Potential of RS/GIS data for GHG inventory in forest sector

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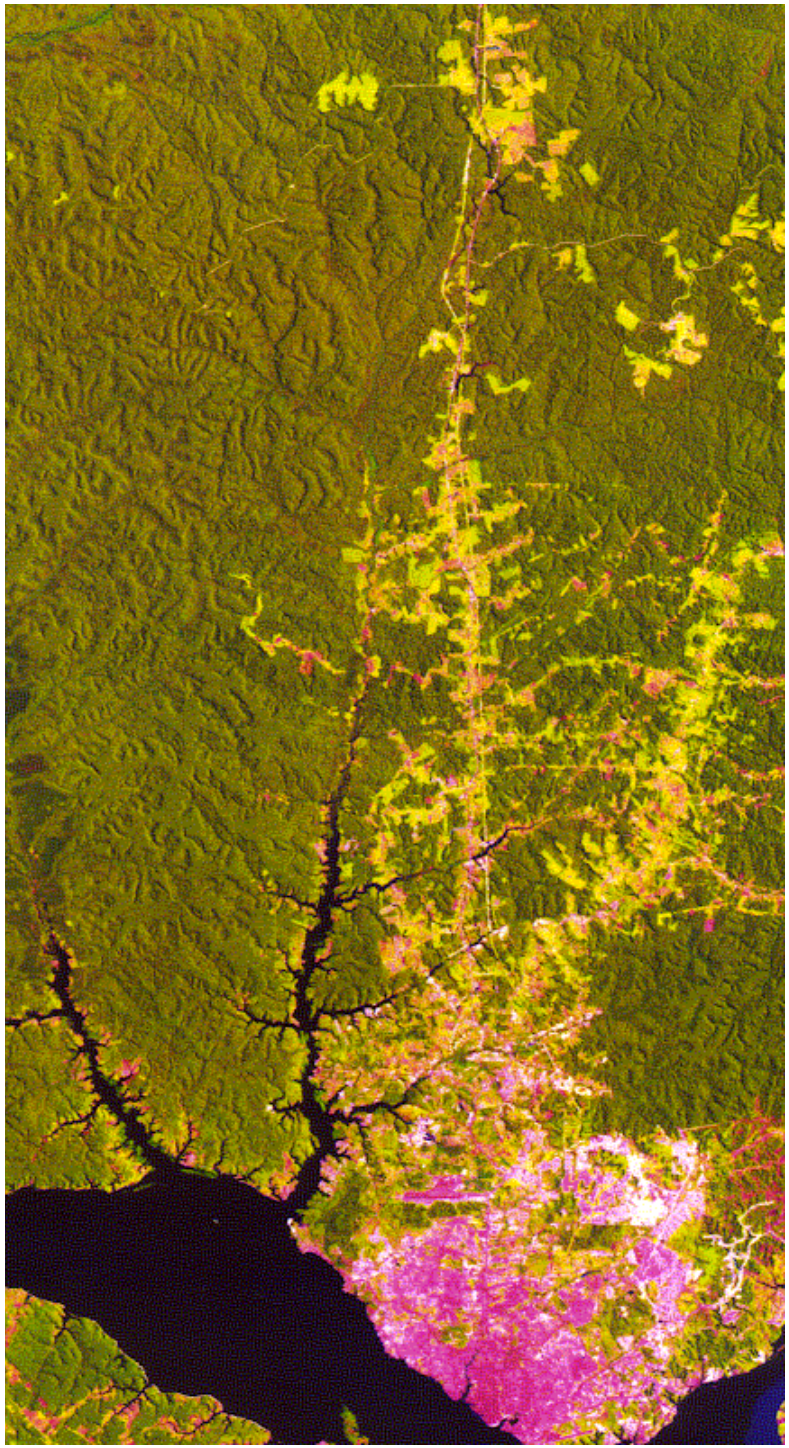
Forest monitoring using remote sensing

- Unique technique of forest monitoring widely and retrospectively.
- Essential tool to identify deforestation and forest degradation in developing countries



Satellite imagery in Manaus, Amazon

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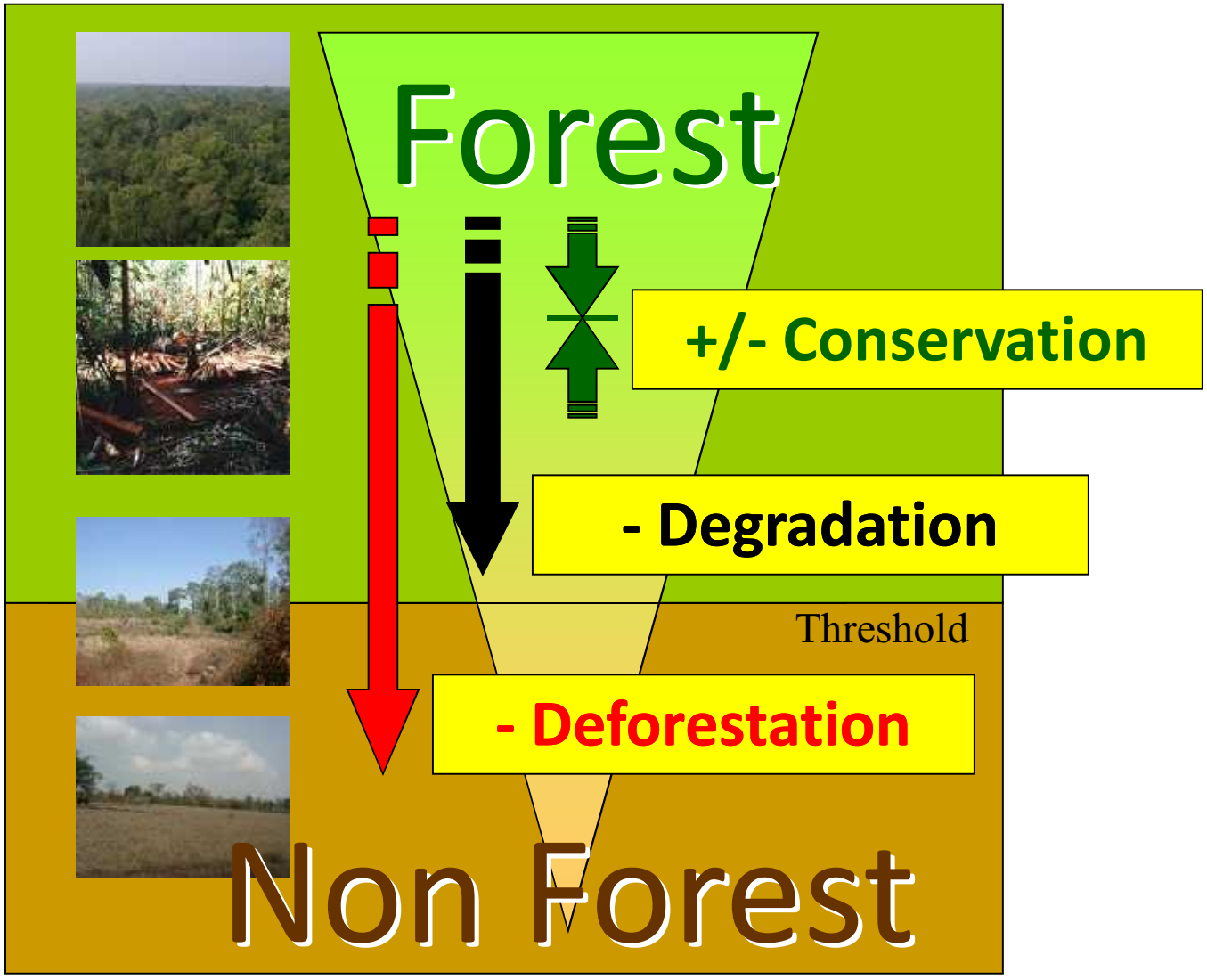
Gap between remote sensing and definitions of forest degradation and deforestation



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Draft decision -/CP.15

Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

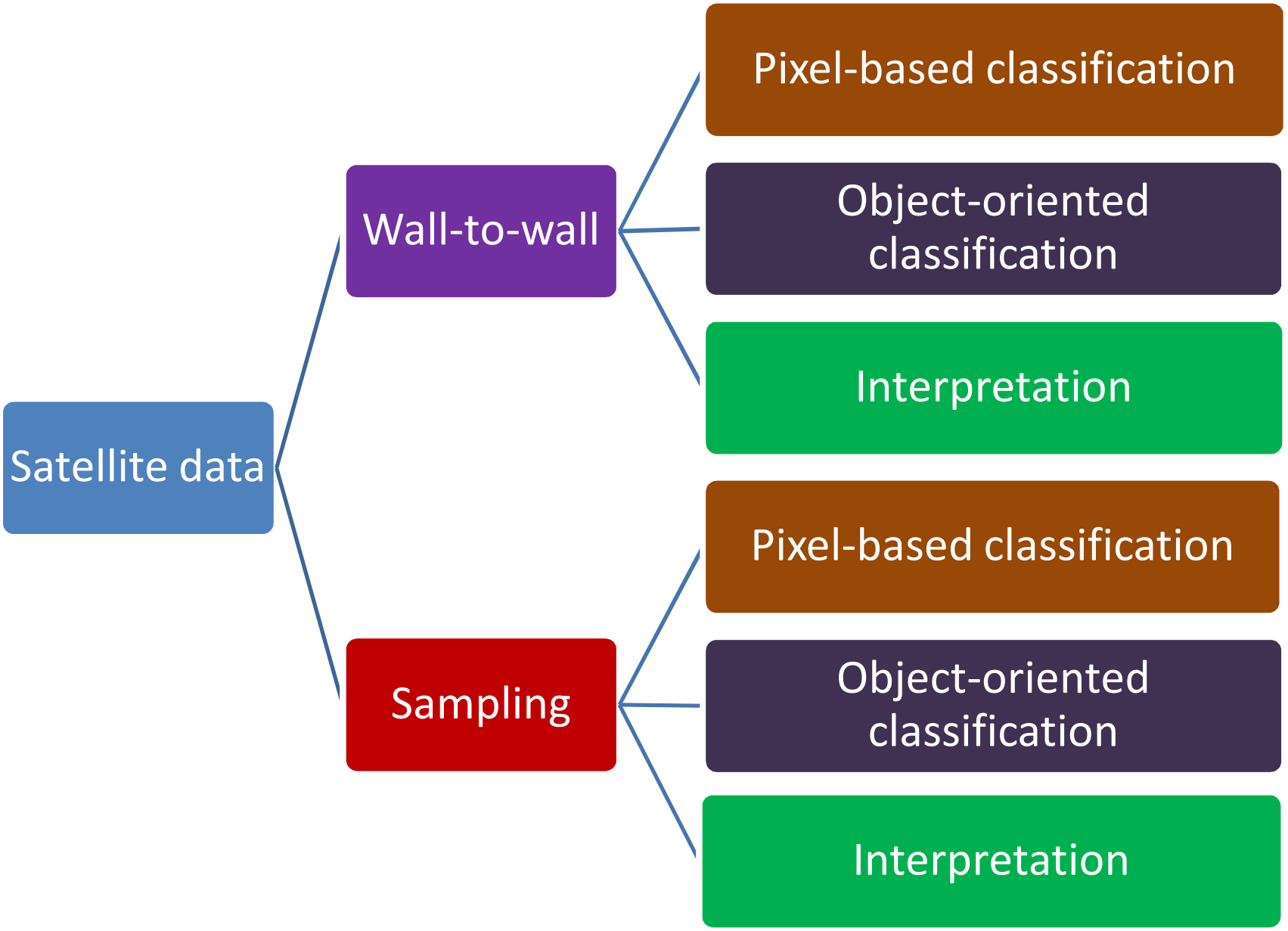
1. (d) To establish, according to national circumstances and capabilities, robust and transparent national forest monitoring systems and, if appropriate, sub-national systems as part of national monitoring systems that:

(i) Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest changes;

(ii) Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities;

(iii) Are transparent and their results are availableand suitable for review as agreed by the Conference of the Parties;

Monitoring of forests by remote sensing



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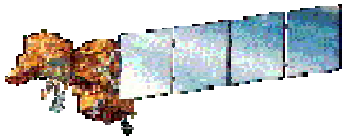
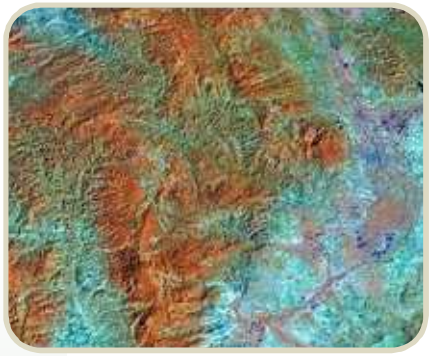
Forest monitoring using satellite remote sensing





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 ?

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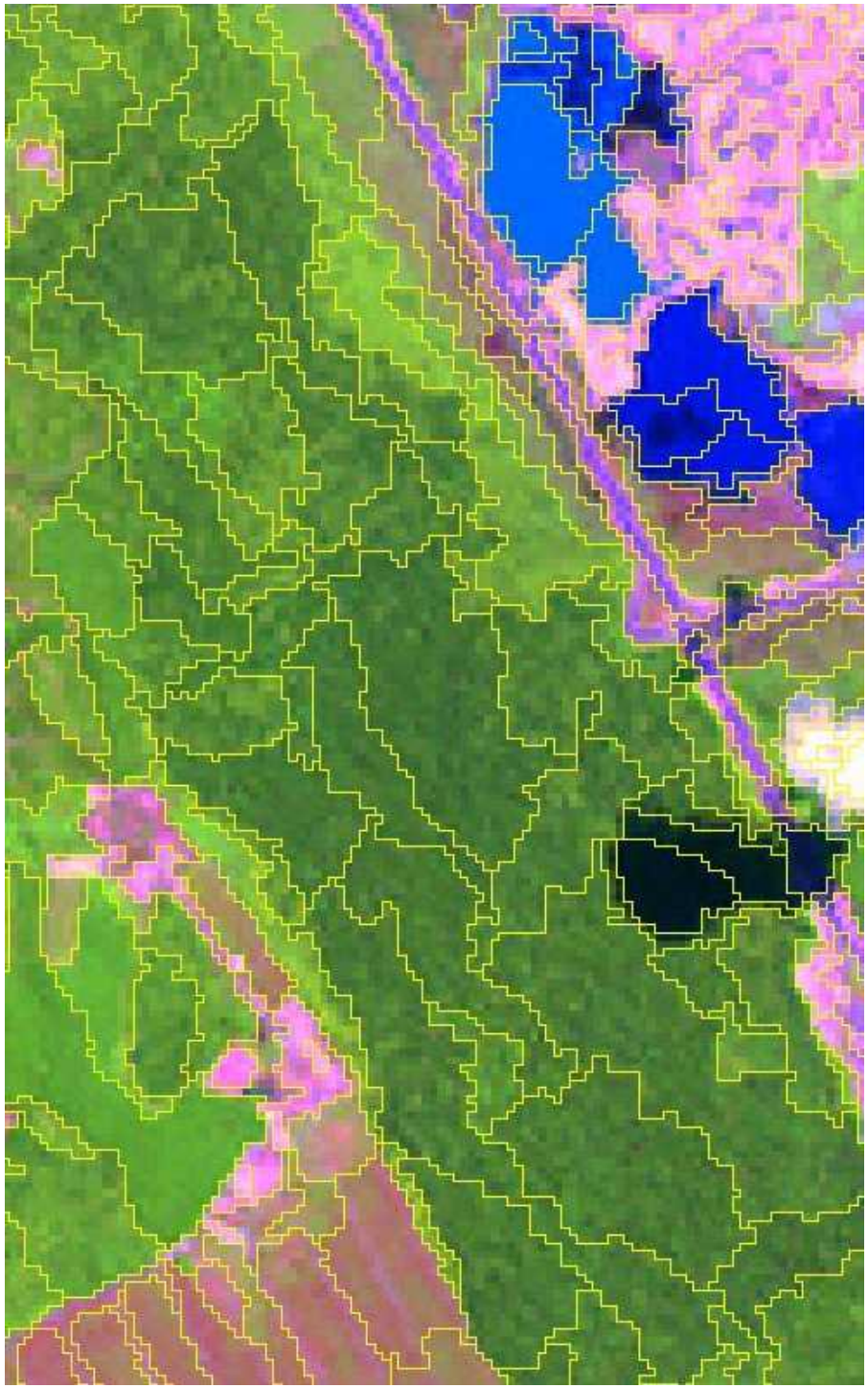
Object-oriented classification

- The object-oriented approach is effective in segmenting an area that consists of various land cover types into objects with extensions of similar properties (Lamonaca et al. 2008).
- Classification results that is similar to human interpretation
- Advantage of handling by object (segment)



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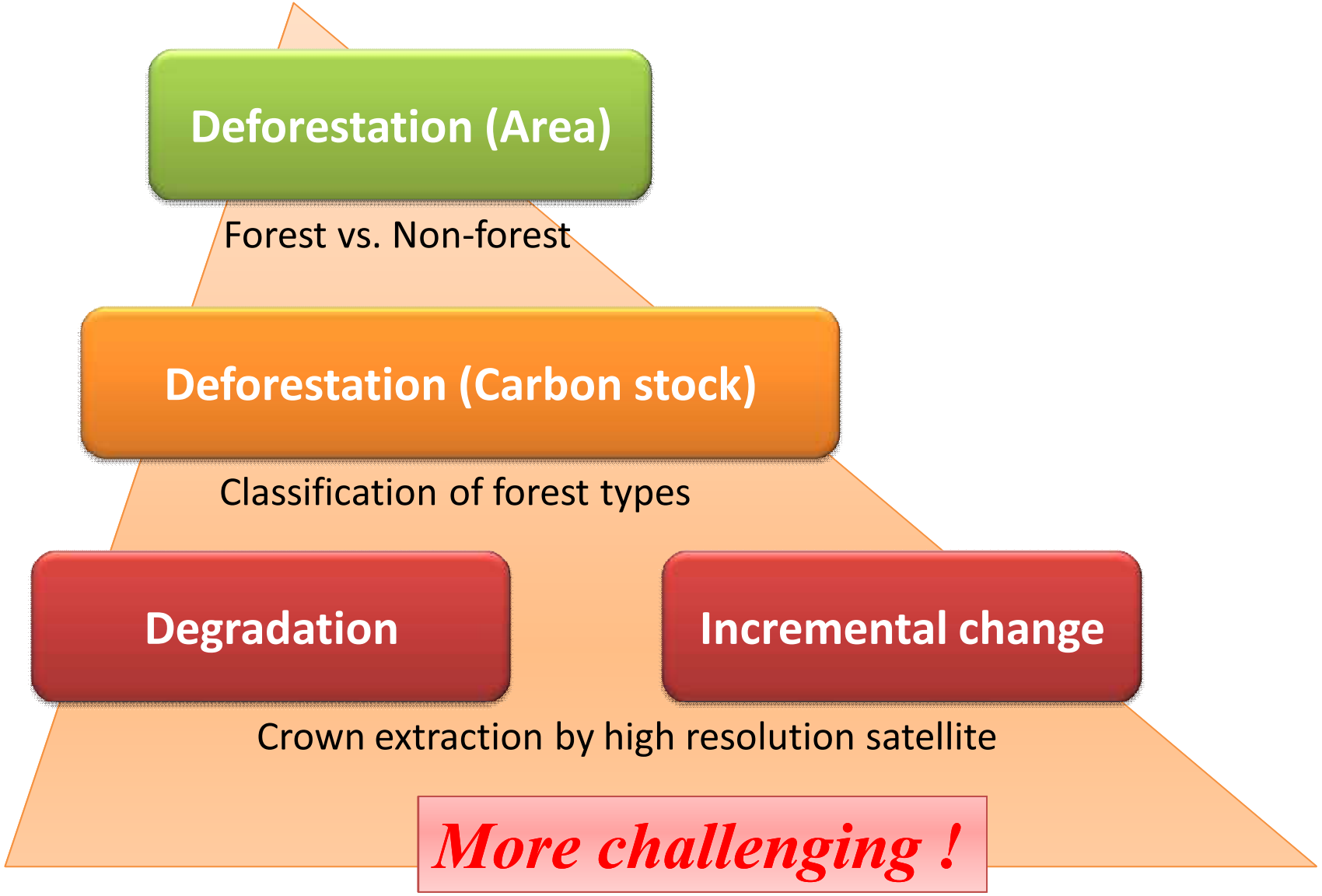
The challenges of forest monitoring



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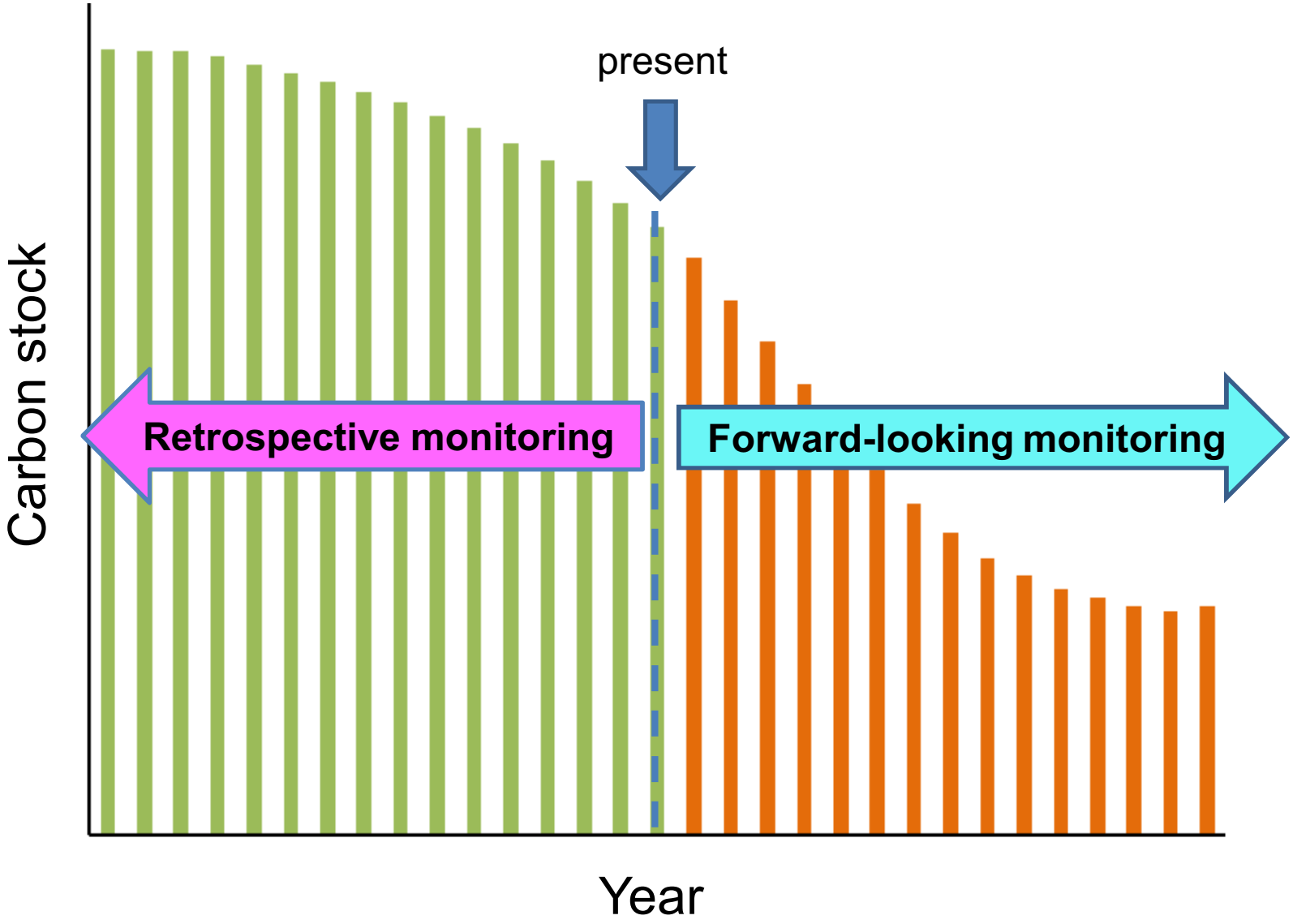
Two types of forest monitoring required for REDD



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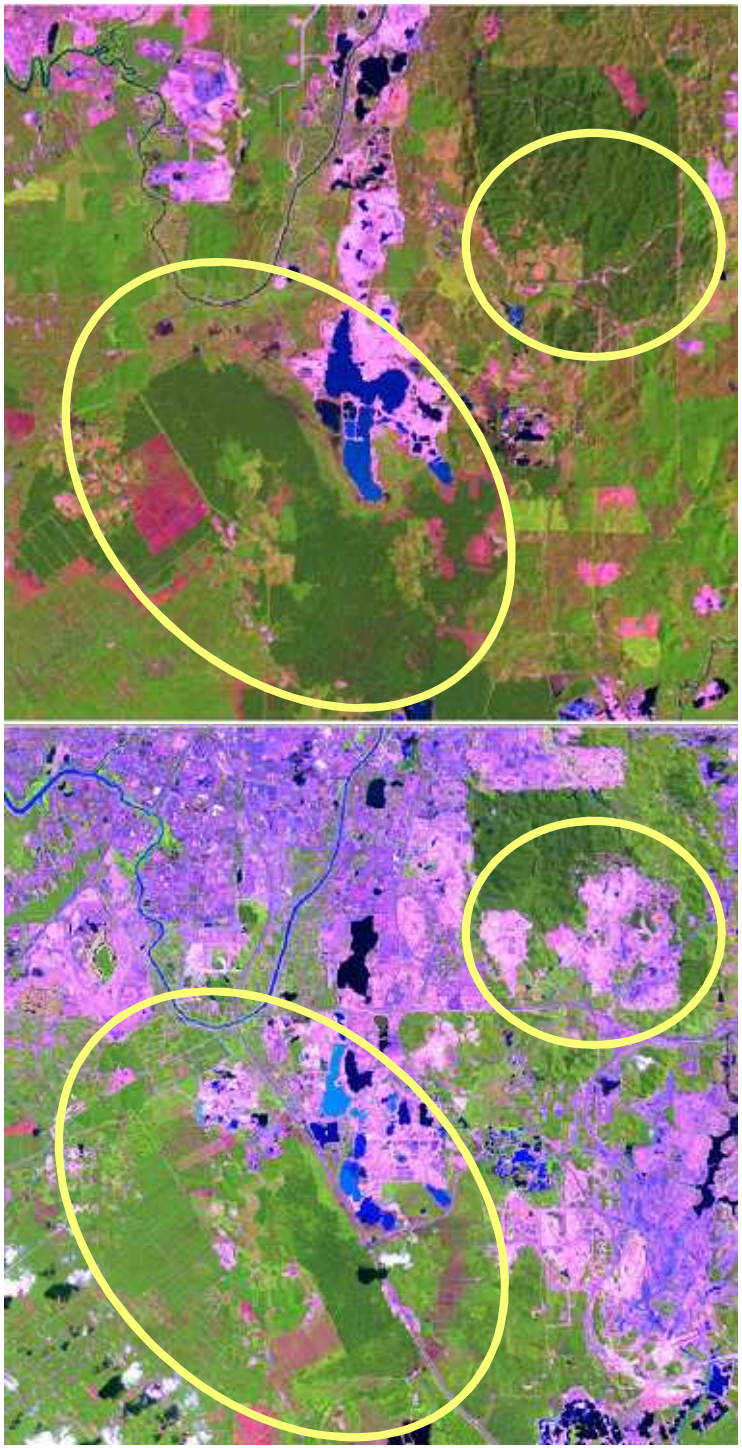
Monitoring of deforestation

- Extracting changes of land use category
- Using properties of reflectance of each category
- Comparing multi-temporal
- Available to identify forest type change



Deforestation in Malaysia
Landsat imagery
Upper 1989 yr, lower 2001 yr

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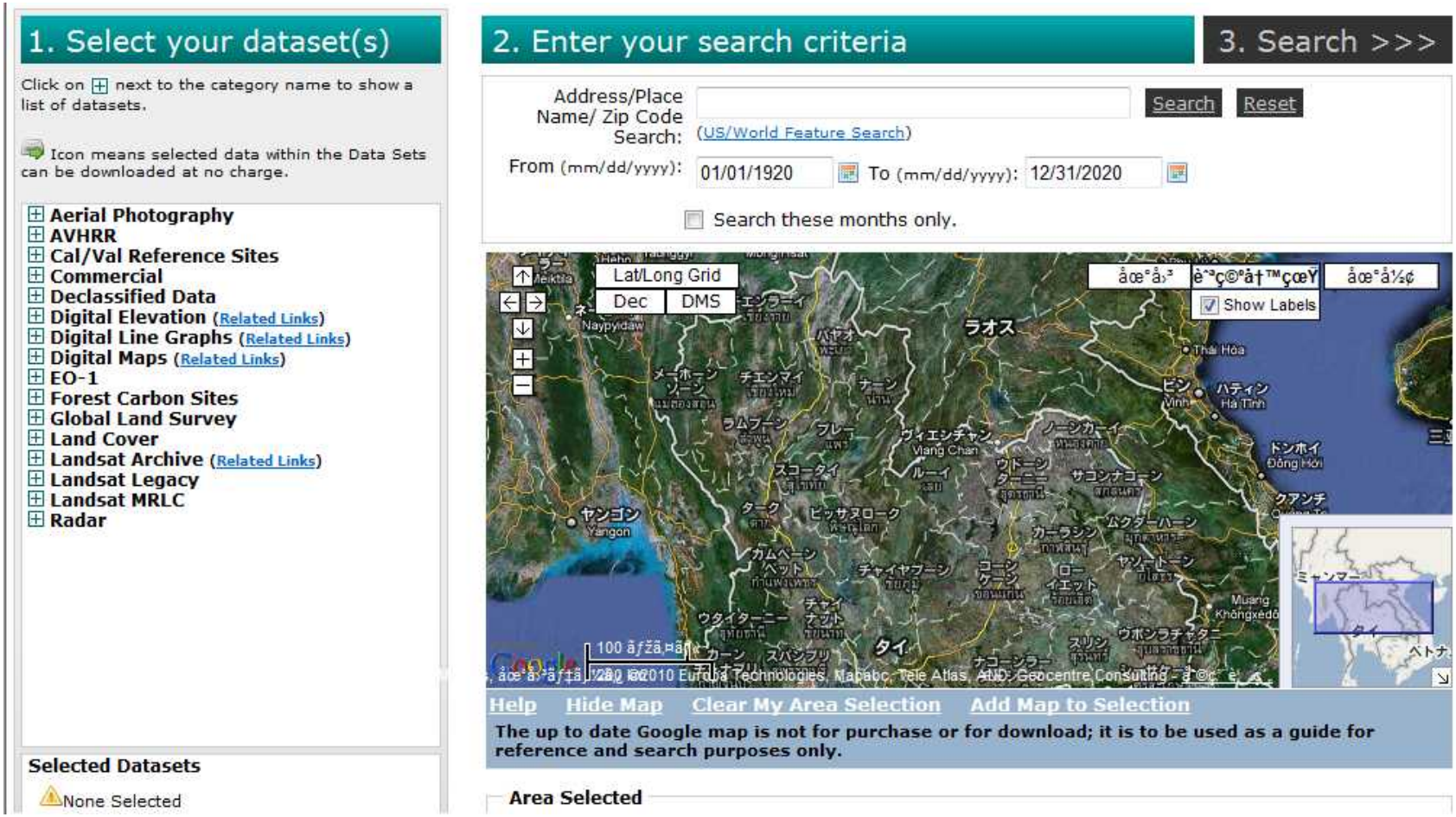
You can get Landsat data from USGS free



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Monitoring of forest degradation

- Various causes of degradation
  - Selective (illegal) logging
  - Forest fire
  - Intensive shifting cultivation
  - development
- Development of method as to each cause of degradation is required

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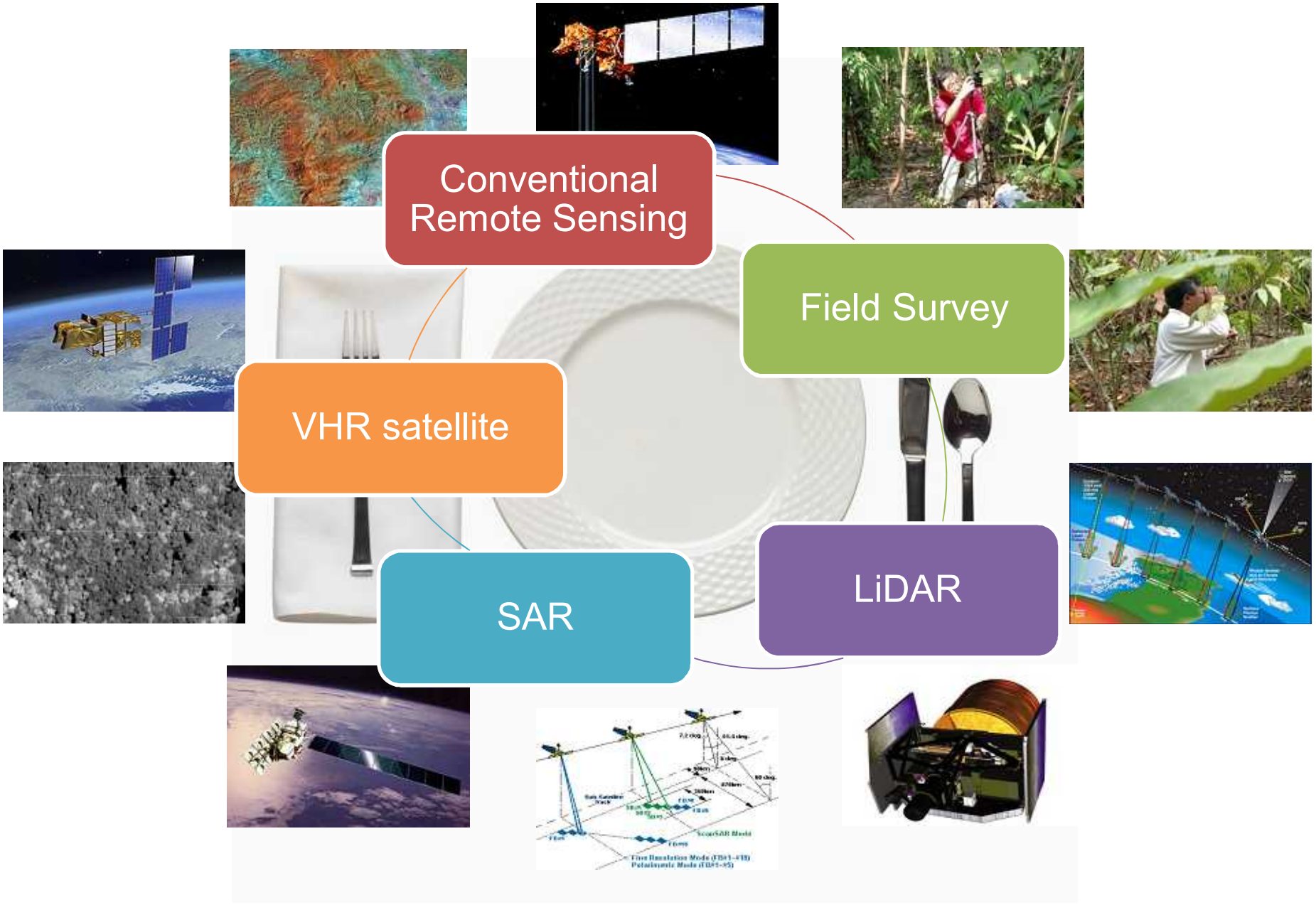
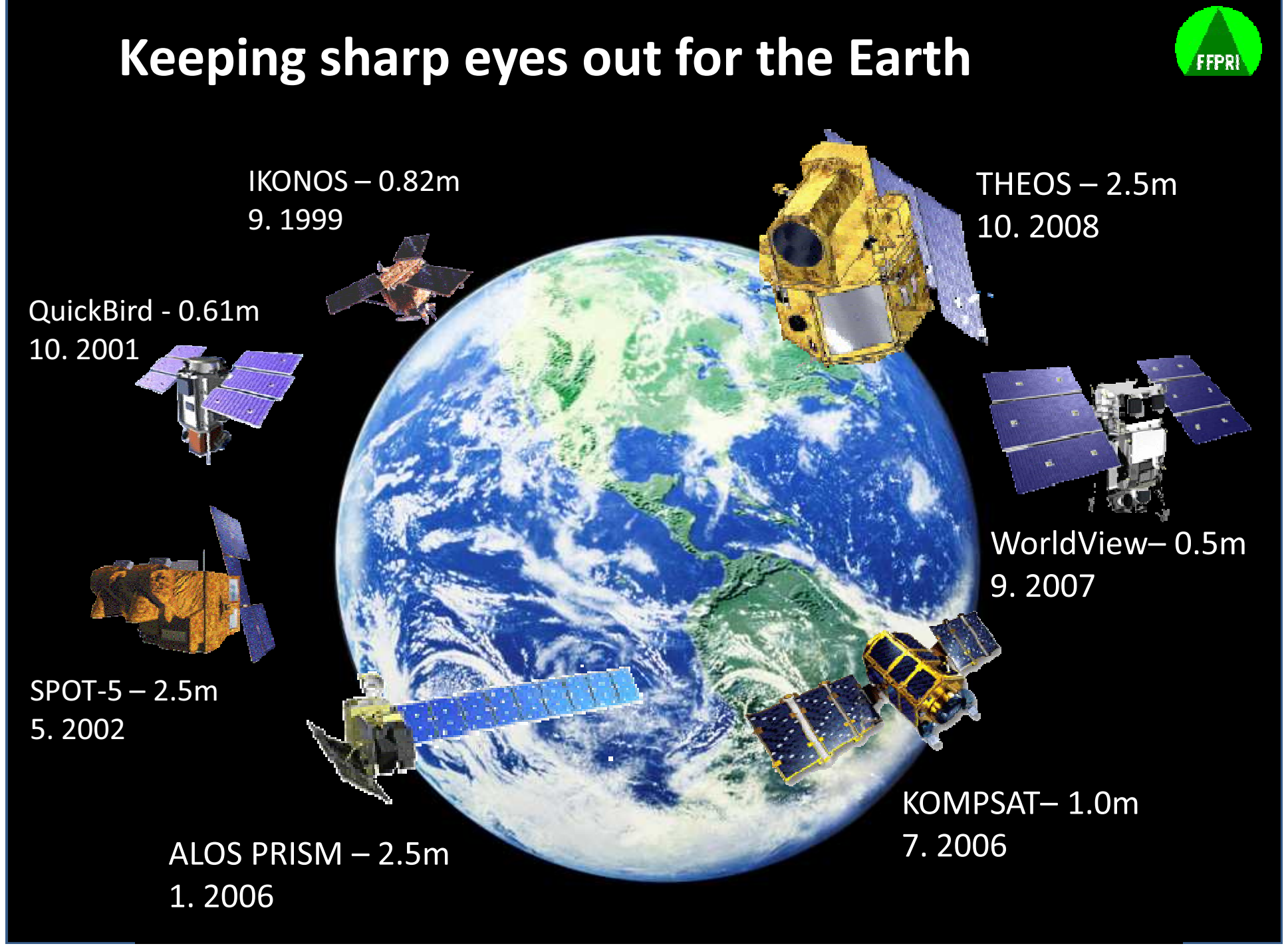
Which method should be selected?



Keeping sharp eyes out for the Earth



Another Choice: Google Earth

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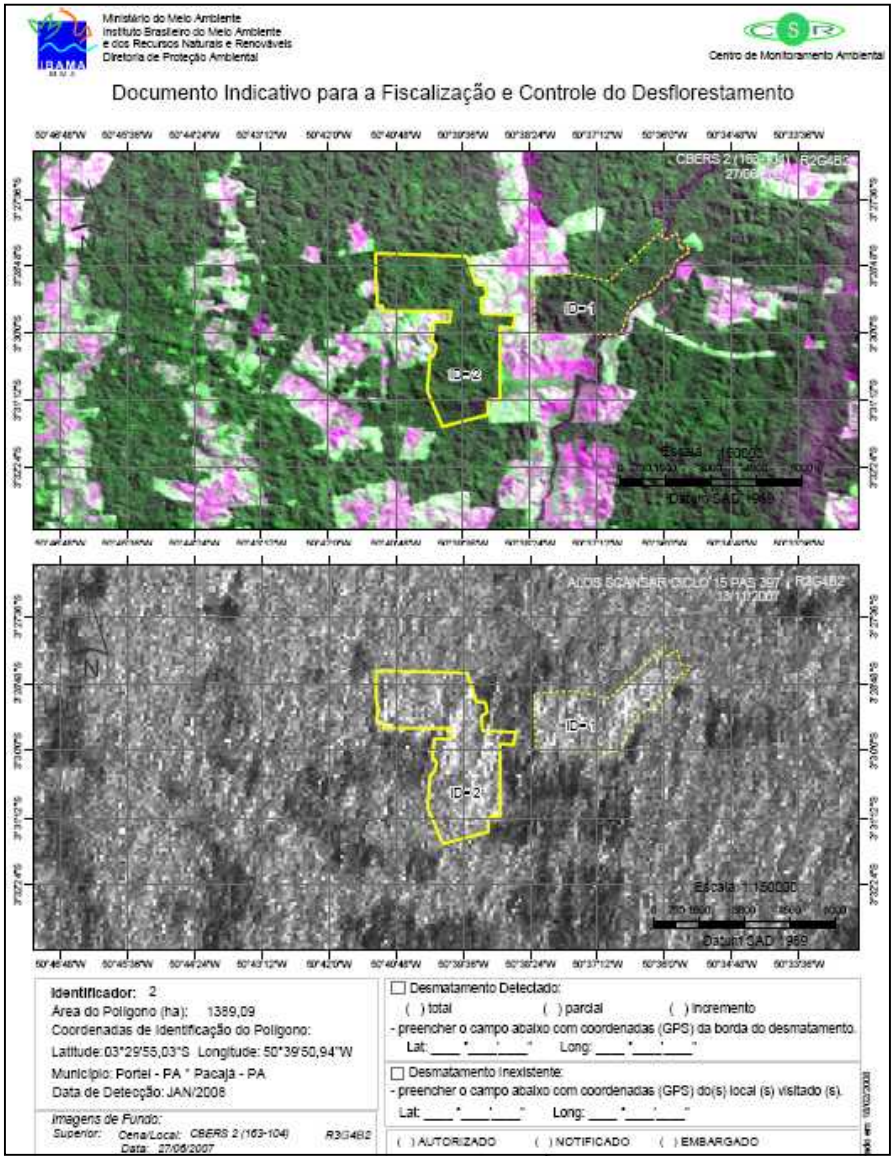
Detection of illegal deforestation using ALOS-PALSAR



Sources of uncertainty in various steps

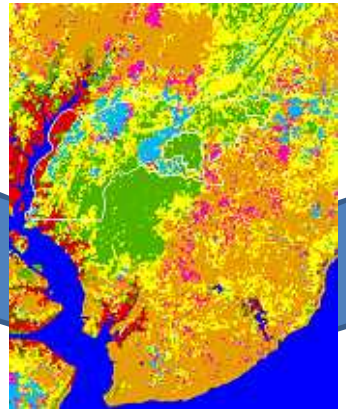
Observation

Sensor

Transformation

Data

Analysis



Thematic map

Use

Real World

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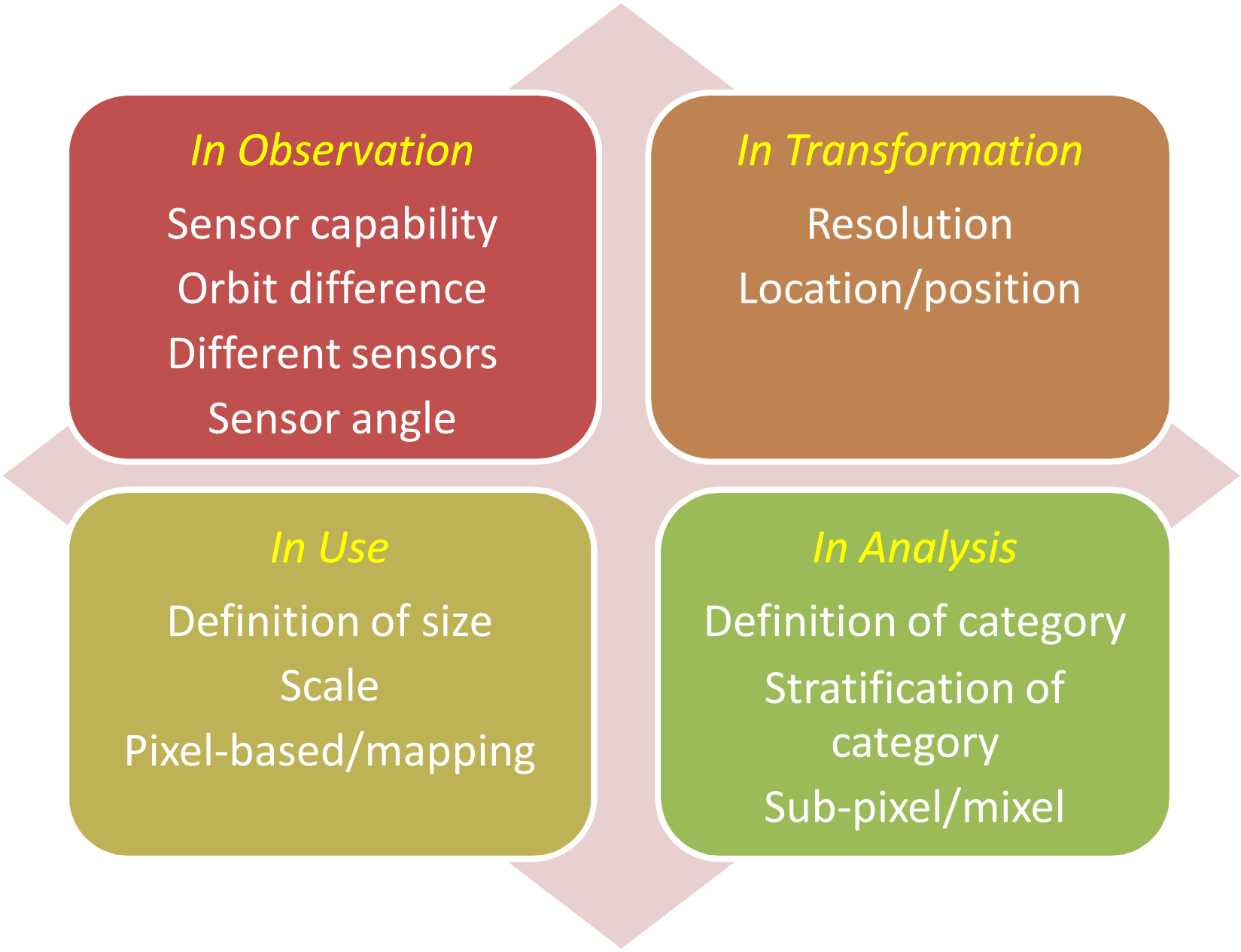
Uncertainty in various steps



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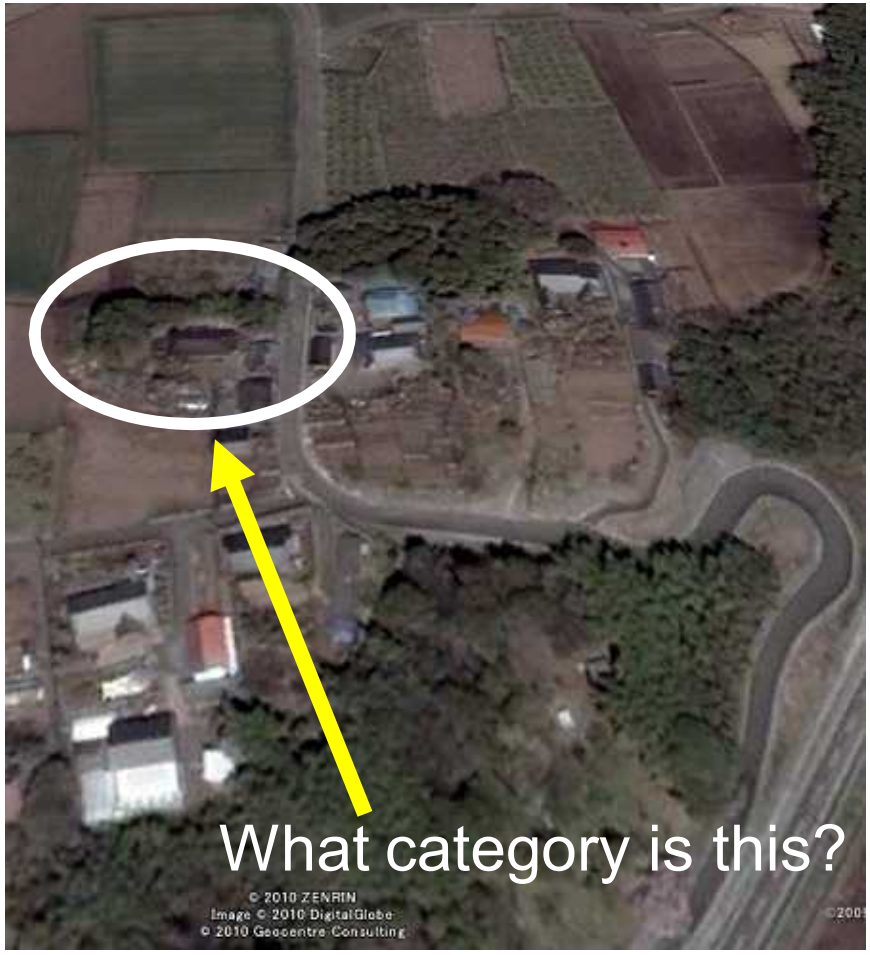
Uncertainty in definition
- for category or class of classification -

- Some land surface cannot be assigned to a certain category
- Gap between definition of category and remote sensing observation



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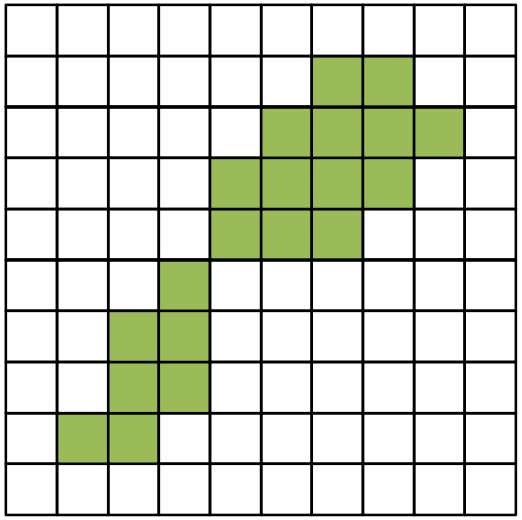
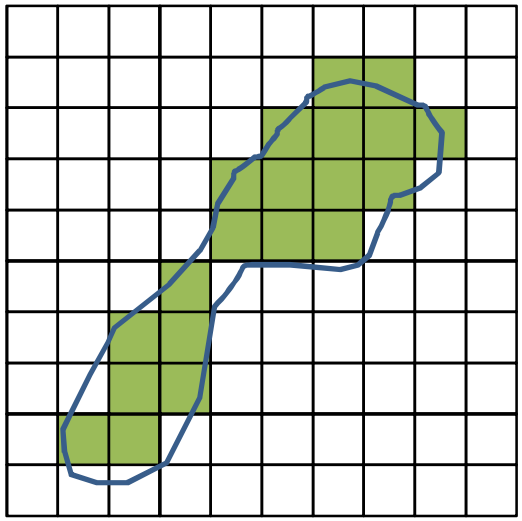
Uncertainty about definition
- minimal size and continuity -

Continuity or discontinuity?

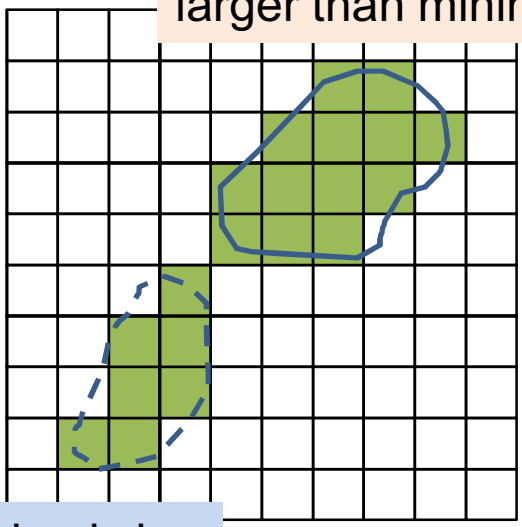


Area: 20 pixel unit



About 20 pixel unit

larger than minimal size



Smaller than minimal size

About 13 pixel unit

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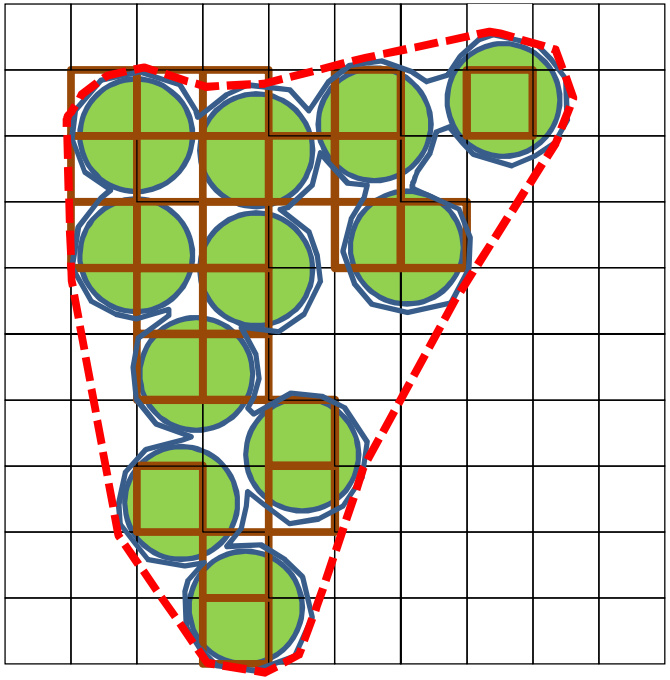
Uncertainty of boundary

- Boundary cannot be decided certainly
- Rule of recognition is required
- Effect on area estimate of category



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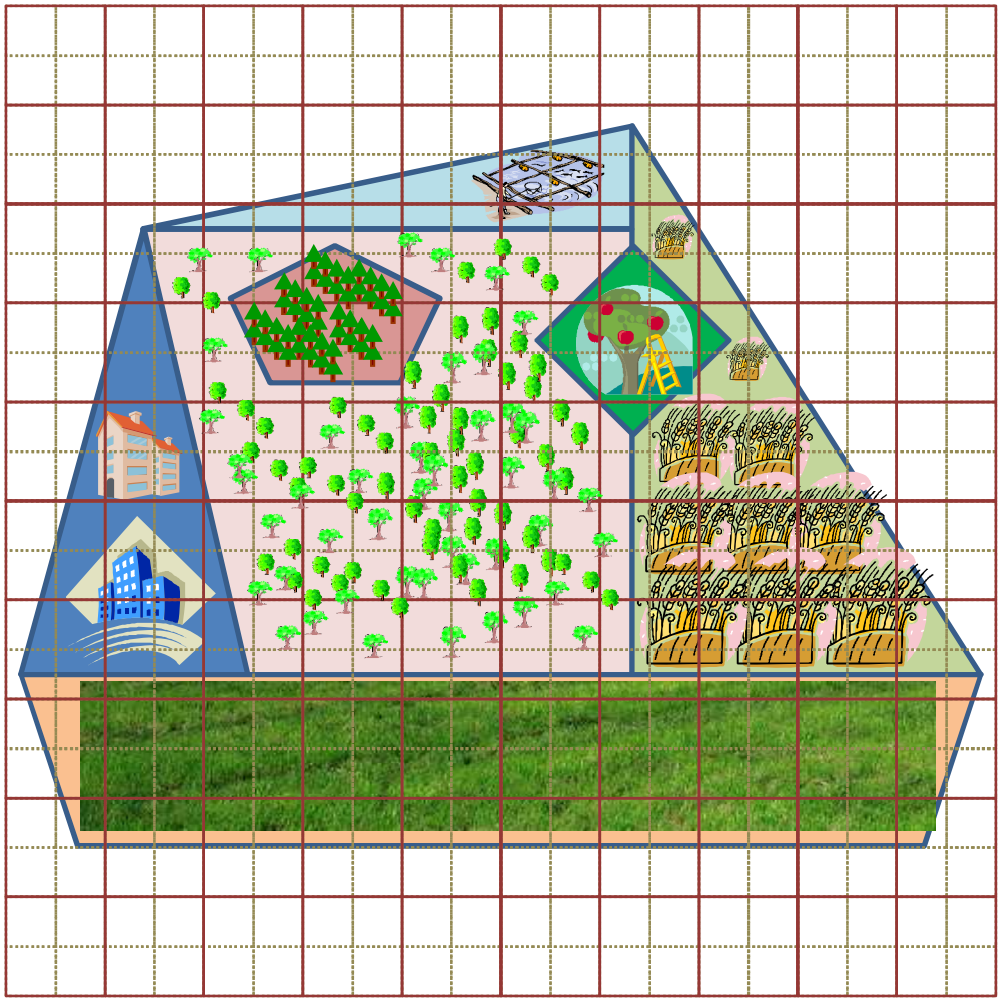
Further issues: Spatial resolution and mixel



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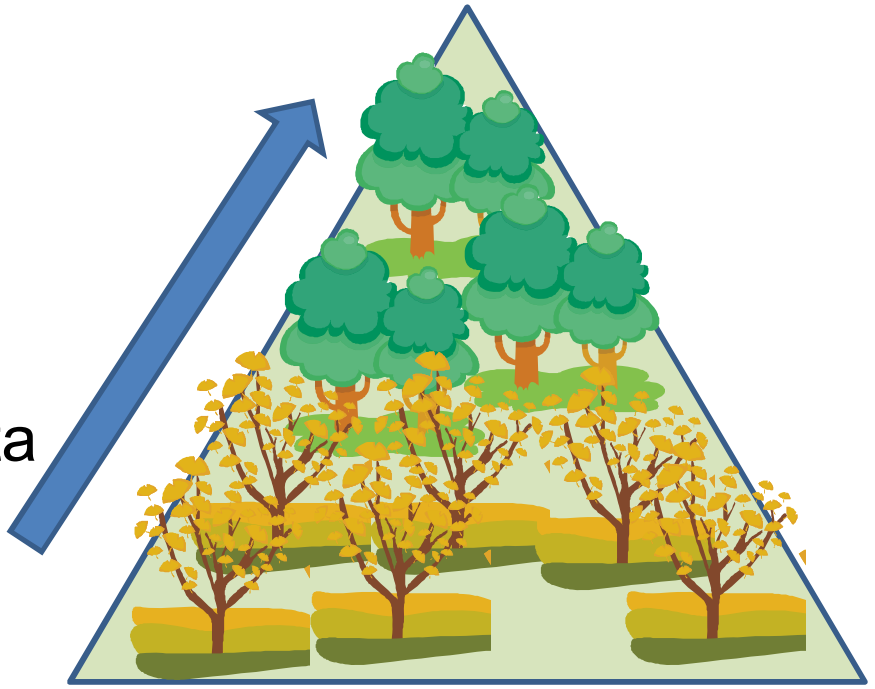
Further issues: Phenology or seasonality

- Elevation
- Latitude
- Annual change of fallen leaves
- Probability of acquiring data



Dryness (in tropical seasonal forest)

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Further issues: Agricultural land with trees

- Rubber plantation vs. plantation for timber production
- Shifting cultivation
  - Fallow land vs. abandoned area?
- Orchard vs. forest
- Similar reflectance of canopy surface

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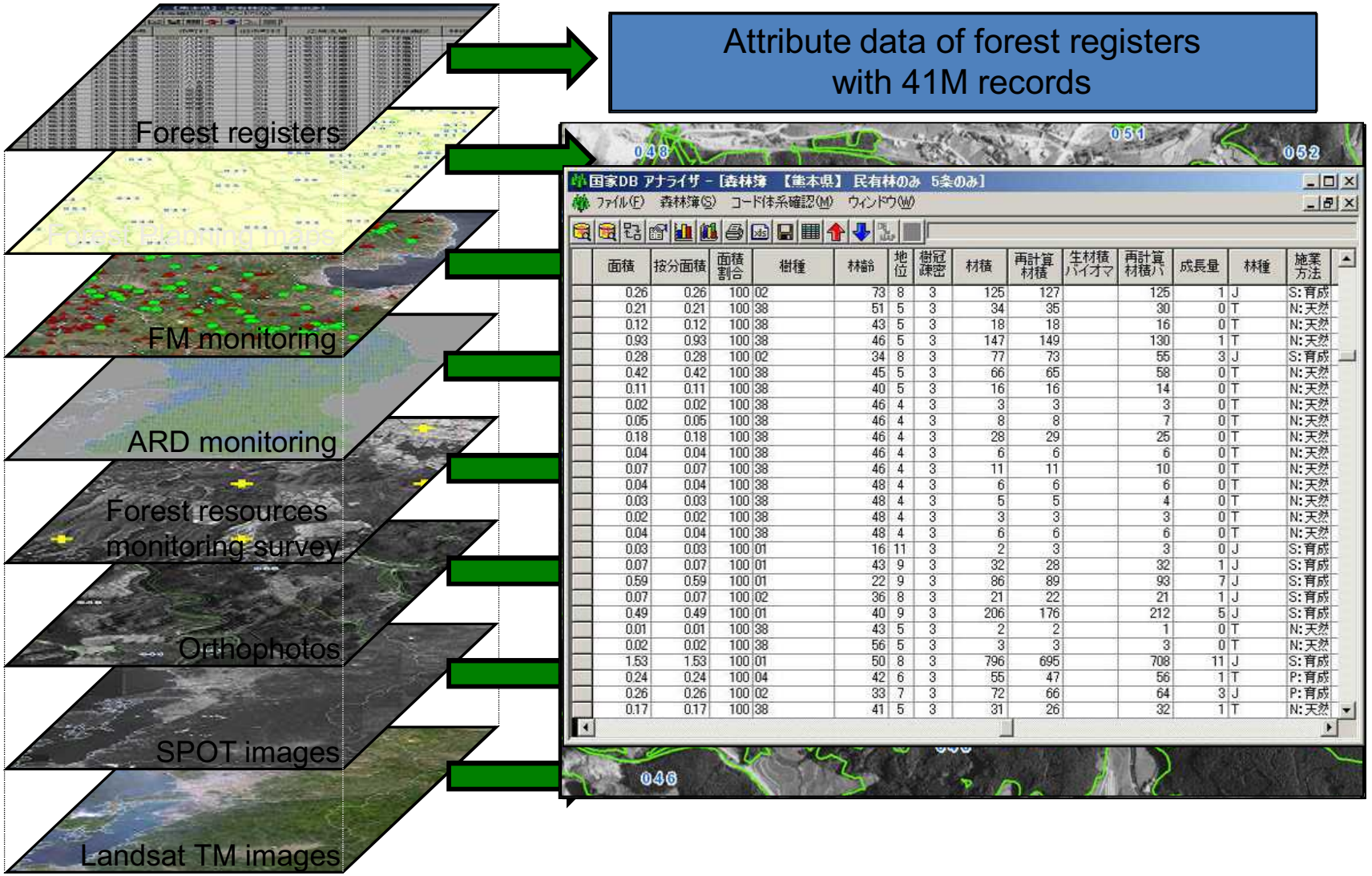
Japanese National Forest Resources Database for forest inventory



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