

Using Landsat to Analyze Tropical Deforestation Worldwide

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Problem

- Tropical deforestation is important to:
 - Global carbon cycle; missing sink
 - Climate change; forcing function
 - Biodiversity; habitat fragmentation
 - Global change generally; food security
- Yet we have very little precise quantitative data on rates and extent
- Previous studies have done well, but we need a high resolution complete analysis
- Moreover many sampling designs have not considered all elements.

Rationale

- *There is now a clearly defined need for a firm measurement base for global change research, for understanding human forcing on climate, and for making periodic assessments; these themes are articulated strongly in the NASA ESE Strategic Research Plan as well as the new Climate Change Science Program Strategic Plan.*

Contributions

- **Key contributions of this proposal to the NASA ESE Strategic Plan:**
 - *Major contribution to understanding carbon cycle and ecosystem dynamics*
 - *Important dataset for making baseline and future assessments*
 - *Underpins the LCLUC program contributions for global and continental scale analysis of human forcing*
- **Key contributions of this proposal to the Climate Change Science Program Strategic Plan:**
 - *Major contribution to components of Chapter 6. Land Use and Cover Change*
 - *Additional contributions to Chapter 7, Carbon Cycle and Chapter 8, Ecosystems*
 - *Significant contributions to Chapter 12 on Observing Systems*

Questions

- ***Major Research Question and Objectives:***
 - What are the rates and extent of the full suite of land cover and land use changes in tropical forests and to what level of accuracy and precision can proposed sampling efforts be expected to estimate the magnitude and location of these changes?

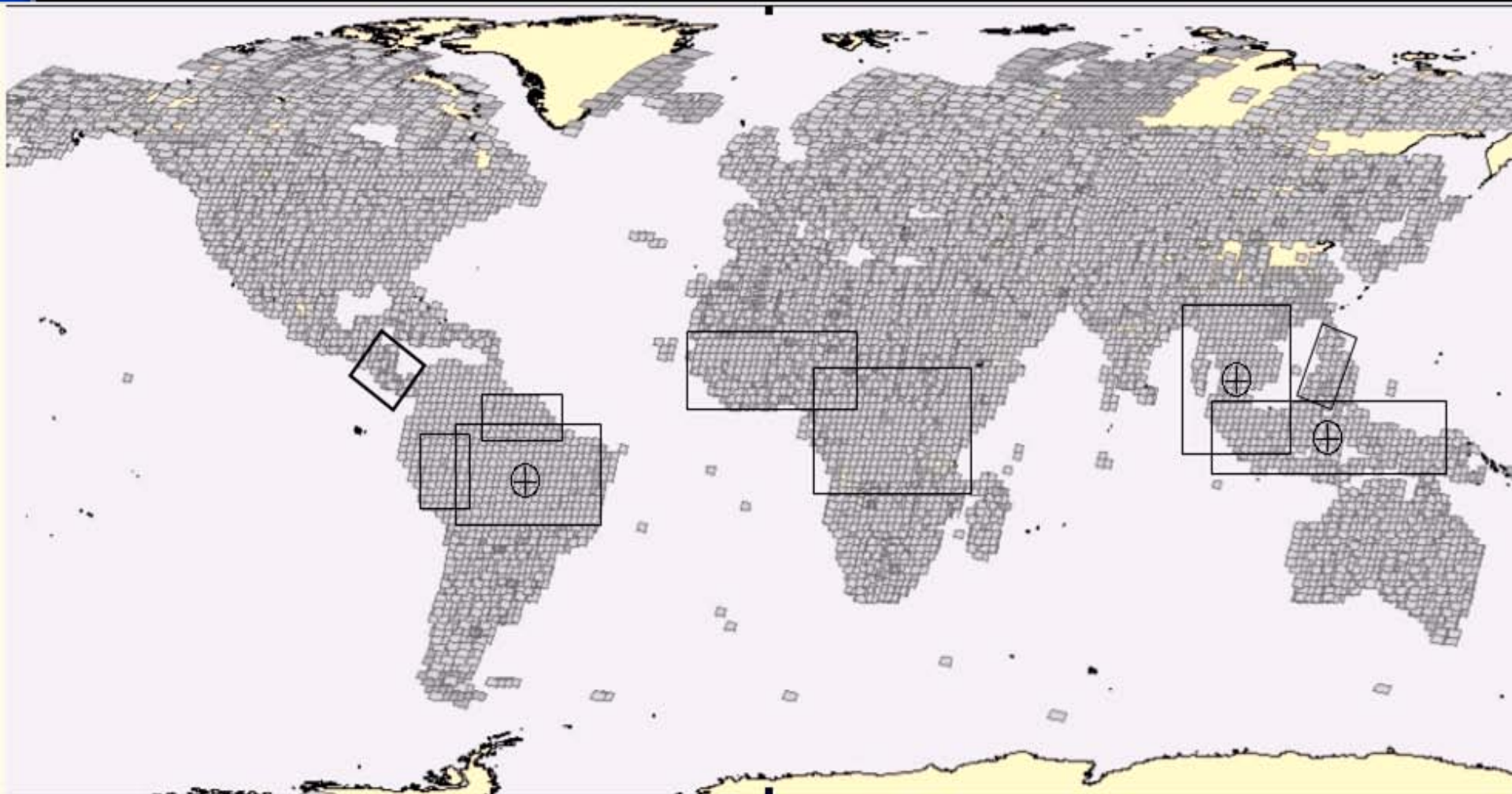
Objectives

- **Provide 30-m resolution multi-temporal regional maps of deforestation, regeneration, and degradation.**
 - While Pathfinder research has emphasized forest and non forest mapping (i.e. deforestation) we will now include measures of a more complete suite of disturbances including logging and fragmentation as well as regeneration of forests. Among other things, this study will be able to make a definitive statement on the quantitative significance of degradation via logging, and an assessment of recent studies which have used indirect estimators to claim logging rates within tropical forests as high as or higher than deforestation (e.g. Nepstad et al 1999).

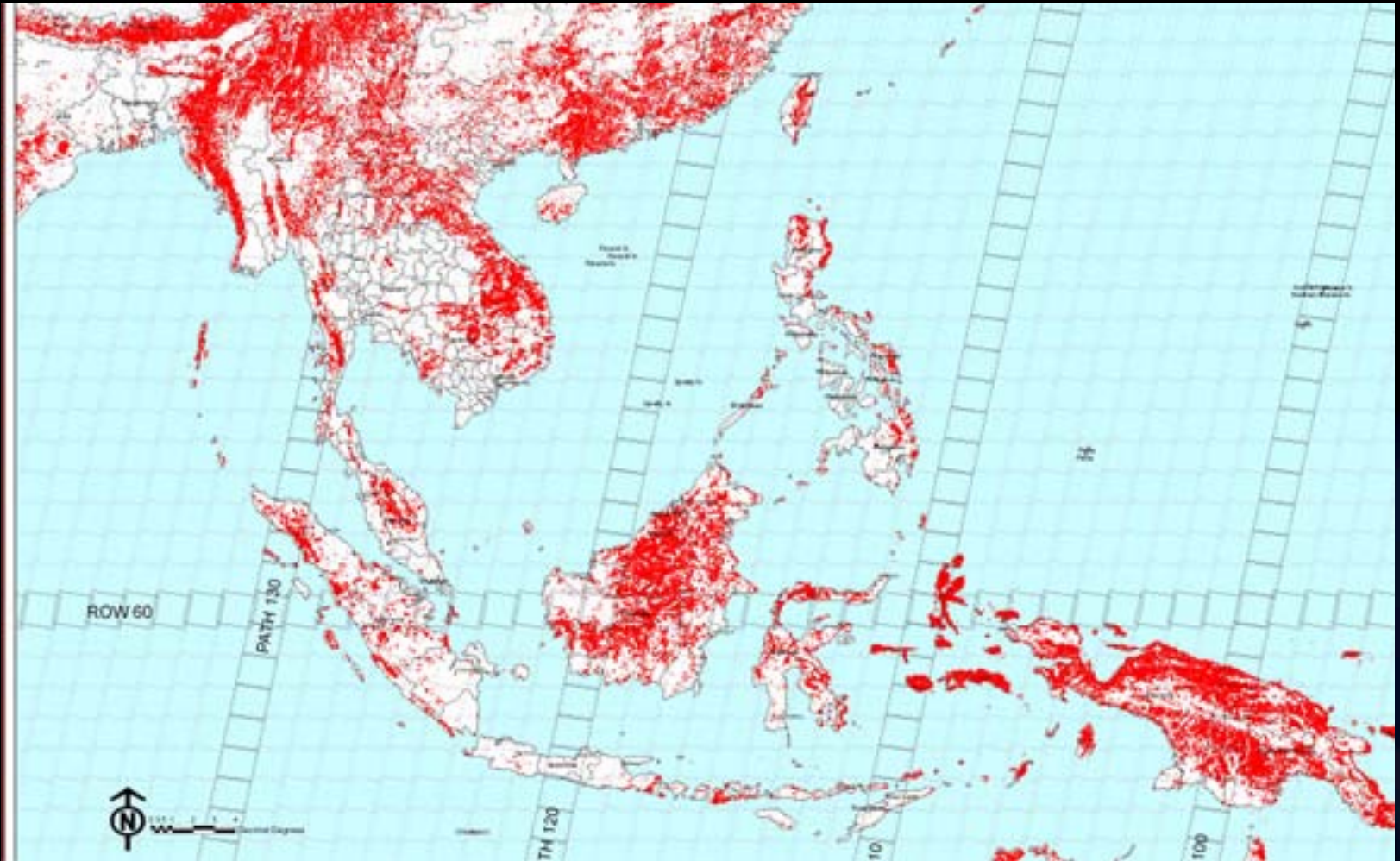
Objectives

- **Provide a comprehensive assessment of the efficacy and accuracy of various sampling schemes for estimating land cover change.**
 - This will be accomplished by comparing known amounts of change from our wall-to-wall coverages to estimates derived by sub-sampling the wall-to-wall land cover information in various ways. This will provide insights into the accuracy of some recent estimates based on sampling (e.g. Achard et al 2002) and additional tests to improve the sampling scheme that will be used in the future by the FAO FRA.

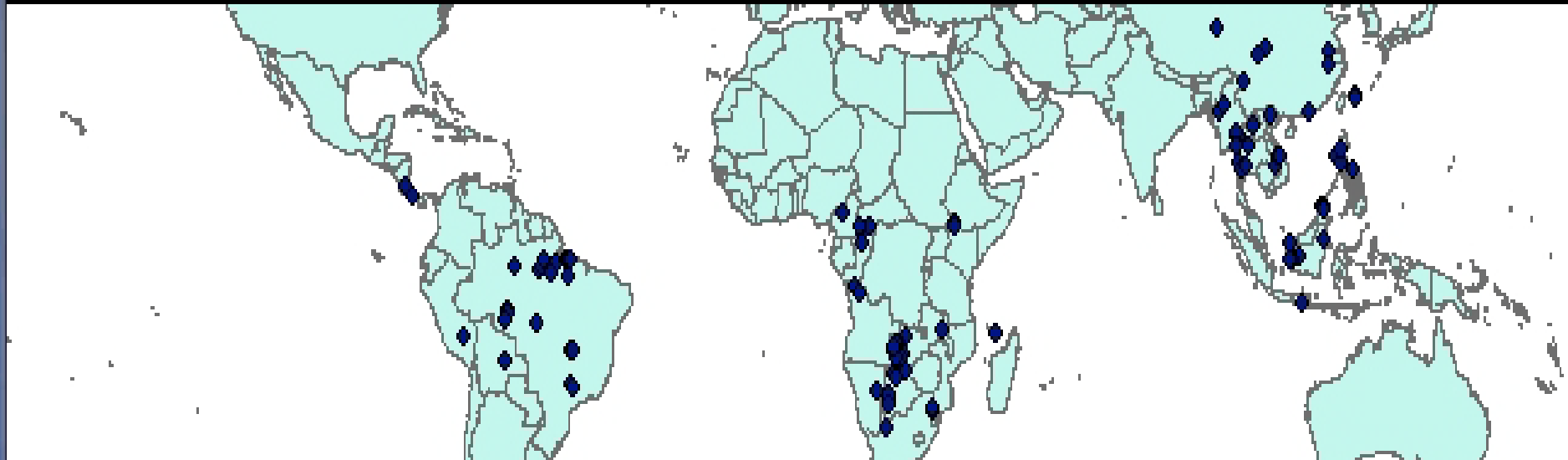
Study Sites



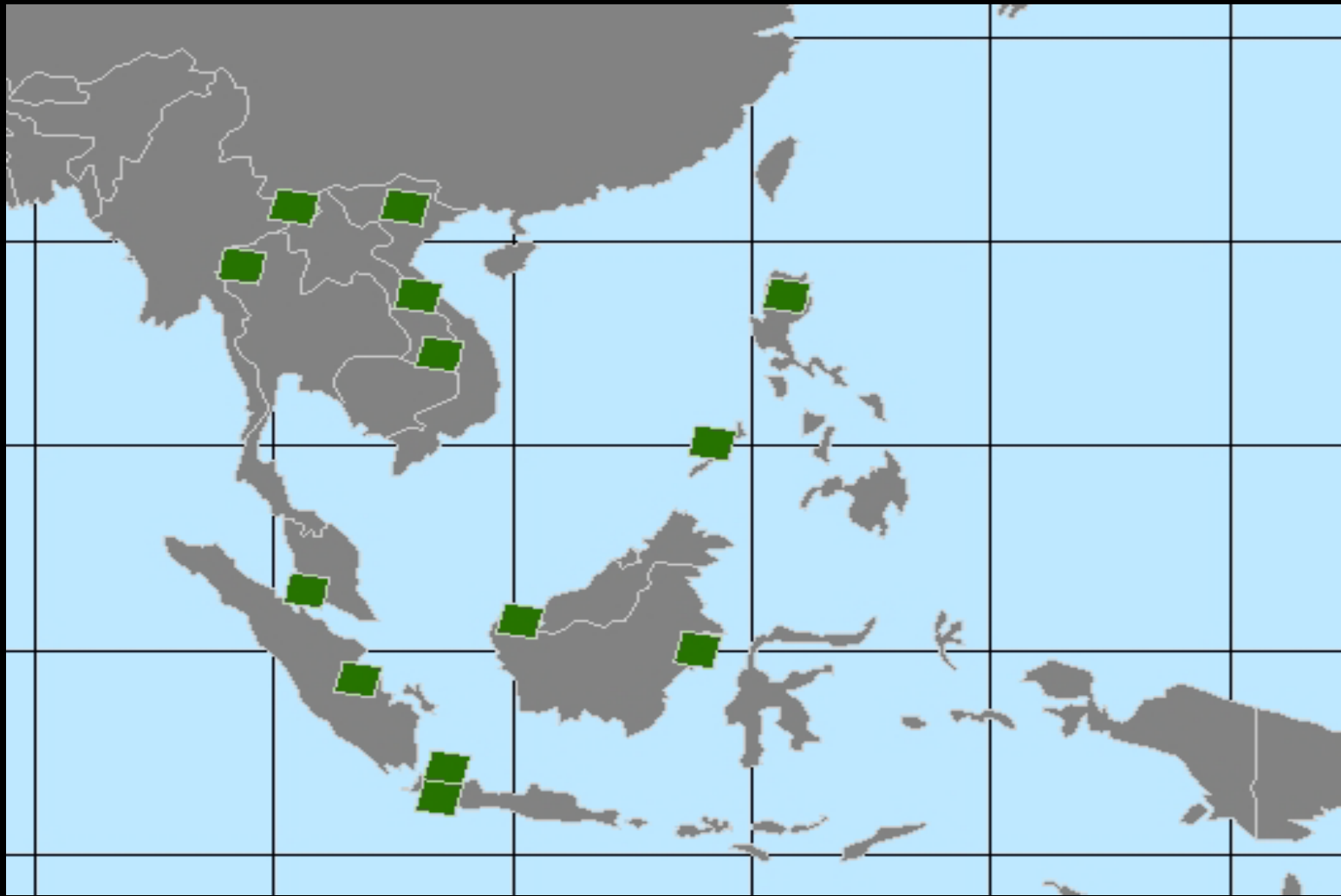
Stratification



Validation sites



Intensive validation



Coordination with international partners

- Field validation
 - Networks of teams
 - West Africa, Central Africa, South Africa, SE Asia
- Coordinated data acquisition
- Data distribution through the TRFIC
 - Main facility at MSU
 - Franchise nodes in the tropics

A constellation of observatories





Orbit Positions of the Major Earth Observation Satellites

Observing Systems

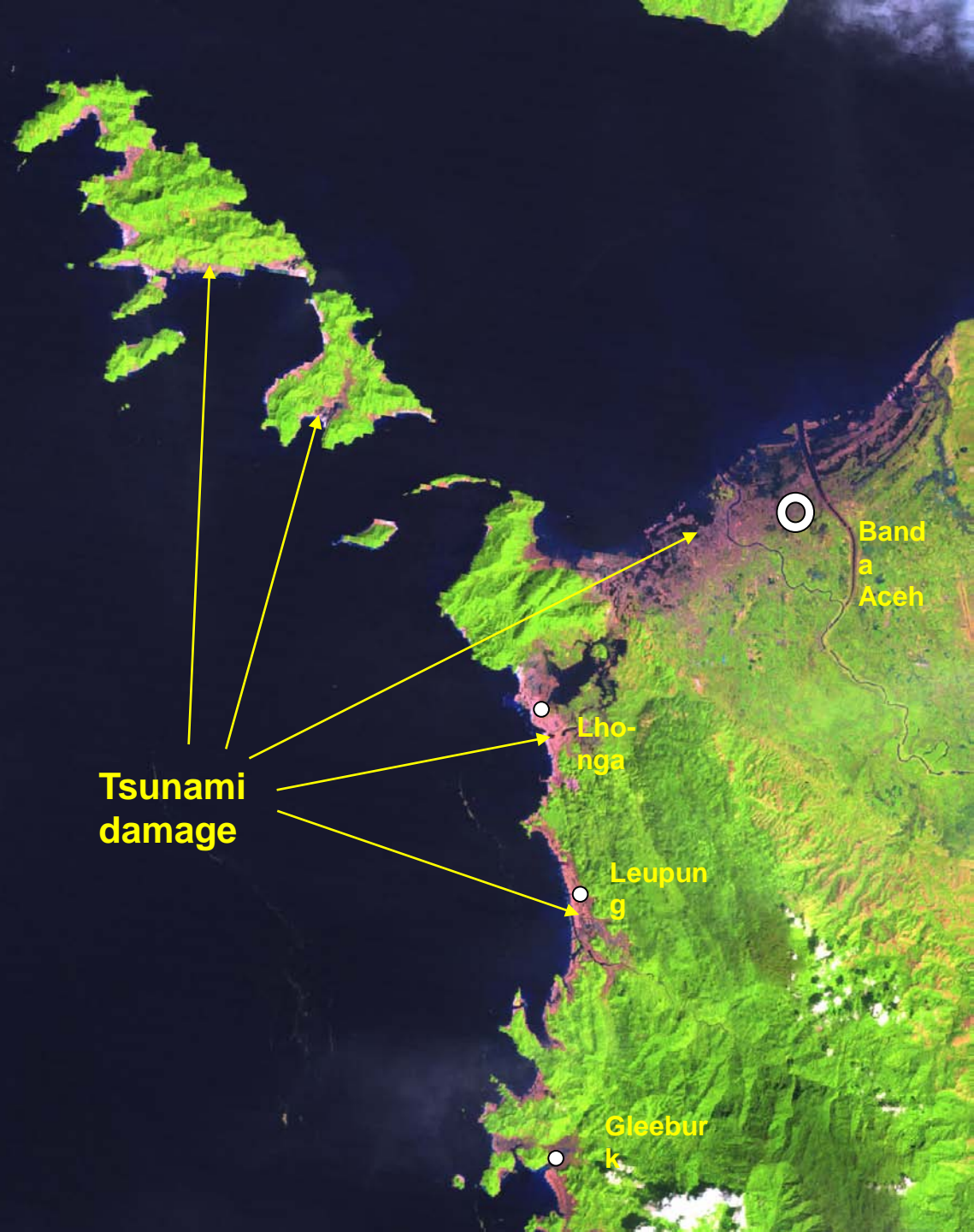
- GEOSS
- Need to couple ground and space based observatories
- Need to understand what to measure, when to measure, and where to measure – these are scientific issues
- Need to understand processes...leading to capability for forecasting
- Need for improved models



Grand Missions

- The community is calling for grand missions for grand challenges
- Not just observing systems, but problem solving missions
- Two “tall poles” are emerging:
- Food and Water – key land based missions that couple to climate missions, focused on big problems facing humanity
- US leadership can make it happen.

Assisting with tsunami relief



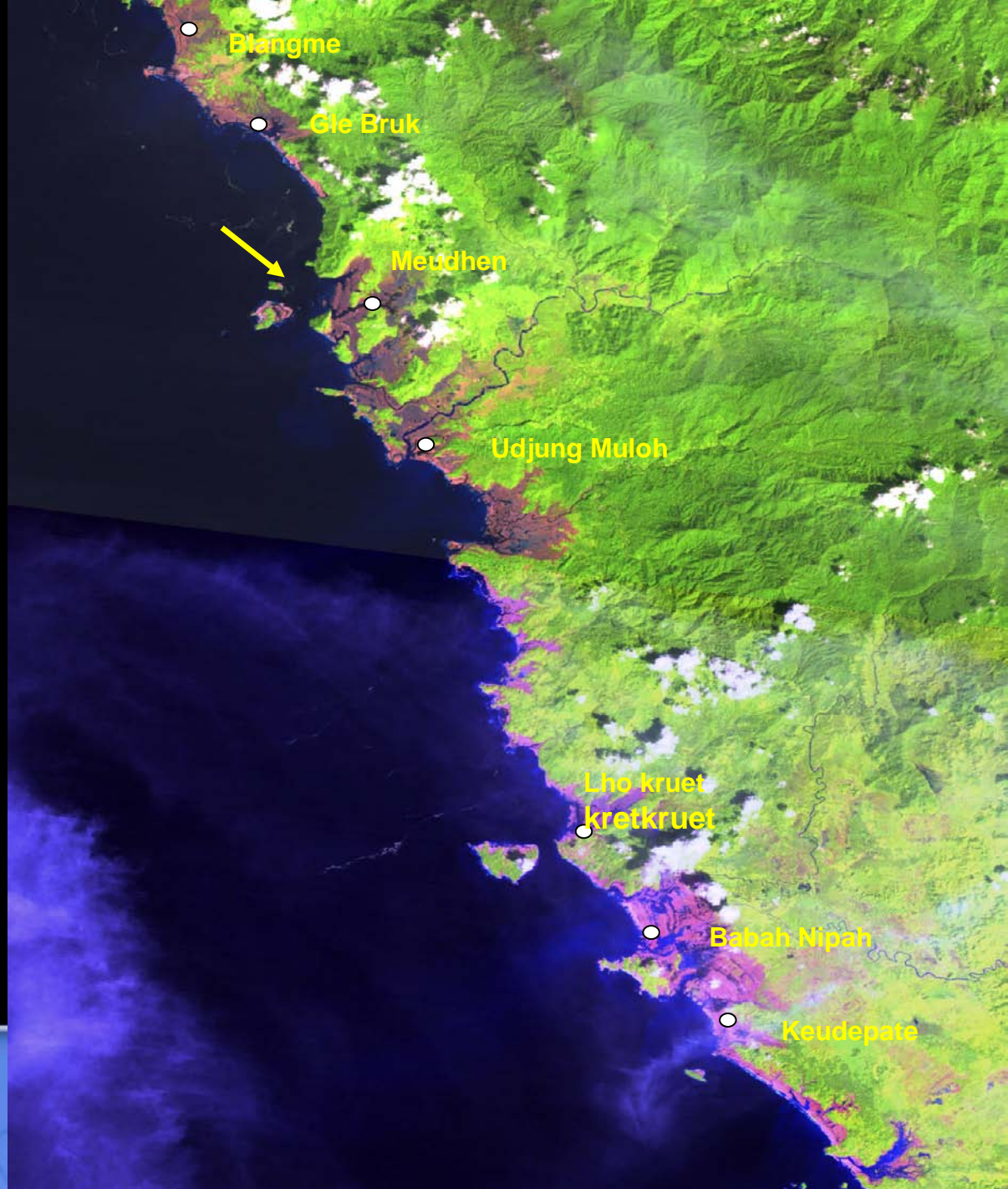
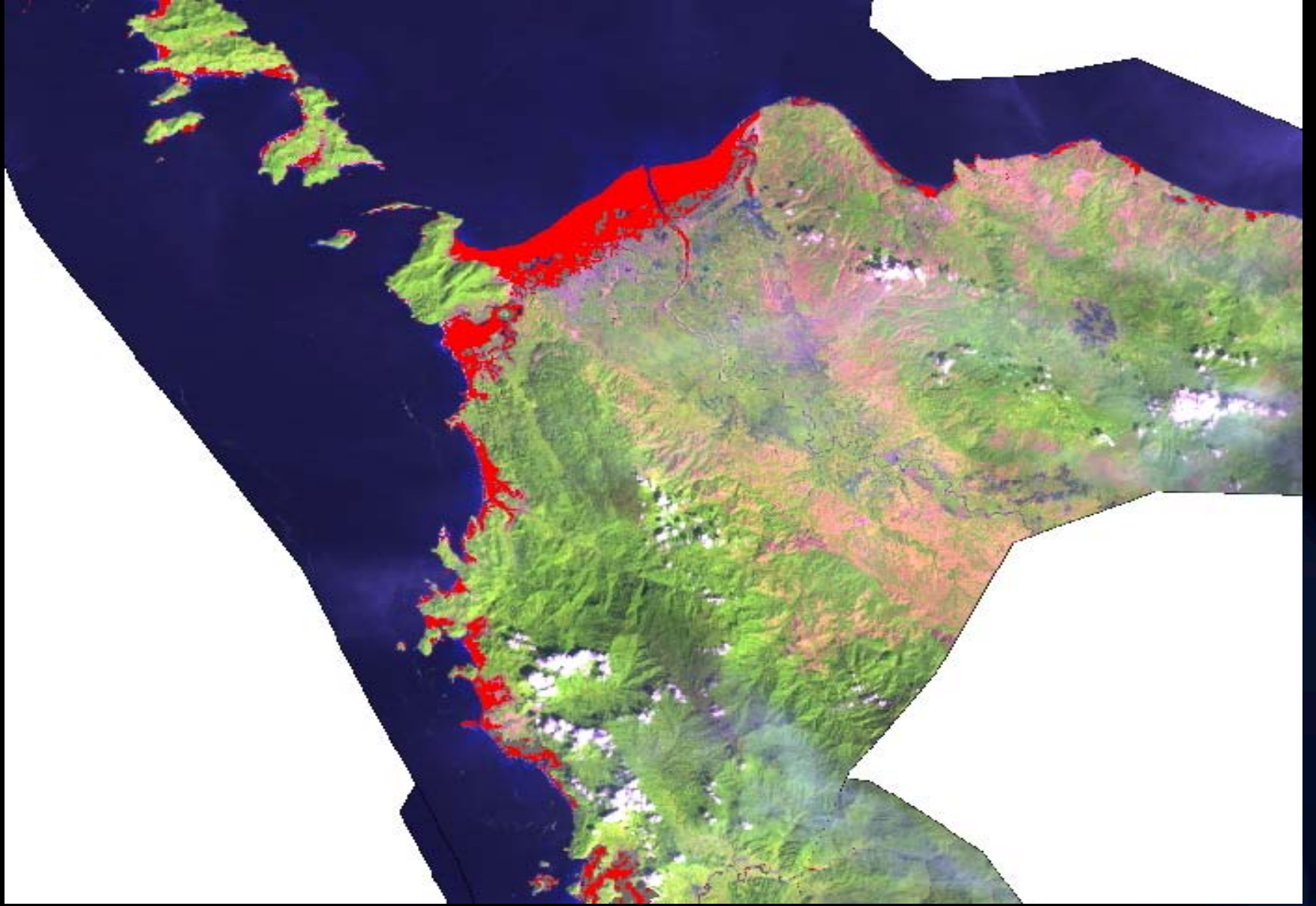
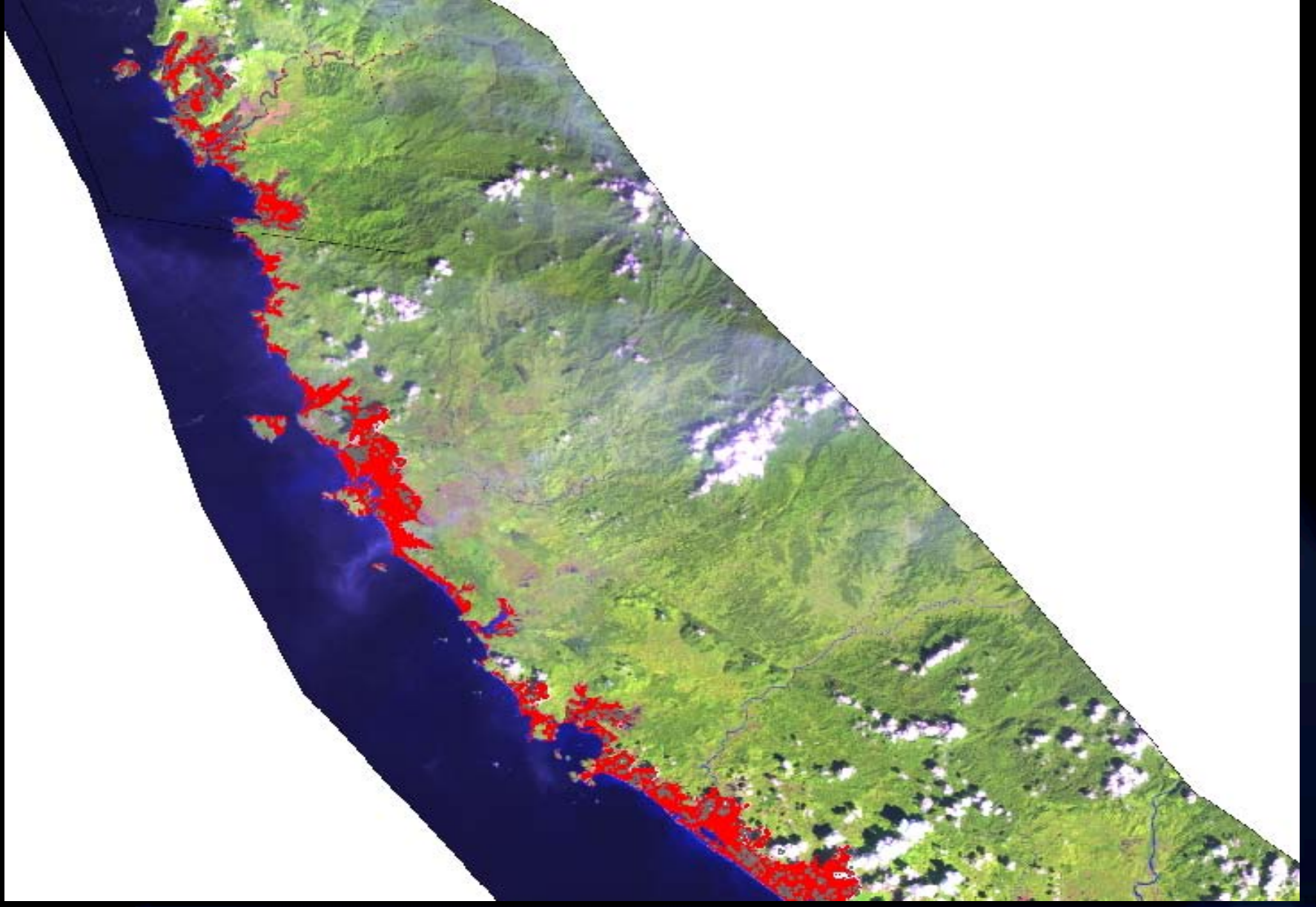






Figure 7. Localized close up view of the coastline around the hard hit city of Babah nipah. Note the significant erosion and “roughening” of the coastline and significant flooding. As seen before there are significant pockets of impact and the effect of the tsunami was not uniform.





Lessons learned

- **Good:**
 - Landsat is clearly what is needed and can be marshaled for quick response
 - Regional assessment was important
 - Ortho dataset was useful
 - ESIPs and LCLUC science teams played a role
- **Bad:**
 - repeat coverage issues
 - Current problems with SLC
 - Data delivery
 - Poor coordination with international assets