# Utilization of Global Map for GHG Inventory

WGIA8

14th July, 2010
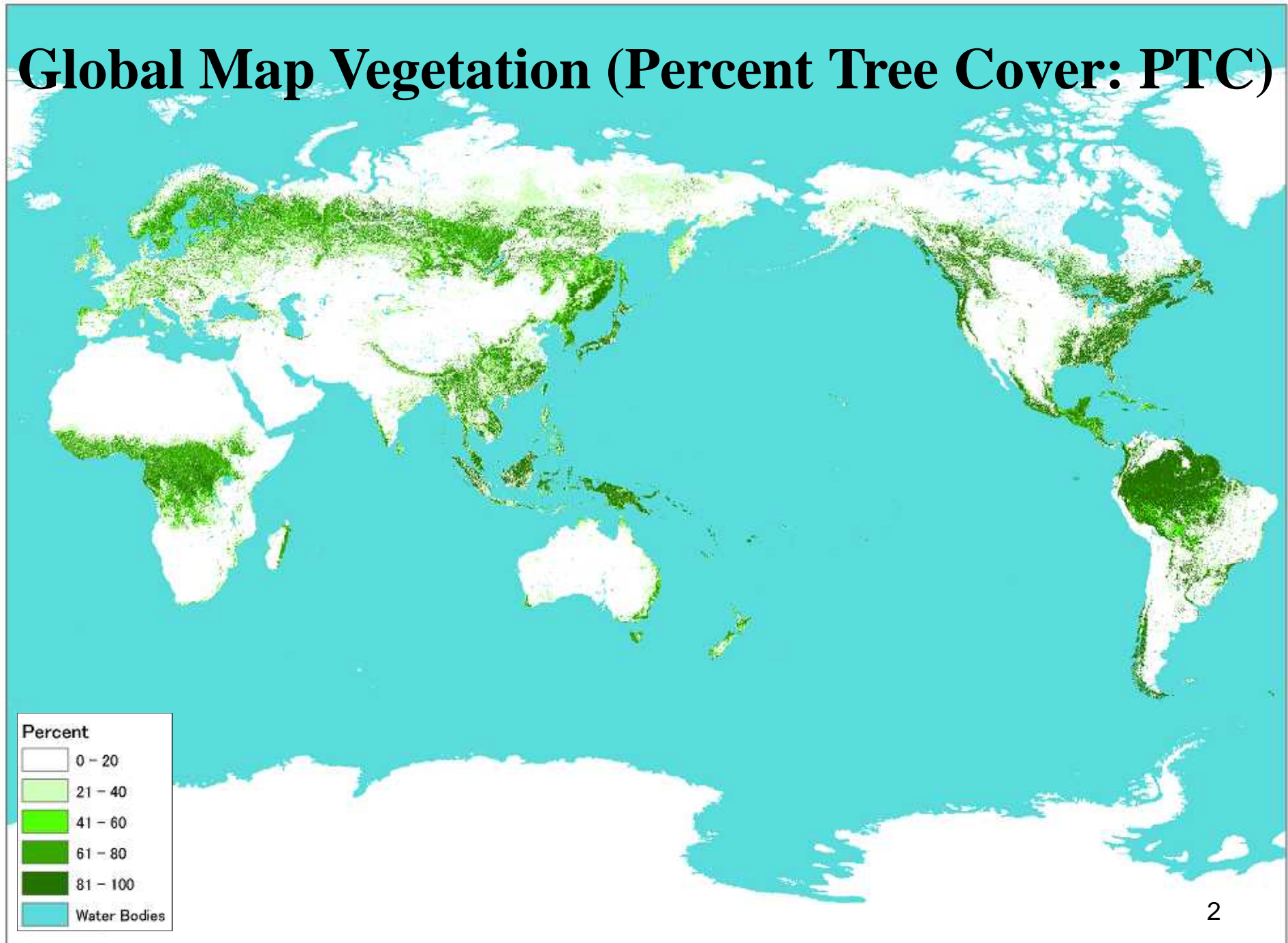
Vientiane, Lao P. D.R.

Noriko KISHIMOTO
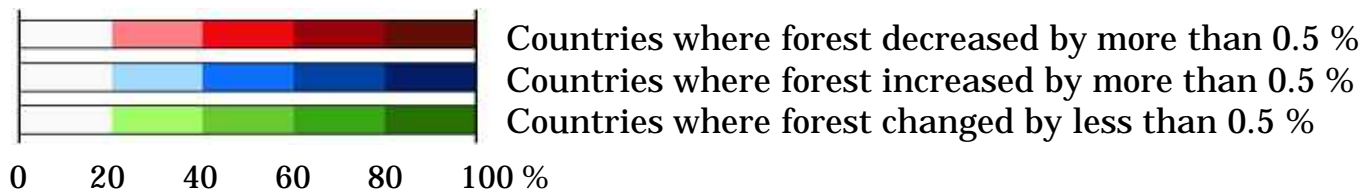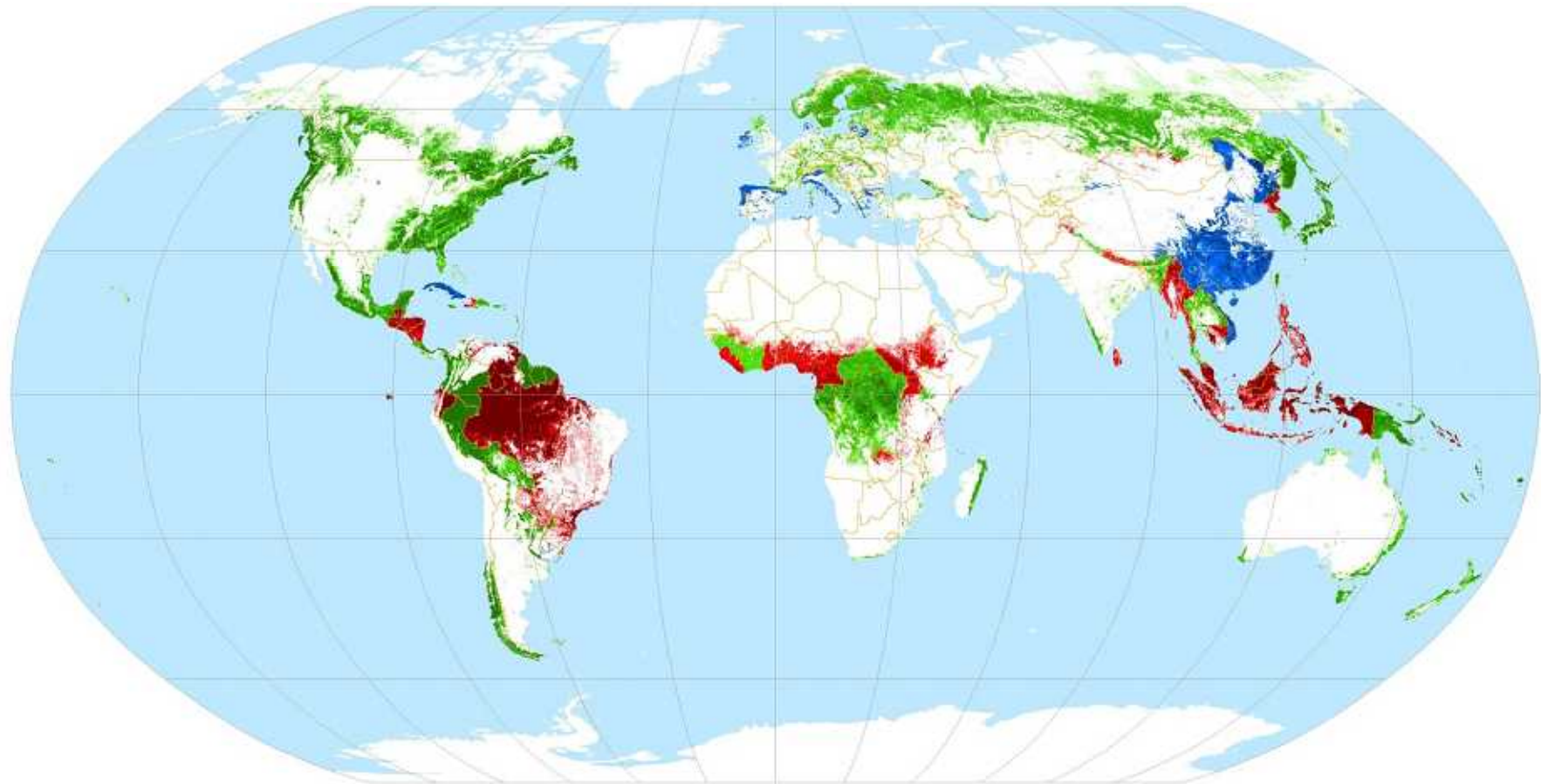
n-kishimoto@gsi.go.jp

Geospatial Information Authority of JAPAN

# Global Map Vegetation (Percent Tree Cover: PTC)



Percent
- 0 – 20
- 21 – 40
- 41 – 60
- 61 – 80
- 81 – 100
- Water Bodies

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GLOBAL MAP – Percent Tree Cover © Geographical Survey Institute, Chiba University and Collaborating Organizations

# Annual Change Rate of Forest Area (2000-2005)



Countries where forest decreased by more than 0.5 %
Countries where forest increased by more than 0.5 %
Countries where forest changed by less than 0.5 %

0    20    40    60    80    100 %

# Outline of the Global Map

# What is Global Map ?

**Digital Geographic Dataset**

- Covering the <u>whole land area </u>of the globe
- With <u>consistent specifications</u>
- <u>freely downloadable </u>for non-commercial use

**Global Mapping aims to contribute to**
- Solving and tackling with <u>global environmental issues</u>
- Achieving <u>sustainable development</u>
- Mitigating large scale <u>disasters</u>

# Global Map Specifications

- Spatial resolution: **1km**

  equivalent to  1:1million scale

- **8 layers**

– Vector data  area, line, point

<span style="color:red">Transportation,  Boundaries</span>

<span style="color:red">Drainage,  Population centers</span>

– Raster data  grid

<span style="color:red">Elevation,  Vegetation (Percent Tree Cover),</span>

<span style="color:red">Land Cover,  Land Use</span>

- Update interval: **Five years**

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# Vector Data

| Transportation | Boundary | Drainage | Population Centers |
|---|---|---|---|
| Road, Railway, Airport | Coastline, Administrative boundaries | River, Inland water, Dams | Location, Name of Cities |

# Raster Data

| Elevation | Vegetation (Percent Tree Cover) | Land cover | Land use |
|---|---|---|---|
| 1m step information | Percent tree cover | 20 categories | 9 categories |
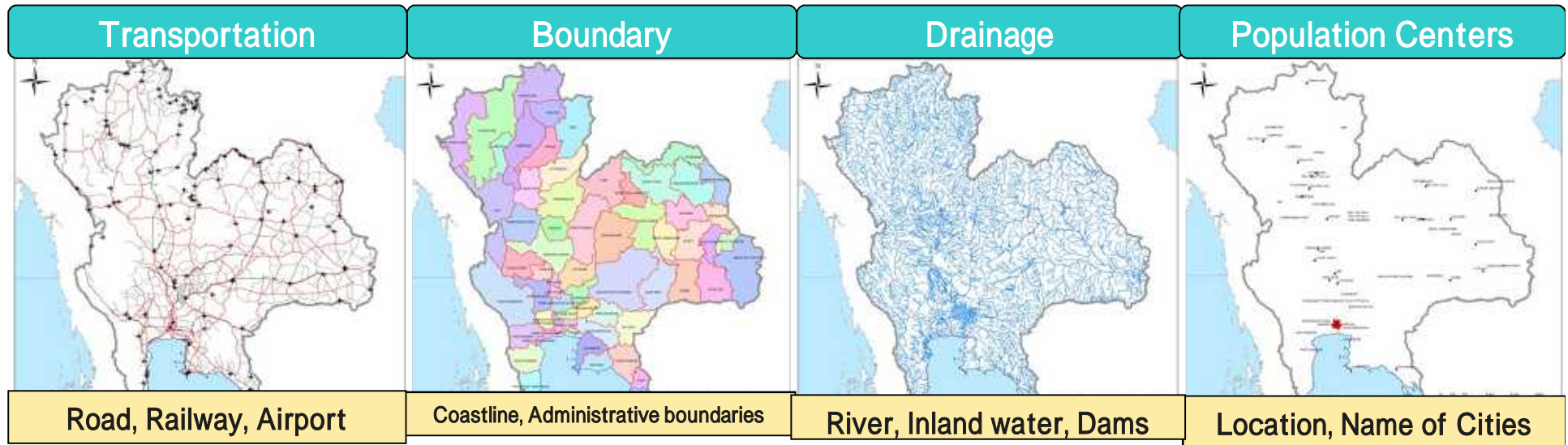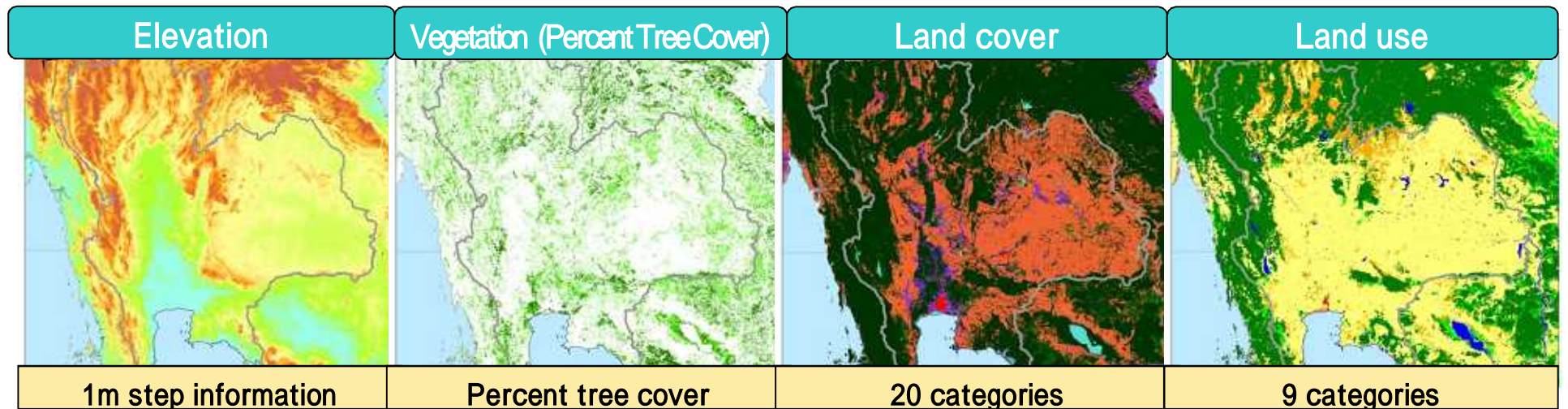
# Global Mapping Project

**Who makes Global Map?**

Each National Mapping Organization (NMO)

- Responsible for developing data of its own country
- Supported by other NMOs, aid organizations

**Coordinating Mechanism**

- ISCGM (International Steering Committee for Global Mapping)

  formulate policies and manage project progress

- Secretariat : GSI (Geospatial Information Authority of Japan)

# Progress of Global Mapping Project

As of 2009-12-25
International Steering Committee for Global Mapping
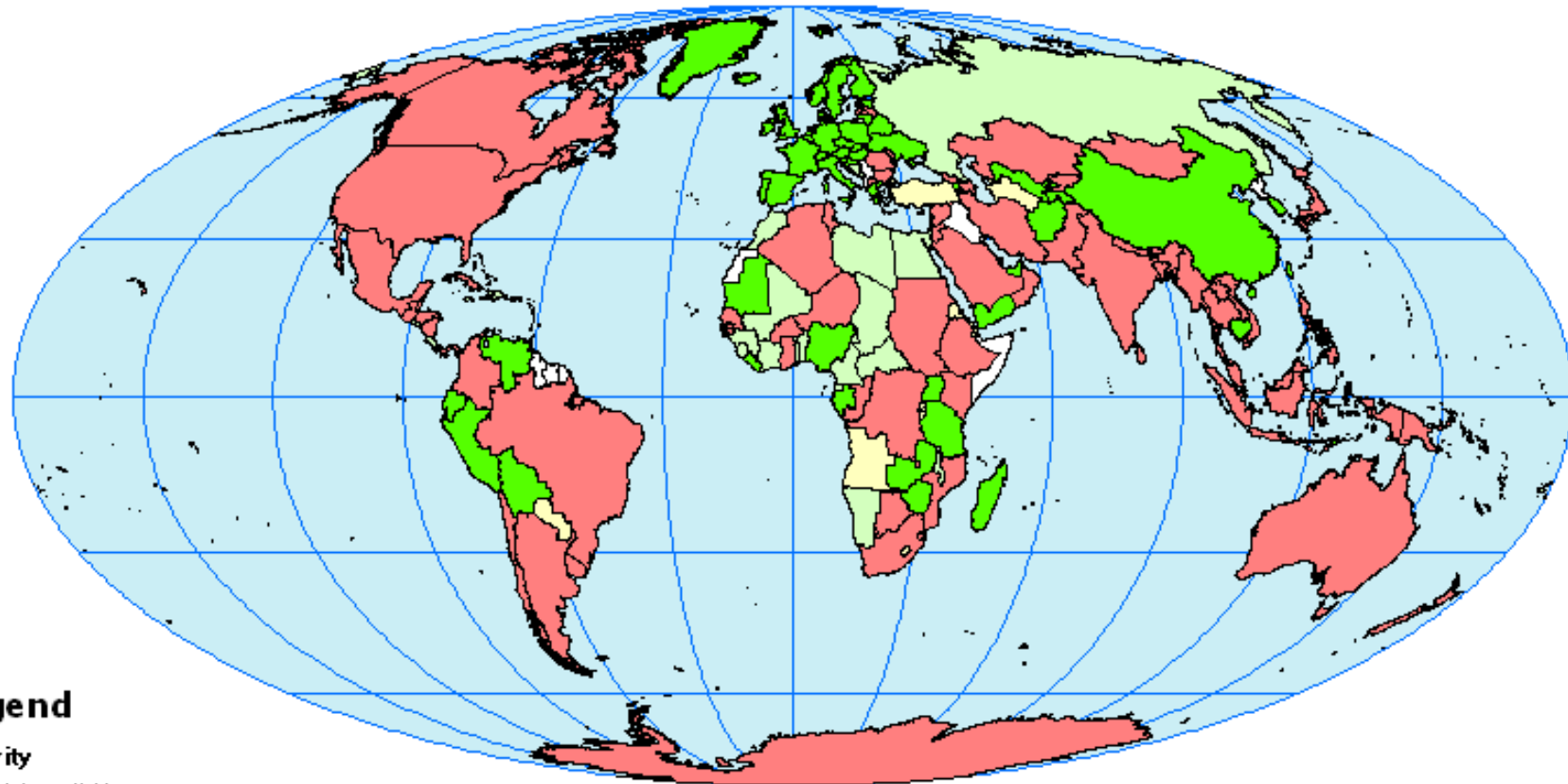
## Legend

**maturity**

- data available
- data for verification
- developing data
- considering joining the project
- not participating in the project

Most elevation data of current Global Map are compiled from GTOPO30, contribution of United States of America.

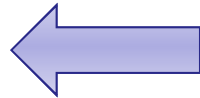This map is for the purpose of reference and the boundaries in this map are not authorized by any organizations.

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# Why Global Map
## for addressing Climate Change
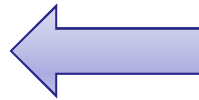
**Comparability** ⬅
- Global Coverage
- Consistent specifications
- 5-year update

**Usability** ⬅
- Essential environmental data
- Open data policy
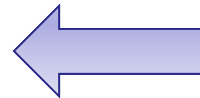
**Reliability** ⬅
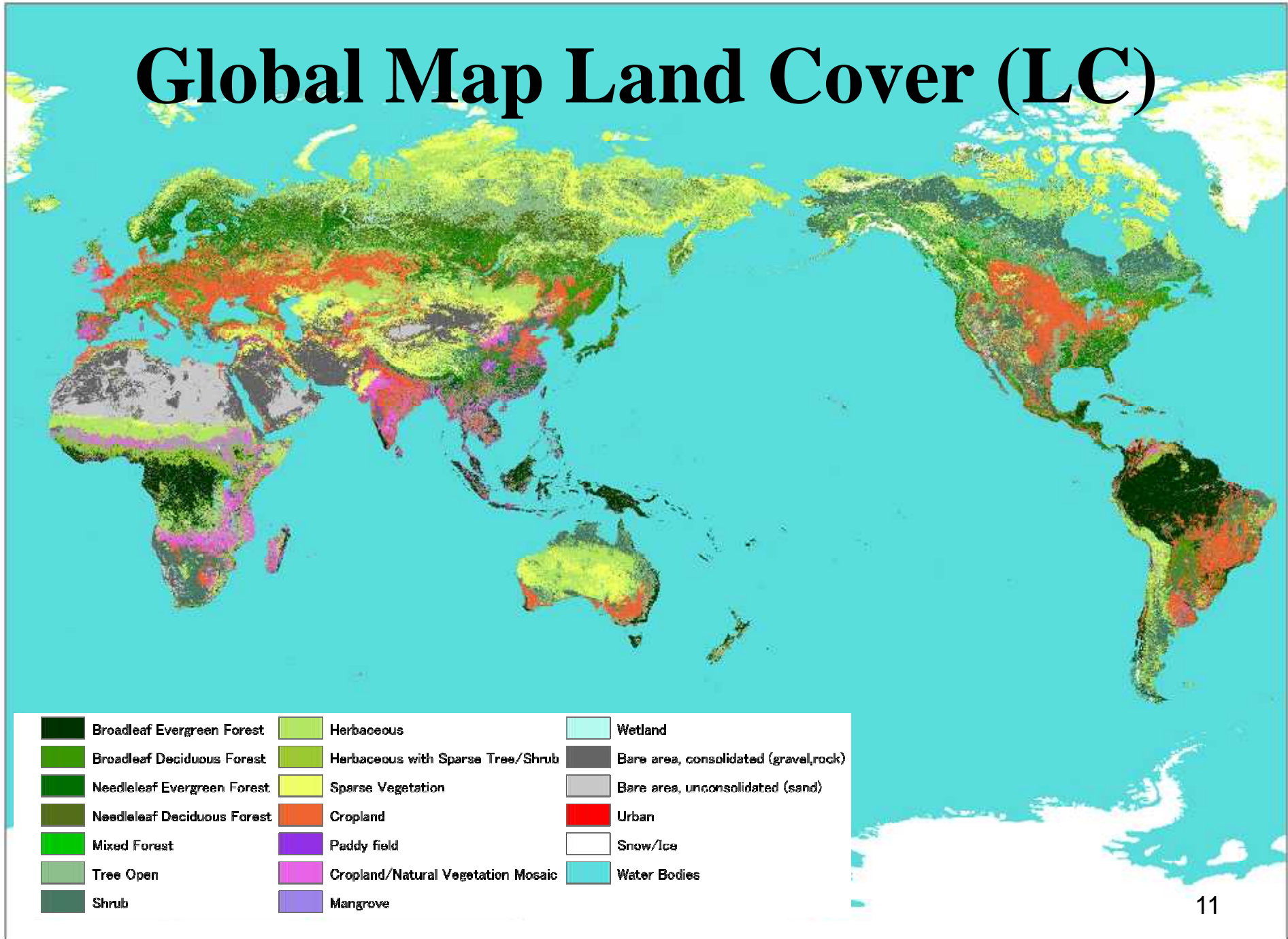- Government authorization

⬇
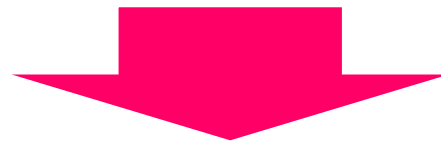
Analyses based on Global Map
contribute to ensuring equitability and effectiveness
in Climate Change Policy Framework

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# Global Map Land Cover (LC)

Legend:

- Broadleaf Evergreen Forest
- Broadleaf Deciduous Forest
- Needleleaf Evergreen Forest
- Needleleaf Deciduous Forest
- Mixed Forest
- Tree Open
- Shrub
- Herbaceous
- Herbaceous with Sparse Tree/Shrub
- Sparse Vegetation
- Cropland
- Paddy field
- Cropland/Natural Vegetation Mosaic
- Mangrove
- Wetland
- Bare area, consolidated (gravel,rock)
- Bare area, unconsolidated (sand)
- Urban
- Snow/Ice
- Water Bodies

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Global Map – Land Cover (GLCNMO) © Geographical Survey Institute, Chiba University and Collaborating Organizations

# Data sources

- **Primary source data :** <u>MODIS data in 2003</u>, which is 7-band, <u>1-km resolution </u>and eight periods of 16-day composite

- **Training Data :**
  - 1607 polygons for supervised classifications, collected from Landsat images,
  - MODIS NDVI seasonal change patterns,
  - NMO's comments on the reference of satellite images and regional maps

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# Vegetation (Percent Tree Cover)

- The ratio of the area covered with branches and leaves of trees (tree canopy) to the ground surface seen from the above (vertical direction).

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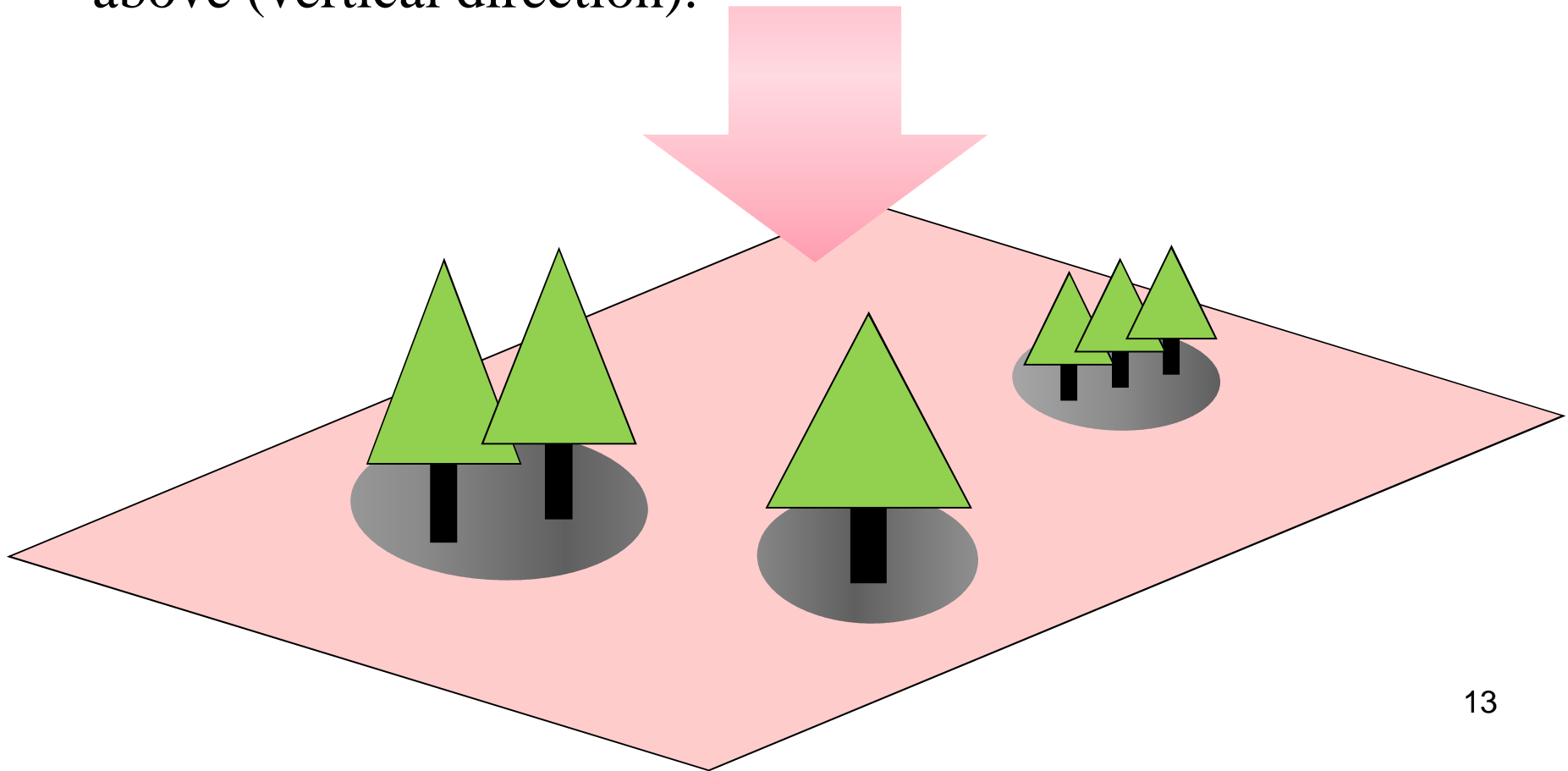
# Major points of PTC

- Value range: from 0% to 100% with interval of 1 %

- Definition of Tree: woody perennial with a single main stem or in the case of coppice with several stems, having more or less a definite crown

- Height threshold value of tree: approximate 3-5 meters at minimum

- Training data: derived from 221 satellite images

# Deforestation of the Amazons Forests



Global Map Land Cover Data

( )LANDSAT5 TM 1986 7 15
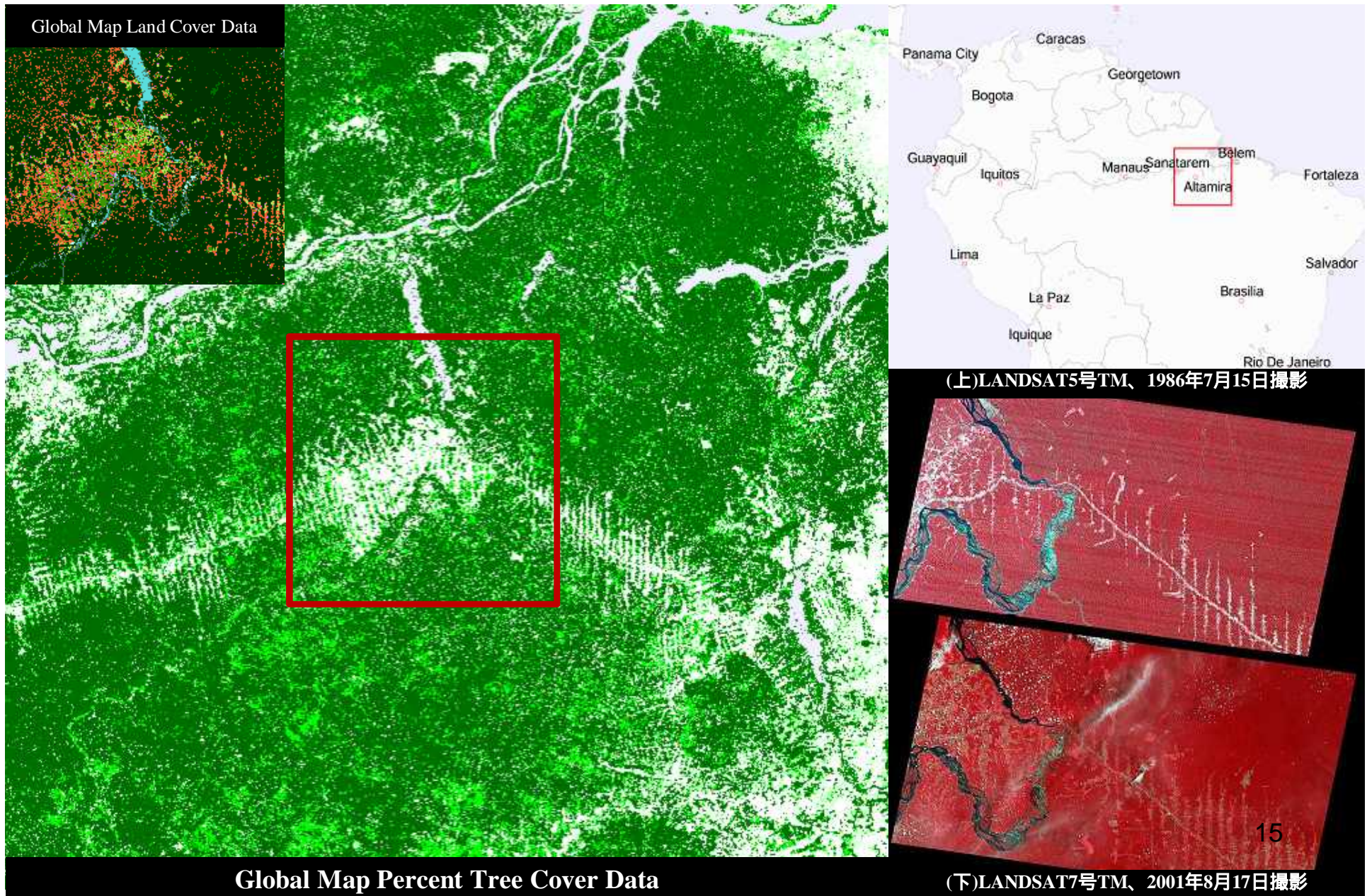
**Global Map Percent Tree Cover Data**

( )LANDSAT7 TM 2001 8 17

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# Global Map Version 2

- Global Map Version 2 is now under construction
  - Data source: MODIS data in 2008 on 500m resolution
  - Data release: around 2013

## Comparison of Data Source



Global Map Version1
1km resolution, 2003
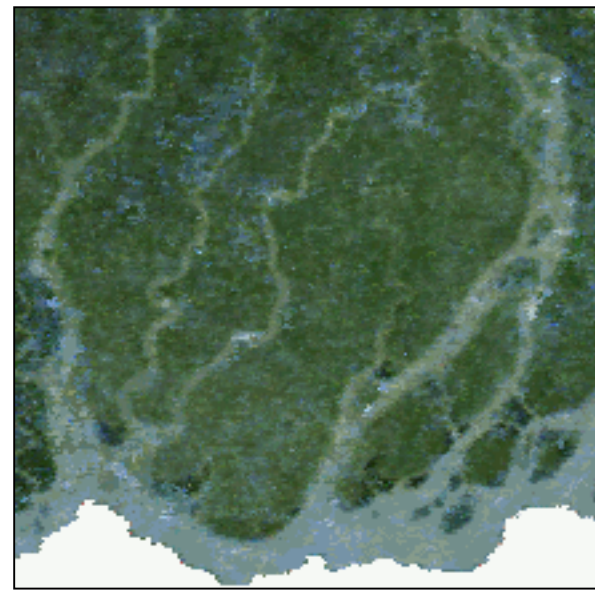


Global Map Version2
500m resolution, 2008

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# For GHG Inventory

Procedure to calculate
each area of categories of
Land Cover and Percent Tree Cover

# How to Utilize GM LC to LULUCF

*This integration is just a sample
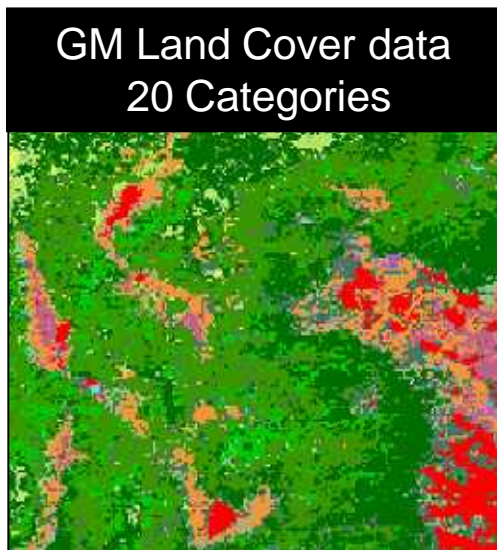
**Calculate each area of 20 categories of Global Map Land Cover**

GM Land Cover data
20 Categories

| Global Map Land Cover 20 Categories | Estimate emissions and removals of GHGs | Integrate the amount of GHSs into LULUCF 6 categories | LULUCF 6 land-use categories |
|---|---|---|---|
| Broadleaf Evergreen Forest | | | Forest land |
| Broadleaf Deciduous Forest | | | |
| Needleleaf Evergreen Forest | | | |
| Needleleaf Deciduous Forest | | | |
| Mixed Forest | | | |
| Tree Open | | | |
| Mangrove | | | |
| Shrub | | | |
| Herbaceous | | | Grassland |
| Herbaceous with Sparse Tree/Shrub | | | |
| Sparse vegetation | | | |
| Cropland | | | Cropland |
| Paddy field | | | |
| Cropland/Other Vegetation Mosaic | | | |
| Wetland | | | Wetlands |
| Urban | | | Settlements |
| Bare area, consolidated (gravel, rock) | | | Other land |
| Bare area, consolidated (sand) | | | |
| Snow/Ice | | | |
| Water | | | |

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# How to Utilize GM PTC to LULUCF

GM PTC data
100 Categories
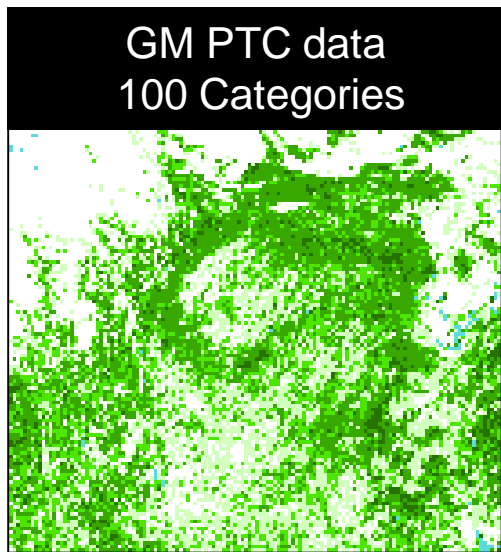
Calculate each percentage of Global Map PTC

| Percentage of Tree Cover | Area Mha | Percentage× Area Mha |
|---|---|---|
| 0% | 0.12 | 0 |
| 1% | 0.97 | 0.0097 |
| 2% | 1.59 | 0.0318 |
| 3% | 0.82 | 0.0248 |
| 4% | 0.47 | 0.0188 |
| 5% | 0.31 | 0.0155 |
| 97% | 5.25 | 5.0941 |
| 98% | 2.62 | 2.5714 |
| 99% | 0.10 | 0.1003 |
| 100% | 0.03 | 0.0311 |
| Total | 37.8 | 23.3 |

Needle Leaf Evergreen Forest

Broad Leaf Ever Green Forest

LC

| 51 | 93 |
|---|---|
| 97 | 94 |

PTC

↓
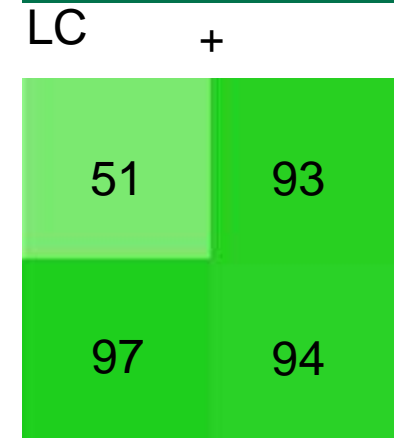
0.51 km2

(0.93+0.94+0.97)
2.84 km2

More detailed forest area can be calculated

More detailed area of each forest related LC categories
can be calculated using PTC

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# Outline of Procedure for area calculation

**Process by GIS Software**

Download GM LC and PTC data

Convert downloaded data from raster to vector

Clip vector data using international boundary data

Give a map projection

Calculate each area

*Estimate amount of emissions and removals of GHG,*

*Interpret GM 20 classes to LULUCF 6 classes*

# Download GM LC and PTC data

## Access to www.iscgm.org



> **Global Version and National Version**(Produced by National Mapping Organizations
>  of respective countries) are downloadable

> TIFF and BIL format data are downloadable

> Detailed information about data is described in metadata
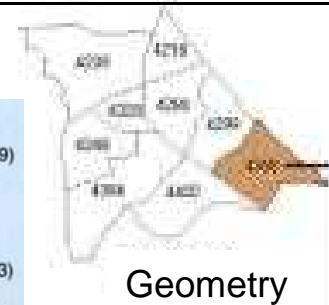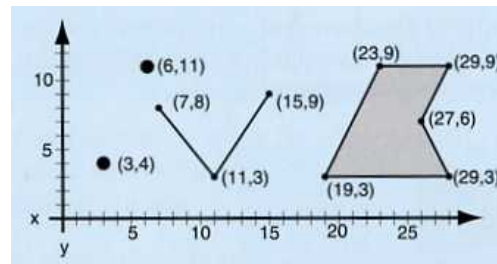
# Convert LC data from raster to vector
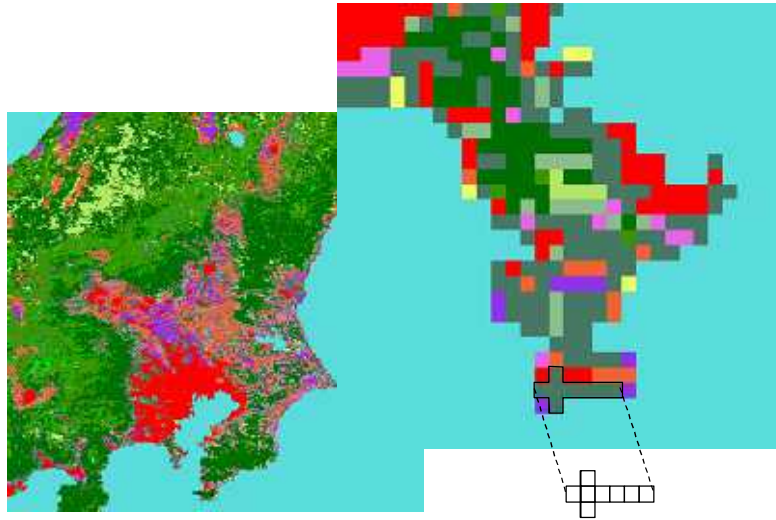


**Raster** : Grid Cell based
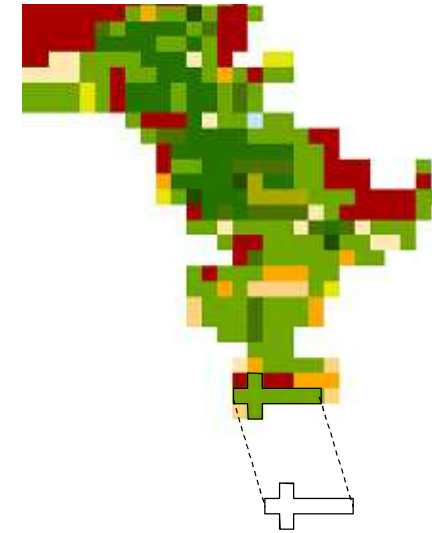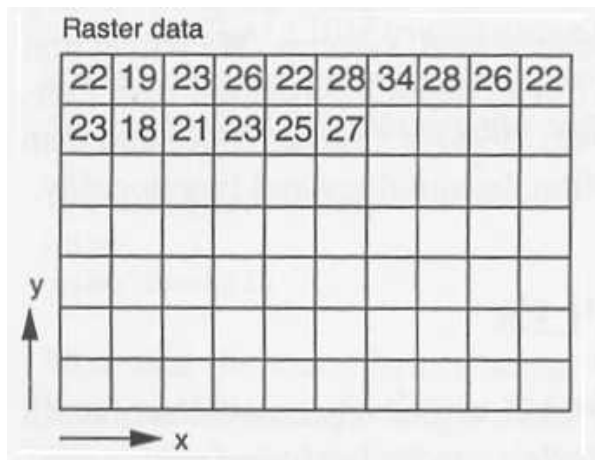
**Vector**:areas, lines, and points
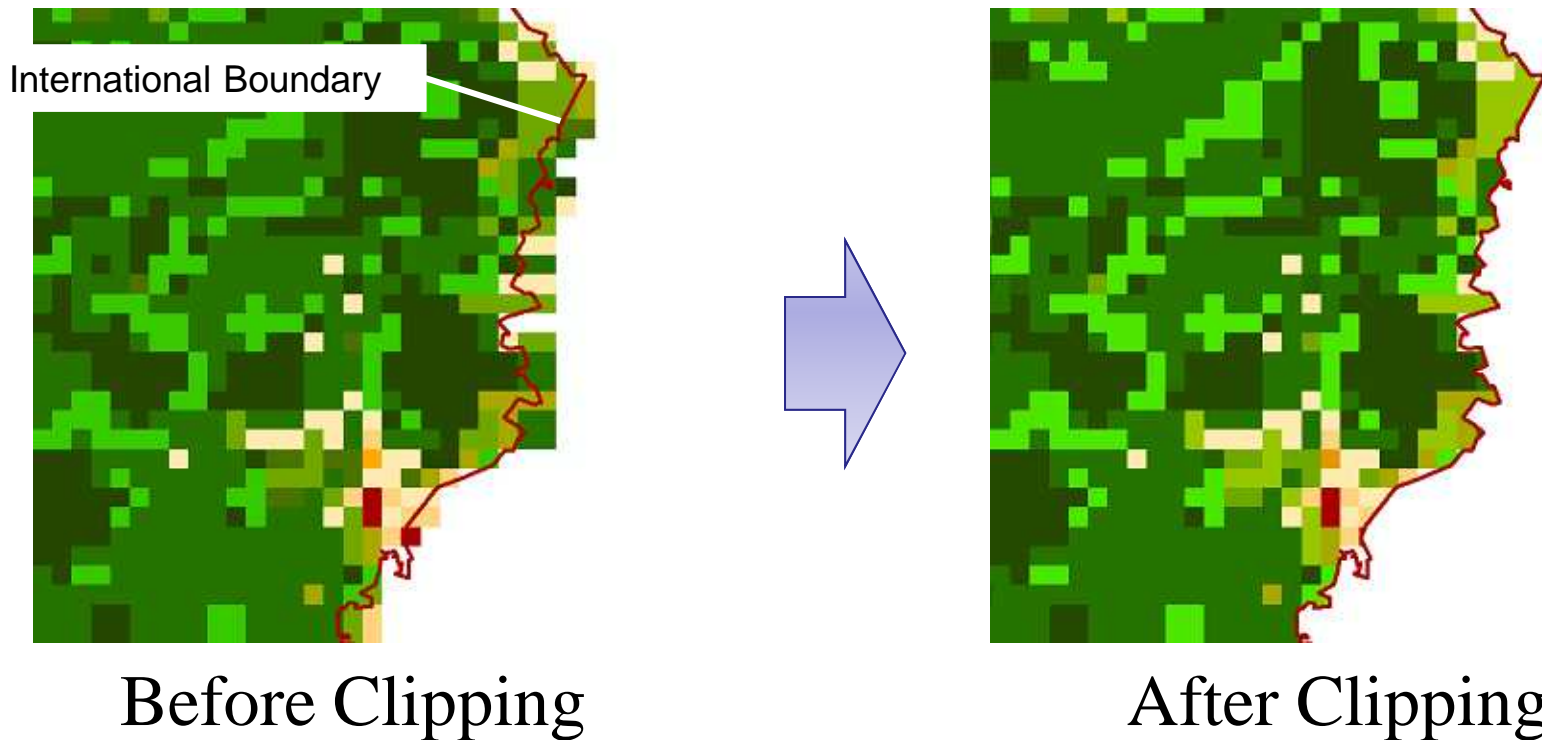
➢ can measure the area more accurately



Attribute

Geometry

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# Clip vector data using International boundary



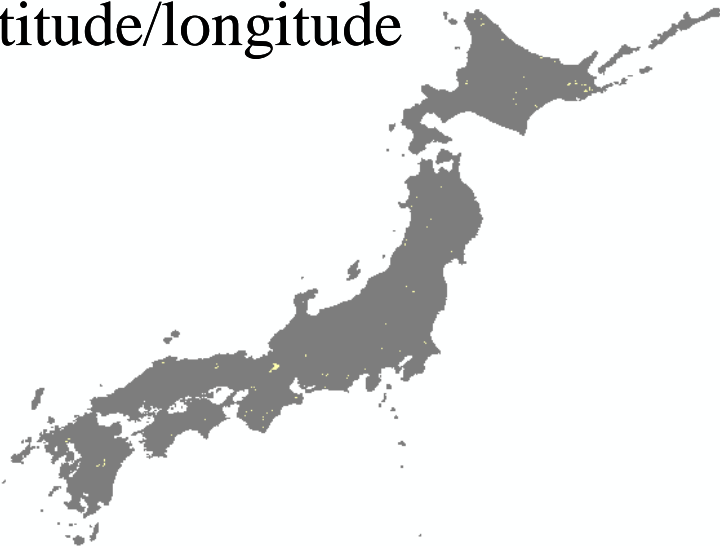International Boundary

Before Clipping

After Clipping

- Clip data to cut outside of the country area
- International Boundary is also available from GM dataset

# Give a map projection

**latitude/longitude**
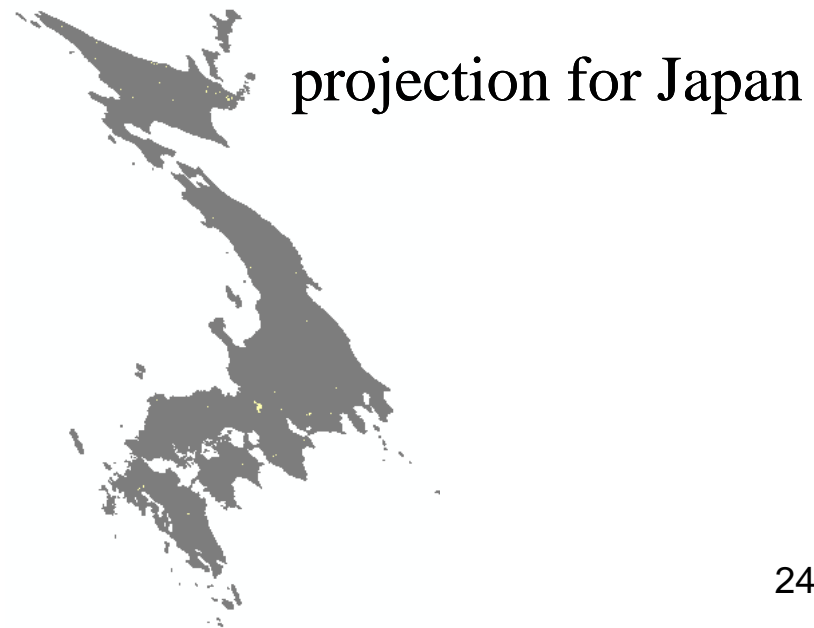
( **Geographic Coordinate system** )

➢ Downloaded GM data is

represented in

latitude/longitude

**Appropriate Projection**

to represent accurate area of

each country

➢ This time I used Mollweide

projection for Japan

# Calculate each area

- Calculate areas of respective polygons



- Sum up areas of polygons of respective classes

# *Interpret GM 20 classes to LULUCF 6 classes*

- Decide classes of interpretation by referring to
  - Definition of each class on the GM LC data
  - Definition of the IPCC guideline, GPG-LULUCF and KP

**Comparison of the Forest definitions**

|  | Kyoto Protocol | Global Map (PTC) |
|---|---|---|
| *Height* | 2 - 5m | 3 - 5m |
| *Minimum tree crown cover* | 10-30% of certain area | - |
| *Minimum Area of land* | 0.05 - 1.0ha | 0.25 ha (500m resolution) or 1 ha (1km resolution) |

# Conclusion

**<u>For LULUCF</u>**

- GM Land Cover data is available to calculate each area of 20 land cover categories

- GM PTC data is available to calculate more detailed area of whole forest and forest related categories

- GM Land Cover and PTC data can be used in combination to calculate detailed area of forest related categories in certain area

- Requisites for area calculation
  - <u>GM data</u>, <u>GIS software</u>, <u>Fundamental GIS skills</u>

# Others

# Capacity Building



- JICA Group Training Course on Global Mapping: Implemented by GSI Japan, 94 experts of 57 countries participated (1994  2008)

- This year, 8 participants (Bangladesh, Bhutan, Kenya, Malaysia, Myanmar, Philippines, Timor-Leste, Uzbekistan) are taking JICA training on Global Mapping, including a lecture of GHG inventory by NIES and deforestation and degradation by FFPRI

**Excerpt from Executive Summary of WGIA 7 in Korea**
➢lack of relevant human resources within inventory compiler teams hampered utilization of such data in many Asian countries
➢the necessity of training RS and GIS experts as well as engaging existing RS and GIS experts within each country in GHG inventory compilation

# Thank you

http//www.iscgm.org

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