

Evaluation Procedure for Carbon Stock Changes in Japanese Forest Sectors

Masahiro Amano
Waseda University

Forest land remaining forest land

- 1995 Report adopted IPCC Default Method
 $\Delta CFFLB = (\Delta CFFG - \Delta CFFL)$

$\Delta CFFLB$ = annual change in carbon stocks in living biomass

$\Delta CFFG$ = annual increase in carbon stocks due to biomass growth

$\Delta CFFL$ = annual decrease in carbon stocks due to biomass loss,

Forest land remaining forest land

- 2005 Report adopted Stock Change Method
 $\Delta \text{CFFLB} = (\text{C } t2 - \text{C } t1) / (t2 - t1)$

ΔCFFLB = annual change in carbon stocks
in living biomass

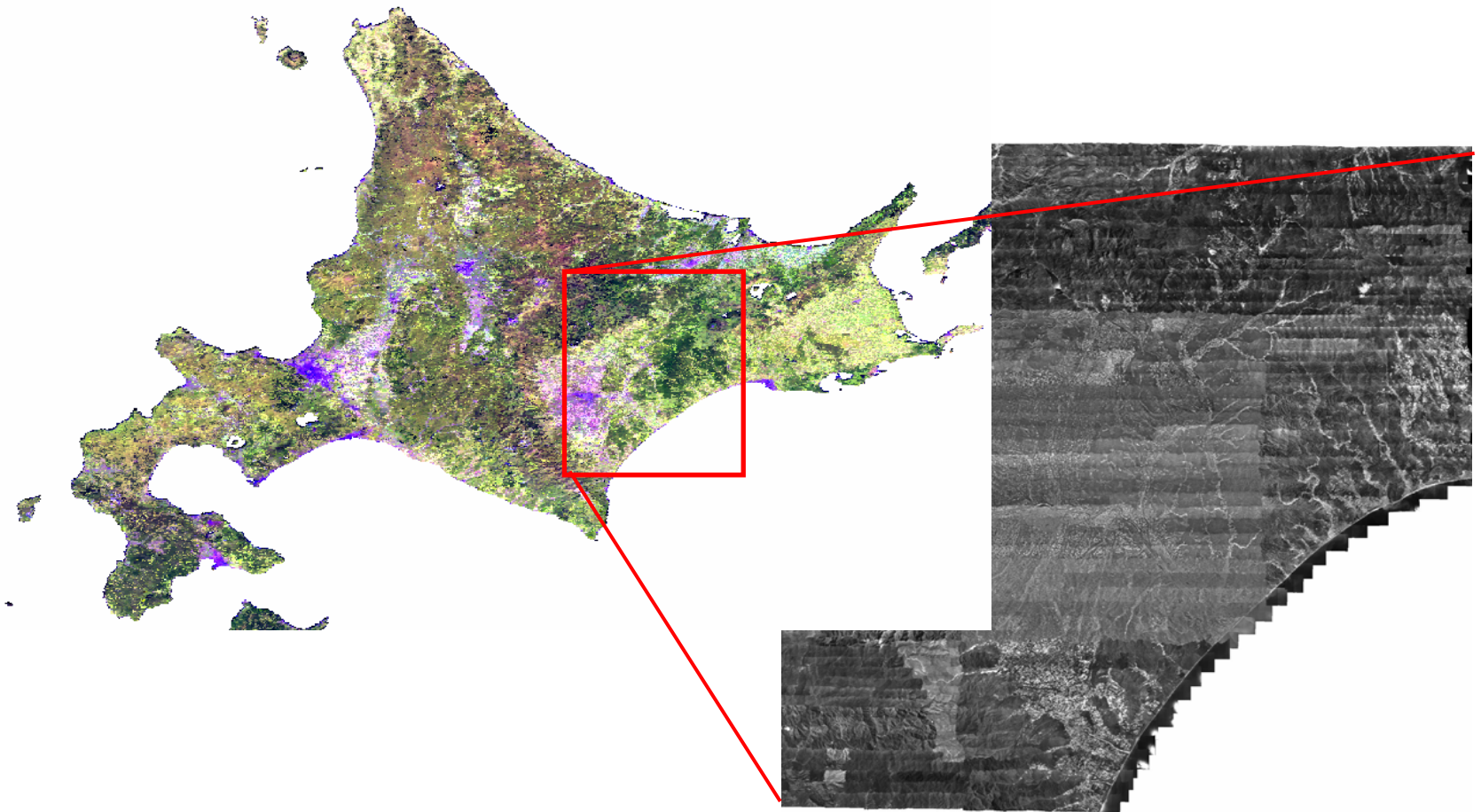
$\text{C } t2$ = total carbon in biomass calculated at
time $t2$

$\text{C } t1$ = total carbon in biomass calculated at
time $t1$

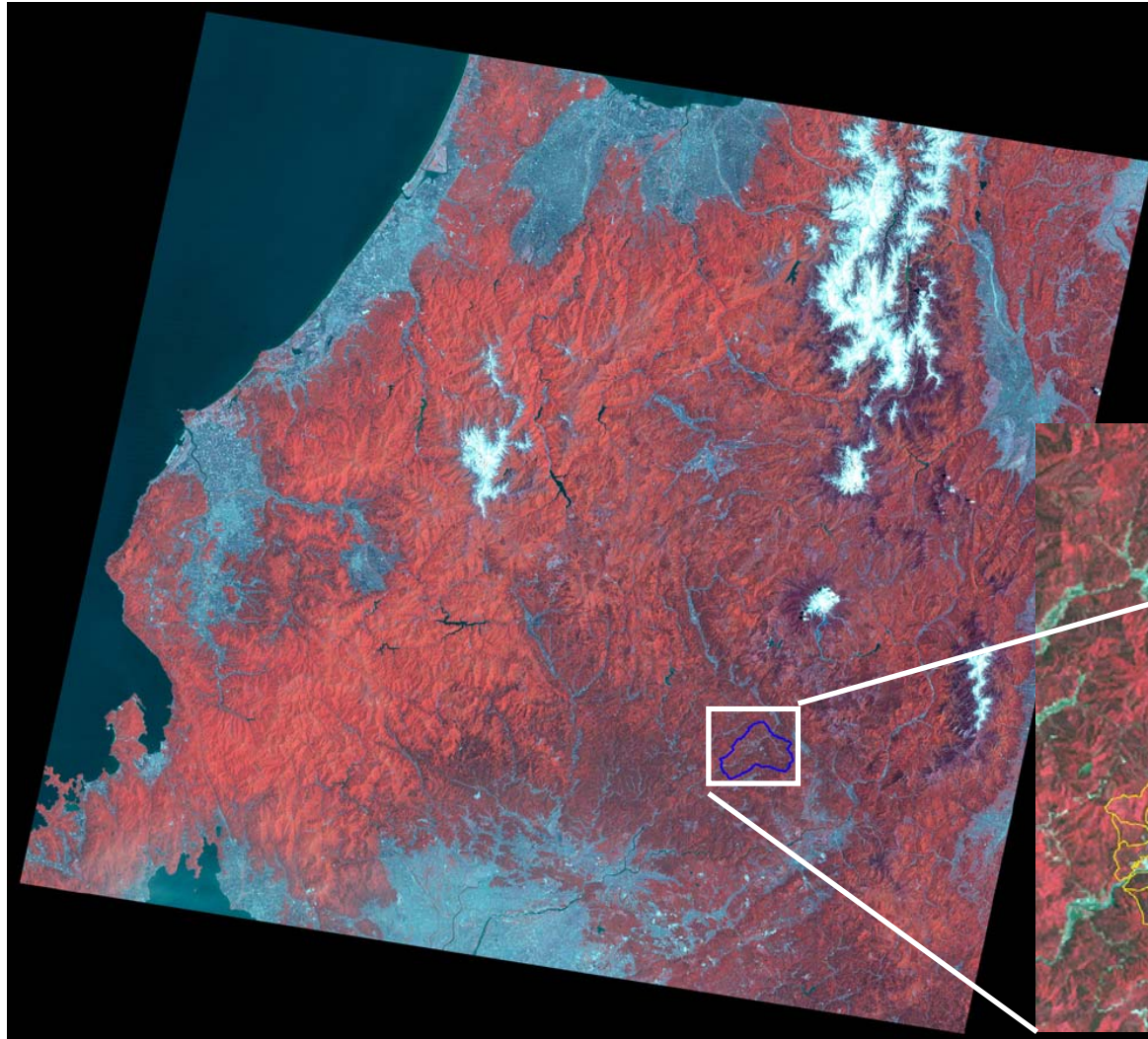
Japanese Inventory System focuses on Kyoto Protocol

Monitoring ARD

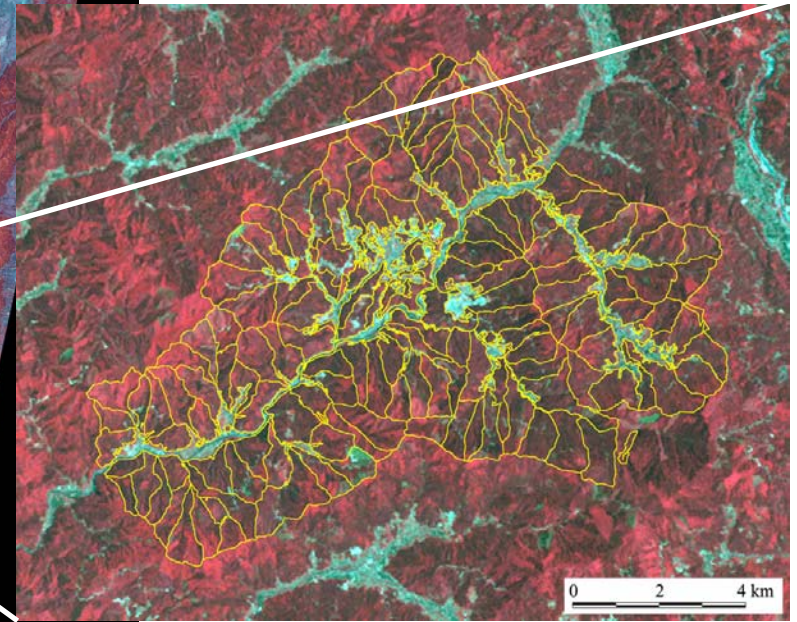
Preparation of orthophotos around 1990
to define forest area in 1989/12/31



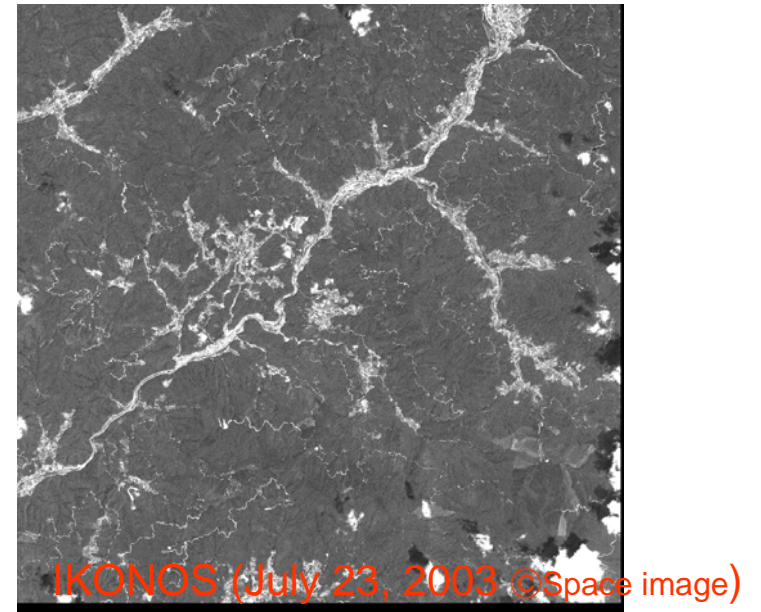
Location of an ARD test area by RS



Higashi-Shirakawa



Images used in ARD monitoring test case



Identification of FM lands

- Narrow and broad interpretation of the definition of FM
 - (LULUCF GPG)... *A party could interpret the definition of forest management **in terms of specified forest management practices**, such as fire suppression, harvesting or thinning, undertaken since 1990. Alternatively, a country could interpret the definition of forest management **in terms of a broad classification** of land subject to a system of forest management practices, without the requirement that a specified forest management practice has occurred on each land.*

Forest Inventory Data 1

- Forest registers
 - Attribute information
 - Area, Species, Age, DBH, Volume, Ownership
 - Number of Compartment and Sub-compartment of all private and national forests
 - Compartments: 370,000 records
 - Sub-compartments: 31,000,000 records
 - Renewal every five years
 - Linkage to boundaries in forest maps

Forest Registers Database

Forest registers

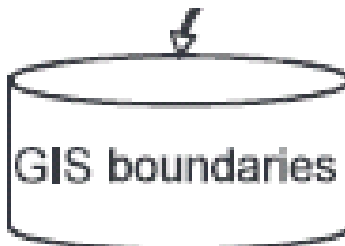
Station	Timing	Year	Forest	Alt-	SYWOOD	Forest	Species	Stand	Tree	County
ID	Code		Component	itude	Code	Type		Age	Number	
04	01	00	001	001	000000001	1	01	00	1	0
04	01	00	002	001	000000002	1	01	00	1	0
04	01	00	003	001	000000003	1	01	00	1	0
04	01	00	004	001	000000004	1	01	00	1	0
04	01	00	005	001	000000005	1	01	00	1	0
04	01	00	006	001	000000006	1	01	00	1	0
04	01	00	007	001	000000007	1	01	00	1	0
04	01	00	008	001	000000008	1	01	00	1	0
04	01	00	009	001	000000009	1	01	00	1	0
04	01	00	010	001	000000010	1	01	00	1	0
04	01	00	011	001	000000011	1	01	00	1	0
04	01	00	012	001	000000012	1	01	00	1	0
04	01	00	013	001	000000013	1	01	00	1	0
04	01	00	014	001	000000014	1	01	00	1	0
04	01	00	015	001	000000015	1	01	00	1	0
04	01	00	016	001	000000016	1	01	00	1	0
04	01	00	017	001	000000017	1	01	00	1	0
04	01	00	018	001	000000018	1	01	00	1	0
04	01	00	019	001	000000019	1	01	00	1	0
04	01	00	020	001	000000020	1	01	00	1	0
04	01	00	021	001	000000021	1	01	00	1	0
04	01	00	022	001	000000022	1	01	00	1	0
04	01	00	023	001	000000023	1	01	00	1	0
04	01	00	024	001	000000024	1	01	00	1	0
04	01	00	025	001	000000025	1	01	00	1	0
04	01	00	026	001	000000026	1	01	00	1	0
04	01	00	027	001	000000027	1	01	00	1	0
04	01	00	028	001	000000028	1	01	00	1	0
04	01	00	029	001	000000029	1	01	00	1	0
04	01	00	030	001	000000030	1	01	00	1	0
04	01	00	031	001	000000031	1	01	00	1	0
04	01	00	032	001	000000032	1	01	00	1	0
04	01	00	033	001	000000033	1	01	00	1	0
04	01	00	034	001	000000034	1	01	00	1	0
04	01	00	035	001	000000035	1	01	00	1	0
04	01	00	036	001	000000036	1	01	00	1	0
04	01	00	037	001	000000037	1	01	00	1	0
04	01	00	038	001	000000038	1	01	00	1	0
04	01	00	039	001	000000039	1	01	00	1	0
04	01	00	040	001	000000040	1	01	00	1	0
04	01	00	041	001	000000041	1	01	00	1	0
04	01	00	042	001	000000042	1	01	00	1	0
04	01	00	043	001	000000043	1	01	00	1	0
04	01	00	044	001	000000044	1	01	00	1	0
04	01	00	045	001	000000045	1	01	00	1	0
04	01	00	046	001	000000046	1	01	00	1	0
04	01	00	047	001	000000047	1	01	00	1	0
04	01	00	048	001	000000048	1	01	00	1	0
04	01	00	049	001	000000049	1	01	00	1	0
04	01	00	050	001	000000050	1	01	00	1	0

Historical records of forest management

Station ID	Management Type	Execution Year
04 01 000 001 0	CA	1980
04 01 000 001 1	CA	1980
04 01 000 001 2	CA	1980
04 01 000 001 3	CA	1980
04 01 000 001 4	CA	1980
04 01 000 001 5	CA	1980
04 01 000 001 6	CA	1980
04 01 000 001 7	CA	1980
04 01 000 001 8	CA	1980
04 01 000 001 9	CA	1980
04 01 000 002 0	CA	1980
04 01 000 002 1	CA	1980
04 01 000 002 2	CA	1980
04 01 000 002 3	CA	1980
04 01 000 002 4	CA	1980
04 01 000 002 5	CA	1980
04 01 000 002 6	CA	1980
04 01 000 002 7	CA	1980
04 01 000 002 8	CA	1980
04 01 000 002 9	CA	1980
04 01 000 003 0	CA	1980
04 01 000 003 1	CA	1980
04 01 000 003 2	CA	1980
04 01 000 003 3	CA	1980
04 01 000 003 4	CA	1980
04 01 000 003 5	CA	1980
04 01 000 003 6	CA	1980
04 01 000 003 7	CA	1980
04 01 000 003 8	CA	1980
04 01 000 003 9	CA	1980
04 01 000 004 0	CA	1980
04 01 000 004 1	CA	1980
04 01 000 004 2	CA	1980
04 01 000 004 3	CA	1980
04 01 000 004 4	CA	1980
04 01 000 004 5	CA	1980
04 01 000 004 6	CA	1980
04 01 000 004 7	CA	1980
04 01 000 004 8	CA	1980
04 01 000 004 9	CA	1980
04 01 000 005 0	CA	1980
04 01 000 005 1	CA	1980
04 01 000 005 2	CA	1980
04 01 000 005 3	CA	1980
04 01 000 005 4	CA	1980
04 01 000 005 5	CA	1980
04 01 000 005 6	CA	1980
04 01 000 005 7	CA	1980
04 01 000 005 8	CA	1980
04 01 000 005 9	CA	1980

Linkage
By Key Code

Linkage By Polygon ID

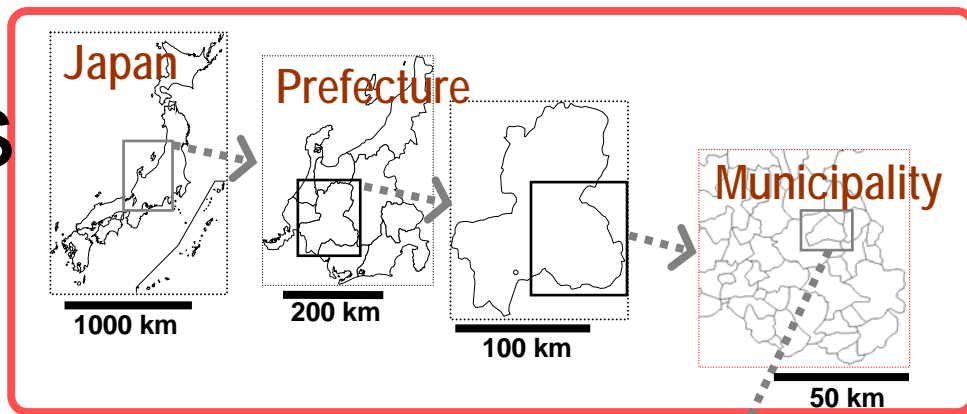


Forest Inventory Data 2

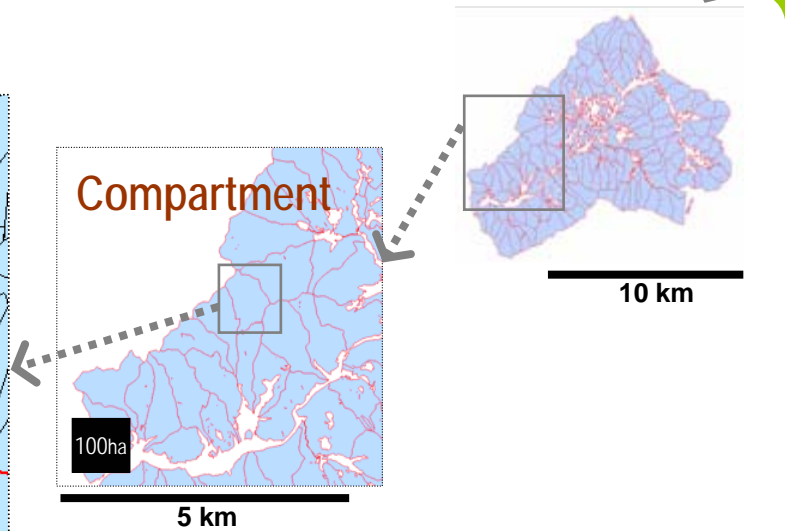
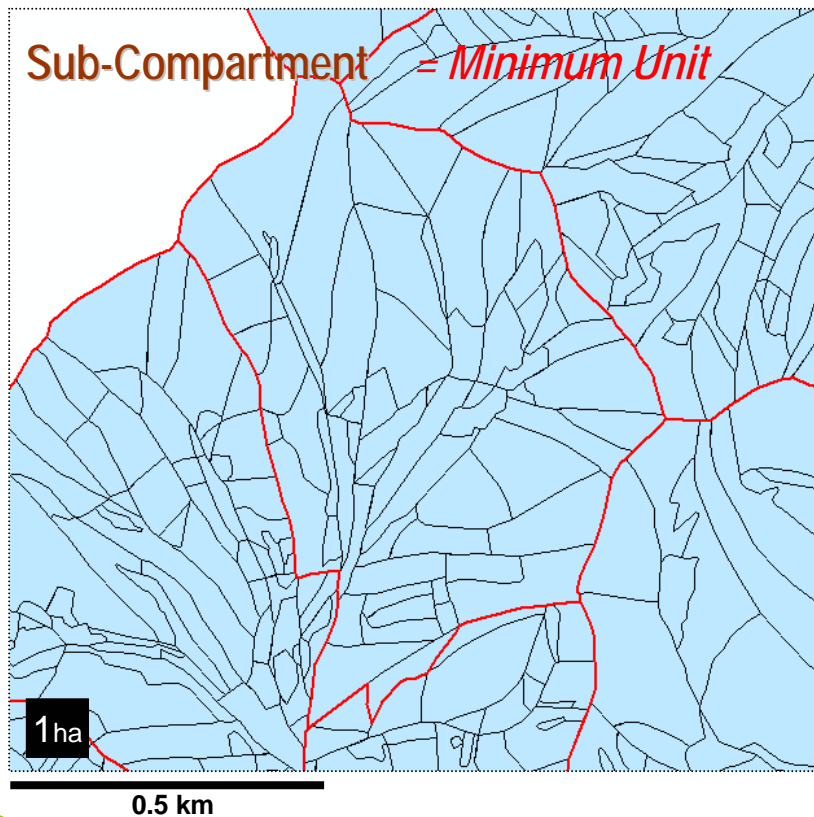
- Forest maps
 - 1/5000 scale maps
 - Boundaries of forest compartments and sub-compartments
 - Around 40% of the boundaries were digitized for GIS so far

Geographic Units

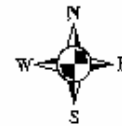
Administrative needs



Forest management needs



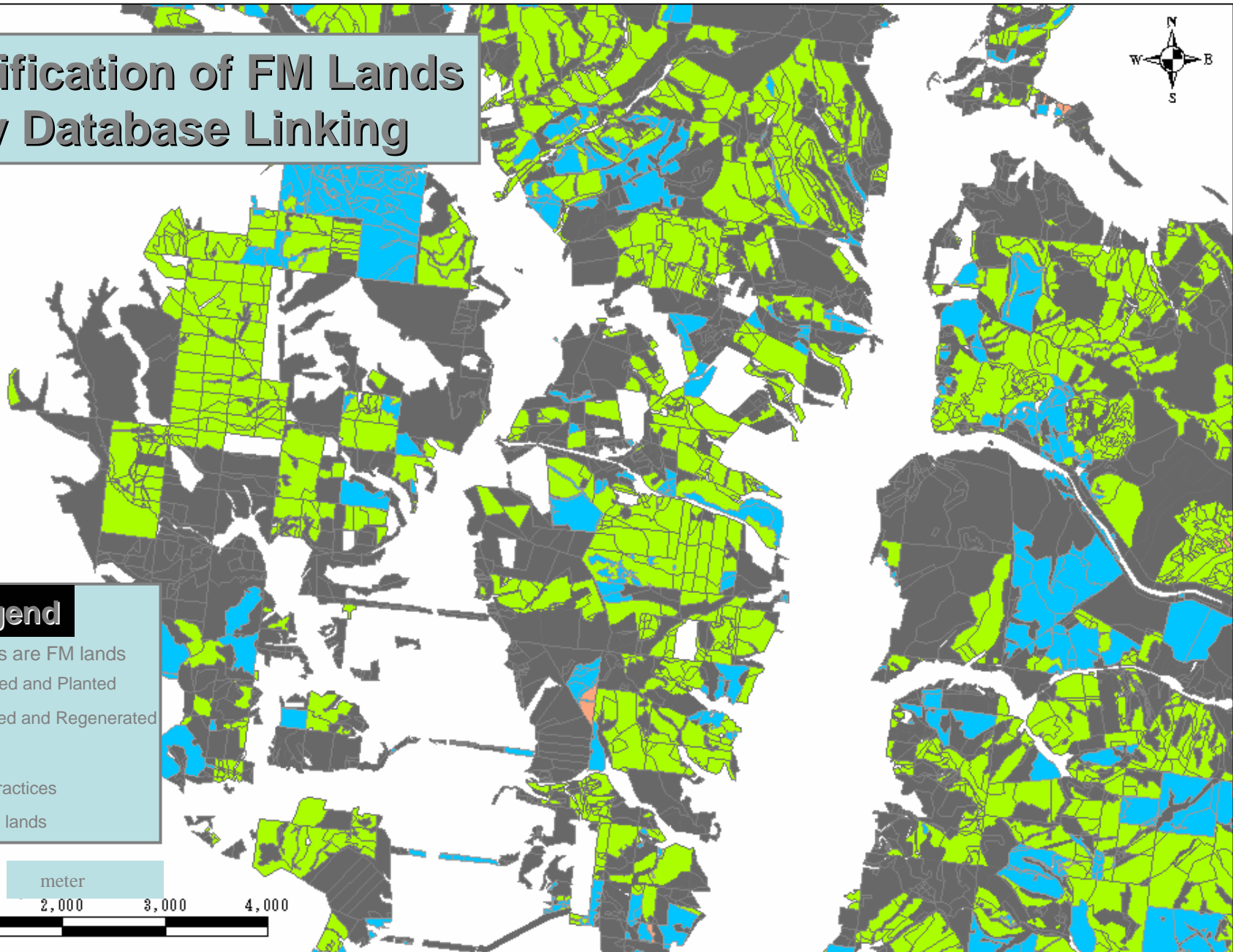
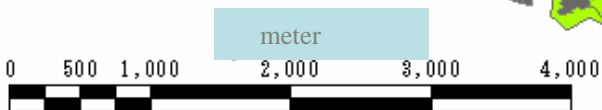
Identification of FM Lands by Database Linking



Legend

Colored areas are FM lands

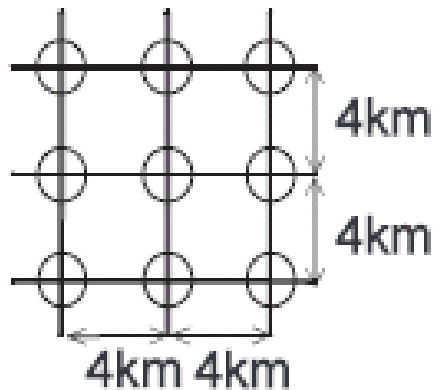
- Harvested and Planted
- Harvested and Regenerated
- Thinned
- Other practices
- Non FM lands



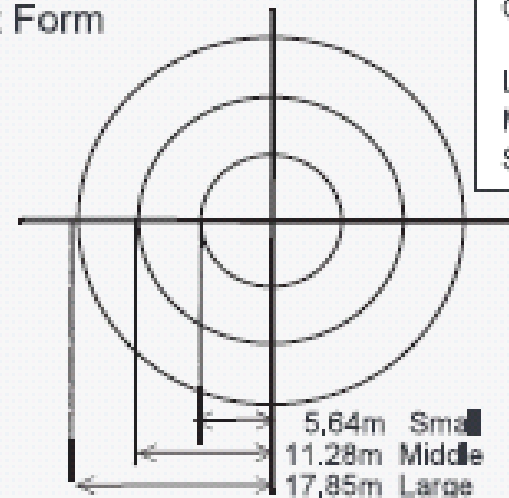
Forest Inventory Data 3

Forest Resource Monitoring System

Configuration of Monitoring Plots



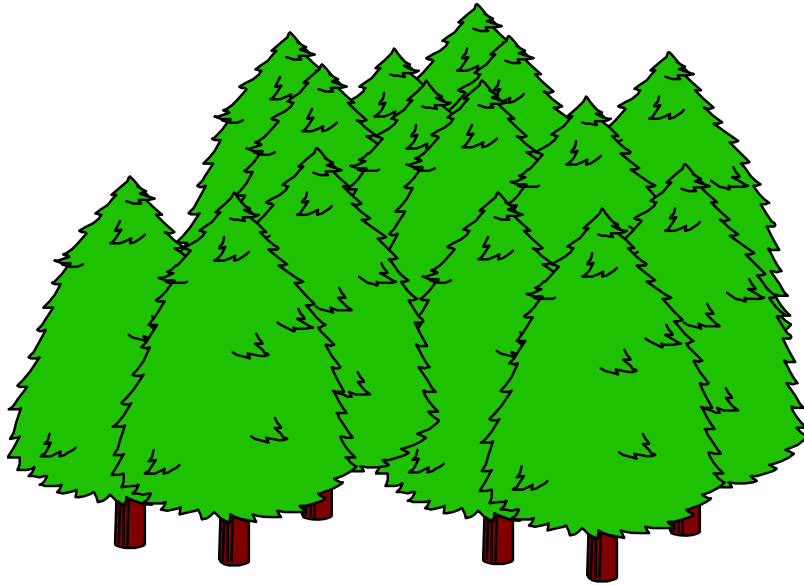
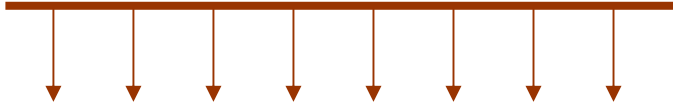
Plot Form



Circle	Area	DBH	to be measured
Large	0,1 ha	> 18cm	
Middle	0,04 ha	> 5 cm	
Small	0,01 ha	> 1 cm	

Definition of Forest

Minimum Crown cover 10-**30%**



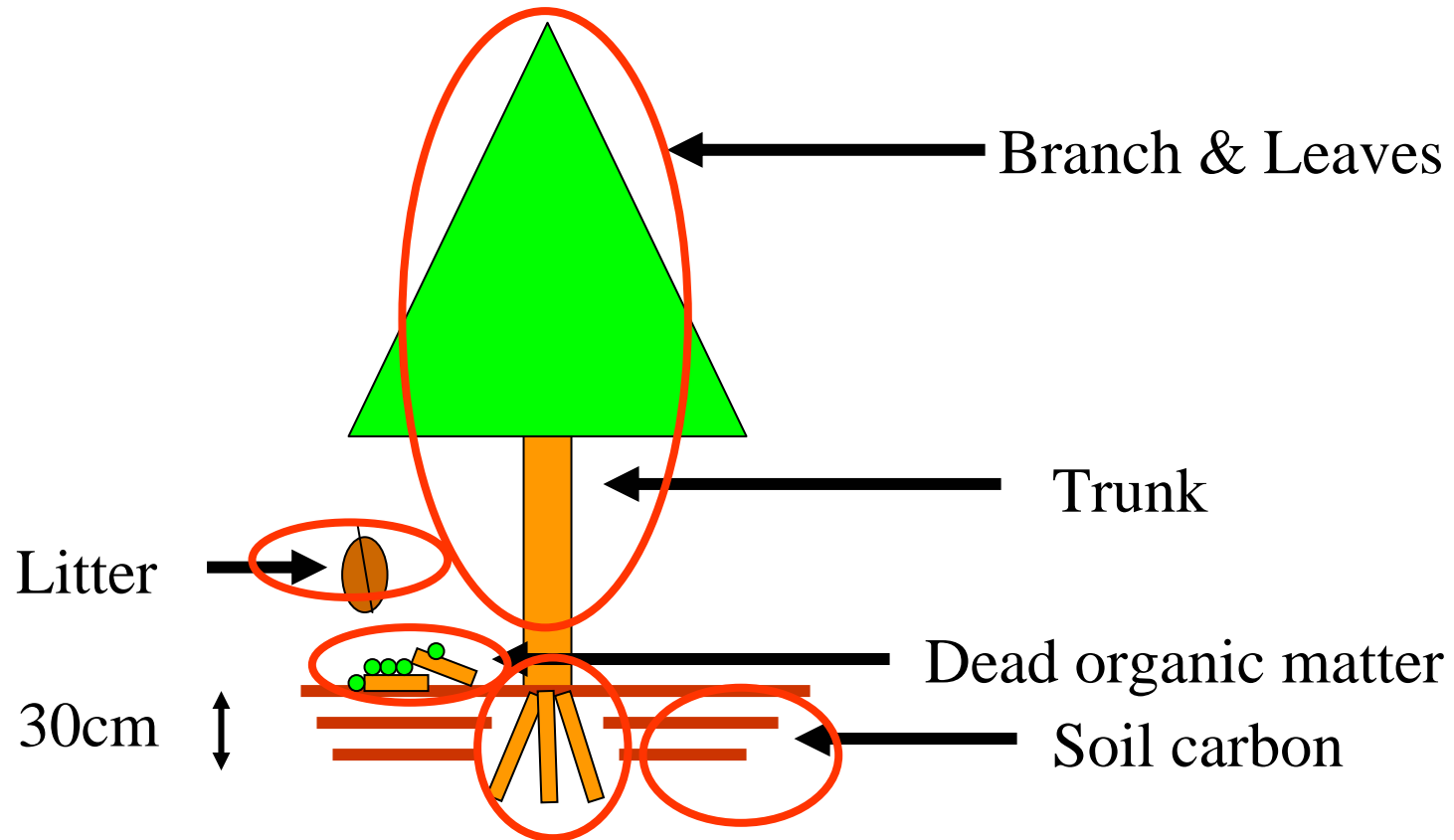
a minimum height
2-**5m**



A minimum area 0.05-1.0ha(**0.3ha**)



Carbon pool in forests defined By Marrakech Accords



Collection of data (above ground biomass)

Tree species	Previous Literature	Research Project	Project by Forest Agency			Total
		①	②	③	④	
<i>Cryptomeria japonica</i>	216	11	66	25	17	335
<i>Chamaecyparis obtusa</i>	82	8		16	39	145
<i>Pinus densiflora</i>	135	0		4	3	142
<i>Larix kaempferi</i>	49	9		8	7	73
<i>Abies sachalinensis</i>	30	2		2	5	39
<i>Picea jezoensis</i>	0	3			3	6
<i>Picea glehnii</i>	1	4		2	5	12
Other conifers	1	1		1	3	6
Broadleaf	171				15	186
Total	685	38	66	58	97	944

① Study on Transparent and Verifiable Method of Evaluating Carbon Sinks (FY2001-2003)

② Project on evaluate to effect of thinning for forest sink (FY1999-2000)

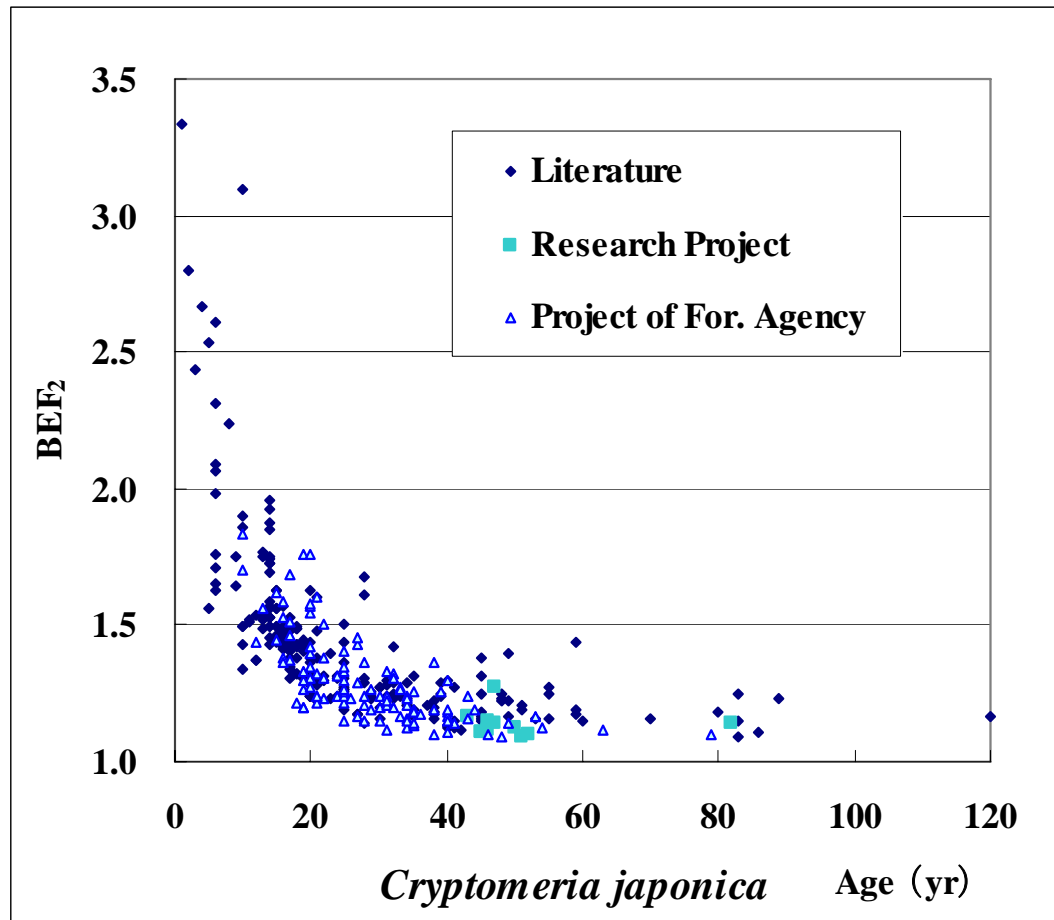
③ Project on development for measurement system of forest sink (FY2001-2002)

④ Project on organization development for measurement and Use of forest sink (FY2003-2006)

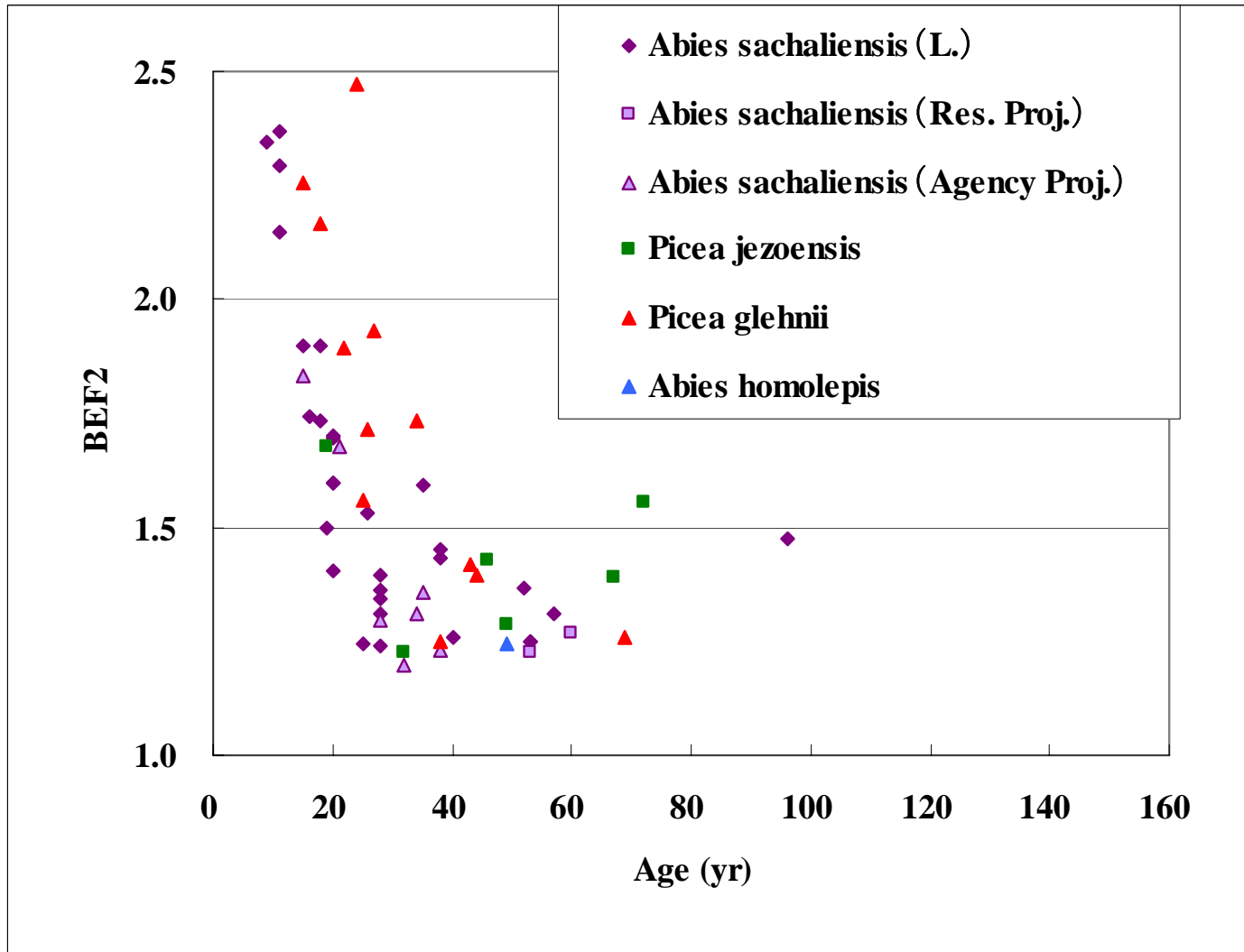
➤ We are measuring 73 plots in which 28 plots are measuring additionally below ground biomass in 2004.

➤ We will repeat same plan to measure in 2005 and 2006.

Biomass Expansion Factor (BEF_2) of Sugi Cedar



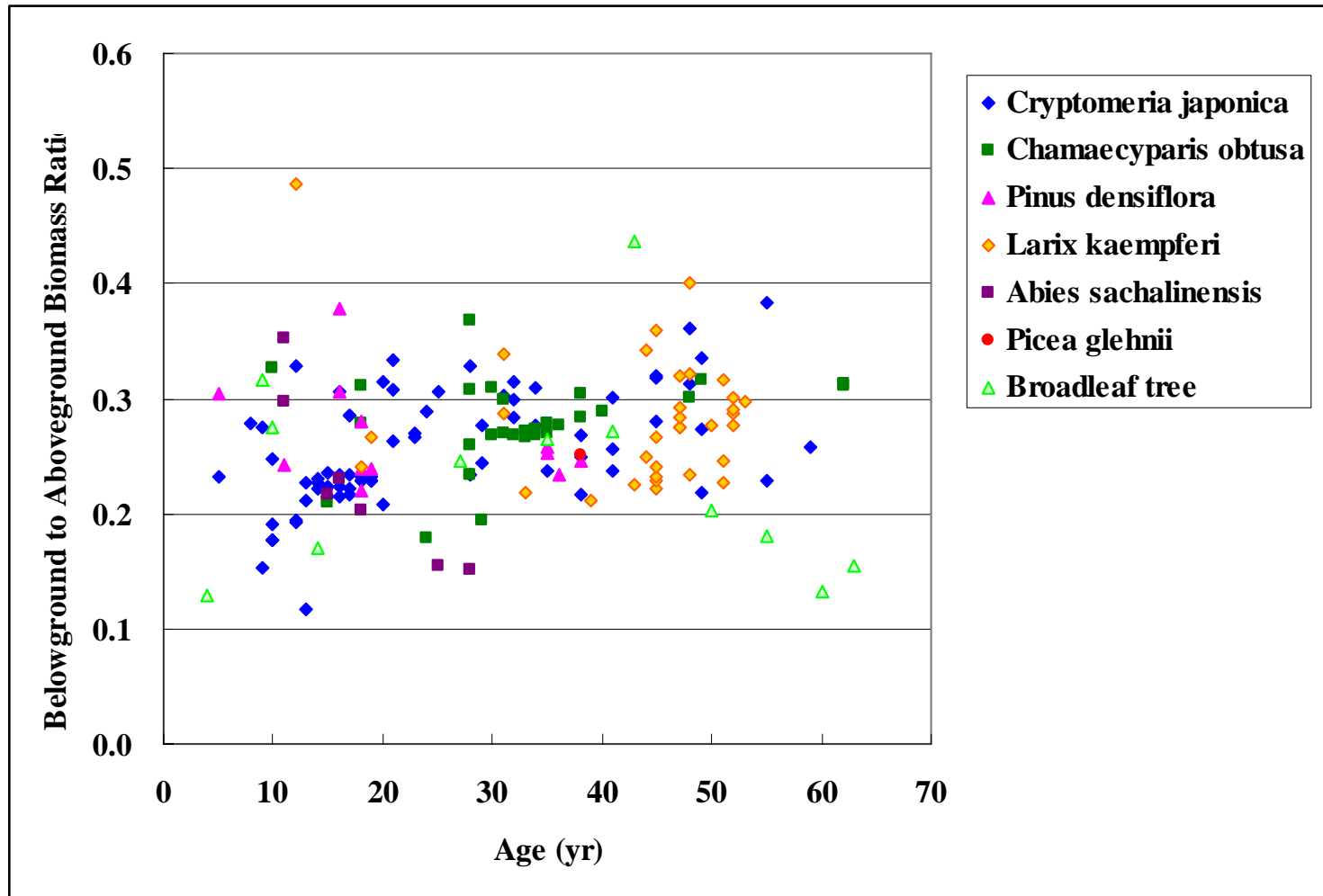
BEF₂ of Boreal Conifer



Biomass Expansion Factors of Some Typical Species in Japan

Stand Age	Tree Species	Previous Literature			by added data of research project FY2001-2003			Tentative value by added data of forest agency project FY1999-2003		
		Number of	Mean	Conf. RSE	Number of	Mean	Conf. RSE	Number of	Mean	Conf. RSE
≤ 20	Cryptomeria japonica	111	1.61	±0.07 4.3%	—	—	—	142	1.58	±0.06 3.6%
	Abies sachalinensis	14	1.85	±0.17 9.0%	—	—	—	15	1.85	±0.16 8.4%
	All of broadleaf	47	1.39	±0.07 4.9%	—	—	—	48	1.40	±0.07 4.9%
≥ 21	Cryptomeria japonica	105	1.25	±0.02 1.6%	116	1.24	±0.02 1.6%	193	1.23	±0.01 1.2%
	Abies sachalinensis	16	1.36	±0.05 3.9%	18	1.35	±0.05 3.7%	24	1.35	±0.05 3.7%
	All of broadleaf	124	1.28	±0.02 1.8%	—	—	—	138	1.27	±0.02 1.6%

Belowground to Aboveground Biomass Ratio (Root-Shoot Ratio, R)



Belowground to Aboveground Biomass Ratio of Some Typical Species in Japan

Stand Age	Tree Species	Previous Literature		
		Number of	Mean	Conf. RSE
≤ 20	Cryptomeria japonica	37	0.23	± 0.01 5.9%
	Abies sachalinensis	5	0.26	± 0.05 21.1%
	All of broadleaf	4	0.22	± 0.09 38.7%
≥ 21	Cryptomeria japonica	35	0.28	± 0.01 4.6%
	Abies sachalinensis	2	0.15	± 0.10 66.2%
	All of broadleaf	8	0.24	± 0.07 28.0%

Forest GHG Accounting System

