



Mid-Decadal Global Land Survey

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Mid-Decadal Global Land Survey (MDGLS)

- **Follow-on to the GeoCover orthorectified global data sets (1975, 1990, and 2000 epochs)**
- **The objective of the Mid-Decadal Global Land Survey (MDGLS) is to extend this series with a new global land survey centered on a 2005-2006 epoch**
 - ◆ Initiated through CCSP, to support global assessments of land-cover, land-cover change, and ecosystem dynamics (disturbance, vegetation health, etc)
 - ◆ Landsat-5 TM and Landsat-7 imagery
 - ◆ Additional Terra ASTER, EO-1 ALI as needed
- **The Project has 3 Phases:**
 - ◆ Phase 1: identify candidate scenes and ingest into the USGS archive
 - ◆ Phase 2: Process the collected data into an ortho-rectified dataset compatible with previous surveys
 - ◆ Phase 3: Analyze data set to quantify trends in land cover and vegetation dynamics



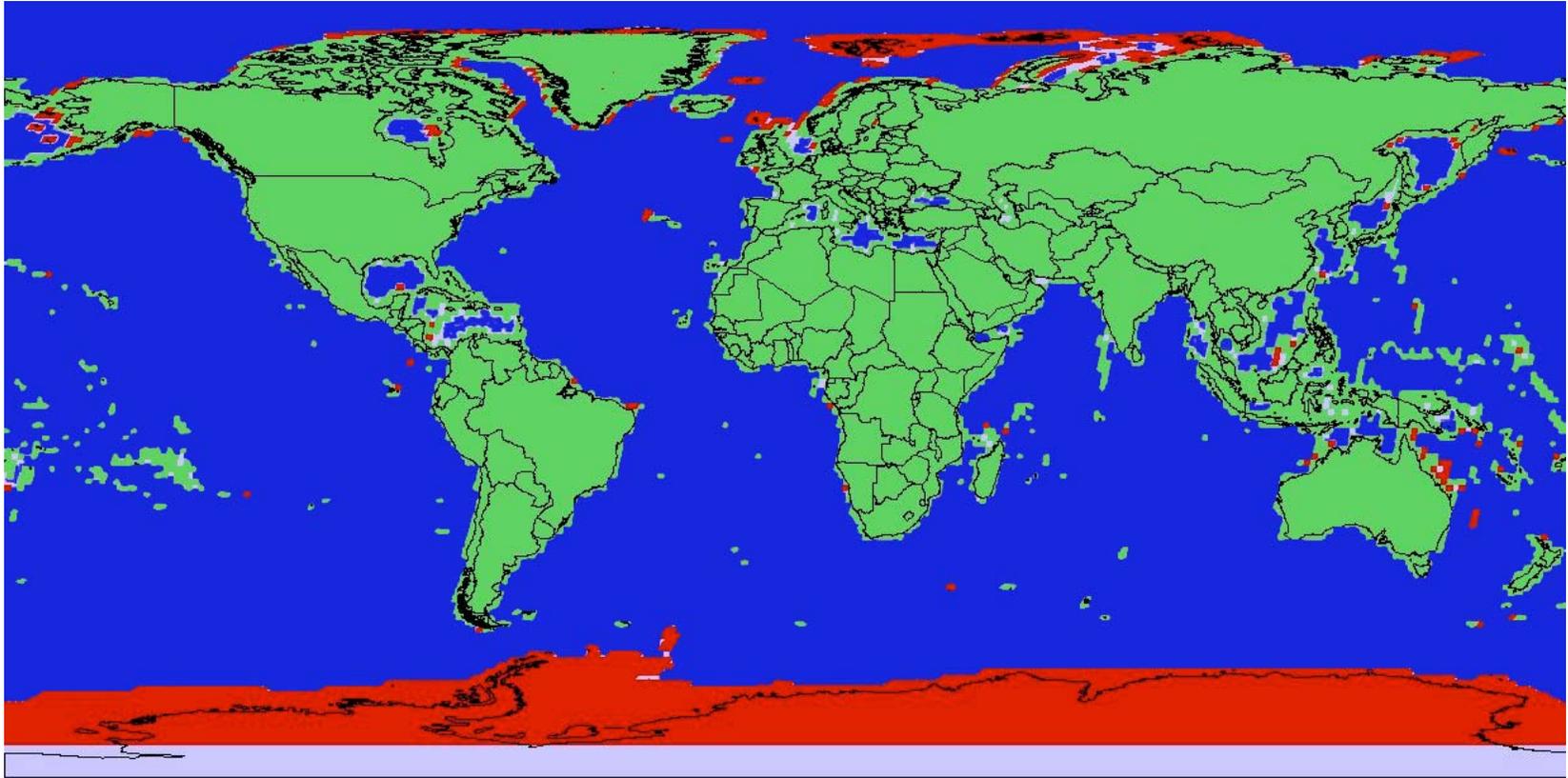
Mid-Decadal Global Land Survey (MDGLS)

Phase I: Identify and Acquire L5 and L7 Data

Phase II: Process MDGLS Data

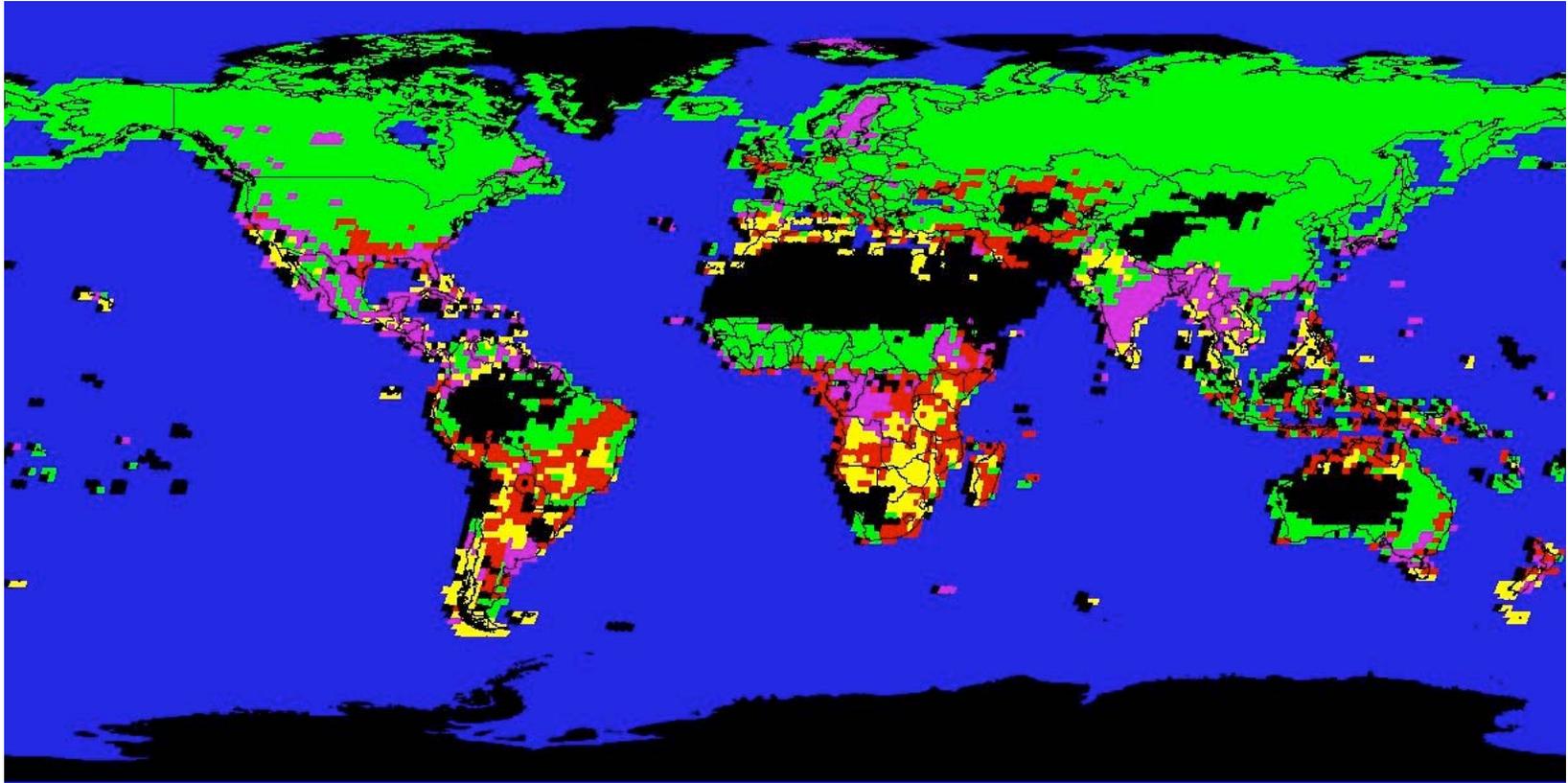
Phase III: Analyze MDGLS Dataset for Land Cover/
Land Cover Change

Where do we want data?



Green = GeoCover 2000 Coverage
Red = New MDGLS Coverage

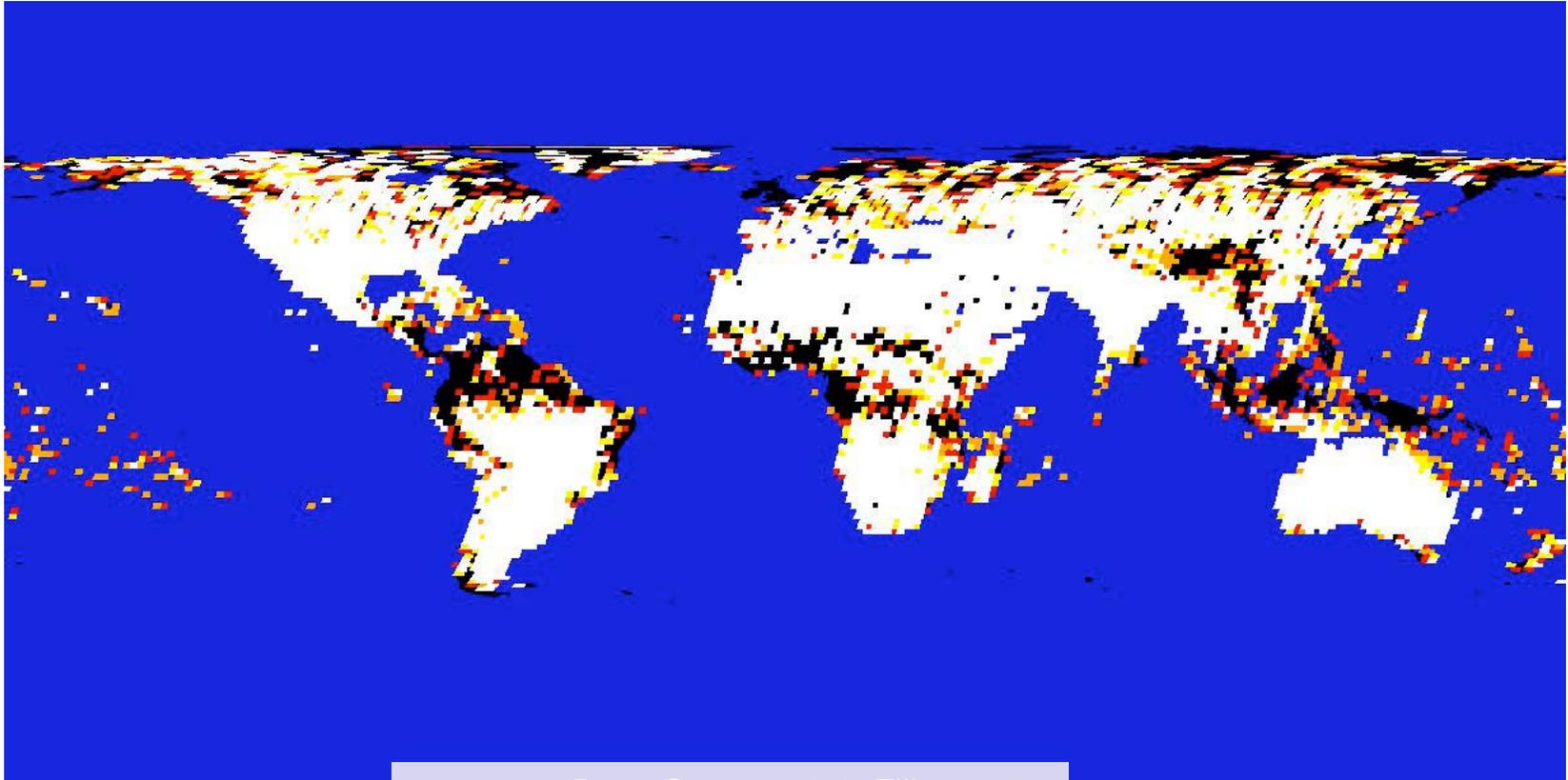
When do we want data?



- Green** = NH Summer (Jun, Jul, Aug, Sep)
- Red** = NH Spring (Apr, May)
- Violet** = NH Fall (Oct, Nov)
- Yellow** = NH Winter (Jan, Feb, Mar, Dec)



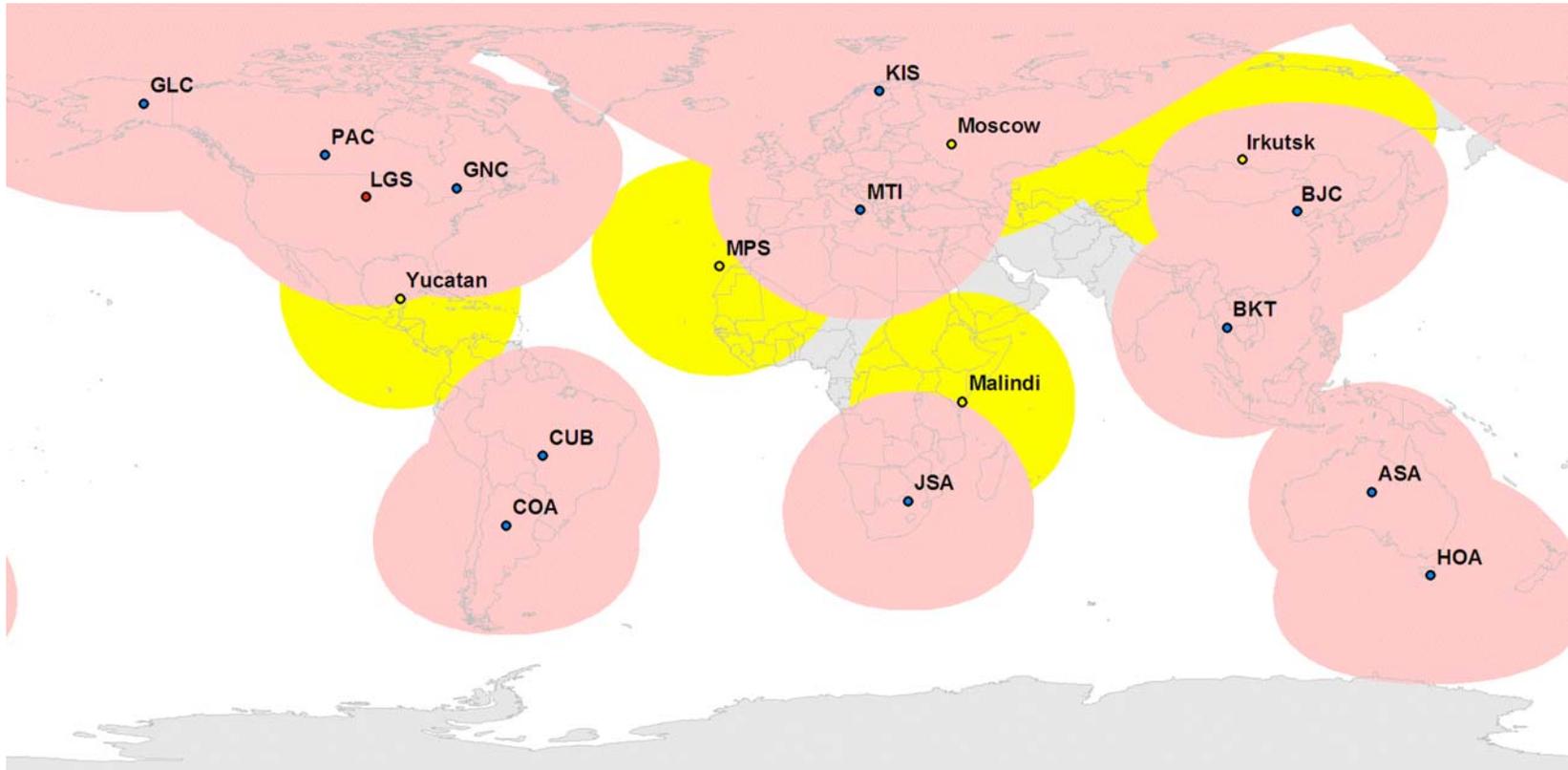
What data are available? Landsat-7



White	= Base Scene < 1%, Fill < 05%
Yellow	= Base Scene < 1%, Fill < 10%
Green	= Base Scene < 5%, Fill < 10%
Red	= Base Scene < 5%, Fill < 20%



What Data Are Available? Landsat-5





Status of Foreign-Source Data

- **8 of 10 International Cooperators (IC) have agreed to support the MDGLS**
- **6 of 10 ICs have submitted metadata**
- **Campaign Station Status**
 - ◆ Kiruna (ESA) – Offline due to L5 Fixed-Array Con Ops. 72 tapes are at EROS to be ingested
 - ◆ Moscow and Irkutsk (ScanEx) – Stations are online and providing data operationally
 - ◆ Chetumal, Mexico (DLR) – Station under construction and due to begin operations in early 2007
 - ◆ Maspalomas (ESA) – Just beginning station certification.
 - ◆ Malindi (ESA) – Implementation schedule to be worked
 - ◆ Hobart (GeoScience Australia) – Coordinating data transfer



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Phase II Tasks

- **Select data source and scenes** (where multiple options are available)
- **Process selected data**
 - Orthorectification
 - Gap-filling (for Landsat-7)
 - Product format
- **Distribute MDGLS data**

Complete dataset available Fall 2008



Data Source Selection: Issues

Landsat-7

- Better radiometry
- 60m TIR band, pan band
- Gaps can be filled in cloud-free conditions

Landsat-5

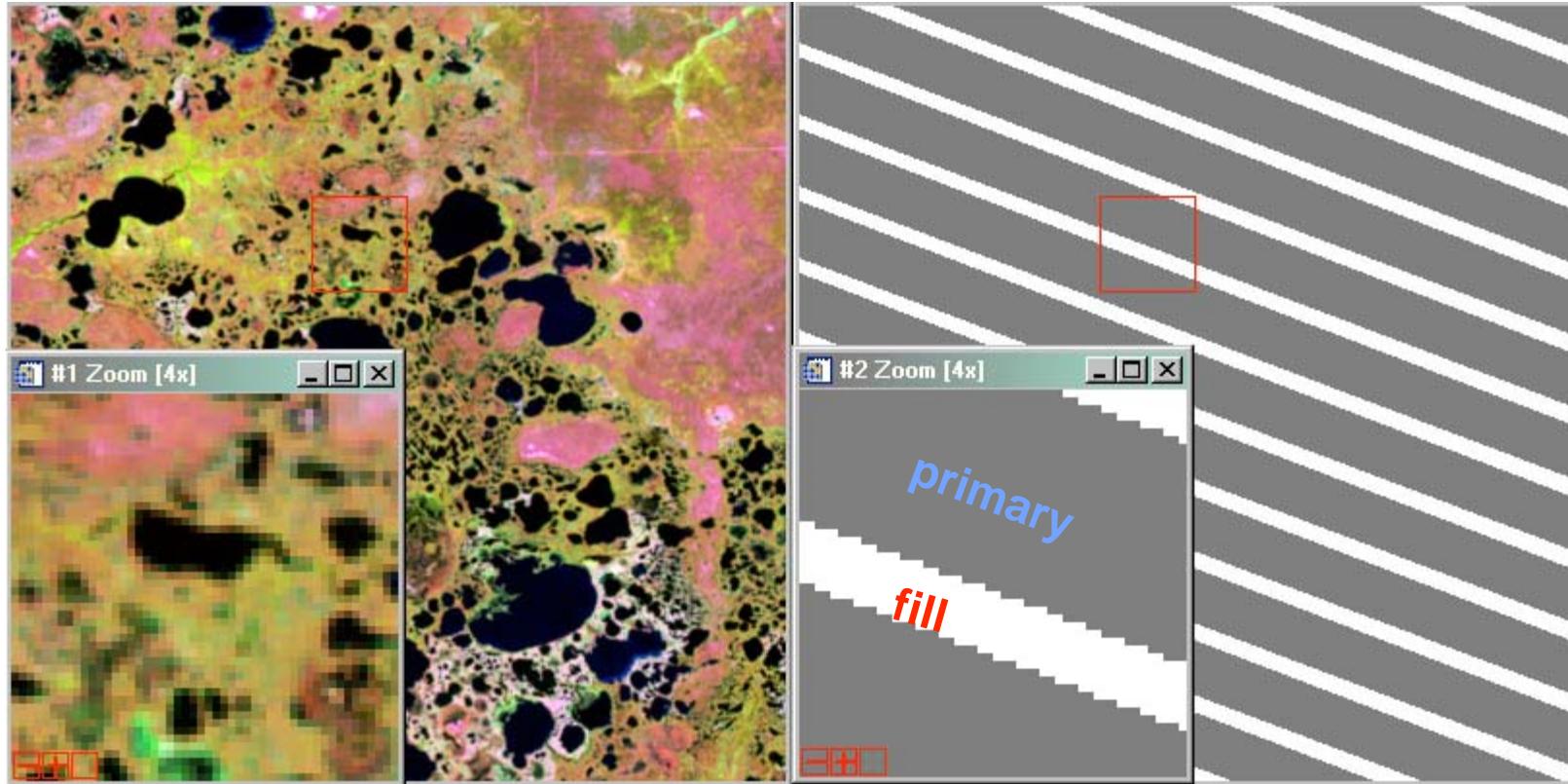
- No gaps
- L7 gap filling can result in radiometric artifacts
- L5 calibration improved for ~2000 to present

Tested ETM+ gap-filled products for change detection

- *Jim Vogelmann – mapping pivot irrigation*
- *Matt Hansen – tropical deforestation*
- *Chengquan Huang – temperate forest disturbance*

Landsat-7 Gap-filling: The Good

Northern Siberia (p159r15)



EROS Gap-filling works very well in cloud free conditions



Example: 1999-2005 forest disturbance, VA

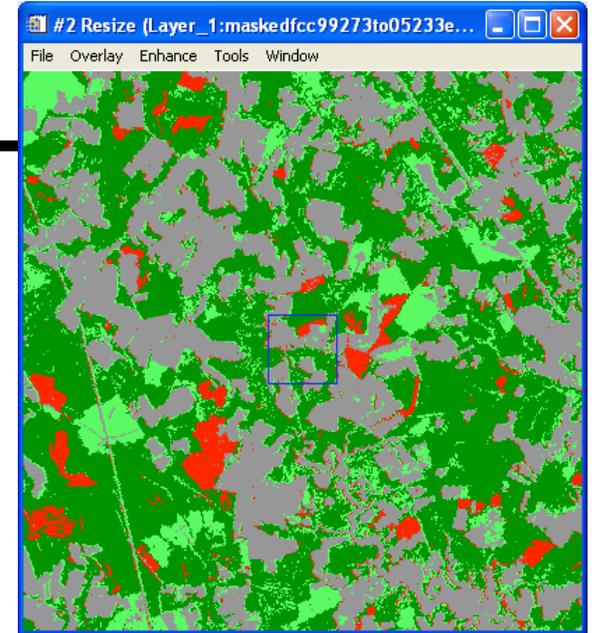
Towards SE of scene edge, no obvious visual artifacts in gap filled areas

Overall agreement = (145710/160000)
91.0687%

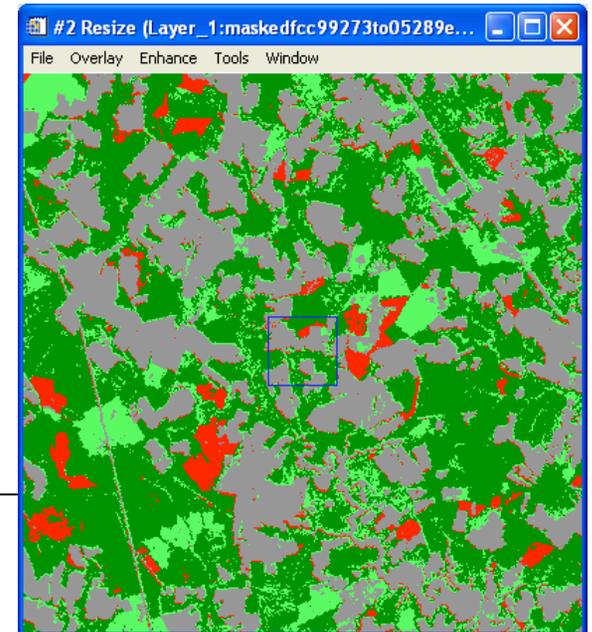
Agreement matrix

Class	forest	non-forest	forest loss	forest gain	Total	Producer's (%)
forest	67808	2	1821	355	69986	96.9
non-forest	46	51664	111	4484	56305	91.8
forest loss	2364	123	7095	180	9762	72.7
forest gain	999	3547	258	19143	23947	79.9
Total	71217	55336	9285	24162	160000	
User's (%)	95.2	93.4	76.4	79.2	Overall (%) =	91.1

2005L5-1999GeoCover



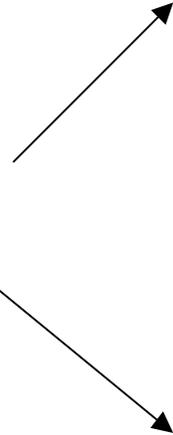
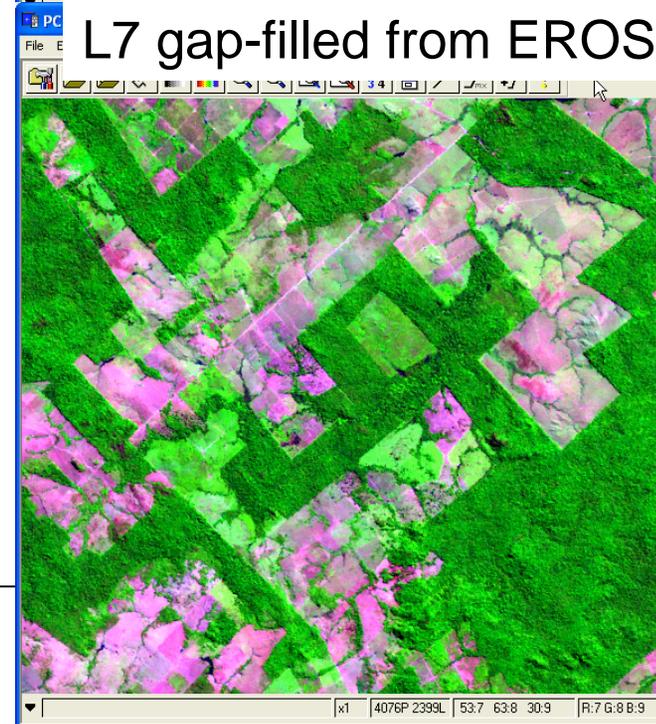
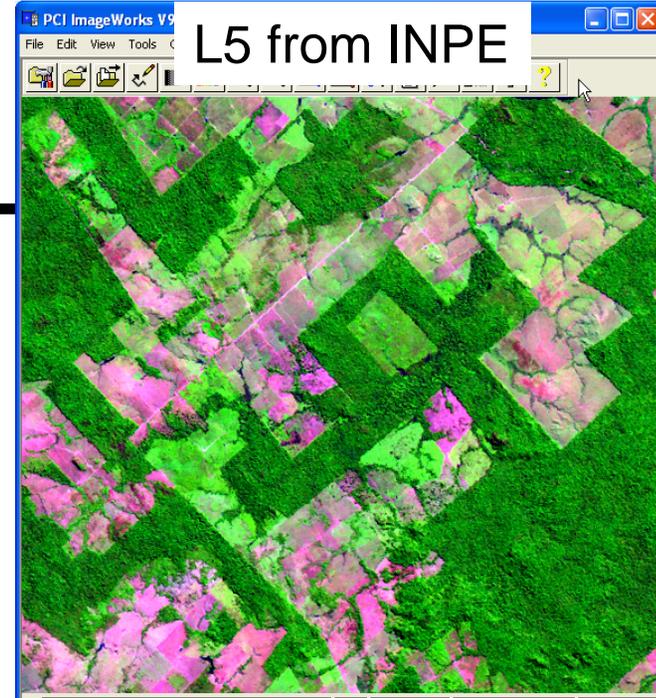
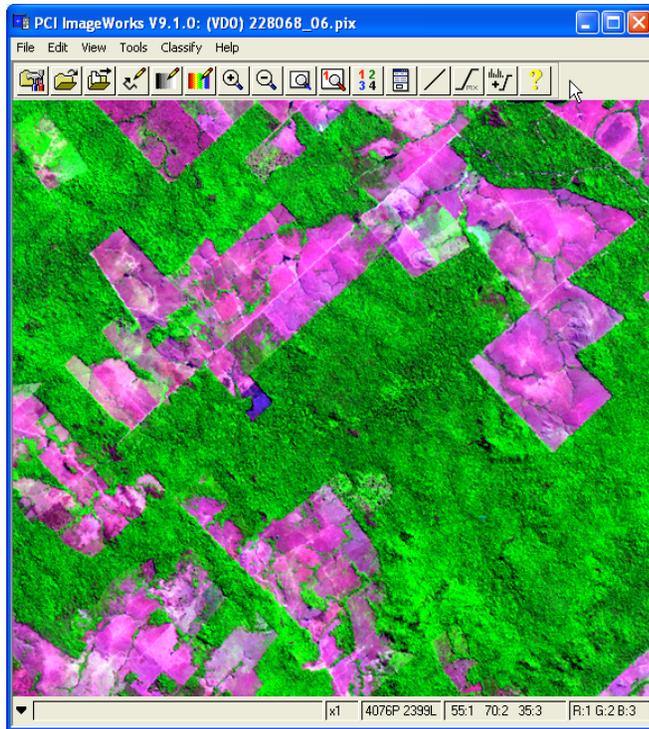
2005L7GF-1999GeoCover



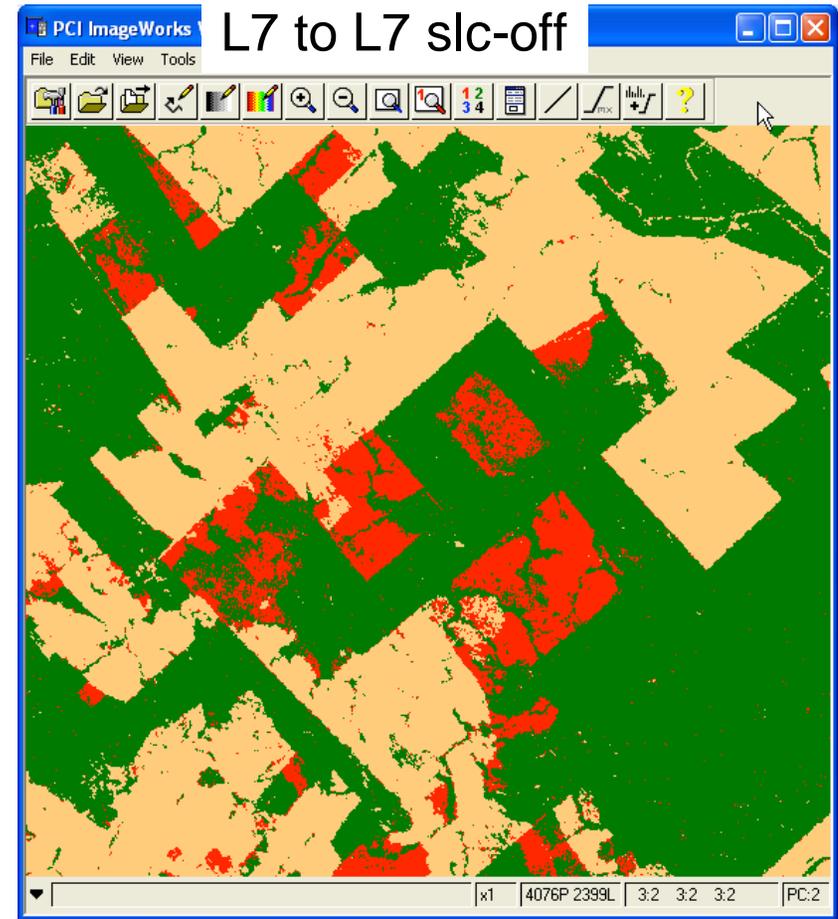
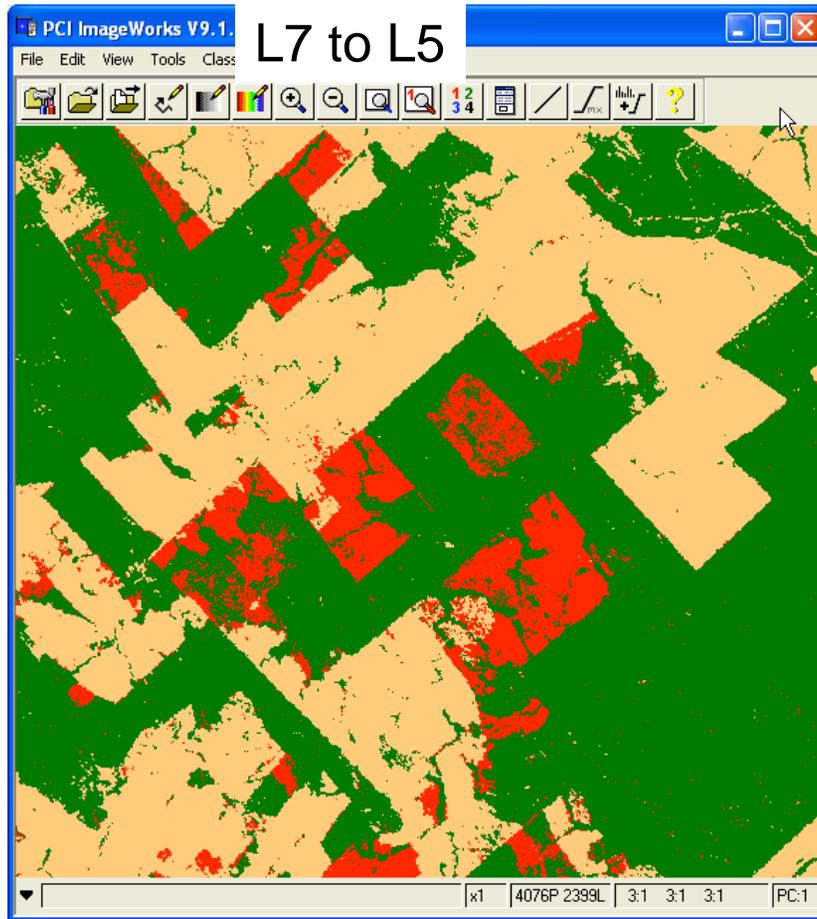


Example: Amazonian Forest Clearing

L7 Geocover



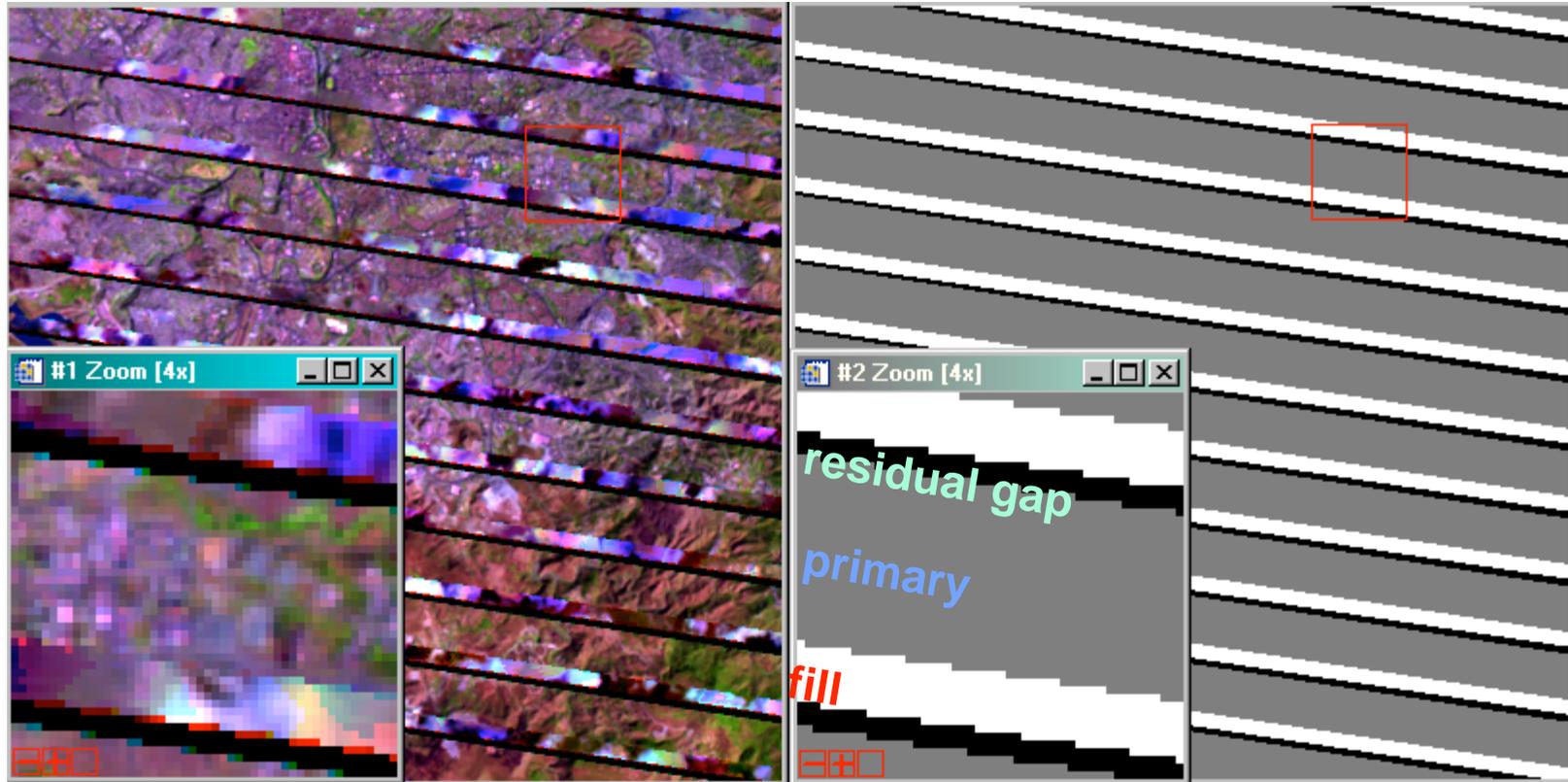
For cloud-free areas, results are very similar



Green=forest to forest, beige=non-forest to non-forest, red=forest to non-forest

Landsat-7 Gap-filling: The Bad and the Ugly

Honduras (p18r50)



Gap-filling with cloudy scenes can introduce radiometric artifacts; small residual gaps are possible



Example: 1999-2005 forest disturbance, VA

Towards SW of scene edge, gap filled with cloud/shadow contaminated pixels

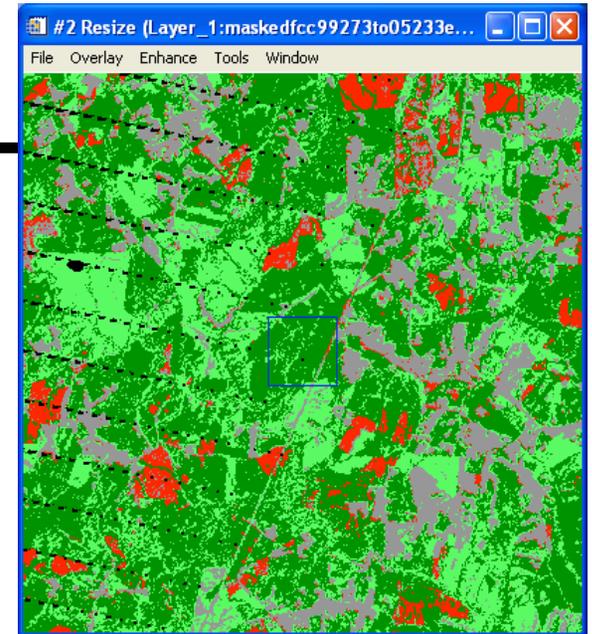
Overall agreement = (123482/158223)
78.0430%

Agreement matrix

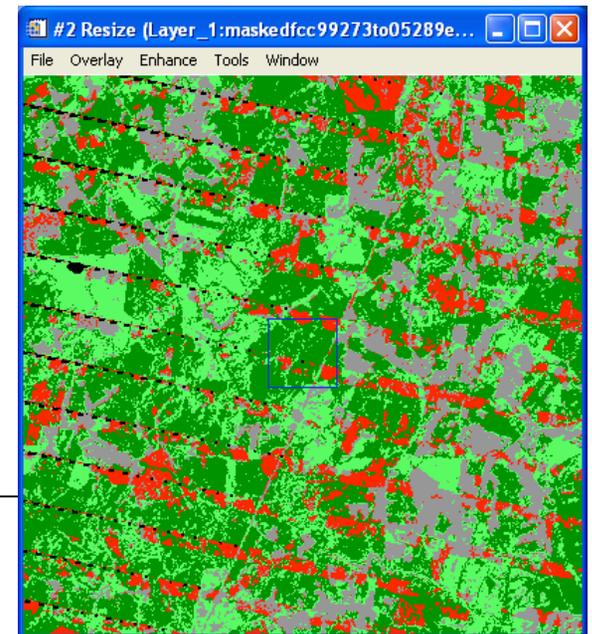
Class	forest	non-forest	forest loss	forest gain	Total	Producer's (%)
forest	59803	174	12384	2311	74672	80.1
non-forest	6	21942	212	6011	28171	77.9
forest loss	2719	188	7038	502	10447	67.4
forest gain	549	9065	1136	34183	44933	76.1
Total	63077	31369	20770	43007	158223	
User's (%)	94.8	69.9	33.9	79.5	Overall (%) =	77.7



2005L5-1999GeoCover



2005L7GF-1999GeoCover





Data Source Selection: Status

Recommendation:

- For cloud-free scenes: lean toward Landsat-7 ETM+
- Cloudier scenes: lean toward Landsat-5 TM
- Humid Tropics: multiple ETM+ acquisitions for compositing

Sensor choice must be balanced against acquisition date, overall cloud cover, and acquisition date of 2000 Geocover

- Optimization algorithm being developed to assist selection



MDGLS Product Specification (Draft)

- UTM / WGS-84 projection
- 14.25 / 28.5/ 57 meter resolution
- Cubic Convolution resampling (1 step)
- GeoTiff format
- Orthorectified, Gap-filled

Processing by USGS EROS

FTP distribution of individual MDGLS scenes at no cost, with limited provision for bulk distribution of entire dataset (e.g. via hard disk transfer).

MDGLS Orthorectification

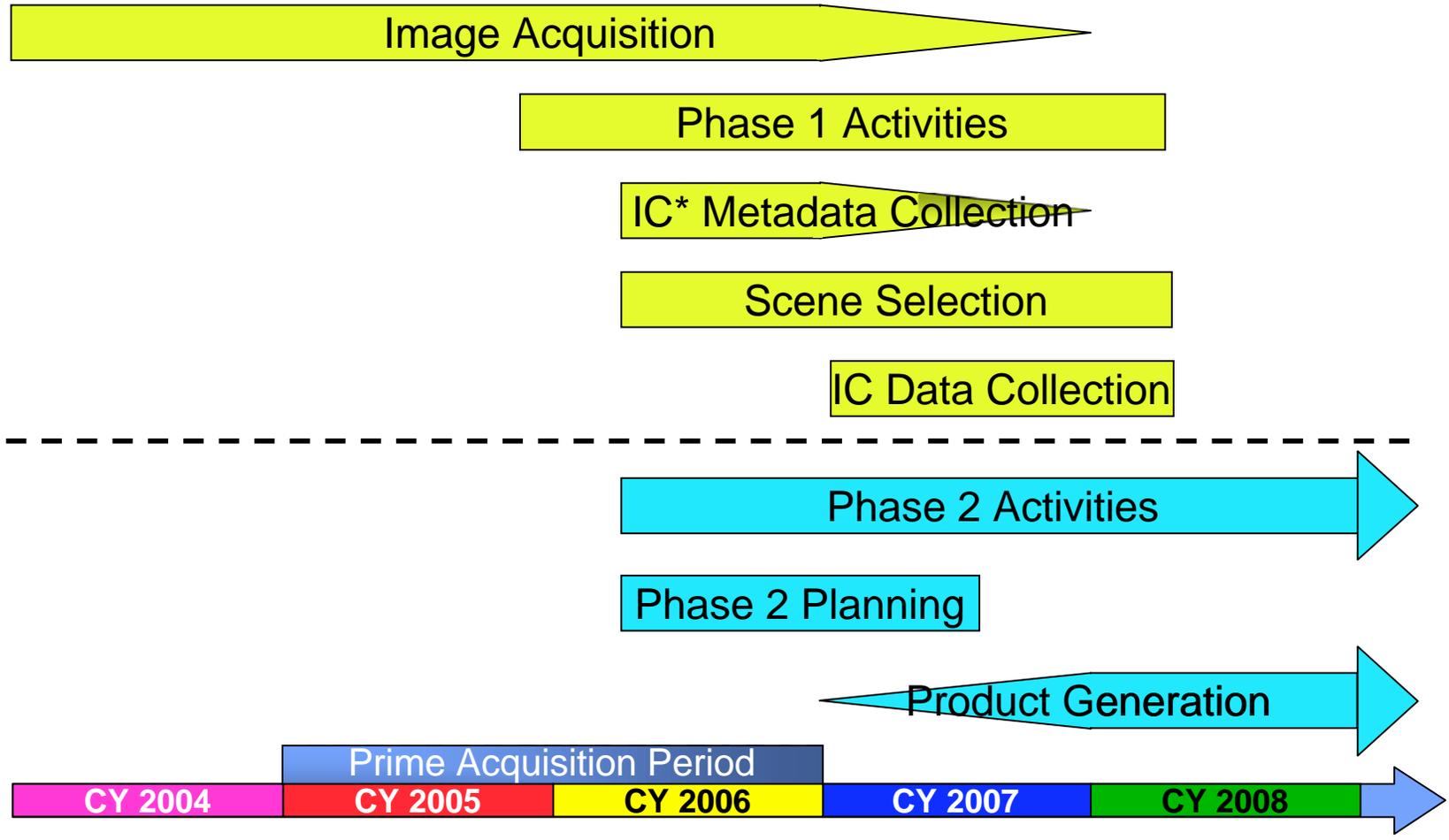
Use 2000 GeoCover chips as geodetic control,
SRTM 30/90m for terrain correction

- L7 automated 1Gt processing available Feb 2007
- L5 automated 1Gt processing available late 2007

Also recommend reprocessing of previous
GeoCover datasets in high-relief areas to maintain
continuity with MDGLS

- model absolute error due to Geocover DEM choice
- reprocess locations with errors >60m using SRTM

MDGLS Schedule



*IC = International Cooperator



Near-Term Schedule

November 2006	Post draft MDGLS Data Product Specification and Implementation Plan for public comment
December 2006	Final Spec and Implementation Plan
February 2007	Finalize scene selection for North America
February 2007	Begin processing North American ETM+



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Phase III: Land Cover Dynamics

Following Jan 2006 MODIS meeting, a small team put together a draft white paper describing a requirements for a Land Cover / Land Cover Change Earth Science Data Record (ESDR).

Four elements described:

- Global 1km land cover type @ 5 years

- Global 1km continuous fields @ year

- Global 30m land cover type @ 5 years

- Regional -> global 30m land cover change/disturbance**

The MDGLS dataset offers a “pilot” opportunity to assess global rates of land cover change for 2000-2005.



Recommended Approaches

Produce products via independent teams, but coordinate tools and class definitions

- regional to continental scales
- thematic projects (e.g. global urbanization)

Prioritize regions with known LC dynamics of critical import for carbon, water, biodiversity, and societal services

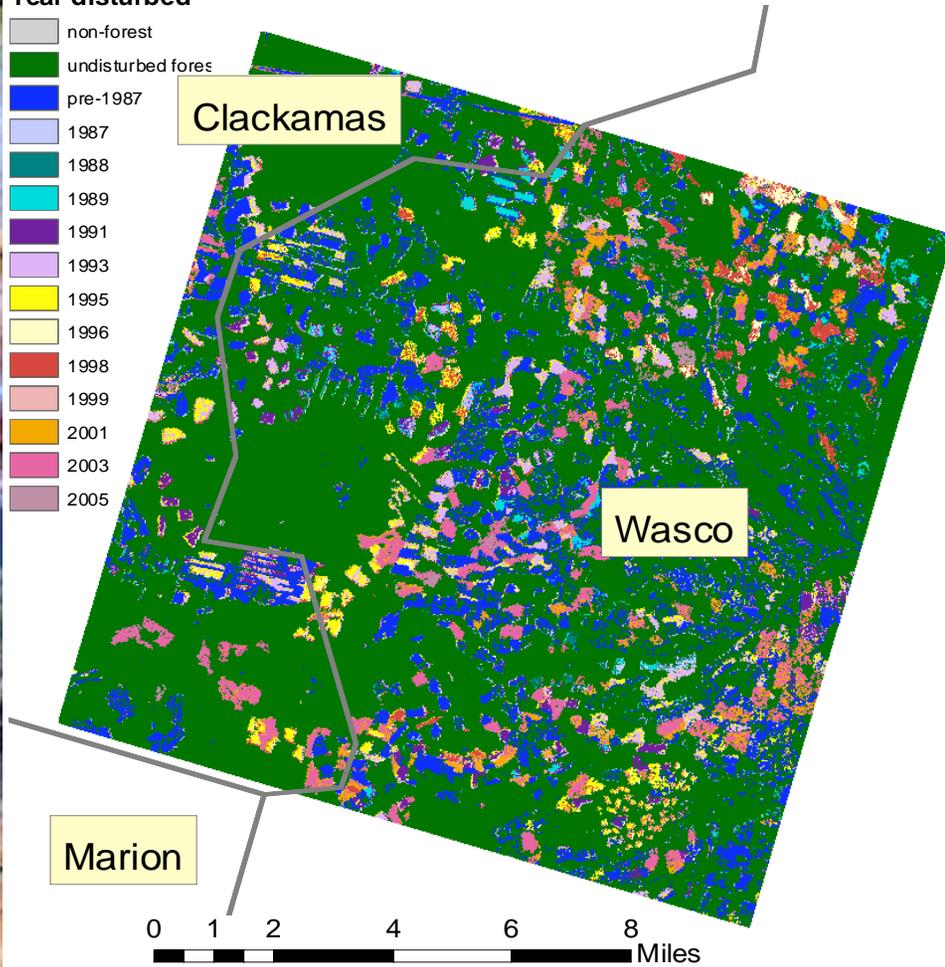
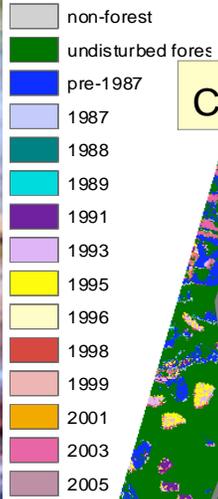
Land cover is necessary but not sufficient; include vegetation dynamics (disturbance, recovery, fragmentation, biome migration, etc).

Establish concurrent validation program



Forest Disturbance, Oregon

Year disturbed



Woody Plant Cover, N. Texas 1937 1999

