JAXA, ESA, ASI, DLR
- **Involvement of both CEOS Chair and SIT Chair**
 - Telecons with CEOS Principals (Providers Agencies)

PALSAR acquisition status (June 12 - Sep 30, 2009)

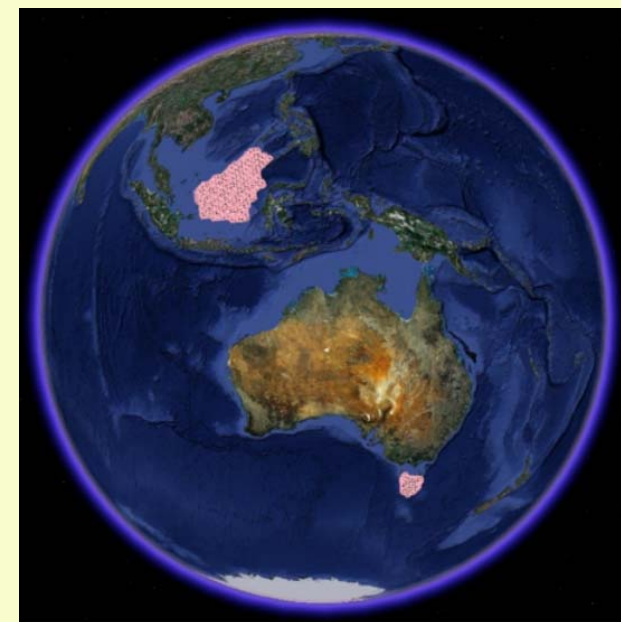


Brazil & Guyana - 2 coverages
June/July [completed] ;
Aug/Sep [completed]

Mexico - 2 coverages
Aug/Sep [partially completed]
Sep/Oct [partially completed]

Cameroon - 2 coverages
June/July [completed] ;
Sep/Oct [completed]

Tanzania - 2 coverages
June/July [completed] ;
Sep/Oct [completed]



Borneo - 2 coverages
June/July [completed] ;
Aug/Sep [completed]

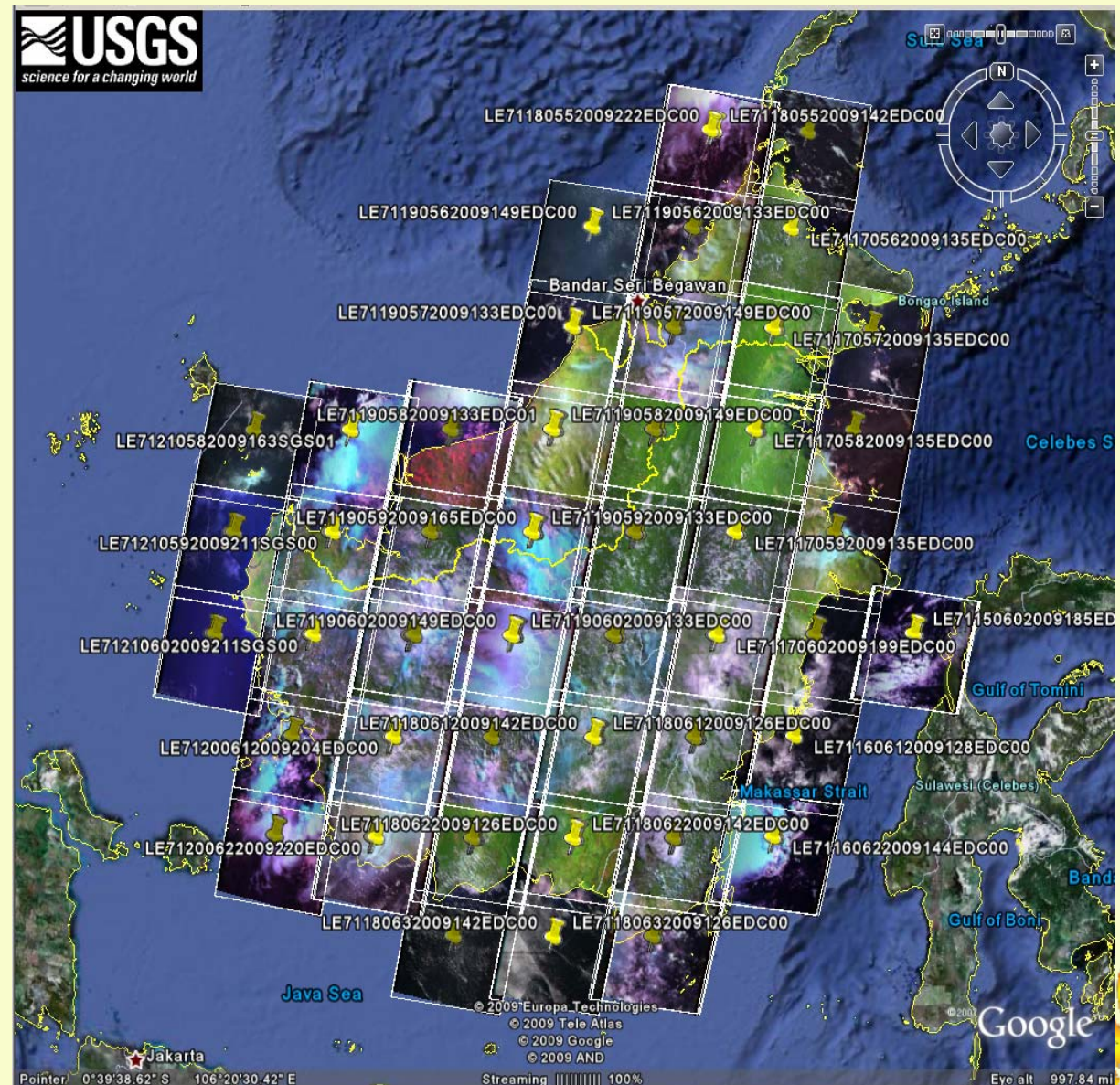
Tasmania - 2 coverages
June/July [completed] ;
Aug/Sep [completed]

Landsat Acquisitions over Borneo

**173 ETM+ Scenes in
USGS Archive from
May – August 2009**

**No Landsat 5 TM data
available from the
USGS archive.**

**Request for Landsat 5
support to GISTDA,
Thailand**



National Demonstrators - SAR sensors

NDs (wall-to-wall)	Brazil (parts)	Guyana	Mexico	Cameroon	Tanzania	Borneo	Tasmania
ALOS - PALSAR	Acquired June/Sept. Fill-in Sept/Oct	Acquired June/Sept	Planned Sept/Oct	Acquired June/Sept	Acquired June/Sept	Acquired June/Sept	Acquired June/Sept
Radarsat-2	partially acquired	Acquired June/Sept	partially acquired (Fill-in ongoing)	Coordinated to be covered by ESA	Coordinated to be covered by ESA	Acquired June/Sept	Acquired June/Sept
Envisat ASAR	partially acquired	Acquired June/Sept	Coordinated to be covered by CSA	Acquired June/Sept	Acquired June/Sept	Coordinated to be covered by CSA	Acquired June/Sept
COSMO - Skymed	Not planned	partially acquired (mainly VS)	Not planned	partially acquired (mainly VS)	Not planned	partially acquired (mainly VS)	partially acquired (mainly VS)
TerraSAR-X **	To be requested for parts of ND	Not to be requested	Not to be requested	Not to be requested	Not to be requested	Not to be requested	To be requested / VS
<div> <div></div> o.k. <div></div> some restrictions <div></div> not feasible <div></div> under discussion </div>							

**** Research proposal submitted to DLR**

National Demonstrators - Optical sensors

ND Sites	Brazil	Guyana	Mexico	Cameroon	Tanzania	Borneo	Tasmania
Landsat 5/7: USGS	Acquired	Acquired	Acquired	Acquired	Acquired	Acquired L1T gen.	Acquired L1T gen.
Landsat 5/7: IC's	Acquired INPE	Acquired INPE	Feasible CONABIO	Not feasible No IGS	Feasible: CSIR SAC & ASI (Kenya)	Feasible GISTDA	Acquired CSIRO
IRS: AWIFS	Feasible INPE	Feasible INPE	Investigated ISRO	Investigated ISRO	Investigated ISRO	Feasible ISRO	Feasible ISRO
IRS: LISS-III	Feasible INPE	Feasible INPE	Investigated ISRO	Investigated ISRO	Investigated ISRO	Feasible ISRO	Feasible ISRO
CBERS2B: CCD	Acquired INPE	Acquired INPE	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009
AVNIR-2	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP
SPOT 4	Feasible ESA TPM	Feasible ESA TPM	Feasible ESA TPM	Feasible ESA TPM	Feasible ESA TPM	Feasible ESA TPM	Feasible ESA TPM
SPOT 5	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009	Not feasible in 2009
Kompsat-2	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP	Investigated ESA TMP

 OK

 Some restrictions

 Not covered

 Under discussion

GEO FCT Data Portal

[<http://portal.geo-fct.org/> - official launch GEO-VI, Nov.18, 2009]

The screenshot displays the GEO FCT Data Portal website. At the top, the CEOS logo is visible. The main header features the 'GROUP ON EARTH OBSERVATIONS' logo and the 'Forest Carbon Tracking Portal' title. A search bar is located in the top right corner.

The left sidebar contains a navigation menu with the following sections:

- Welcome**
 - About
 - Use Guide
 - FAQ
- Forest Carbon Tracking**
 - Task Organisation
- National Demonstrators**
 - Borneo
 - Brazil
 - Cameroon
 - Guyana
 - Mexico
 - Tanzania
 - Tasmania
- Data Processing**
 - Processing Flow
 - Processing Hubs
 - Digital Elevation Models
- Visualisations**
 - Data Acquisitions**
 - GEO-VI
 - The Science of Forest Carbon Tracking
 - External Links
 - Sitemap

The main content area is titled 'Data Acquisitions' and includes a 'Visualisations >' link. Below this, the 'GEO FCT: ND coverage' section features a tree view of data categories:

- ☒ FCT
 - ☒ National Demonstrators
 - ☒ Future ND
 - ☒ Forest Products
 - ☒ Satellite Coverage
 - ☒ ASAR
 - ☐ 2009 (63)
 - ☒ LANDSAT
 - ☐ 2009 (3072)
 - ☒ PALSAR
 - ☐ 2009 (6058)
 - ☒ RADARSAT
 - ☐ 2009 (593)

Below the tree view, logos for USGS, JAXA, CSA ASC, MDA, and esa are displayed. The central part of the page shows a satellite map of South America, specifically Brazil, with a green overlay indicating forest carbon tracking data. The map is dated 'Dec 31, 2009'. On the right side of the map, there are navigation controls including a compass, zoom in/out buttons, and a scale bar. At the bottom of the map, copyright information is listed: '© 2009 Europa Technologies', '© 2009 Tele Atlas', '© 2009 DMapas', and 'Data SIO, NOAA, U.S. Navy, NGA, GEBCO'. The Google logo is also present in the bottom right corner of the map area.

At the bottom of the page, the text 'Supported by Google' is displayed.

Current Activities

- Satellite Data Processing - Coordination
 - Data Processing and Product Development Plan (JAXA lead)
 - Data Product Specification (Document ver.1 due ~Nov. 10, for circulation among task team)
 - Coordination of multi-agency processing efforts: Moving from interim “FCT Processing” , to a fully FCT Operational System from 2012.
- In-situ Forest Verification Data
 - Methodologies and standards document
 - Negotiate access to local/national in-situ forest databases

Data Processing Approach

GEO FCT Team support will be provided upon request by each Country and includes:

- Centralized processing for individual satellite sensors, to ensure processing and delivering of “based-processed data”
 - **ASAR** **ESA-NSC/KSAT**
 - **Radarsat 2** **CSA/MDA**
 - **PALSAR** **JAXA**
 - **Landsat** **USGS**
- A set of specialized Product Development teams, to support thematic processing for each ND;

ND Product Development teams

ND	ND authority	PD team contributing organisations	Status
Brazil	INPE	INPE, NSC, WHRC, IPAM	TBC
Guyana	GFC	?, WU, NSC	TBC
Mexico	SEMARNAT	CONAFOR, CONABIO, INEGI, SAGARPA, CONANP, PMC, USGS, CSA, NRCan	TBC
Cameroon	MINEF?	ESA, GAF, ?	TBC
Tanzania	MNRT	NSC, KSAT	Confirmed
Borneo	LAPAN	LAPAN, WU, CSIRO, CRC-SI, JAXA/NIES	TBC
Tasmania	DCC	CSIRO, CRC-SI	Confirmed

ND Product Development teams

ND	ND Product Development team lead	Organisation	Email	Status
Brazil	Dalton Valeriano	INPE	dalton@dsr.inpe.br	Nominated
Brazil (Xingu VS)	Josef KelIndorfer	WHRC	josefk@whrc.org	Confirmed
Guyana	Dirk Hoekman	Wageningen Univ.	dirk.hoekman@wur.nl	Confirmed
Mexico	Michael Schmidt / Sergio Ojeda	CONABIO / INEGI	michael.schmidt@conabio.gob.mx / sergio.ojeda@inegi.org.mx	Confirmed
Cameroon	Frank Martin Seifert	ESA	frank.martin.seifert@esa.int	Temporary
Tanzania	Jan Petter Pedersen	KSAT	janp@ksat.no	Confirmed
Borneo	Dirk Hoekman	Wageningen Univ.	dirk.hoekman@wur.nl	Confirmed
Tasmania	Anthony Milne	UNSW	T.Milne@unsw.edu.au	Confirmed

Key meeting for Product Development

FCT Science and Data Summit

11th-12th May 2010

Woods Hole Research Center, MA, U.S.A. (co-hosted by WHRC and USGS)

Summit objectives are still under coordination. (See 2nd Dec meeting notes.)

2009 Forest Products generated over National Demonstrator Verification Sites.

Possible wall-to-wall processing for Tasmania and Borneo supported by Australia.

Process refinements and strategy formulation going forward.

3rd GEO FCT Space Data Coordination Meeting

13th-14th May 2010

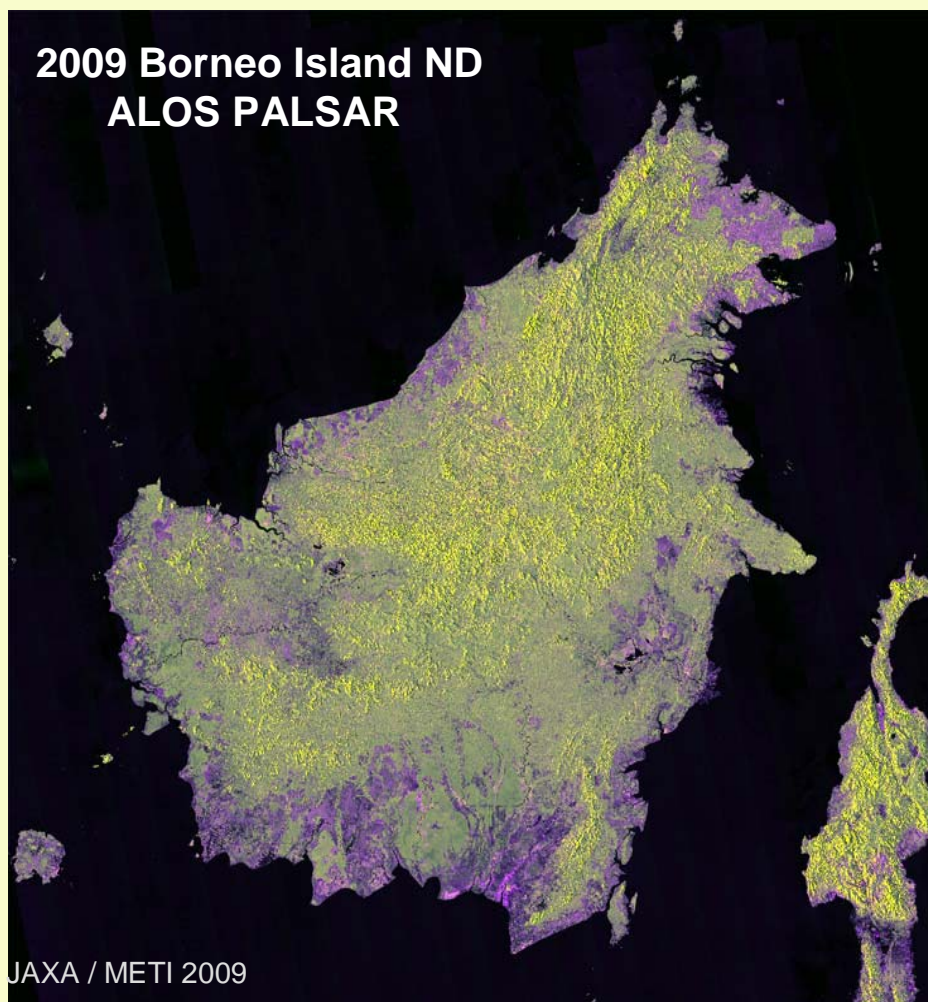
Woods Hole, MA, U.S.A.

To be held in conjunction with the FCT Science and Data Summit

Following on from last meeting in Tokyo

Finalise the 2010 FCT Data Requirements document.

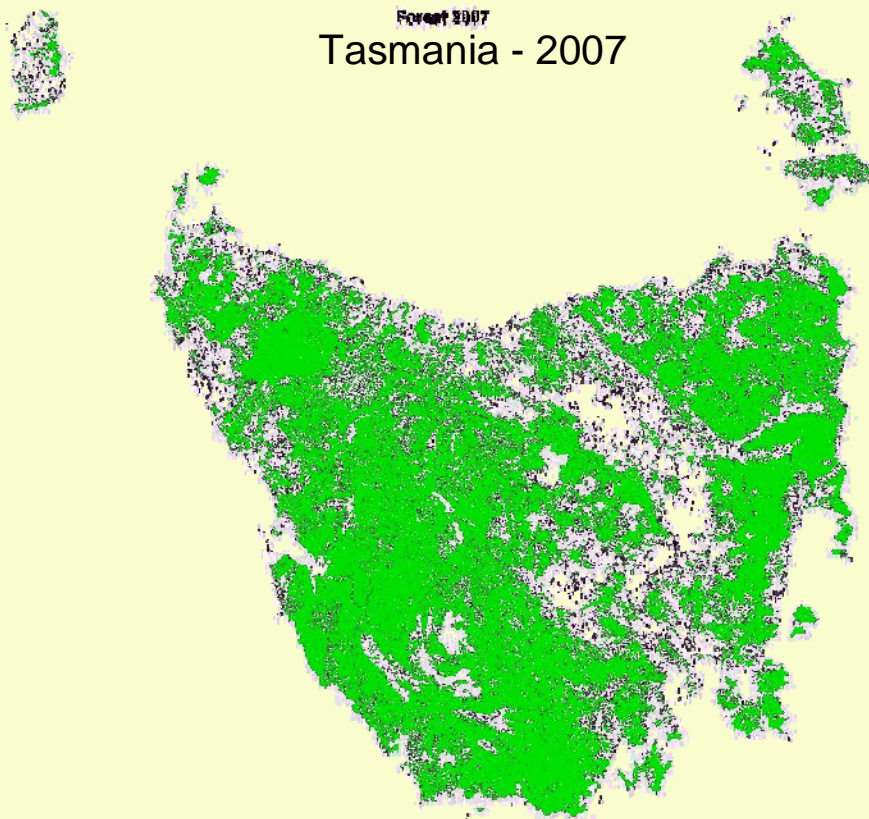
Initial Products: e.g. Ortho-rectified PALSAR image mosaic



Acquisition window:
June 12 - July 27, 2009

Initial Sample Thematic Products

Forest 2007
Tasmania - 2007

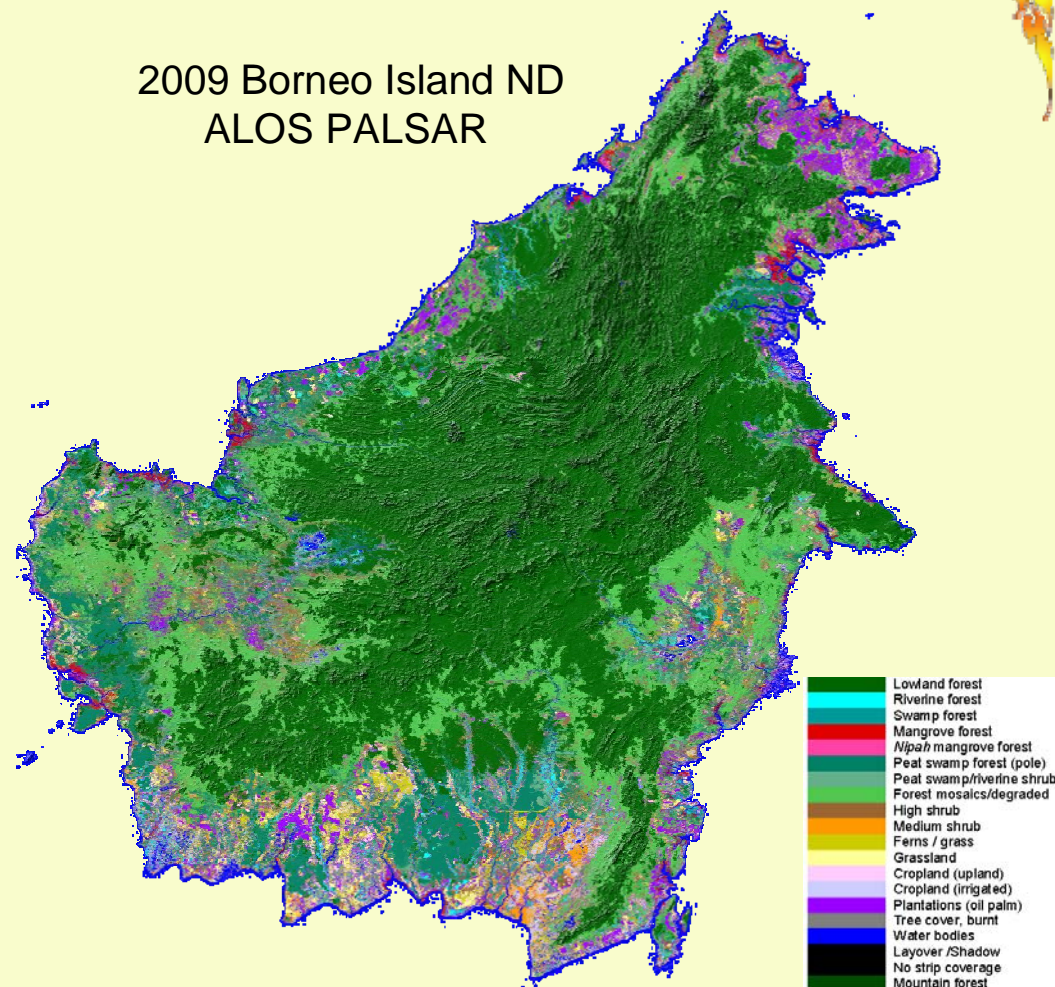


Landsat-derived

**Forest cover time-series (only
2007 data shown)**

JAXA Source; DCC-CSIRO

2009 Borneo Island ND
ALOS PALSAR



ALOS PALSAR 2007

LULC classification

- Lowland forest
- Riverine forest
- Swamp forest
- Mangrove forest
- Nipah mangrove forest
- Peat swamp forest (pole)
- Peat swamp/riverine shrub
- Forest mosaics/degraded
- High shrub
- Medium shrub
- Ferns / grass
- Grassland
- Cropland (upland)
- Cropland (irrigated)
- Plantations (oil palm)
- Tree cover, burnt
- Water bodies
- Layover /Shadow
- No strip coverage
- Mountain forest

WAGENINGEN UNIVERSITY
ENVIRONMENTAL SCIENCES

SarVision

Conclusions.. so far (1/2)

- So far, in the current context, CEOS Agencies response to the FCT needs is rather satisfactory
 - All ND zones observed by at least one SAR and one Optical sensor
 - Good cooperation between Agencies e.g. complementarity between RADARSAT-2 and ENVISAT
- Covers only satellites operated by CEOS Agencies
- For 2010, FCT requirements need to be received well in advance
 - Draft doc expected for Nov 09, final doc for Dec 09
 - Expected “Long-term CEOS Acquisition Strategy” document will be generated only first half 2010
- **Data Processing coordination now a key priority for task in 2010, to ensure efficient use of data acquired**
 - **Note: Many of the ‘thematic’ product expert teams are soft-funded; operational system needs to solve long-term support for FCT product generation**

Conclusions.. so far (2/2)

- Enlargement with new National Demonstrators is needed - to get stronger political support
 - Currently at least 6 new candidate NDs
 - Acquisitions over future NDs will be planned only for 2010.
 - New NDs expected in the “2010 FCT requirements”
 - Political support expected at major events e.g. COP-15
- GEO offers strong opportunity to coordinate integration of observations (satellite, in-situ), processing tool/methods, models and capacity-building, plus the critically needed **inter-institutional frameworks in support of global endeavours under e.g. UNFCCC-IPCC.**

Thank you

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Extra Slides

CEOS Communiqué - highlights:

CEOS will coordinate with the other GEO Co-leads in order to establish and deliver 5 key joint outcomes of the GEO task on Forest Carbon Tracking for 2009:

- 1) *Agreement among willing **CEOS Member agencies** to ensure **availability of current and future data supply** on a basis adequate for the implementation and operation of continuous services;*
- 2) *Documented procedures to secure **interoperability** of optical and SAR sensors based on case study results;*
- 3) *Documented procedures on **linking wall-to-wall, time series satellite data coverage to (1) ecosystem models and (2) traditional forest inventories**, to consistently estimate carbon stocks at project and national scales;*
- 4) ***Validation procedures** for satellite applications in forest monitoring;*
- 5) ***Visualisations** of progress and demonstration results for GEO-VI and COP-15, making clear the capacity of these initiatives to support policy objectives.*

Next Steps (Detailed)

- Finalise satellite data processing methodologies & standards (Lead: NSC, GOFC-GOLD and experts)
- 2010 Satellite Data Requirements (Lead: CEOS PoC and JAXA)
- Transition 'Processing hubs' data processing concept to Operational framework (Lead: GEO FCT, CEOS & global partner agencies)
- Expand number of National Demonstrators (Coordination Canadian Forest Service – M. Brady)
- Satellite Data & Science Summit: Woods Hole, April 2010.
- Working group on in-situ forest measurement and verification (USDA, FAO and task partners)
- Develop guidelines for integration of remote sensing, in-situ and carbon modelling (Lead tbd)