

Utilization of Global Map for GHG Inventory

WGIA8

14th July, 2010

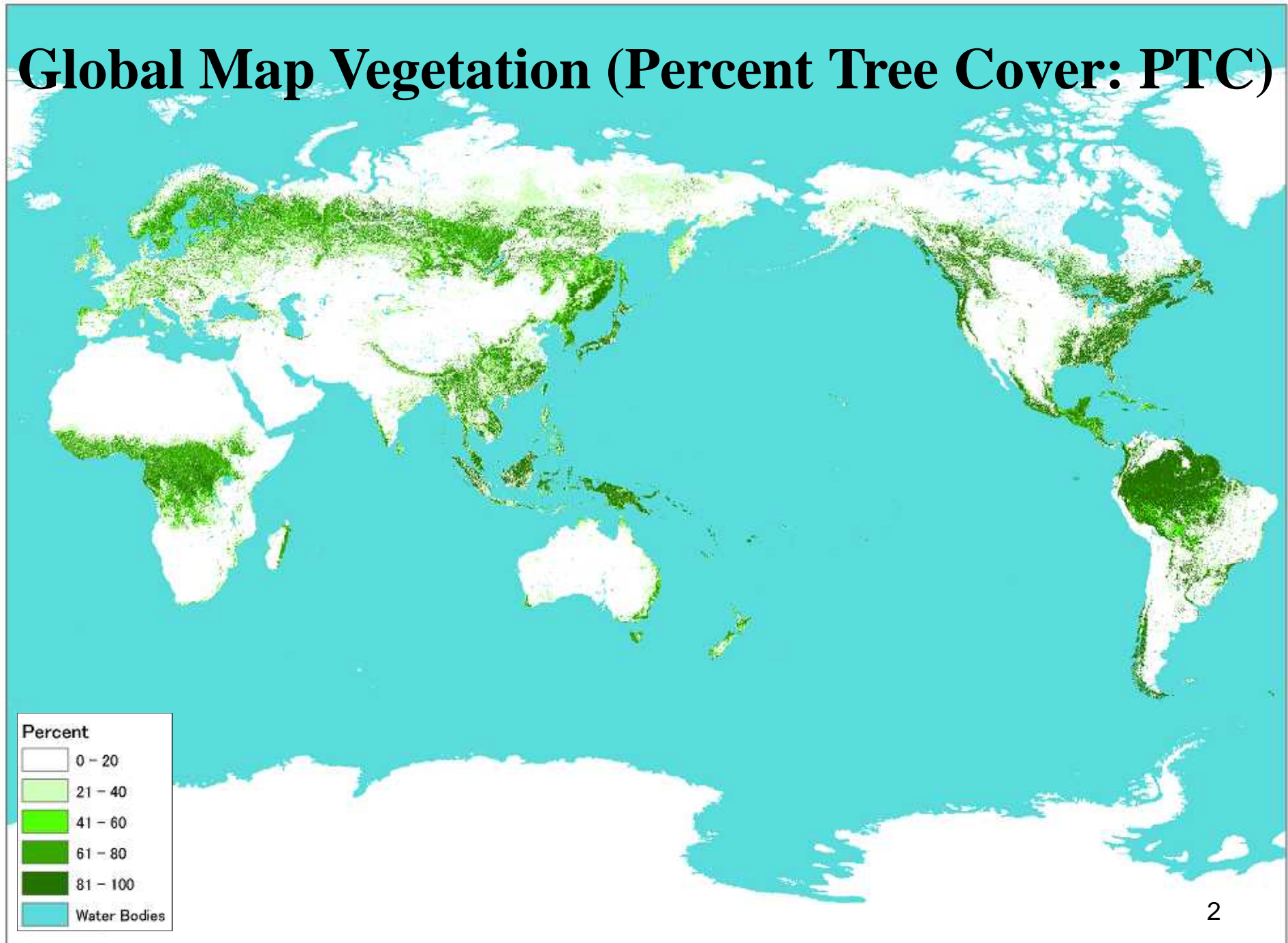
Vientiane, Lao P. D.R.

Noriko KISHIMOTO

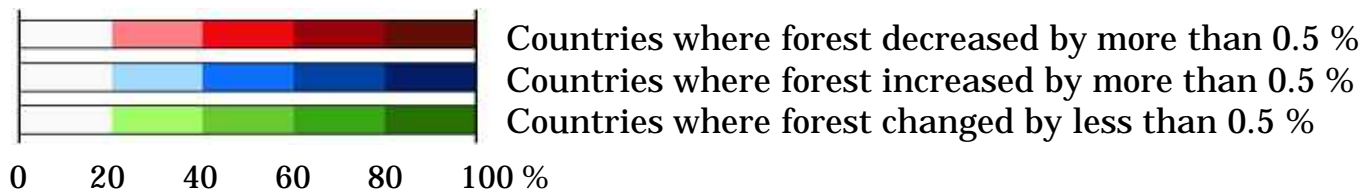
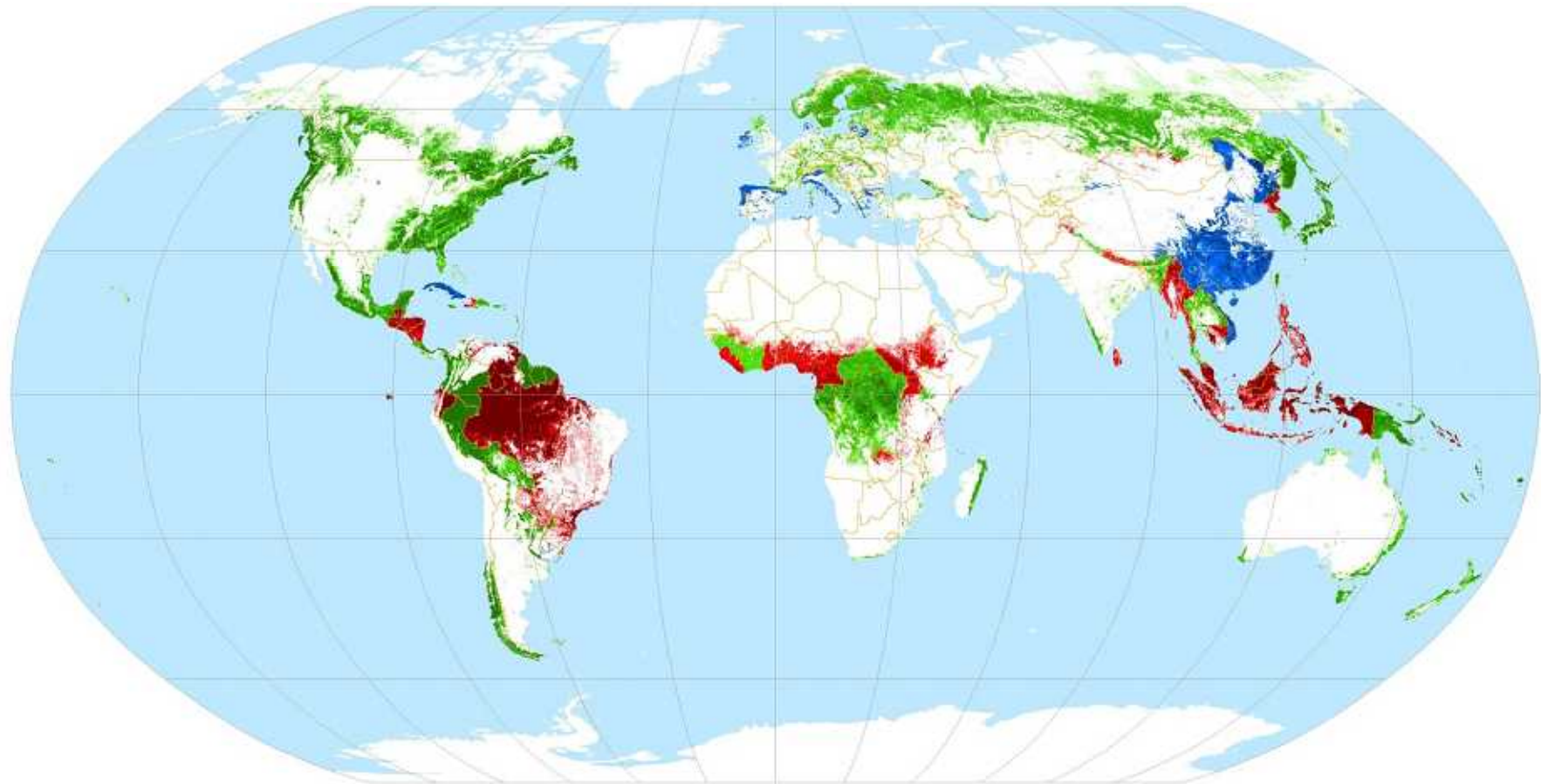
n-kishimoto@gsi.go.jp

Geospatial Information Authority of JAPAN

Global Map Vegetation (Percent Tree Cover: PTC)



Annual Change Rate of Forest Area (2000-2005)



Outline of the Global Map

What is Global Map ?

Digital Geographic Dataset

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

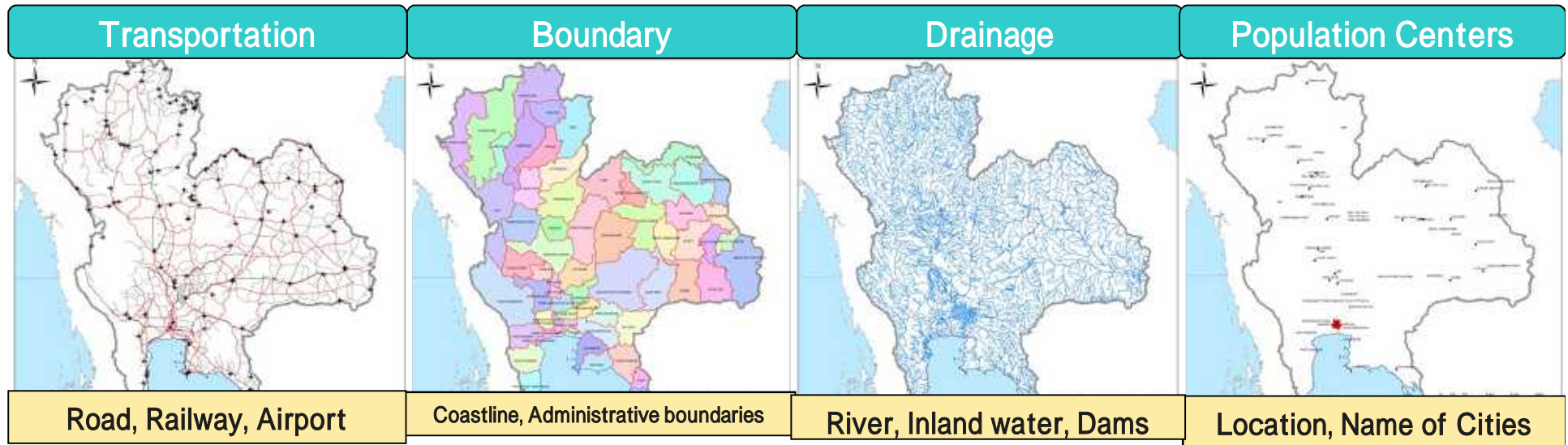
Global Mapping aims to contribute to

- Solving and tackling with global environmental issues
- Achieving sustainable development
- Mitigating large scale disasters

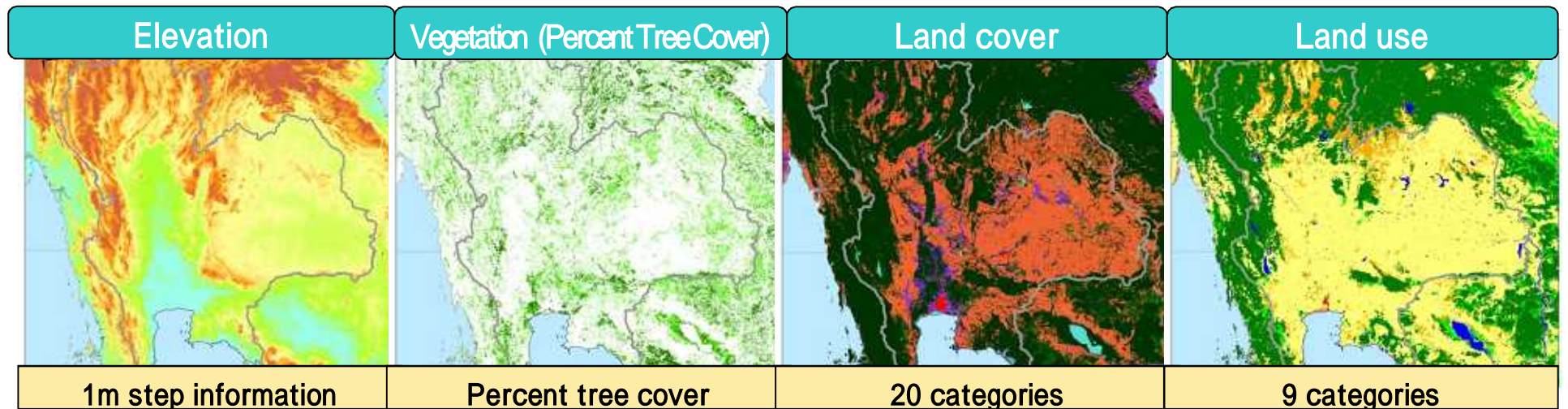
Global Map Specifications

- Spatial resolution: **1km**
(equivalent to 1:1million scale)
- **8 layers**
 - Vector data (area, line, point)
 - Transportation, Boundaries
 - Drainage, Population centers
 - Raster data (grid)
 - Elevation, Vegetation (Percent Tree Cover),
Land Cover, Land Use
- Update interval: **Five years**

Vector Data



Raster Data



Global Mapping Project

Who makes Global Map?

Each National Mapping Organization (NMO)

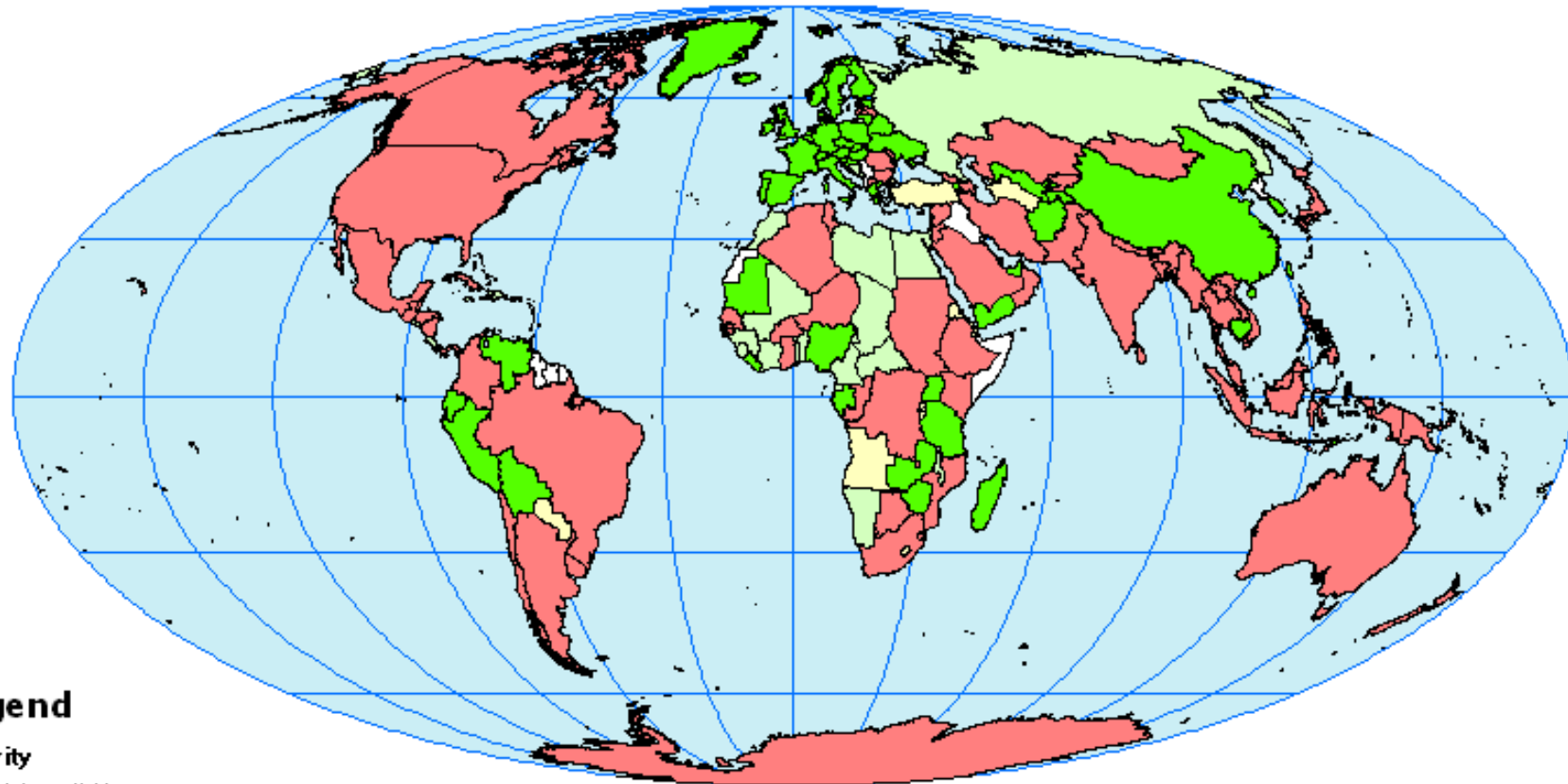
- Responsible for developing data of its own country
- Supported by other NMOs, aid organizations

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

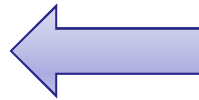
Most elevation data of current Global Map are compiled from GTOPO30, contribution of United States of America.

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

Why Global Map ?

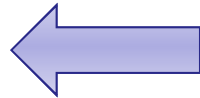
for addressing Climate Change

Comparability



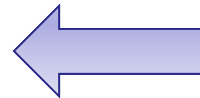
- Global Coverage
- Consistent specifications
- 5-year update

Usability

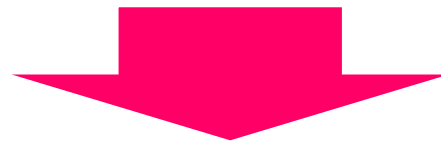


- Essential environmental data
- Open data policy

Reliability

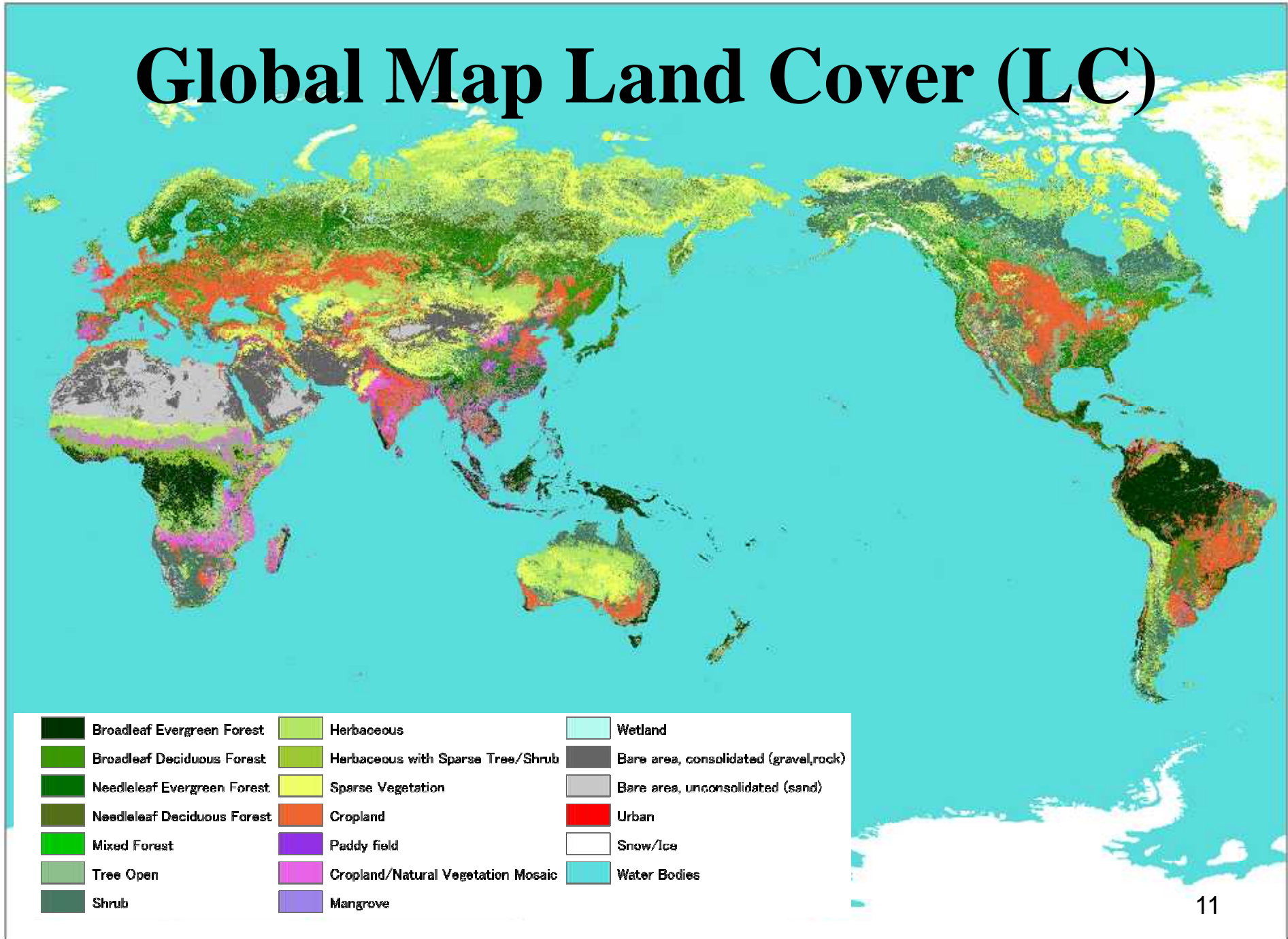


- Government authorization



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

Global Map Land Cover (LC)

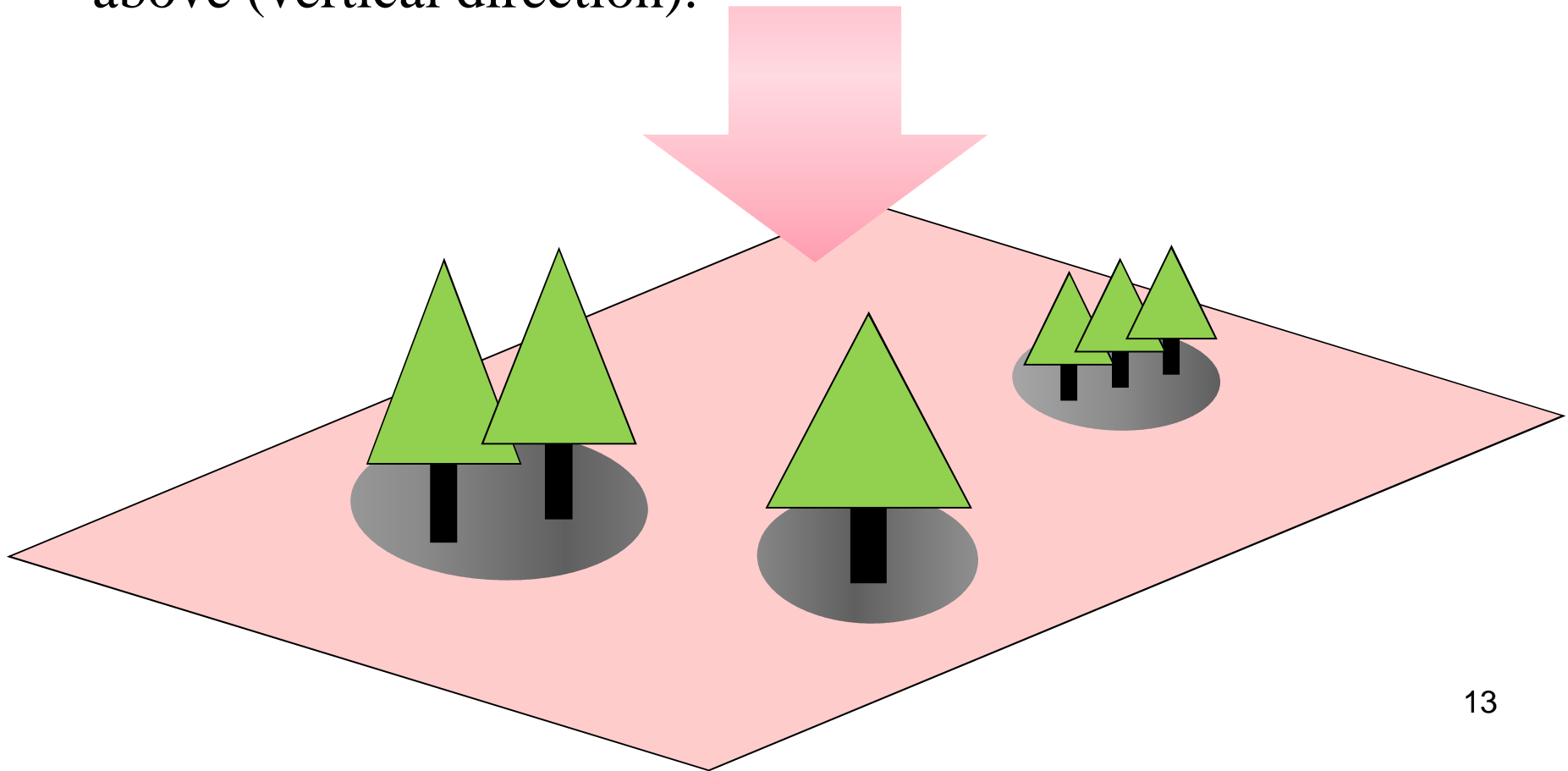


Data sources

- **Primary source data :** MODIS data in 2003, which is 7-band, 1-km resolution 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

Vegetation (Percent Tree Cover)

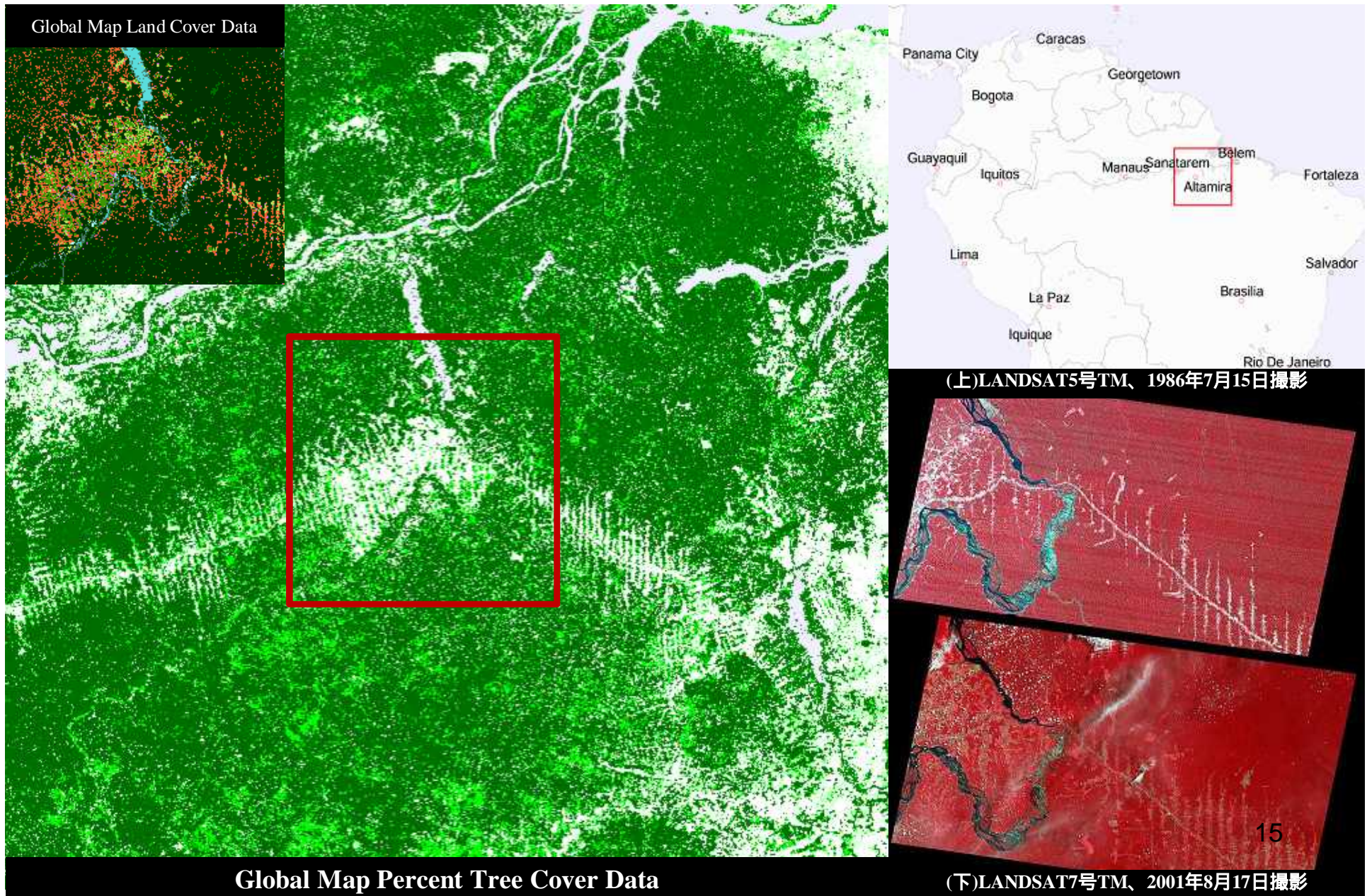
- The ratio of the area covered with branches and leaves of trees (tree canopy) to the ground surface seen from the above (vertical direction).



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 Percent Tree Cover Data

(下)LANDSAT7号TM、2001年8月17日摄影

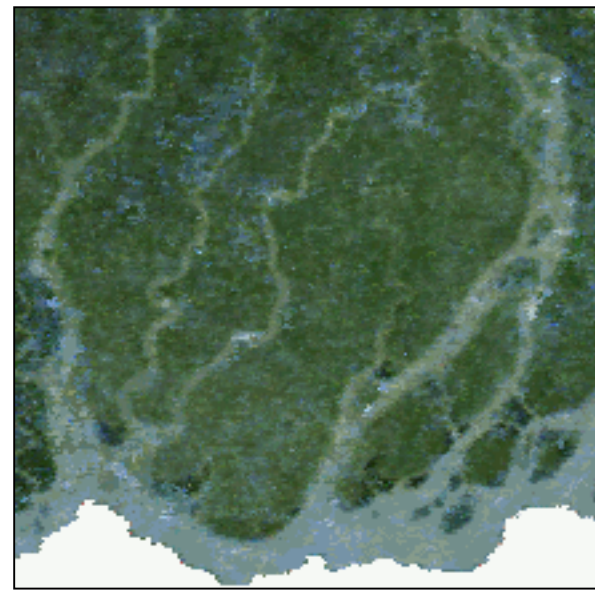
Global Map Version 2

- 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



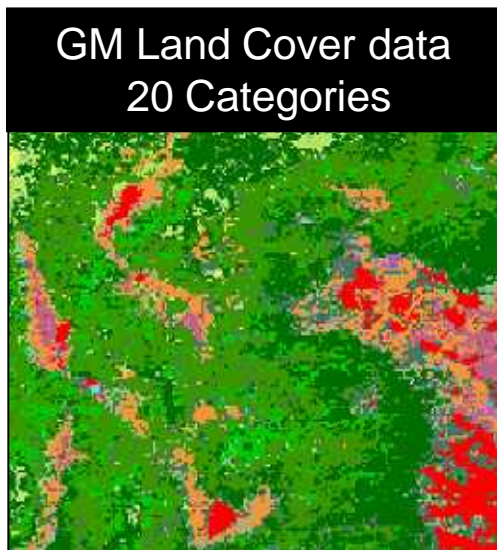
Global Map Version2
500m resolution, 2008

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

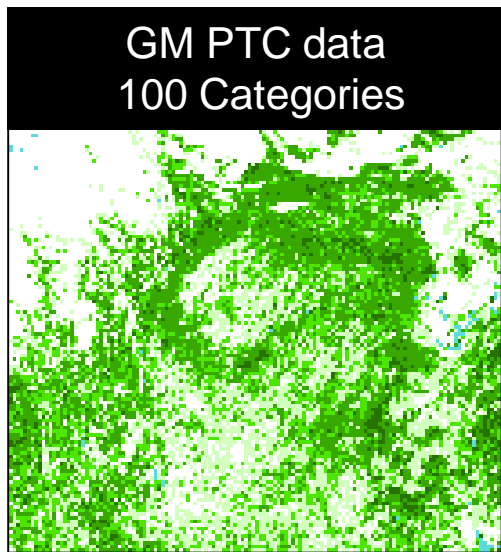


Calculate each area of 20 categories of Global Map Land Cover

Global Map Land Cover 20 Categories		LULUCF 6 land-use categories	
Broadleaf Evergreen Forest	Estimate emissions and removals of GHGs	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 18		
Bare area, consolidated (sand)			
Snow/Ice			
Water			

Integrate the amount of GHGs into LULUCF 6 categories

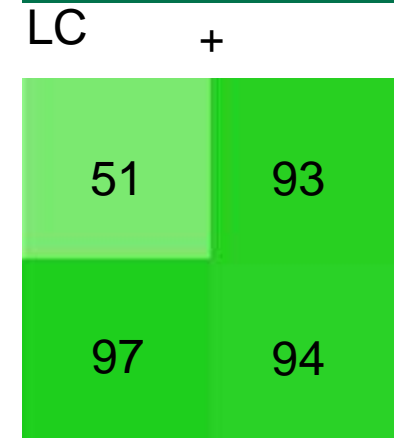
How to Utilize GM PTC to LULUCF



Calculate each percentage of Global Map PTC

Percentage of Tree Cover	Area (Mha)	Percentage x 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



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

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

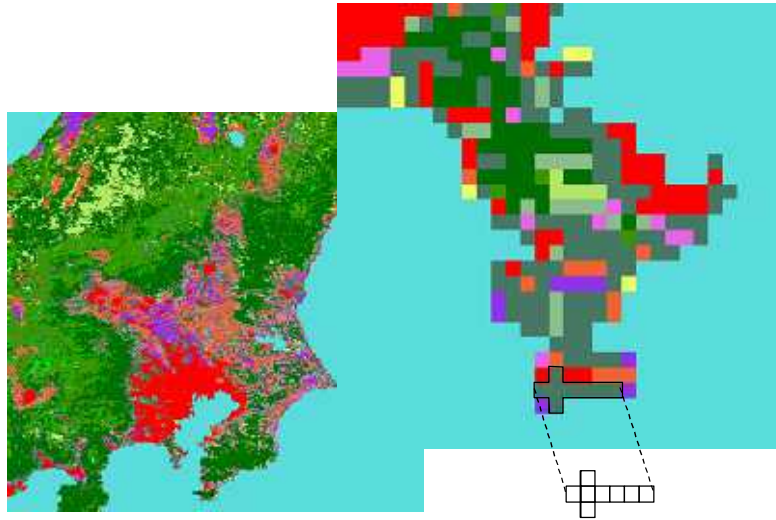
Download GM LC and PTC data

Access to www.iscgm.org

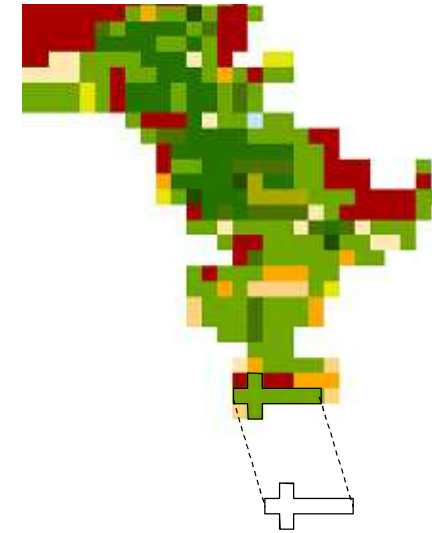
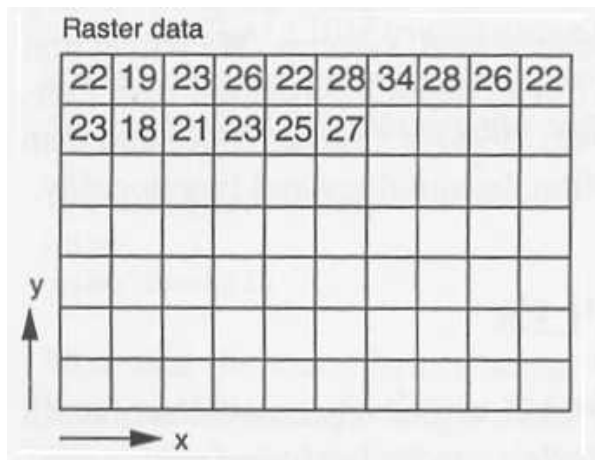
The screenshot displays the ISC GM website interface. On the left, a navigation menu includes links such as 'Top page', 'News Archives', 'Summary', 'Schedule', 'About Us', 'Participants', 'What is Global Map', 'Browse', 'Download' (circled in red), 'Screenshot', 'Application', 'Documentation', 'History', 'Newsletter', 'FAQ', 'Links to', and 'Sitemap'. The 'Download' link is highlighted with a red circle. The main content area is divided into three columns. The first column contains a 'User Login' section with fields for 'Your ID:' and 'Password:', a 'Login' button, and instructions: 'Please click "Login" button after entering your ID and Password. (You cannot login the page with enter key.) Please also check if you permit your browser to use cookies and JavaScript. If you don't have User ID and Password, [Go to Registration Page](#)' (the link is circled in red). The second column is titled 'What's' and lists various map versions. The third column is titled 'Please Enter Your Information' and contains a registration form. The form includes fields for 'E-mail Address' (with the value 'n-kishimoto@esi.go.jp'), 'Occupation category' (set to 'Public employee'), and 'Country' (set to 'JAPAN'). Below these are checkboxes for 'Purpose of Use' with options: 'Analysis, research and examination of an environment' (checked), 'Analysis, research and examination of fields other than environment', 'Learning materials', 'For a base map to make other maps', 'Personal use (interest)', and 'Others'. A 'Purpose of download (What kind of use)' dropdown menu is set to 'Calculation of Land cover area for GHG Inventory on LULUCF sector'. At the bottom right of the form, 'Regist' and 'Clear' buttons are visible, with 'Regist' circled in red.

- 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

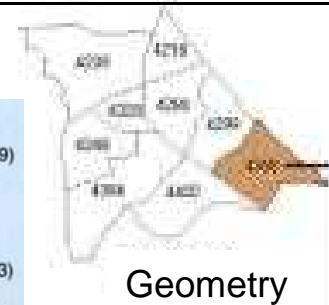
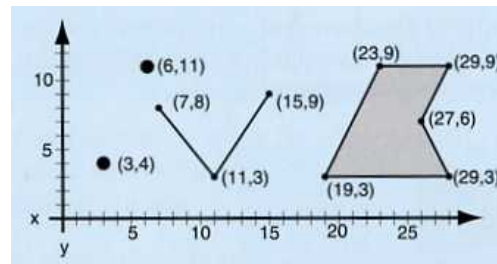


Raster : Grid Cell based



Vector: areas, lines, and points

➤ can measure the area more accurately

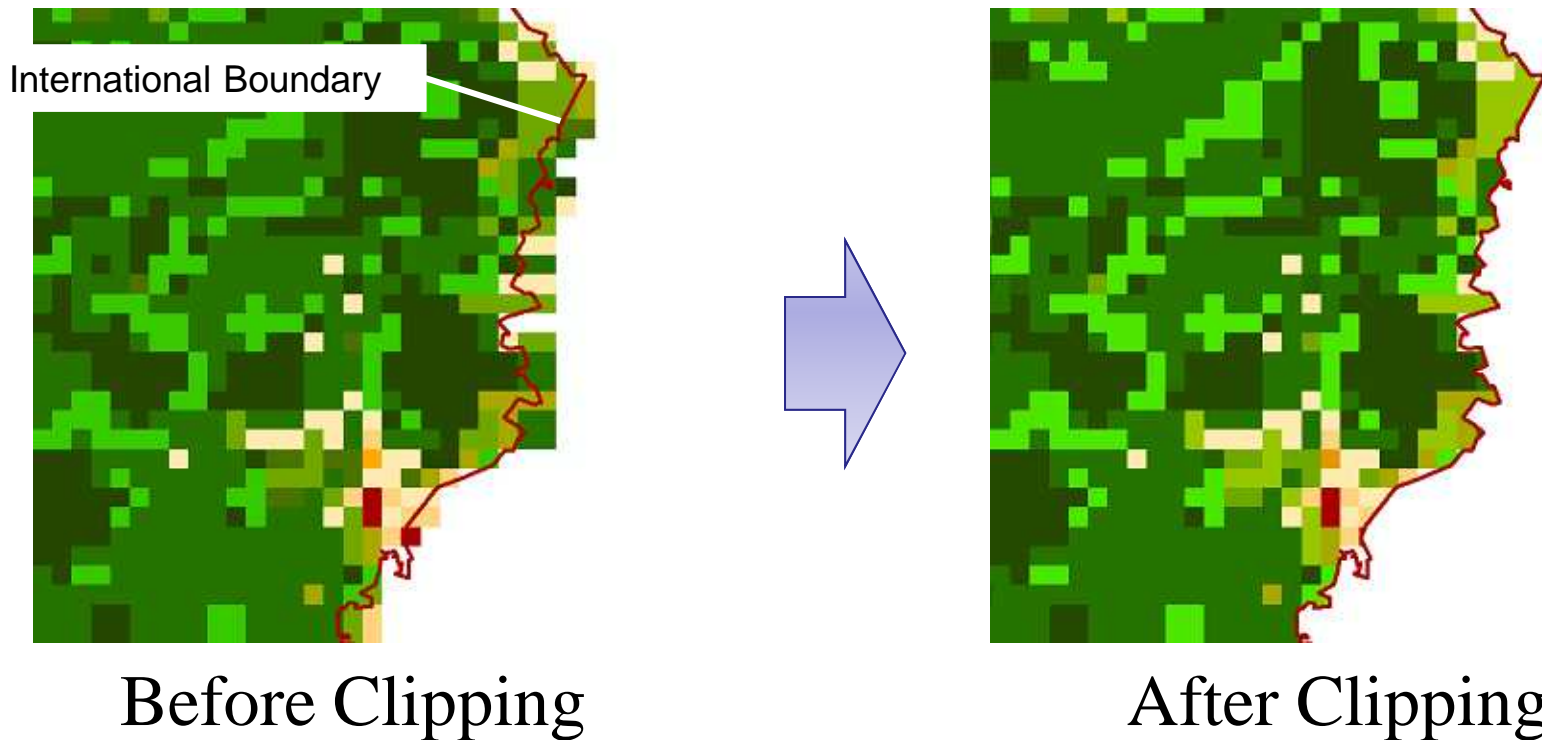


Attribute

ID	NAME	AREA	PERCENT
000	WATER	1000	10
001	FOREST	1000	10
002	AGRICULTURE	1000	10
003	URBAN	1000	10
004	WATER	1000	10
005	WATER	1000	10
006	WATER	1000	10
007	WATER	1000	10
008	WATER	1000	10
009	WATER	1000	10
010	WATER	1000	10
011	WATER	1000	10
012	WATER	1000	10

22

Clip vector data using International boundary



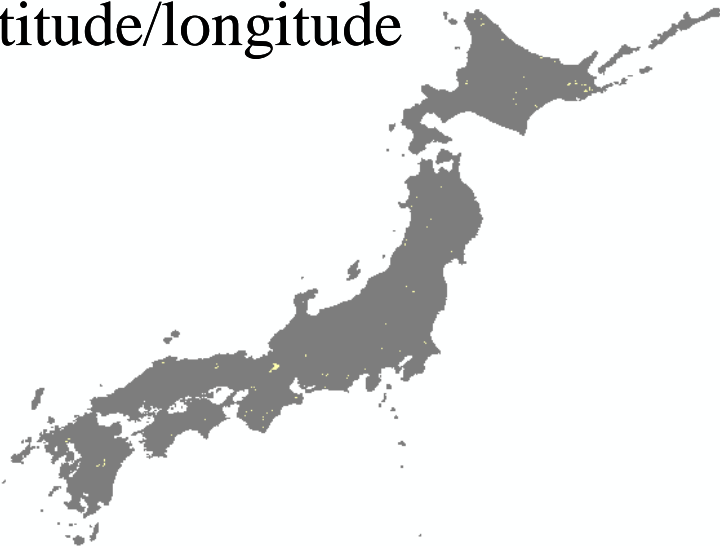
- Clip data to cut outside of the country area
- International Boundary is also available from GM dataset ²³

Give a map projection

latitude/longitude

(Geographic Coordinate system)

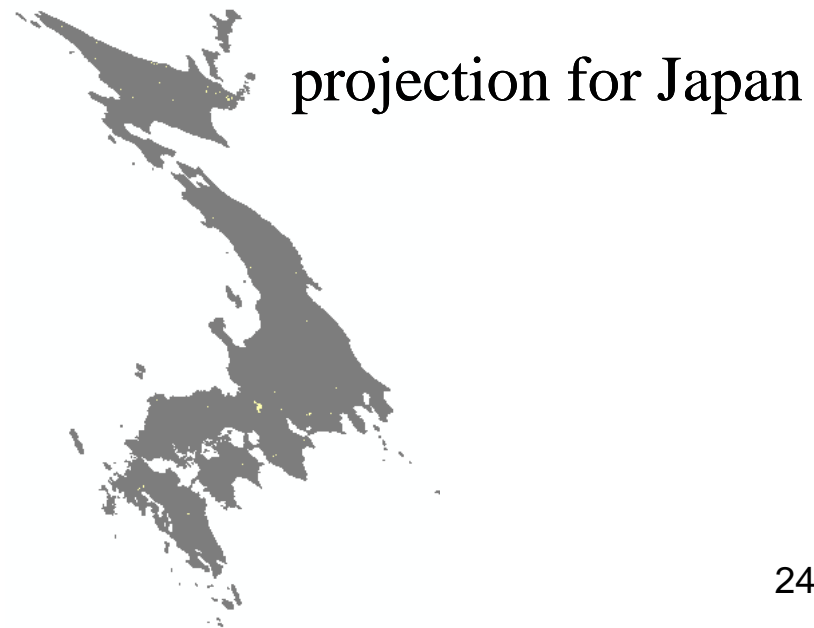
- Downloaded GM data is represented in latitude/longitude



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

The image shows a workflow in ArcGIS. On the left, the Field Calculator dialog box is open, showing the 'Pre-Logic VBA Script Code' with the following code:

```
Dim dblArea as double  
Dim pArea as Iarea  
Set pArea = [shape]  
dblArea = pArea.area
```

The 'Advanced' checkbox is checked. Below the code, the 'fac_id' and 'dblArea' fields are listed. A pink arrow points from the Field Calculator to a table window on the right. The table window, titled '3_UTM54_final', displays a table with the following columns: Shape#, ID, GRIDCODE, area, and LULUCF. The 'area' column is highlighted in light blue. Below the table, a status bar indicates 'レコード: 0 / 78822 選択されました'.

Shape#	ID	GRIDCODE	area	LULUCF
10	337948	1	2499613.381141	Forestland
10	339406	1	1877170.180030	Forestland
16	340814	1	1252934.961867	Forestland
18	340816	1	1252975.301529	Forestland
18	341589	1	626745.195900	Forestland
19	343159	1	1253746.283533	Forestland
11	349460	1	630443.219062	Forestland
18	354508	1	633616.308795	Forestland
19	365044	1	641431.368752	Forestland
11	367771	1	643935.658245	Forestland
18	369492	1	1290522.516274	Forestland
19	369493	1	1290521.588753	Forestland
10	369494	1	1290521.588760	Forestland
12	369946	1	645628.284488	Forestland
12	370735	1	646194.176105	Forestland
17	381911	1	655827.209132	Forestland
19	394426	1	668750.928666	Forestland
19	405156	1	1355042.674094	Forestland
19	407650	1	679255.591221	Forestland

- 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)
<i>Height</i>	2 - 5m	3 - 5m
<i>Minimum tree crown cover</i>	10-30% of certain area	-
<i>Minimum Area of land</i>	0.05 - 1.0ha	0.25 ha (500m resolution) or 1 ha (1km resolution) ²⁶

Conclusion

For LULUCF

- 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
 - GM data, GIS software, Fundamental GIS skills

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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