

## Japan's experience in forest carbon accounting

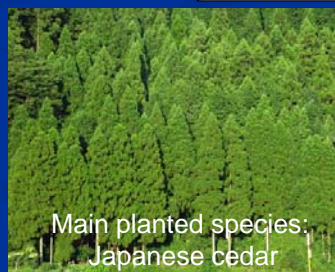
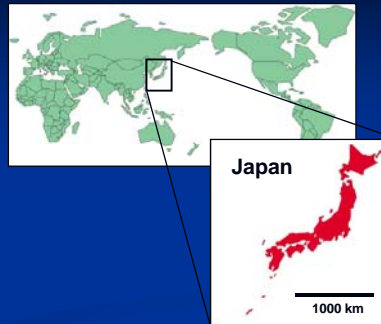
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1

## Japan's Forests

- Total land is 37 M ha and islands are distributed over about 3,000km from South-West to North-East.
- Four climatic zones:
  - Sub-tropic, Warm temperate, Cool temperate, Boreal
- Large amount of precipitation (1,700 mm/year)
- Large proportion of land is occupied by steep mountains with forest cover.
- 67% of total land is forest
- 40% of forest is planted forest and 60% is semi-natural forest
- 69% of forest is private and 31% is national



Main planted species:  
Japanese cedar

2

## Japan's Forest Inventory System based on Forest registers and Forest maps

- Forest registers
  - Enumeration
    - Attribute information : Area, Species, Age, DBH, Volume etc.
  - Every sub-compartment of all private and national forests
    - Total 41 M records
  - Updating every 5 years
  - Linkage with boundaries in forest planning maps
- Forest maps
  - 1/5000 scale maps
  - Boundaries of forest compartments and sub-compartment
  - 100% of the boundaries of forest components have been digitized for GIS.
  - Around 80% of the boundaries of sub-compartment have been digitized for GIS

3

## Definitions and Choices for Kyoto Reporting

- Definition of forests
  - Minimum value for forest area: 0.3ha
  - Minimum value for tree crown cover: 30%
  - Minimum value for tree height: 5m
  - Minimum value for forest width: 20m
- Election of Article 3.4 activities
  - Forest Management
  - Revegetation
- Choice of reporting method
  - Reporting method 1
  - 47 prefectures



4

## Data and Method for Carbon Flux Estimation

### ■ Base data

- Forest registers
- Forest planning maps

### ■ Estimation methods

- Stock Change Method
- Carbon stock changes  

$$= (C \text{ stocks at } t_2 - C \text{ stocks at } t_1) / (t_2 - t_1)$$
- Carbon stocks  

$$= \text{Volume} \times \text{Density} \times \text{BEF} \times (1 + R/S \text{ ratio}) \times \text{Carbon fraction}$$

5

## Parameters for conifer trees BEF, Root/Shoot ratio, Density and Carbon fraction

		BEF		R	D	Carbon fraction	Note
		≤ 20	> 20				
Conifer trees	Japanese cedar	1.57	1.23	0.25	0.314	0.5	
	Hinoki cypress	1.55	1.24	0.26	0.407		
	Sawara cypress	1.55	1.24	0.26	0.287		
	Japanese red pine	1.63	1.23	0.27	0.416		
	Japanese black pine	1.39	1.36	0.34	0.464		
	Hiba arborvitae	2.43	1.38	0.18	0.429		
	Japanese larch	1.50	1.15	0.29	0.404		
	Momi fir	1.40	1.40	0.40	0.423		
	Sakhalin fir	1.88	1.38	0.21	0.319		
	Japanese hemlock	1.40	1.40	0.40	0.464		
	Yezo spruce	1.92	1.46	0.22	0.348		
	Sakhalin spruce	2.15	1.67	0.21	0.364		
	Japanese umbrella pine	1.39	1.23	0.18	0.455		
	Japanese yew	1.39	1.23	0.18	0.454		
	Ginkgo	1.51	1.15	0.18	0.451		
	Exotic conifer trees	1.41	1.41	0.17	0.320		
	Other conifer trees	2.55	1.32	0.34	0.352		Hokkaido, Tohoku, Tohigi, Gunma, Saitama, Niigata, Toyama, Yamaguchi, Nagano, Gifu, Shizuoka
		1.39	1.36	0.34	0.464		Okinawa
		1.40	1.40	0.40	0.423		Other prefectures

6

## Parameters for broad leaf trees BEF, Root/Shoot ratio, Density and Carbon fraction

		BEF		R	D	Carbon fraction	Note
		≤ 20	> 20				
Broad leaf trees	Japanese beech	1.58	1.32	0.25	0.573	0.5	
	Oak (evergreen tree)	1.52	1.33	0.25	0.629		
	Japanese chestnut	1.50	1.17	0.25	0.426		
	Japanese chestnut oak	1.36	1.33	0.25	0.668		
	Oak (deciduous tree)	1.40	1.26	0.25	0.619		
	Japanese poplar	1.33	1.17	0.25	0.291		
	Alder	1.33	1.19	0.25	0.382		
	Japanese elm	1.33	1.17	0.25	0.494		
	Japanese zelkova	1.58	1.28	0.25	0.611		
	Cercidiphyllum	1.33	1.17	0.25	0.446		
	Japanese big-leaf	1.33	1.17	0.25	0.386		
	Maple tree	1.33	1.17	0.25	0.519		
	Amur cork	1.33	1.17	0.25	0.344		
	Linden	1.33	1.17	0.25	0.369		
	Kakapanax	1.33	1.17	0.25	0.398		
	Paulownia	1.33	1.17	0.25	0.234		
	Exotic broad leaf trees	1.41	1.41	0.25	0.660		
	Japanese birch	1.31	1.20	0.25	0.619		
Other broad leaf trees		1.37	1.37	0.25	0.473		Chiba, Tokyo, Kochi, Fukuoka, Nagasaki, Kagoshima, Okinawa
		1.52	1.33	0.25	0.629		Mie, Wakayama, Oita, Kumamoto, Miyazaki, Saga
		1.40	1.26	0.25	0.619		Other prefectures

7

## Why Stock Change Method?

- Default method (GPG) or Gain-Loss method (2006GL)
  - Annual biomass change = Annual growth (gain) – Annual loss
- Estimation of loss is not easy
  - GPG & GL shows that loss is estimated from commercial harvested woods, fuel woods and disturbances
  - Statistics of commercial harvested woods are not enough
  - Prefectures of harvesting and dealing are often different
- Choice of Stock change method
  - Need not estimation of annual loss
  - Need repeated monitoring
  - Available for deforestation and forest degradation

8

## Carbon in 3 pools Litter, Dead wood, Soil organic matter

### ■ Marrakesh Accords

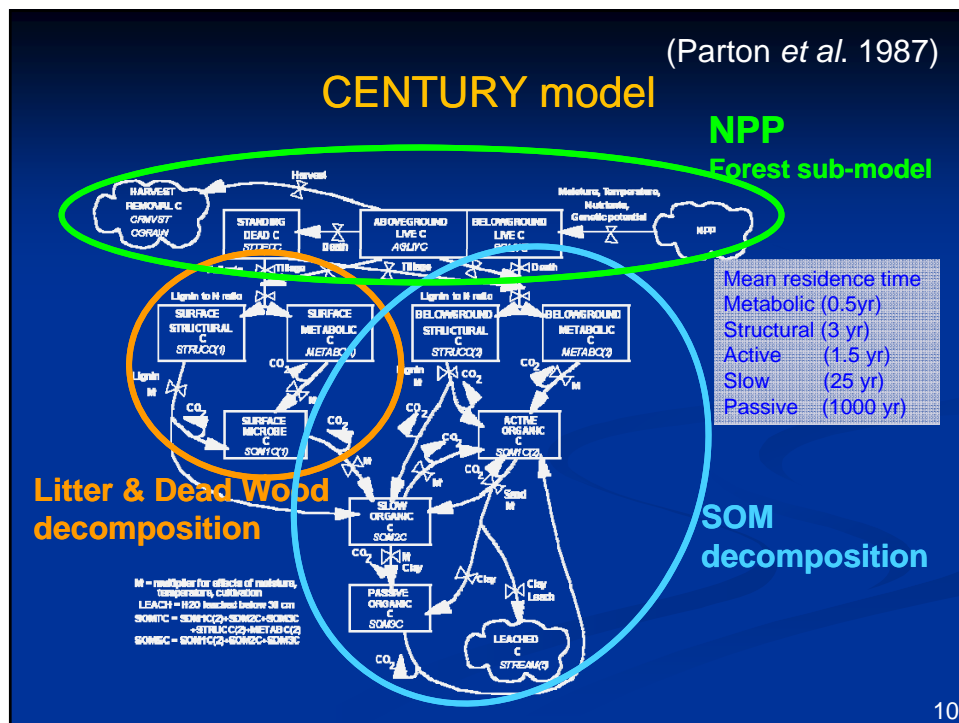
- require reports of carbon in litter, dead wood, soil organic matter, not only in above and below ground biomass
- also say that a Party may choose not to account for a given pool in a commitment period, if transparent and verifiable information is provided that the pool is not a source.

### ■ Discussion

- Carbon in SOM is stable in forest-remaining-forest, but carbon in litter and dead wood may change easily.
- Data are not enough, but surveys of 3 pools are not easy because of costs and time.

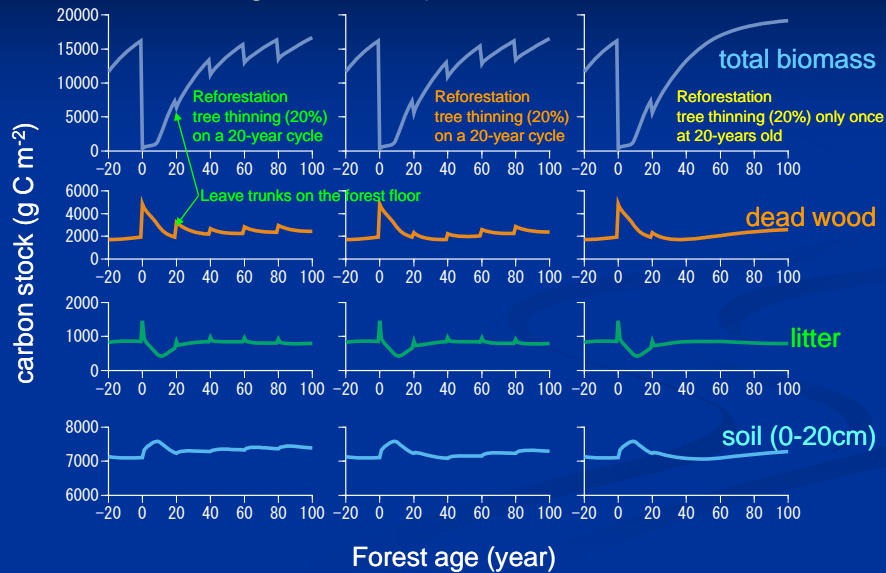
- We decided to apply a carbon process model for estimation of carbon stock changes in 3 pools

9



10

## Changes in C stocks in planted forests under forest management by the CENTURY model



11

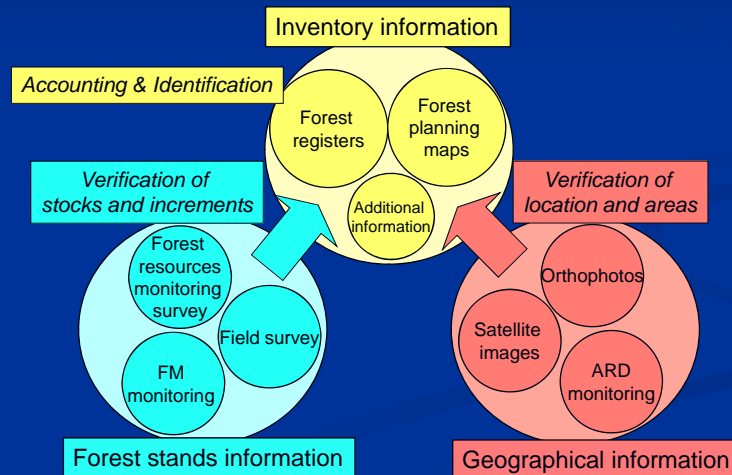
## Carbon Stock Changes in 3 pools by CENTURY-jfos model

- CENTURY-jfos: tuned CENTURY model with Japan specific parameters and data.
- Parameters and data sets for 5 species, 47 prefectures
  - Temperature and precipitation considering distribution of species
- Typical management
- Average carbon stock changes in 3 pools

12

## Design of Accounting and Reporting System Considering Verification

- Accounting is based on forest registers and forest planning maps mainly
- It is verified with independent stands and geographical information



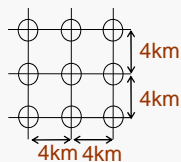
13

## Forest Resources Monitoring Survey

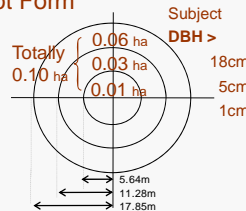
- Started from 1999
- About 15,700 permanent plots on  $4\text{km} \times 4\text{km}$  grid points over the whole of national territory
- Each plot is surveyed every 5 years. 3,200 plots are surveyed annually.
- Each monitoring plot: triple circle of 0.1 ha



Configuration of Monitoring Plot



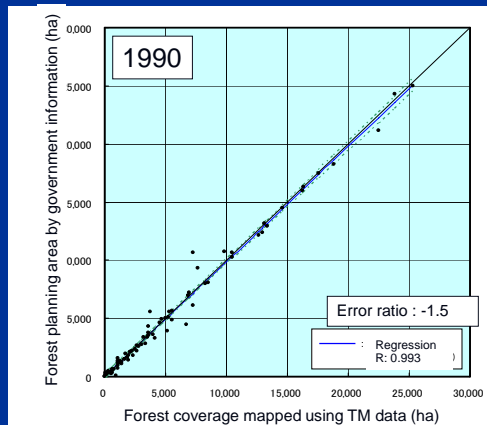
Plot Form



14

## Verification of forest area - RS mapping and forest registers -

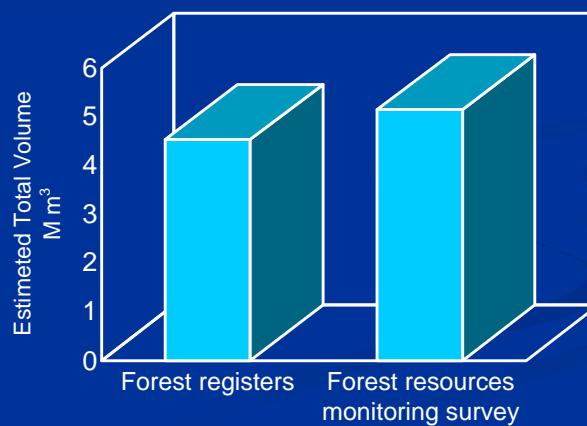
- Comparison of forest area by TM and forest registers in municipalities.
- Error ratios were less than 5%



15

## Verification of Forest Volume

- Estimated forest volume by Forest resources monitoring survey was 13.8% larger than one by forest registers.



16



[illegible]

# National Forest Resources Database – NFRDB –

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



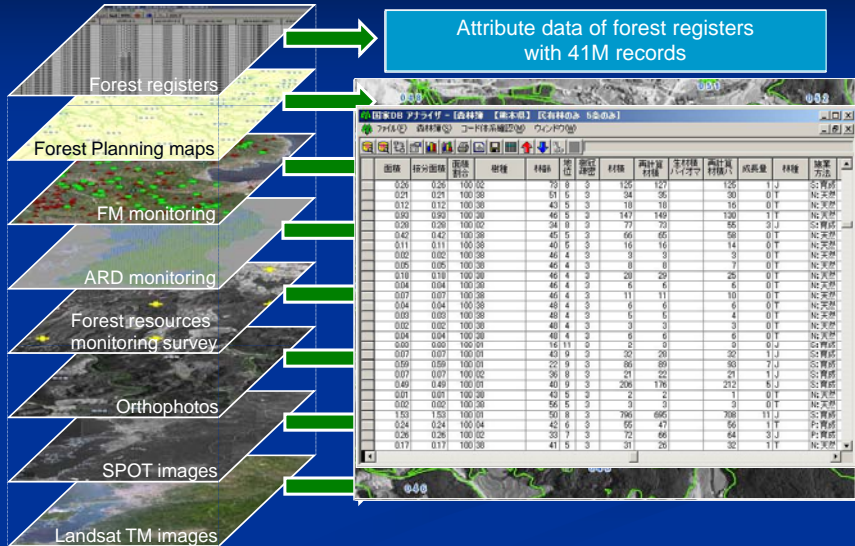
Database Room in Forestry agency



NFRDB Server

18

## Main Data on The NFRDB



19

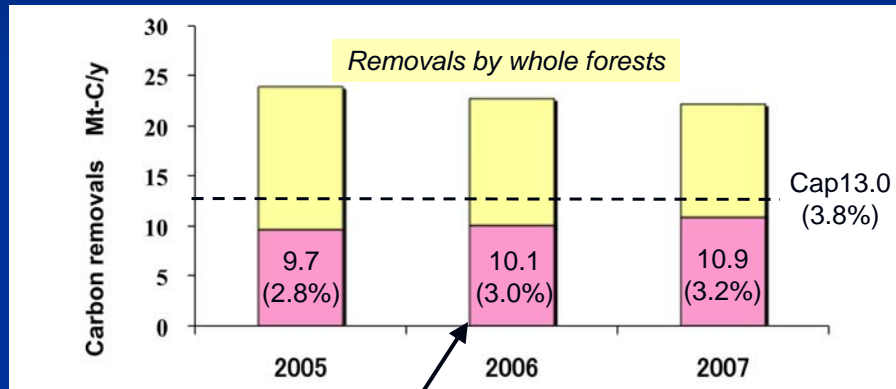
# Carbon Flux in Japanese Forests in 2007 under UNFCCC and the Kyoto Protocol

							1,000t-C/yr
		Above-ground Biomass	Below-ground Biomass	Dead wood	Litter	Soil	Total
Carbon Sinks							2,219
Carbin Sinks under KP		875	221	▲ 26	8	13	1,090
	Aforestation and Reforestation	6	2	2	1	1	11
	Deforestation	▲ 31	▲ 8	▲ 12	▲ 4	▲ 8	▲ 64
	Forest Management	900	228	▲ 16	11	20	1,143

cf. Japan's Cap of FM is 13 M t-C/yr

20

## Reported Carbon Removals under UNFCCC and KP from 2005 to 2007



Available removals for achievement of the Kyoto target

21

*Thank you for your attention*

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22