7-10 July 2009, The 7th Workshop on GHG Inventories in Asia in Seoul

Application of Remote Sensing to Forest Inventory for Identifying Deforestation and Degradation

Forestry and Forest Products Research Institute

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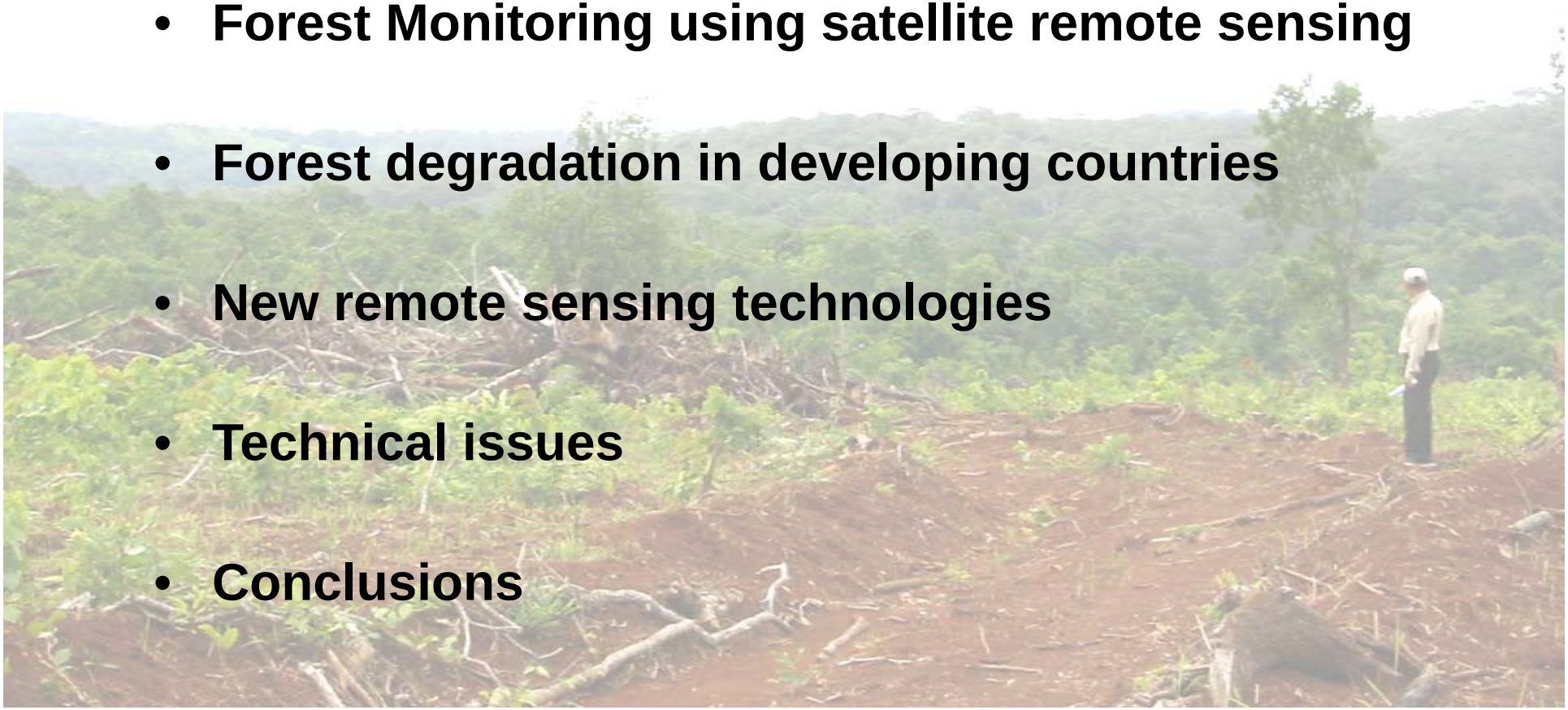
Outlines

- National Forest Resource DB (NFRDB)
- Forest Monitoring using satellite remote sensing
- Forest degradation in developing countries
- New remote sensing technologies
- Technical issues
- Conclusions



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National Forest Resources Database – NFRDB –

- Two servers
  - Main system in Forestry Agency
    - Ordinary use
  - Sub system in FFPRI
    - Backup system
    - Research and development

NFRDB Server

Database Room
in Forestry Agency

Outline of NFRDB

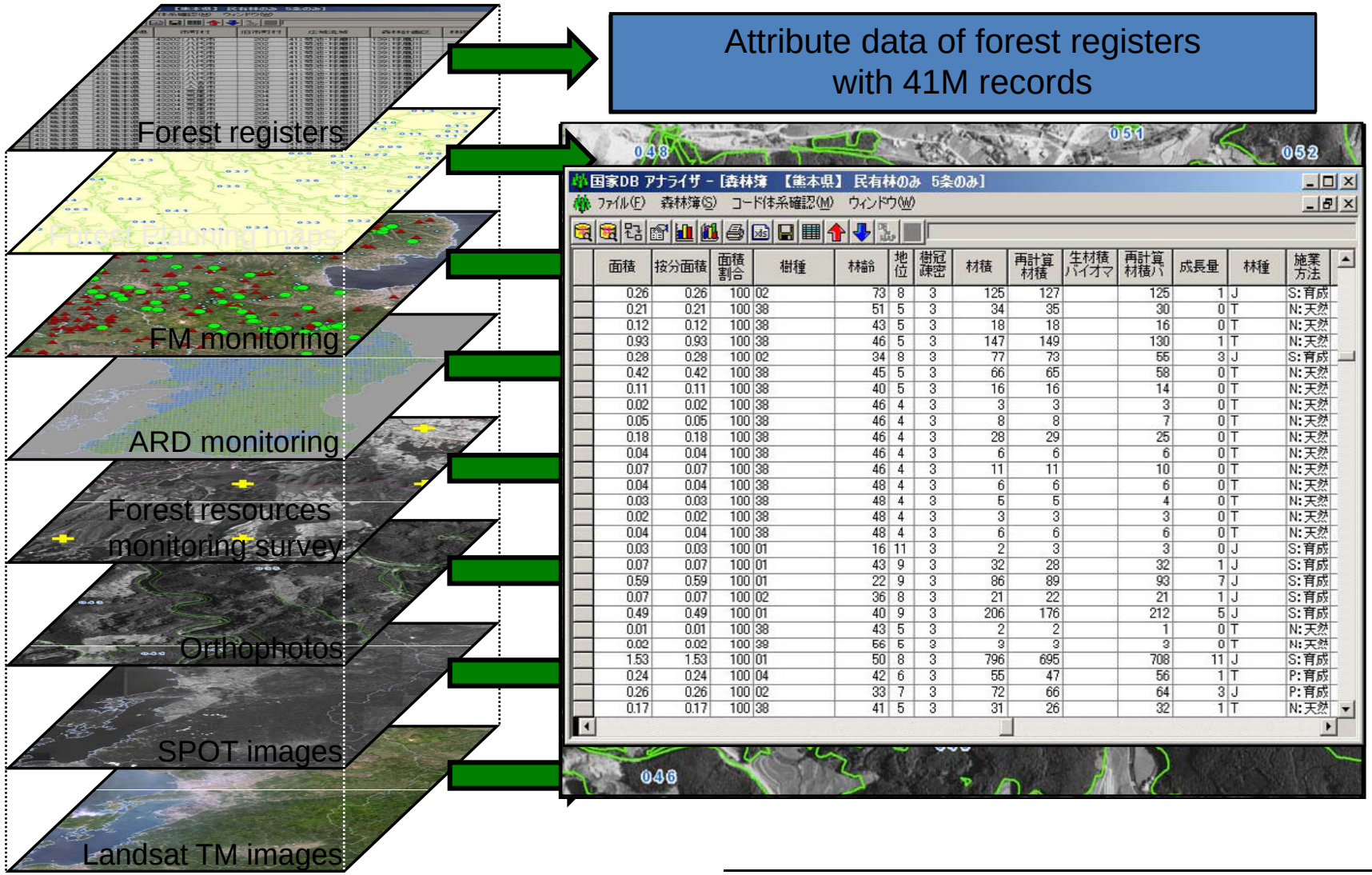
- Purpose
  - Accounting and reporting for KP
  - Integration of forest information
  - Forest statistics
  - Forest plannning
  - Evaluation of multifunction of forests

- System boundary
  - Whole forests including national and private forests in Japan

Outline of NFRDB

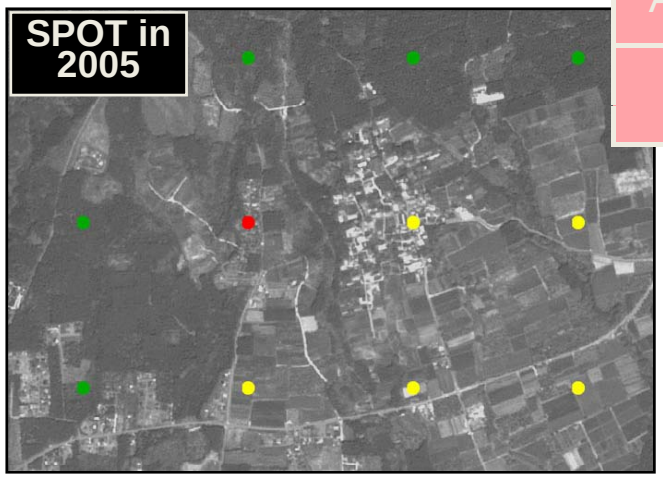
- Functions
  - Basic functions
    - Database, GIS, Data import & export, Data analysis, Image analysis
  - Accounting and reporting
    - Estimation of Carbon flux, Identification of ARD & FM, Presentation
  - Totaling forest resources for
    - Forestry statistics, Forest planning, Forestry census, etc.

Main Data on NFRDB



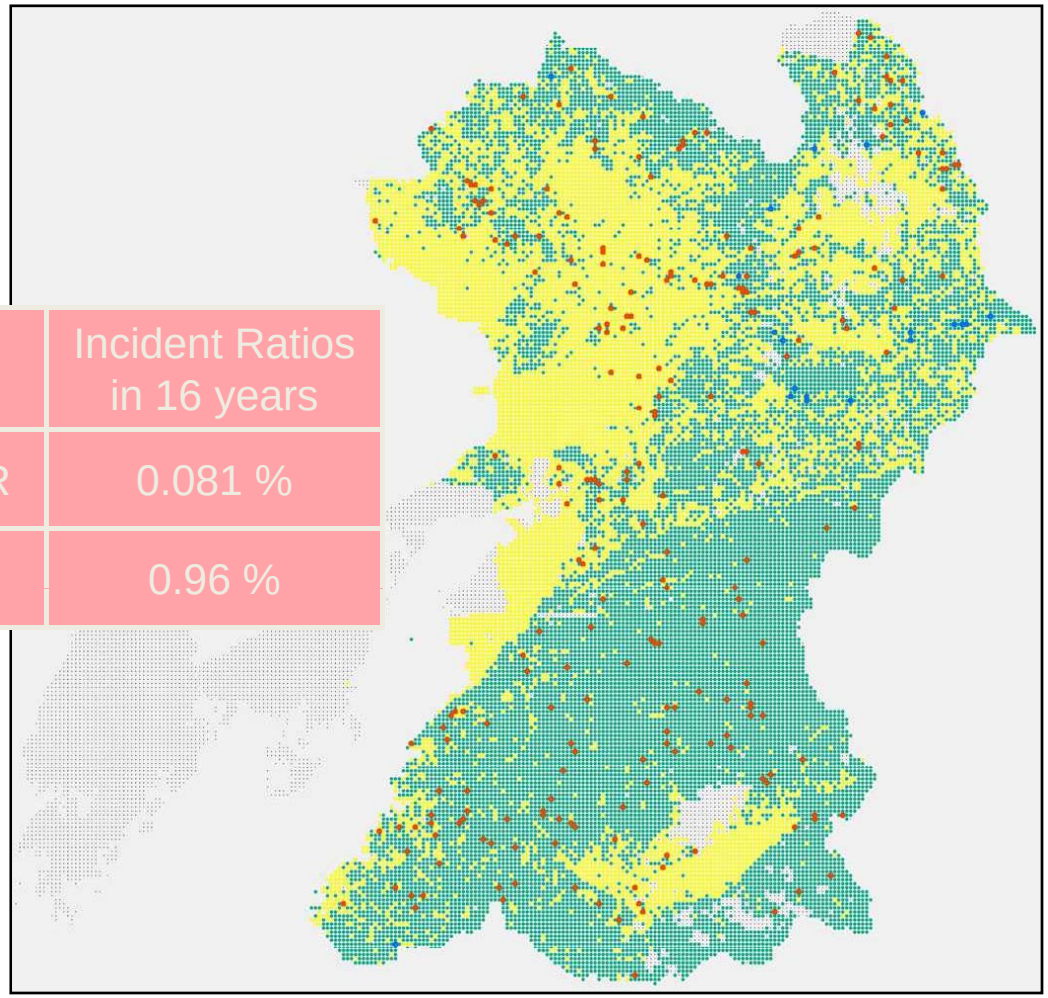
ARD Detection by Interpretation of Orthophotos and SPOT Images with 500m grids

【 ARD Interpretation 】



【 Result of ARD Detection 】

	Incident Ratios in 16 years
AR	0.081 %
D	0.96 %



● : Non-changed forests, ● : Non-changed Non-forests, ● : AR、 ● : D

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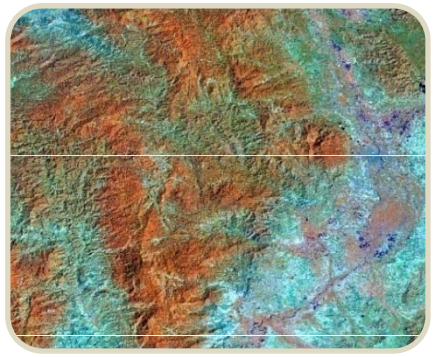
Forest monitoring using satellite remote sensing

No leakage in the area.
Coat is large.
Difficulty of acquiring cloud-free data.
Applicability for local policy is large.

Satellite data

Wall-to-wall

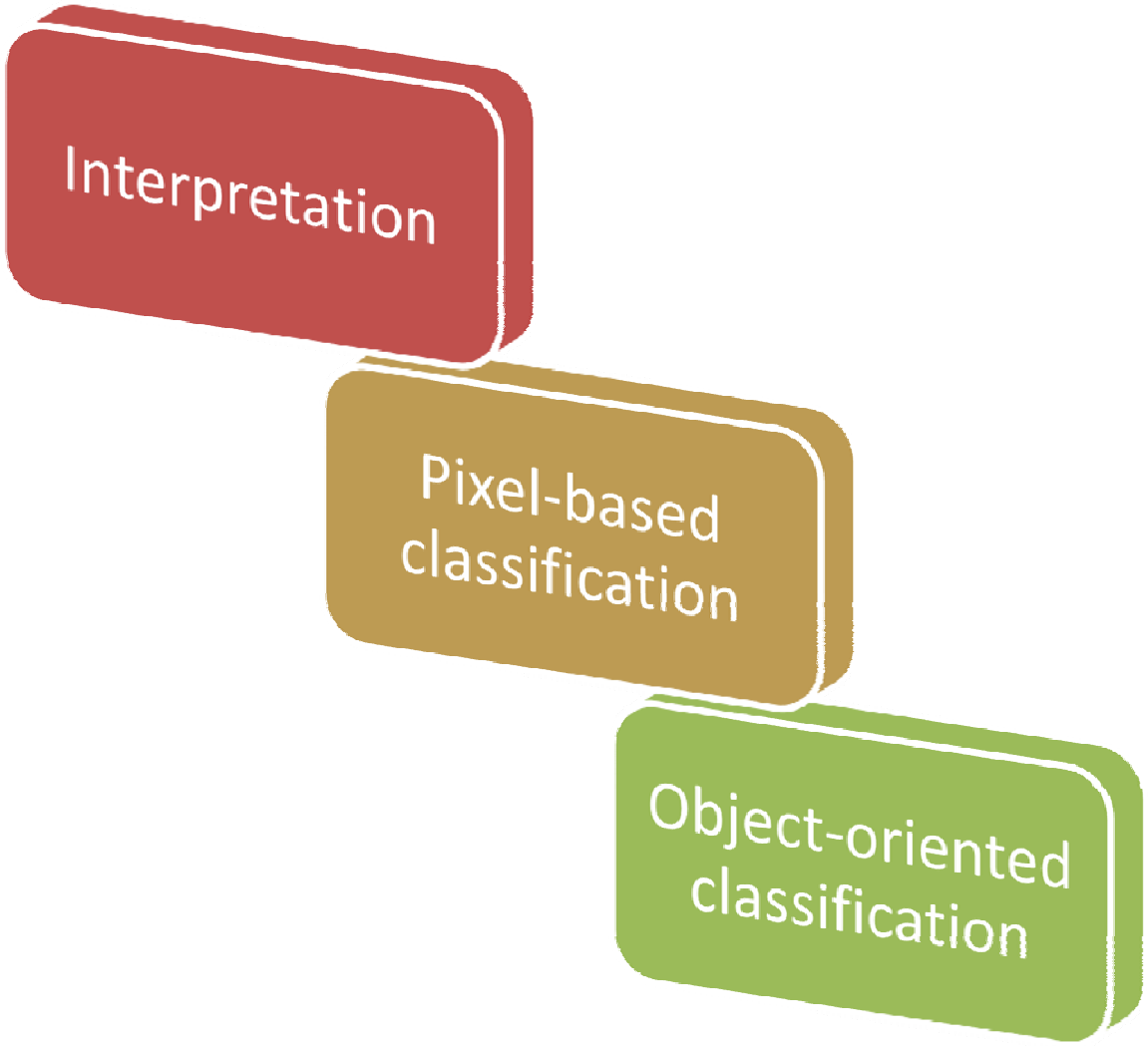
Sampling



Accuracy for sampling rate.
Coat is effective.
Acquiring cloud-free data is relatively easy.
Applicability for local policy ?

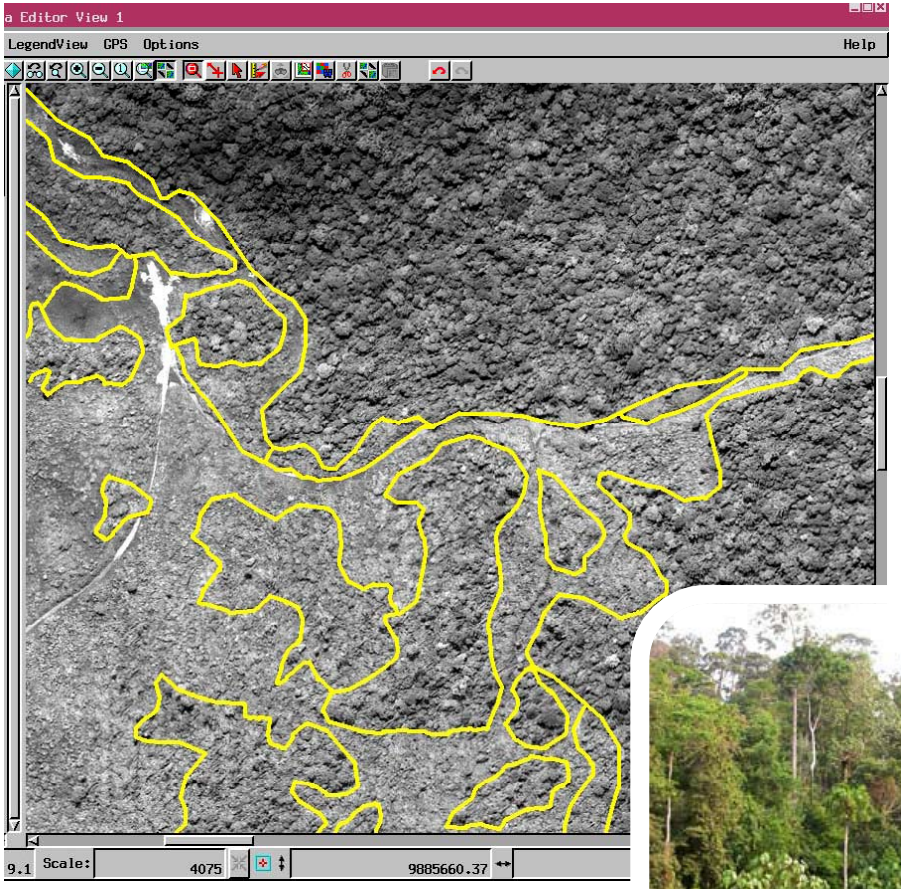
Ref. FRA2010 Remote Sensing Survey Task Force

Understanding of land-cover from remotely sensed data



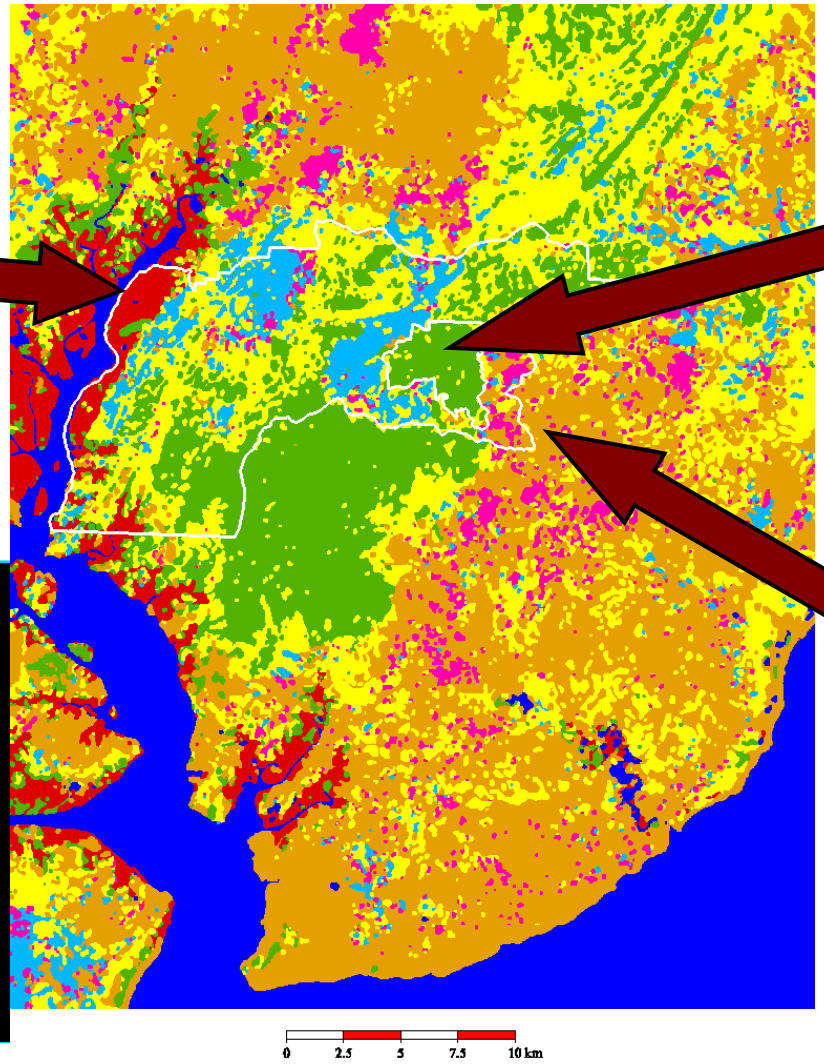
Interpretation of satellite images

- Appropriate segmentation of ambiguous domain
- Requirement of interpretation technique
- Different outcomes by interpreter



Pixel-based classification

Mangrove forest

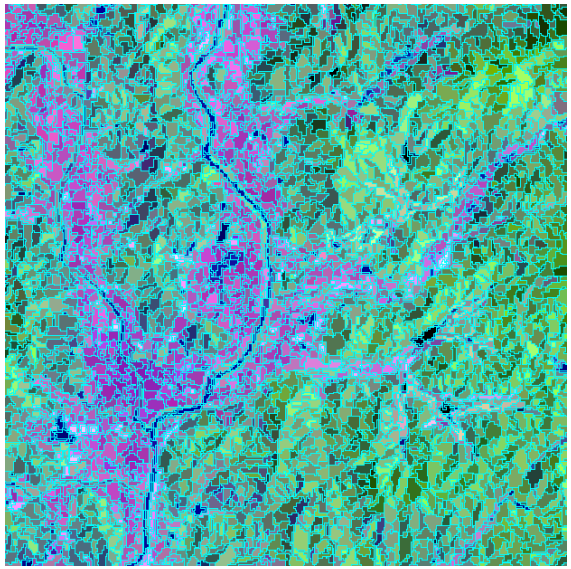


Natural forest

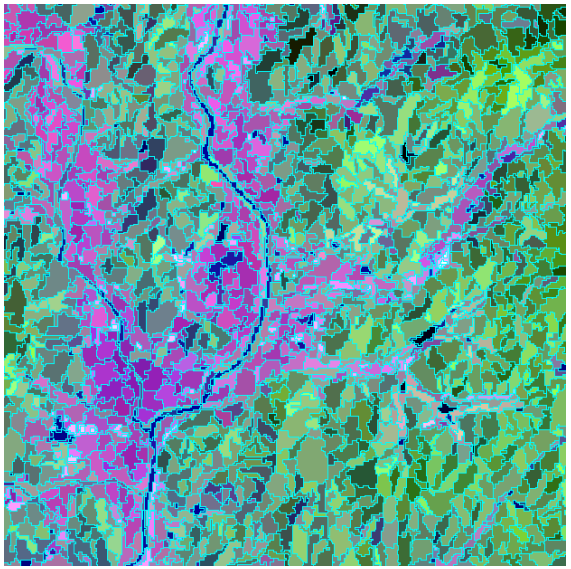
Agricultural land

Object-oriented classification

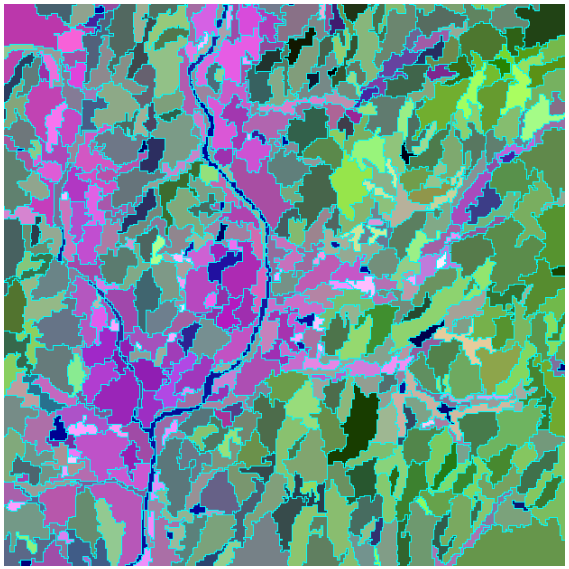
- Classification results that is similar to human interpretation
- Advantage of handling by object （segment）



SP=5



SP=10

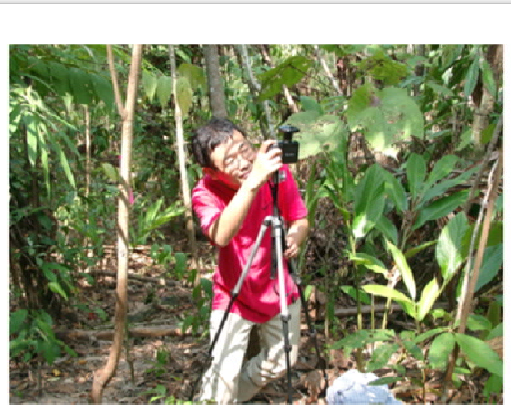


SP=15

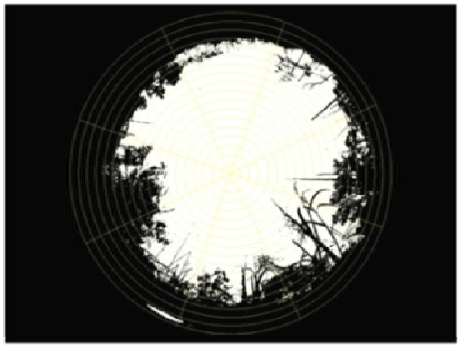
Ref. FRA2010 Remote Sensing Survey Task Force

Field survey and Database

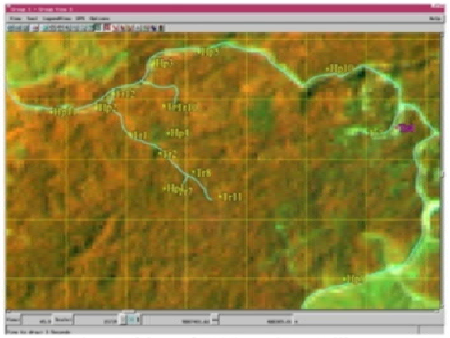
Importance of ground-based data
Necessity of geo-reference for the data



Field Survey at the point of Tr04



Hemispherical photo at Tr04



Site Description

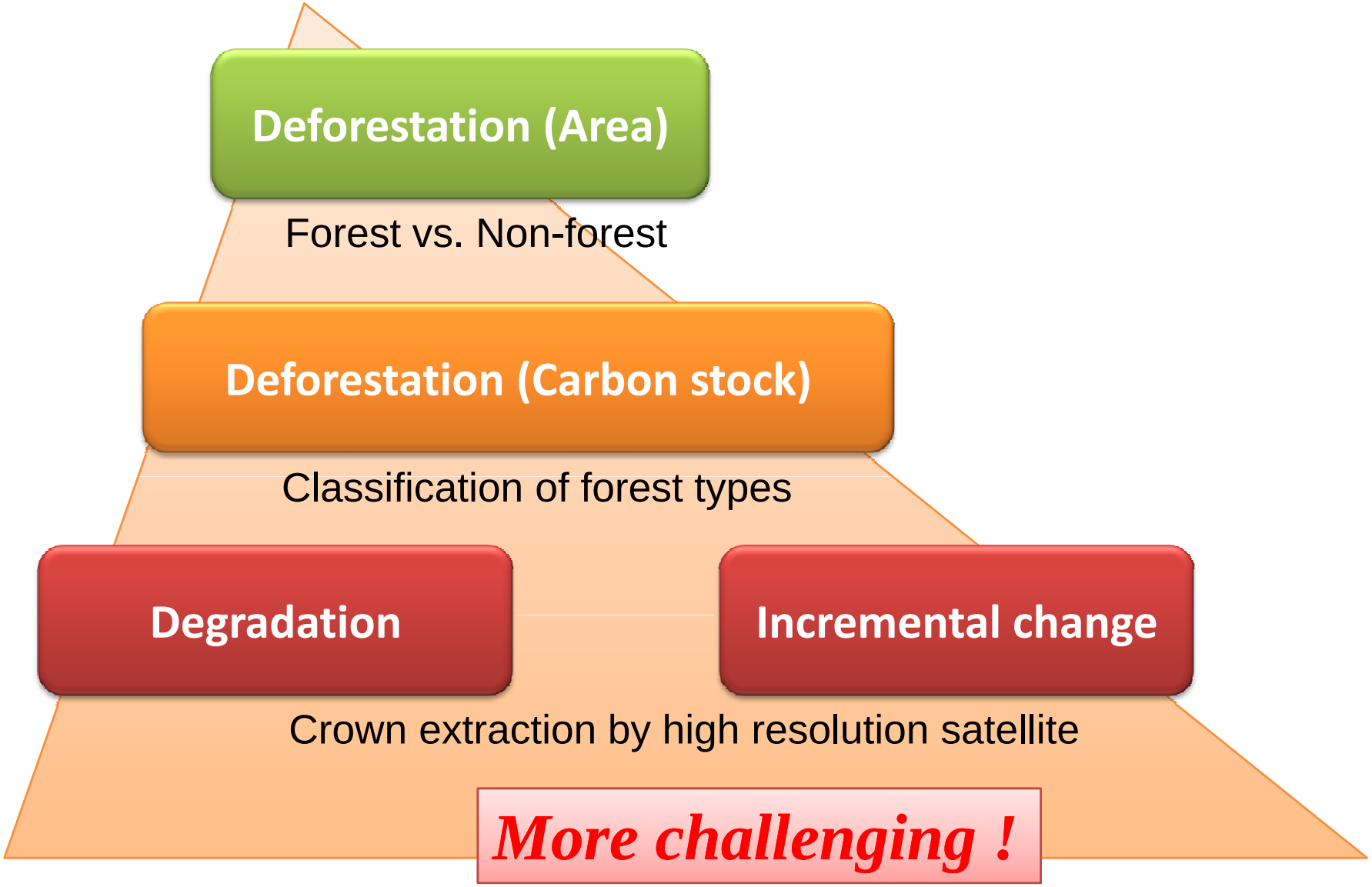
Coordinates 489757E 9887762N

UTM Datum: Indonesian 1974 Zone: 50 South

Basal Area: 12(4) m^2 Highest tree: 26.8 m

Number of Dead trees (within 10 m): 7 LAI: 0.492

The challenges of forest monitoring



Role of forest monitoring using remote sensing

- For clarifying historic trend of forest change
- For planning and implementing certain actions after assessment of forest change

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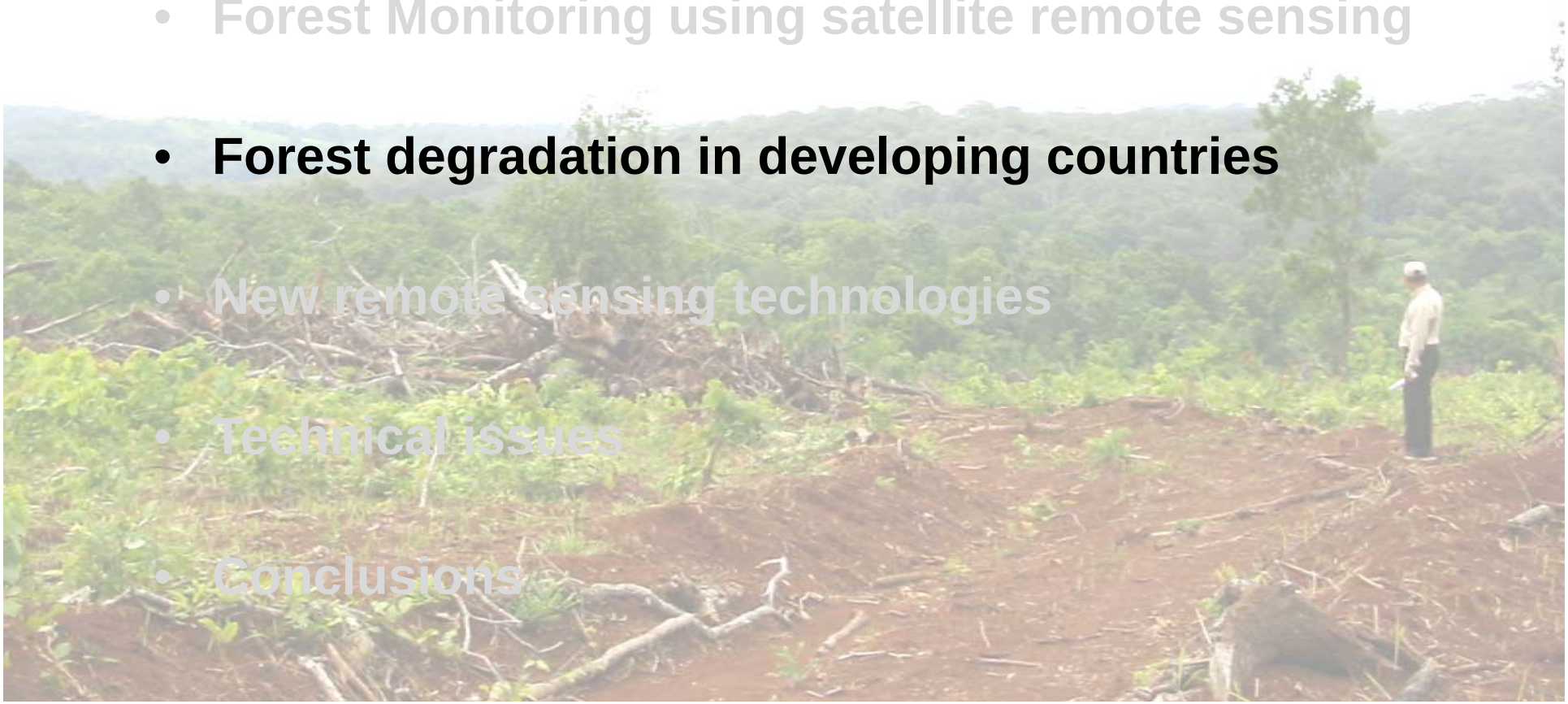
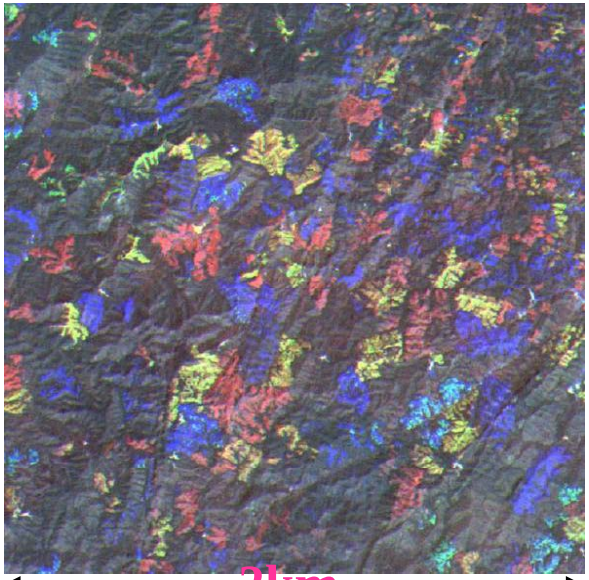
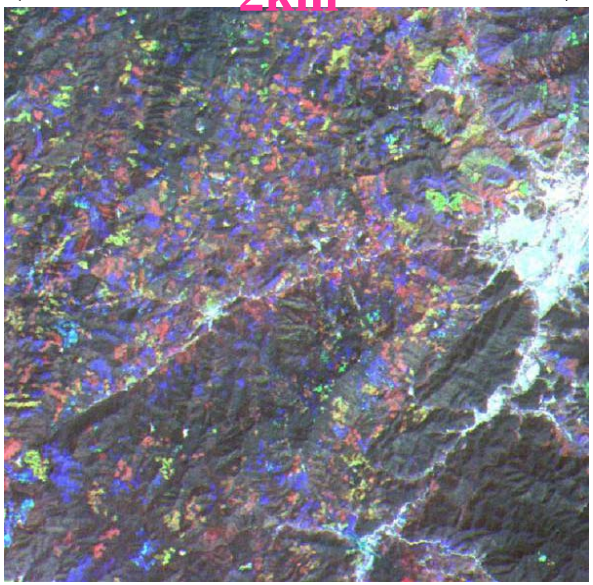


Shifting cultivation

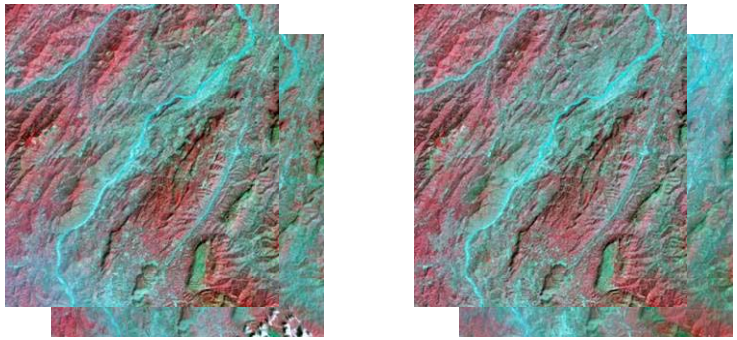




Shortening of rotation and enlargement of cultivation area

Conversion to rubber plantation after shifting cultivation

Monitoring of sifting cultivation by ASTER images



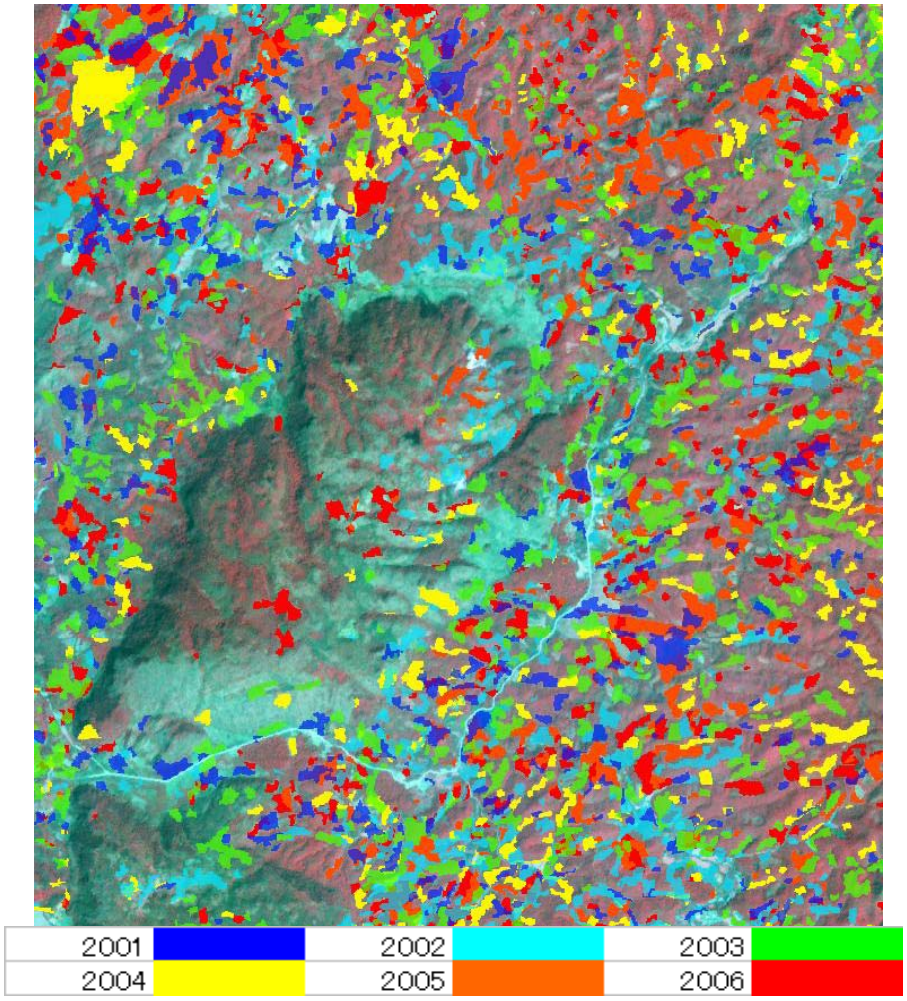
2002/2/9 2005/2/1

2003/3/16 2006/3/8

Image pre-processing

Object-oriented classification

6 years - shifting cultivation distribution map



Monitoring of sifting cultivation for six years

Forest fire

- Type of fire
  - Fire up to canopy
  - Surface fire
    - ex. Tropical seasonal forest in dry season
  - Fire in peat of underground
- Intensity of fire
- Development vs. restoration

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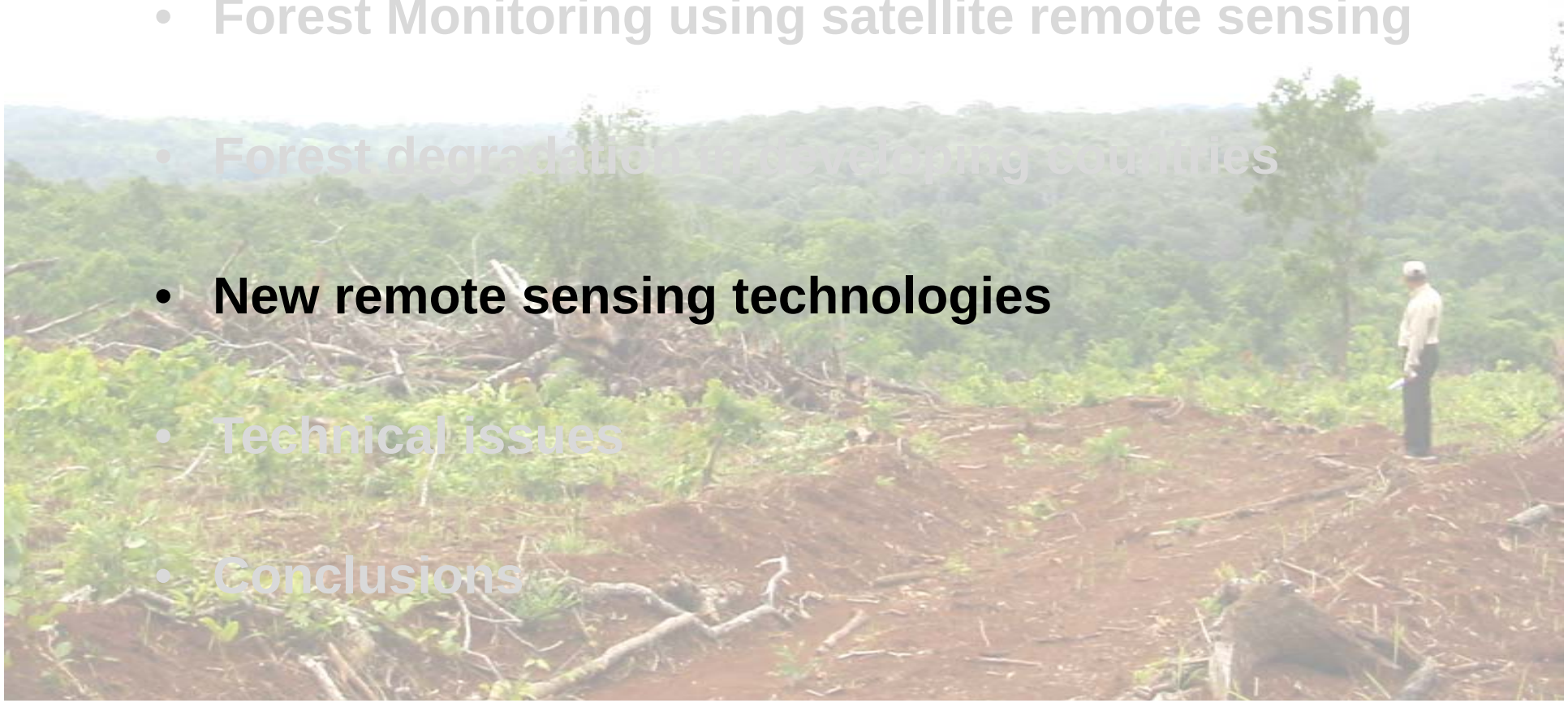
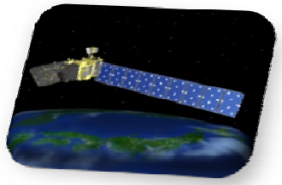
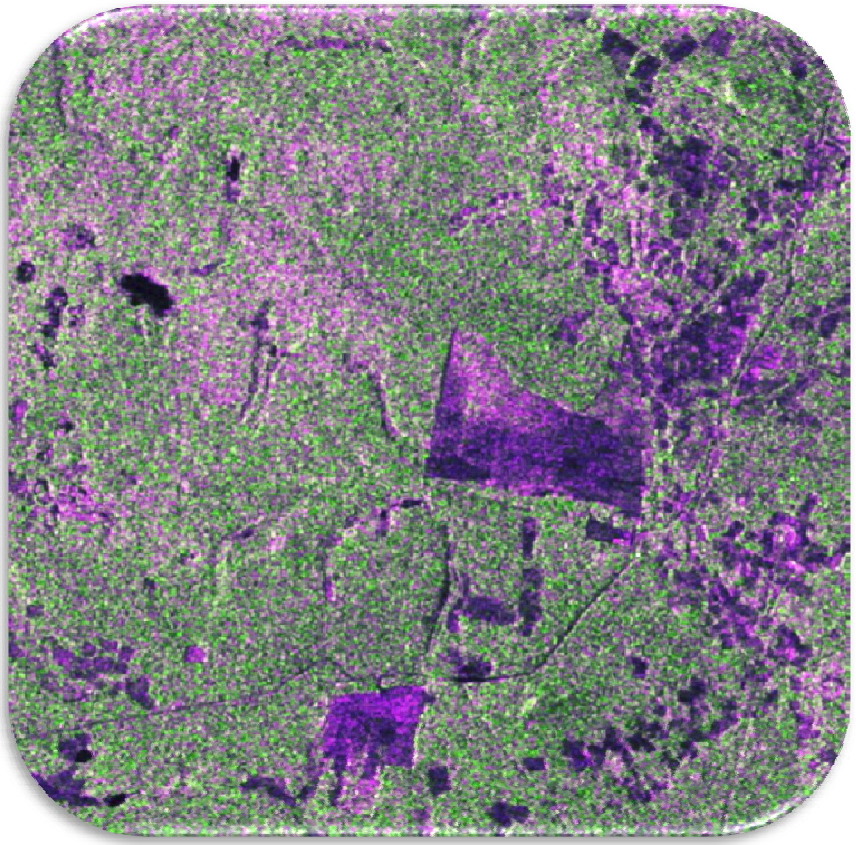


Comparability between SAR and optical sensor

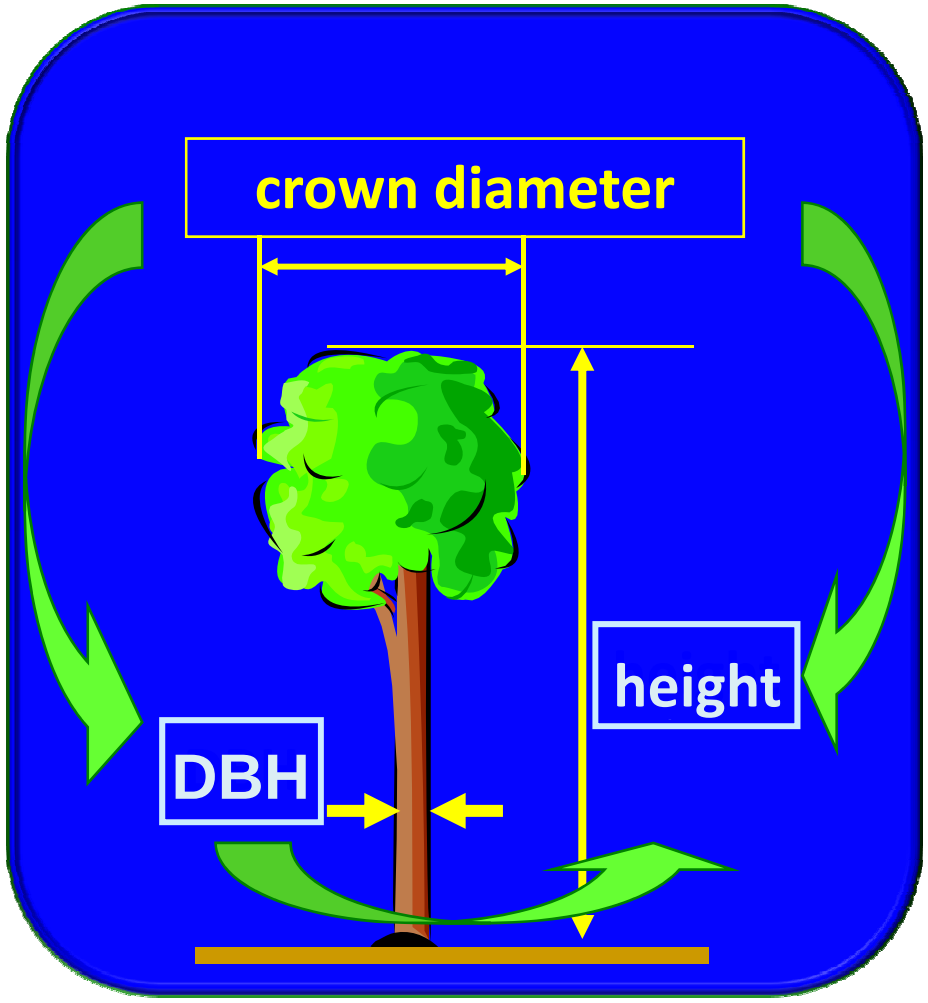


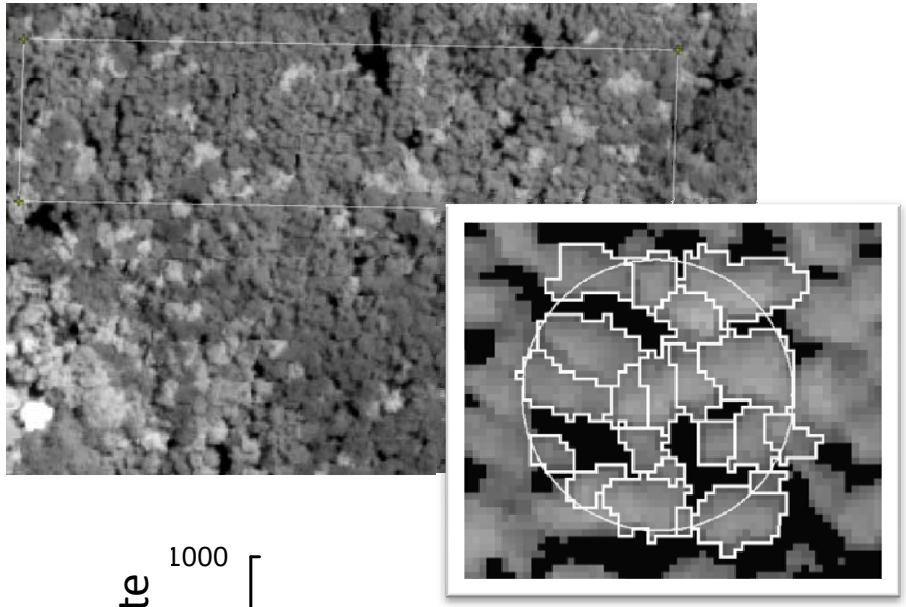
ALOS PALSAR data

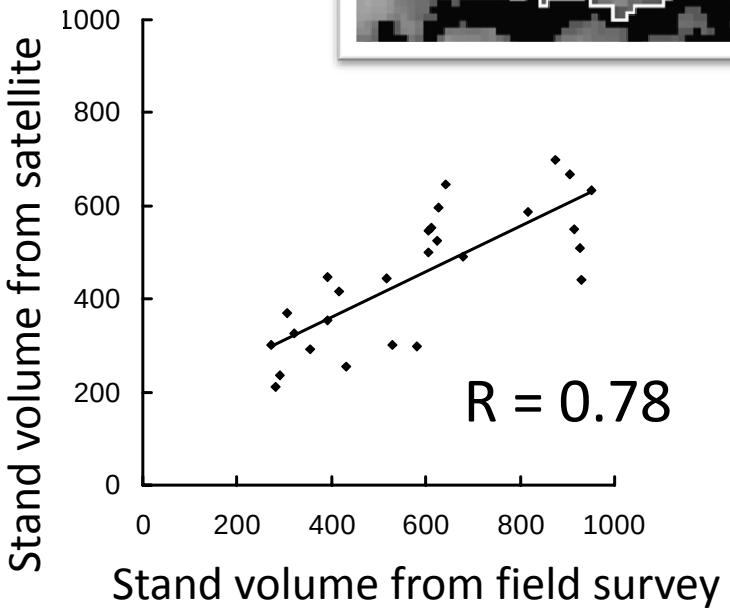


ALOS AVNIR II data (optical)

Estimating biomass using high resolution satellite data





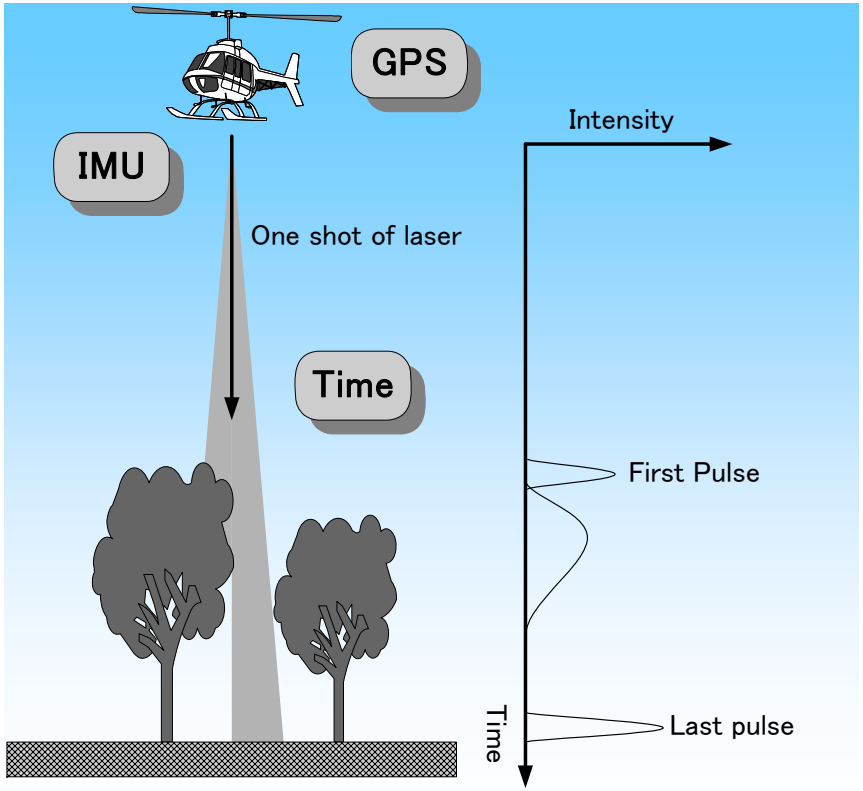


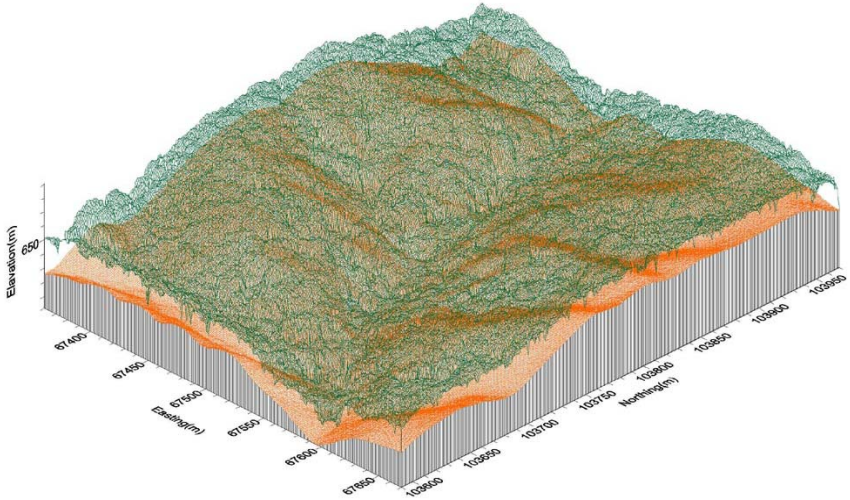
Source: Hirata (2008) *Journal of Forest Research 14*

3-D forest measurement with LiDAR

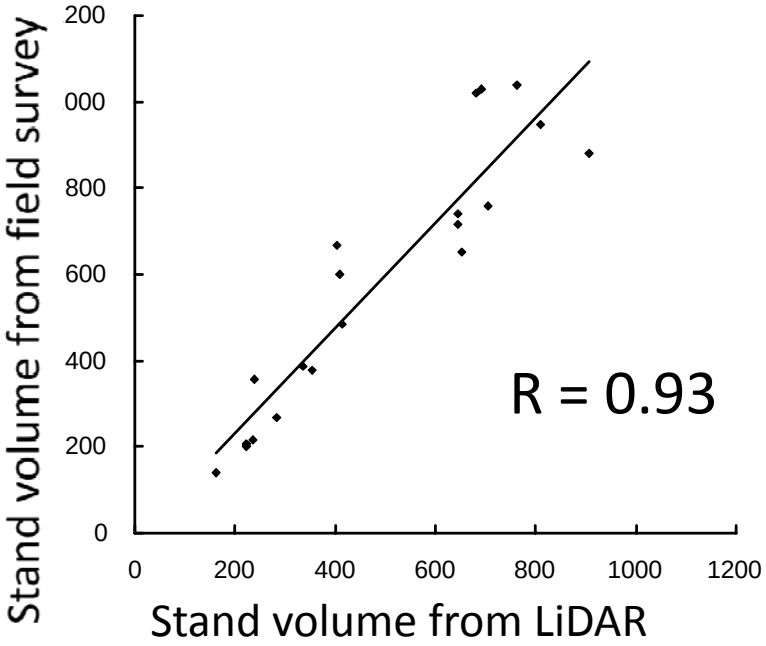
A part of the laser beam reflects on canopy .

The rest goes through canopy and reflects on the ground.





Measurement of ground and canopy surface



Source: Hirata et al (2008) *Journal of Forest Planning 14*

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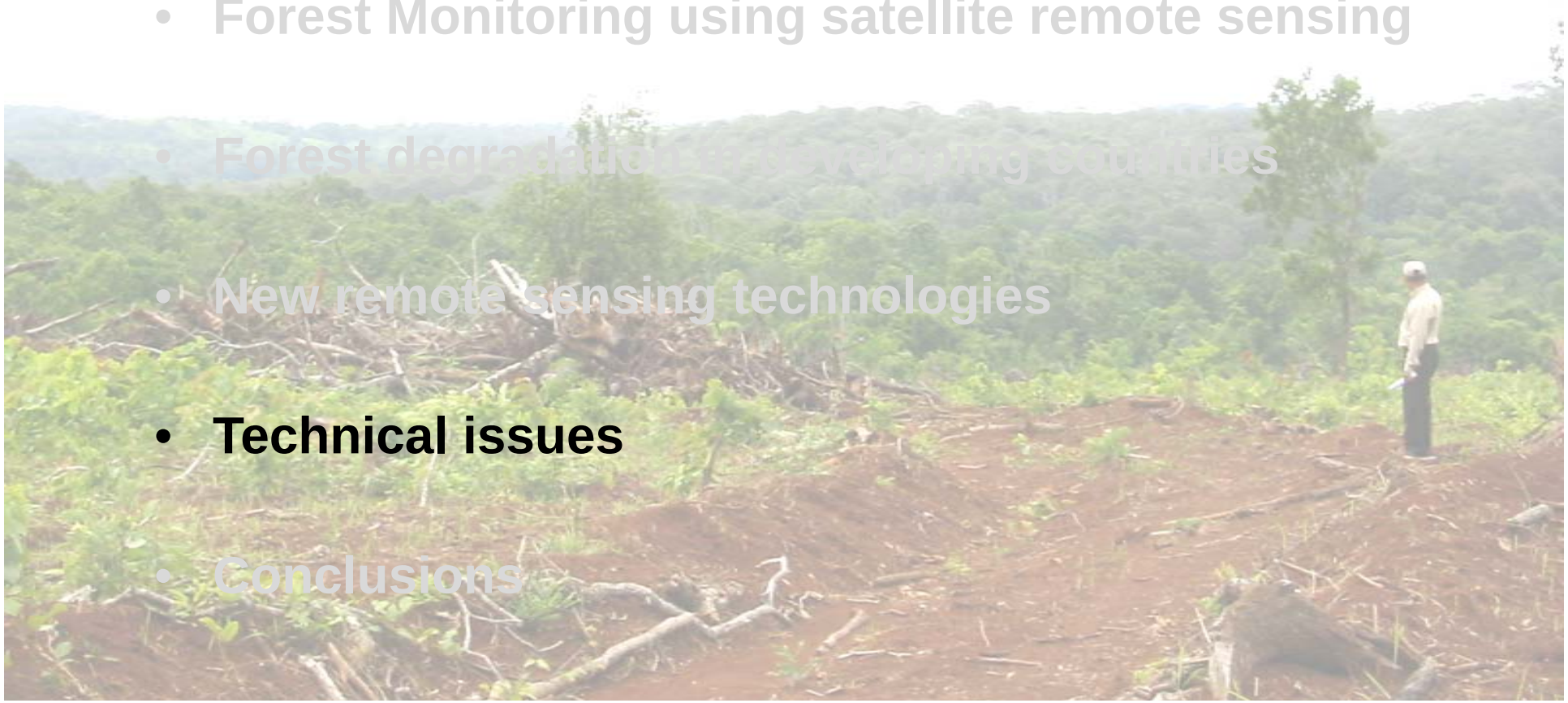
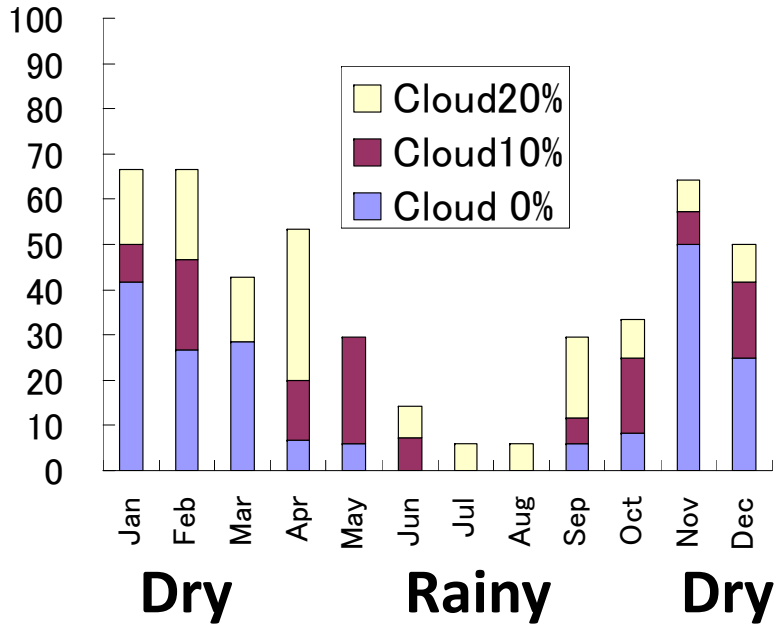
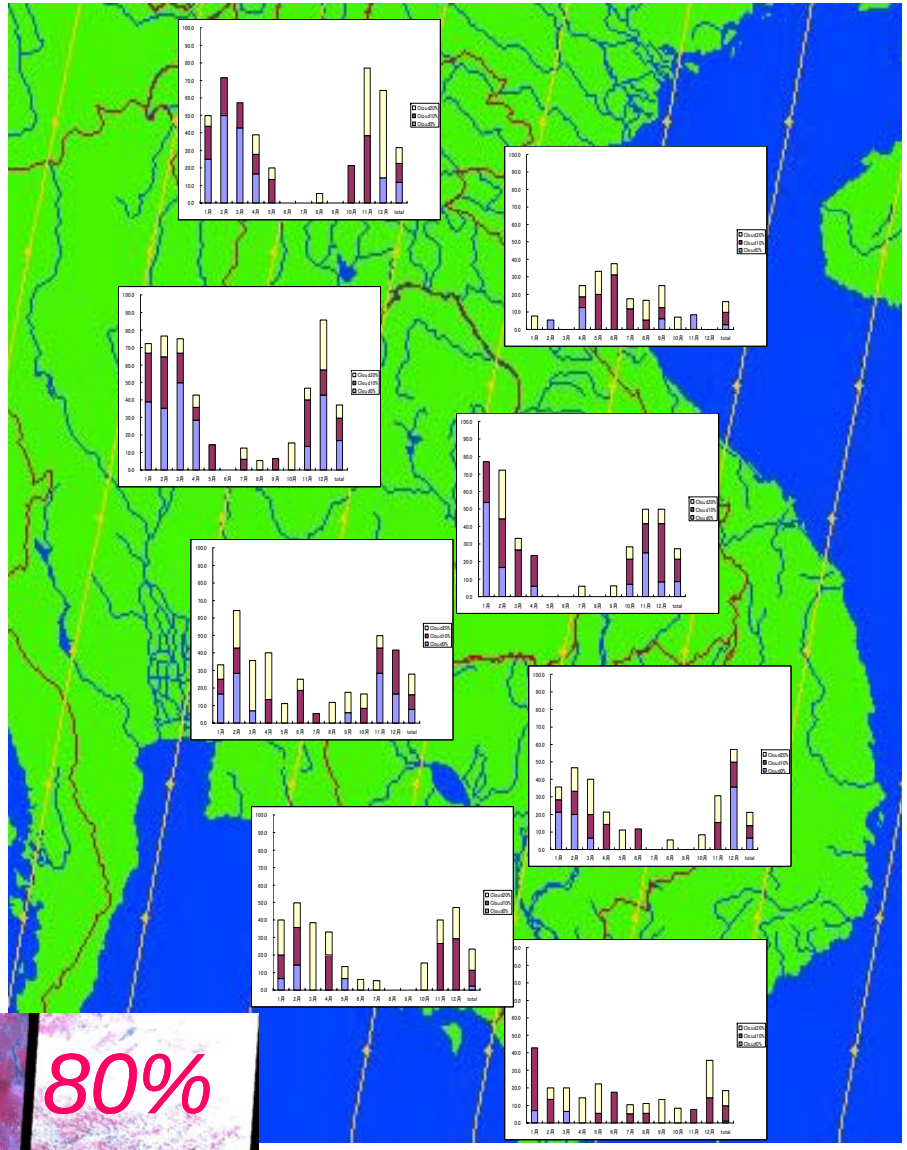
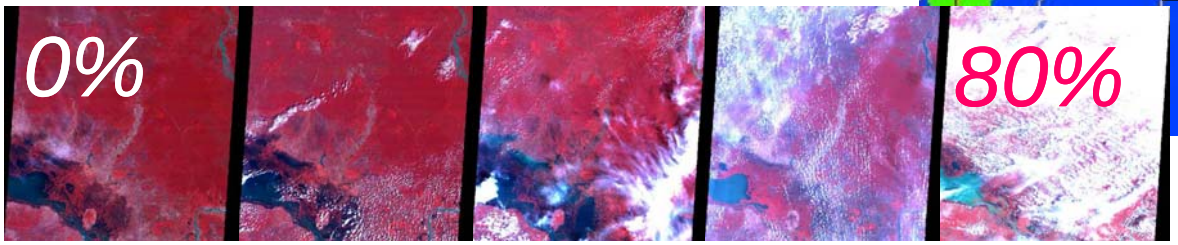


Locality and seasonality of data acquisition

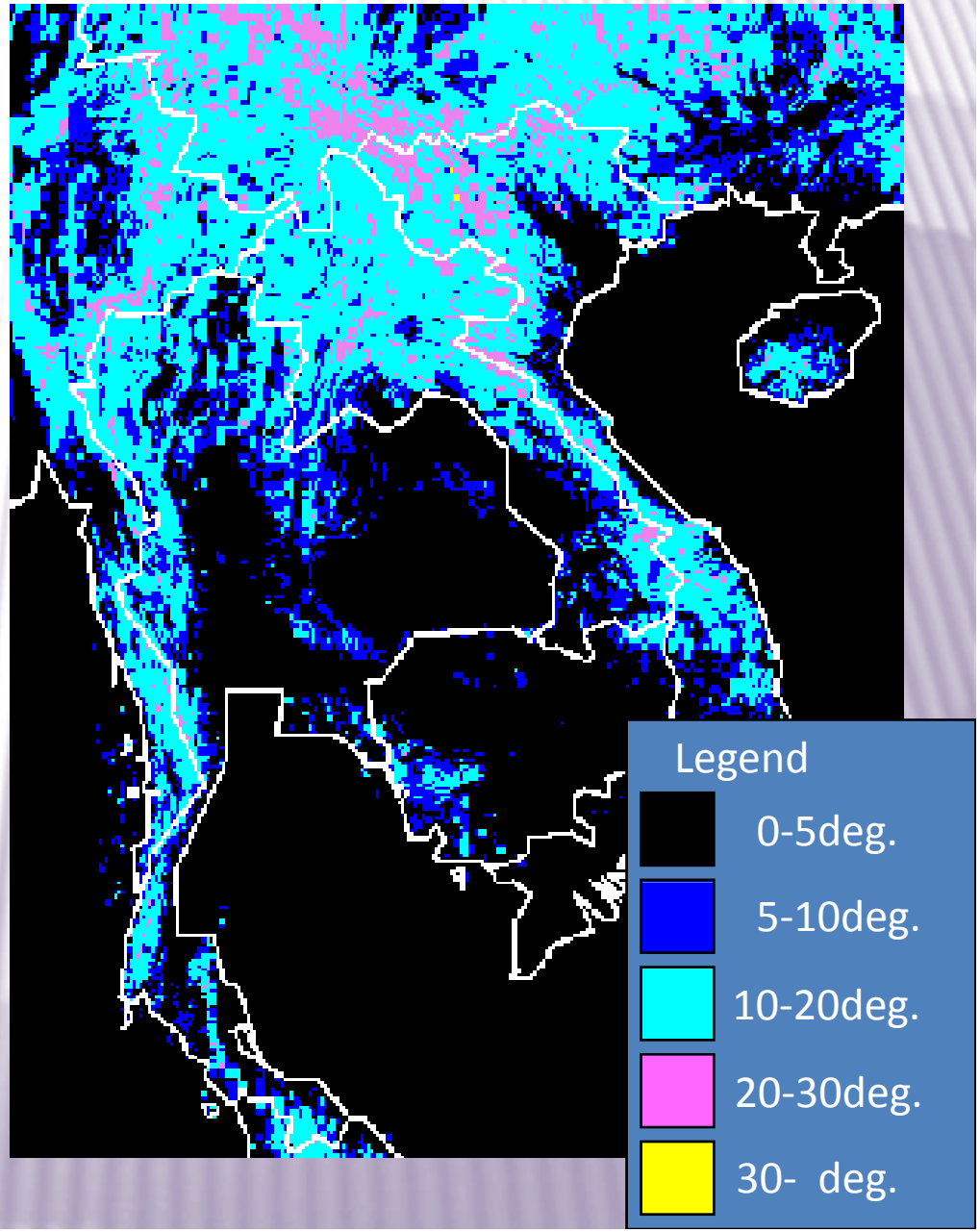






Topographic effect

- Forest remains in mountainous area.
- Effect of topography on both SAR and optical sensor data



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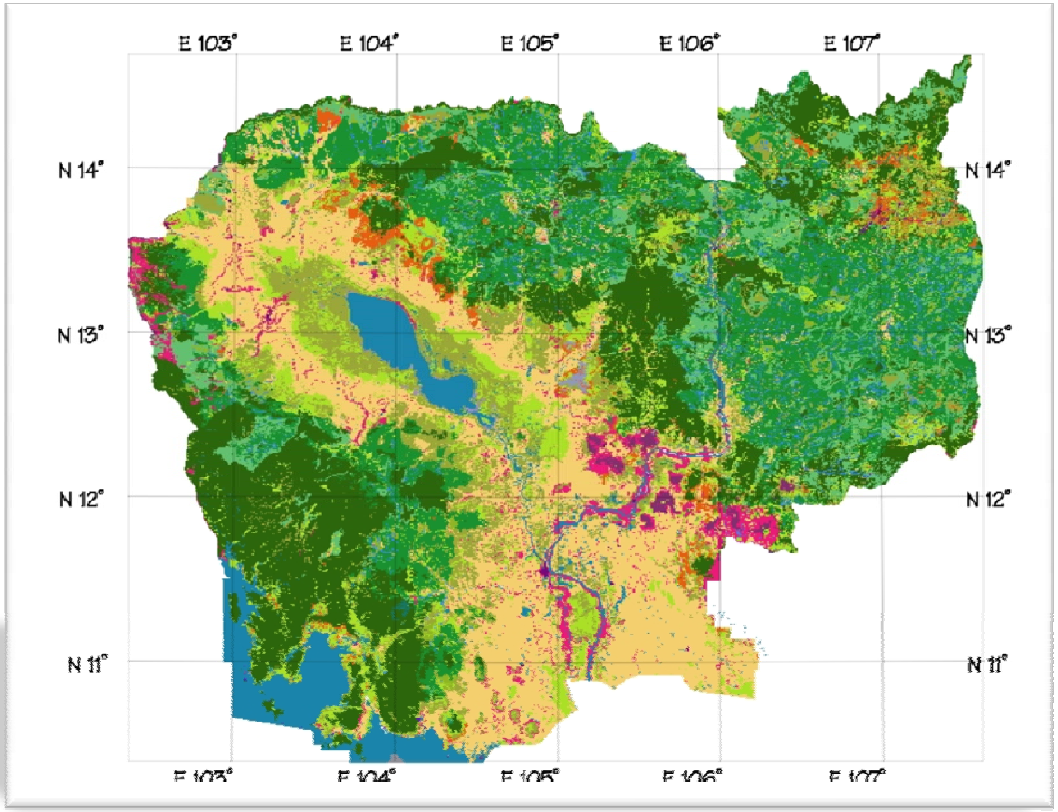
Conclusions

- Consistency of satellite data and the results
- Determining methodology
- Issue of definition
- Importance of field survey
  - There is much grand-based data, which was collected by different organizations, for different factors with different formats, without geo-reference
- Established methods and further challenging studies

Thank you for your attention!



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