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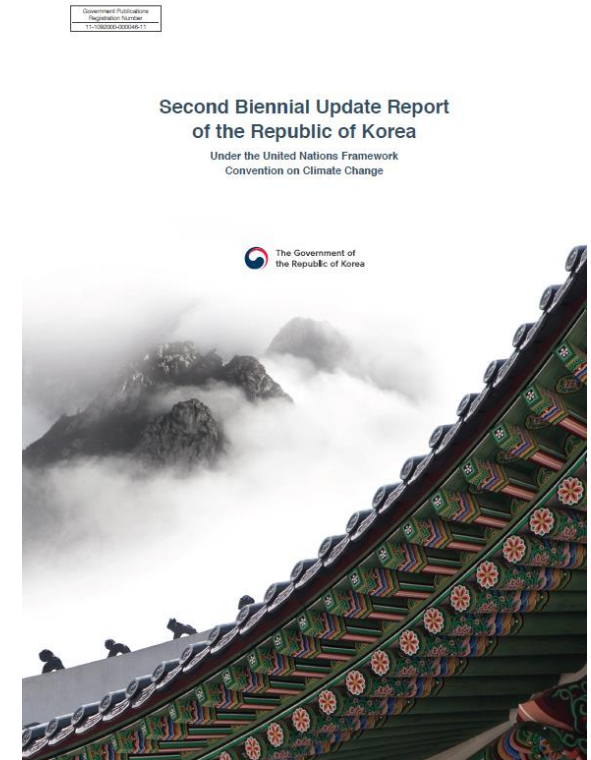# The Role of AFOLU sector in the NDC

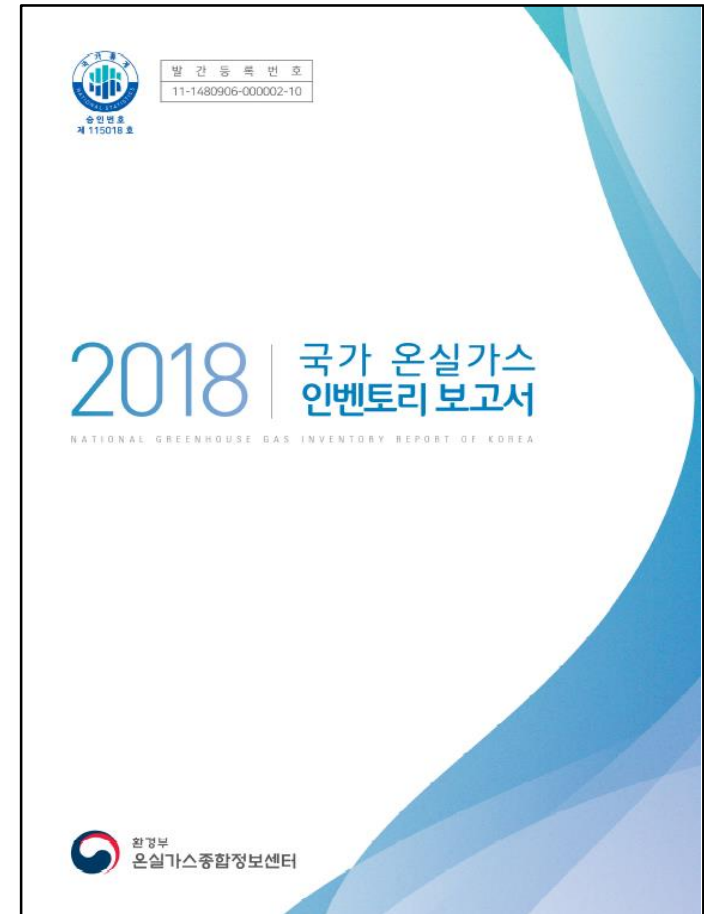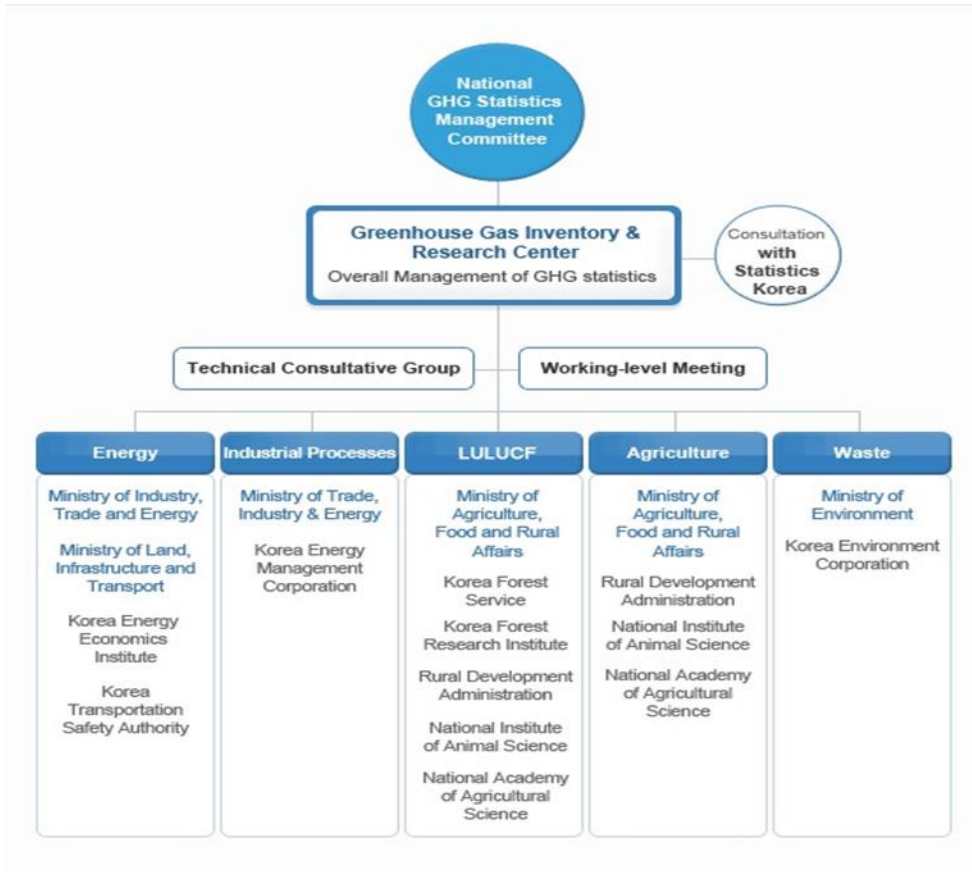# - Republic of Korea -

24. April 2019.

Yim, Jong-Su

National Institute of Forest Science

◆ The trend of GHG Emission and Removal

◆ NDC status and Roadmap

◆ GHG Inventory in AFOLU sector

◆ Challenges to improve GHG inventory

◆ Challenges to track NDC progress

Government Publications
Registration Number
11-1062000-000046-11

**Second Biennial Update Report
of the Republic of Korea**

Under the United Nations Framework
Convention on Climate Change

The Government of
the Republic of Korea

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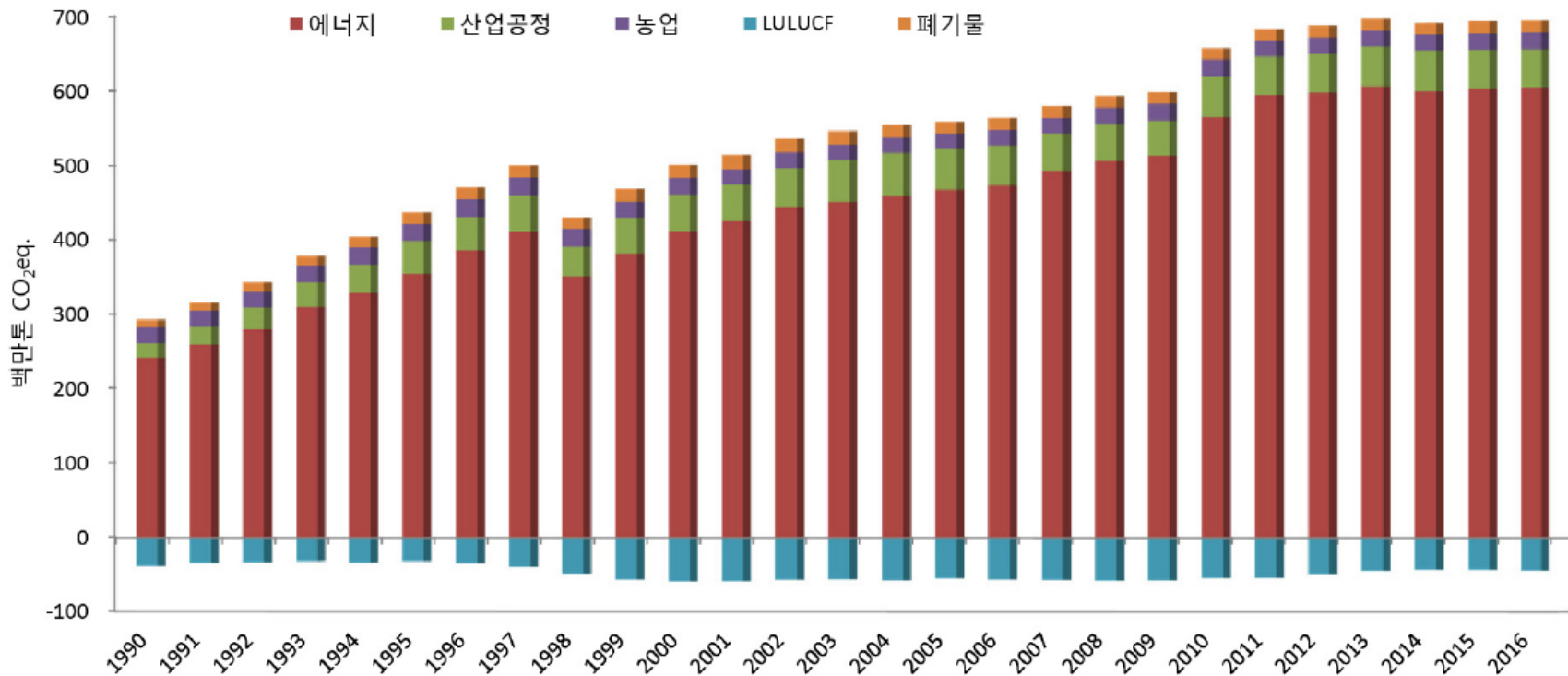
- GHG inventory process in ROK


< Source: http://www.gir.go.kr/eng/>

- Base year: 2016 year

- Total GHG emission (TE): 694 Mton $CO_{2eq.}$(Excluding LULUCF) ; Energy sector account for 87%

- Emission of AFLOU sector: 21.2 in Agriculture (3% of TE) & -44.5 in LULUCF (6% of TE)

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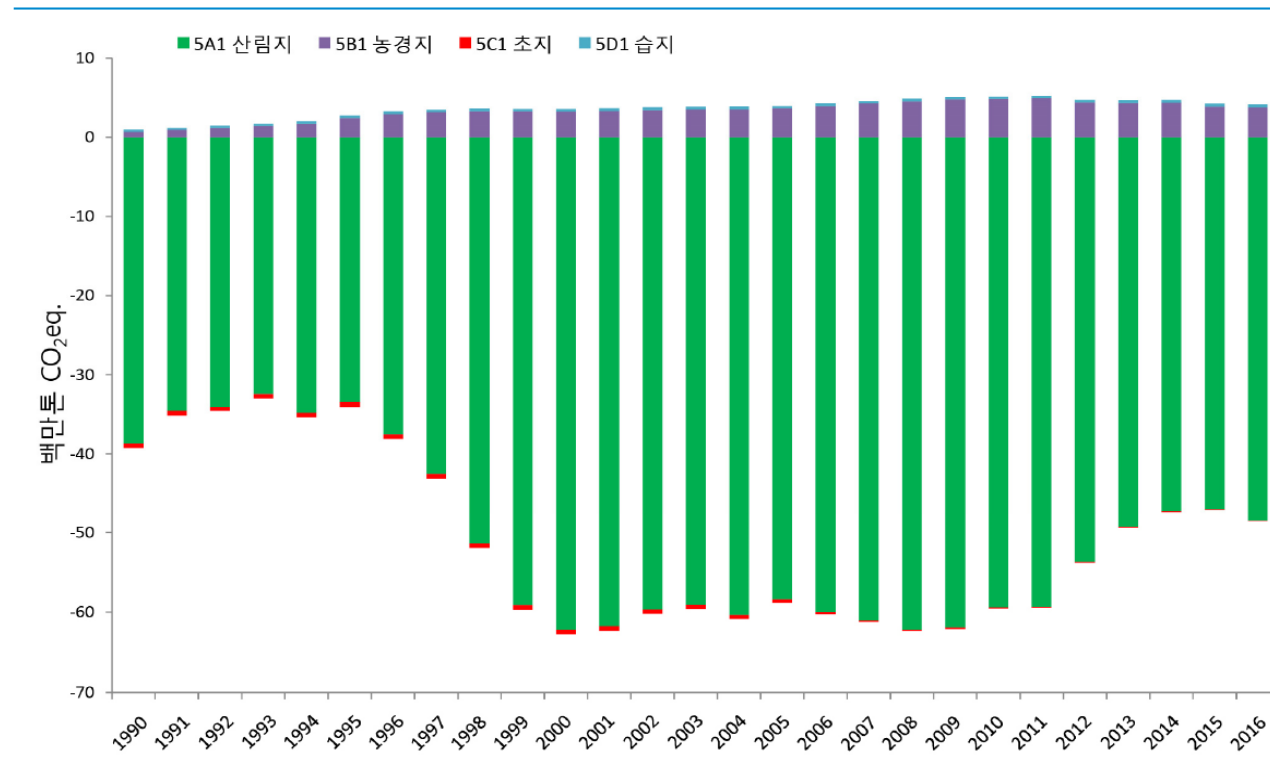| Contents | **GHG Inventory** | NDC status | AFOLU sector | Improvement | Tracking progress |

- GL : 1996 IPCC GL / 2000 GPG ⇨ 2006 GL

- Agriculture Categories : Rice cultivation (4C) > Agricultural soil (4D) > Manure management (4B)

   * Reduction of Agricultural area (4C) ; Increase in livestock number (4B)

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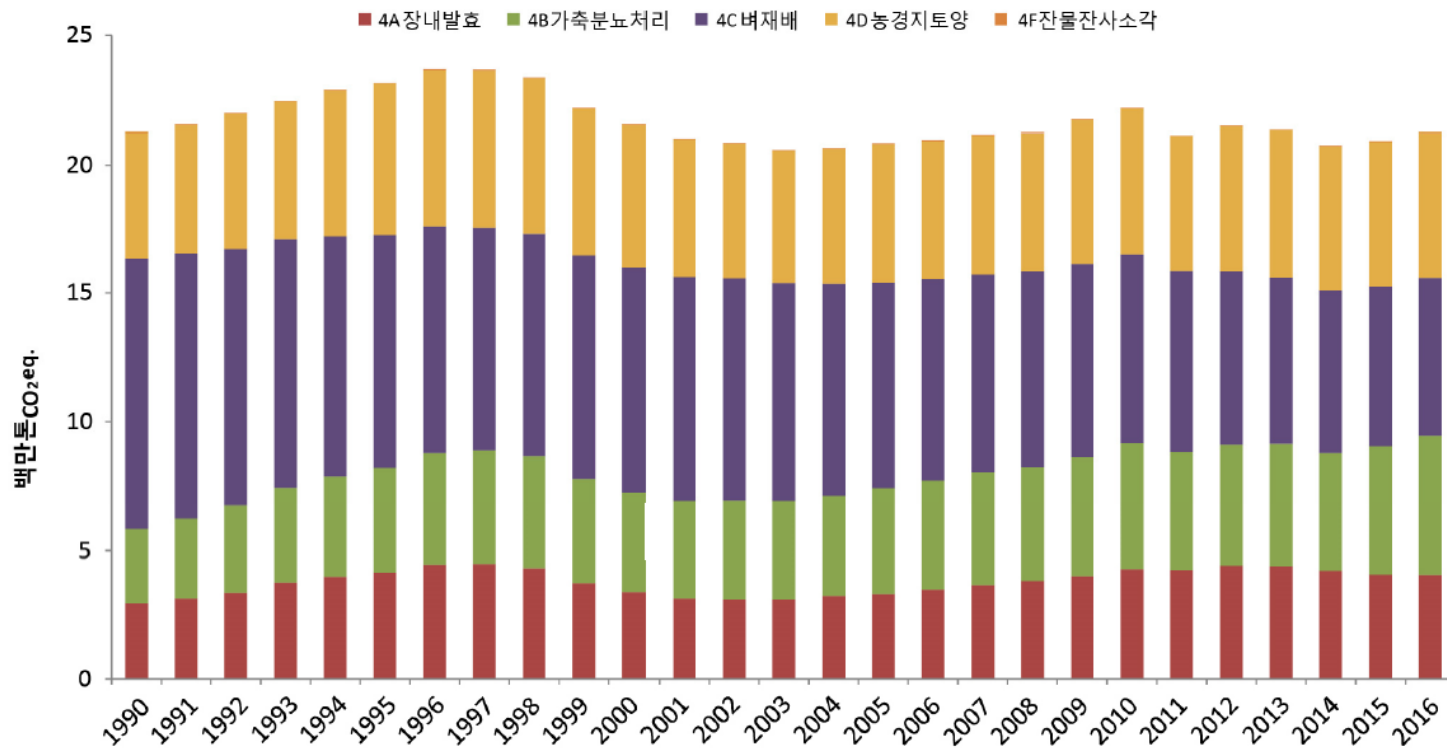
- GHG gases : CH_4 (54.1%) > N_2O (45.9%)
- Emissions of CH4 are on a steady decline (67.1→54.1%), which of N_2O are increasing (32.8→45.9%) .

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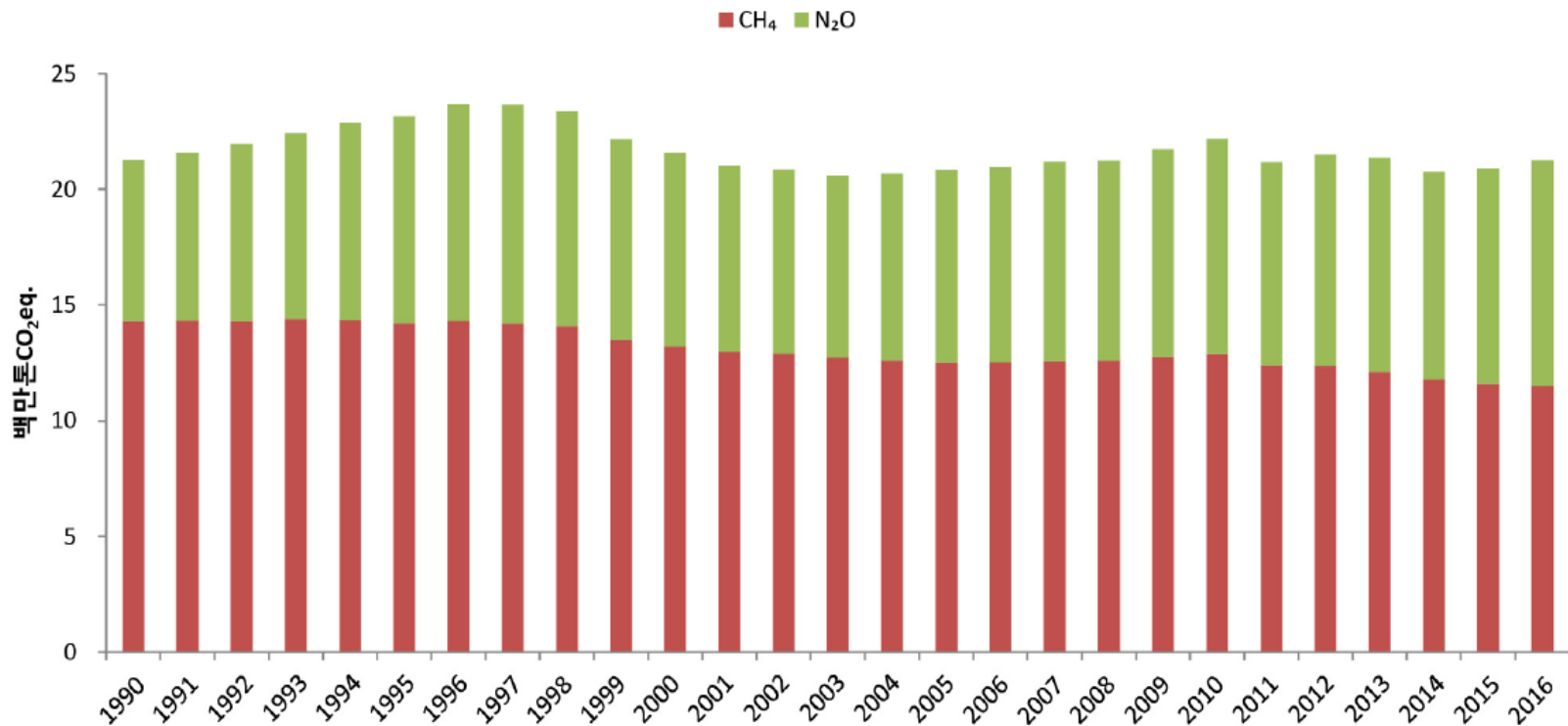
- LULUCF : Emissions (Cropland > Wetlands) ; Removals (Forest land > Grass land)

    * Carbon pool in forest land : above- and below- biomass

    * Carbon removals in forest lands gradually decreased depending on age class distributions


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Baseline	(MtCO$_2$eq)			
	Year	2020	2025	2030
	BAU	782.5	809.7	850.6
	The scenario is based on the BAU projection of KEEI-EGMS (the Korea Energy Economics Institute Energy and GHG Modeling System), taking into account projections for key economic variables, including population, GDP, industrial structure and oil price.			
Reduction Level	Emission reduction by 37% from the BAU level by 2030			
Coverage	Economy-wide			
Sectors	Energy, industrial processes and product use, agriculture and waste (A decision on whether to include land use, land-use change and forestry (LULUCF) will be made at a later stage.)			

(Source: Intended NDC of ROK, 2015)

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| Contents | GHG Inventory | **NDC status** | AFOLU sector | Improvement | Tracking progress |

- Revision of the 2030 National GHG Mitigation Roadmap (`18.7)
- Emission Target in 2030 : 536 Mton $CO_{2eq.}$ (Domestic target ↑, ITMOs ↓ included forestry sector)
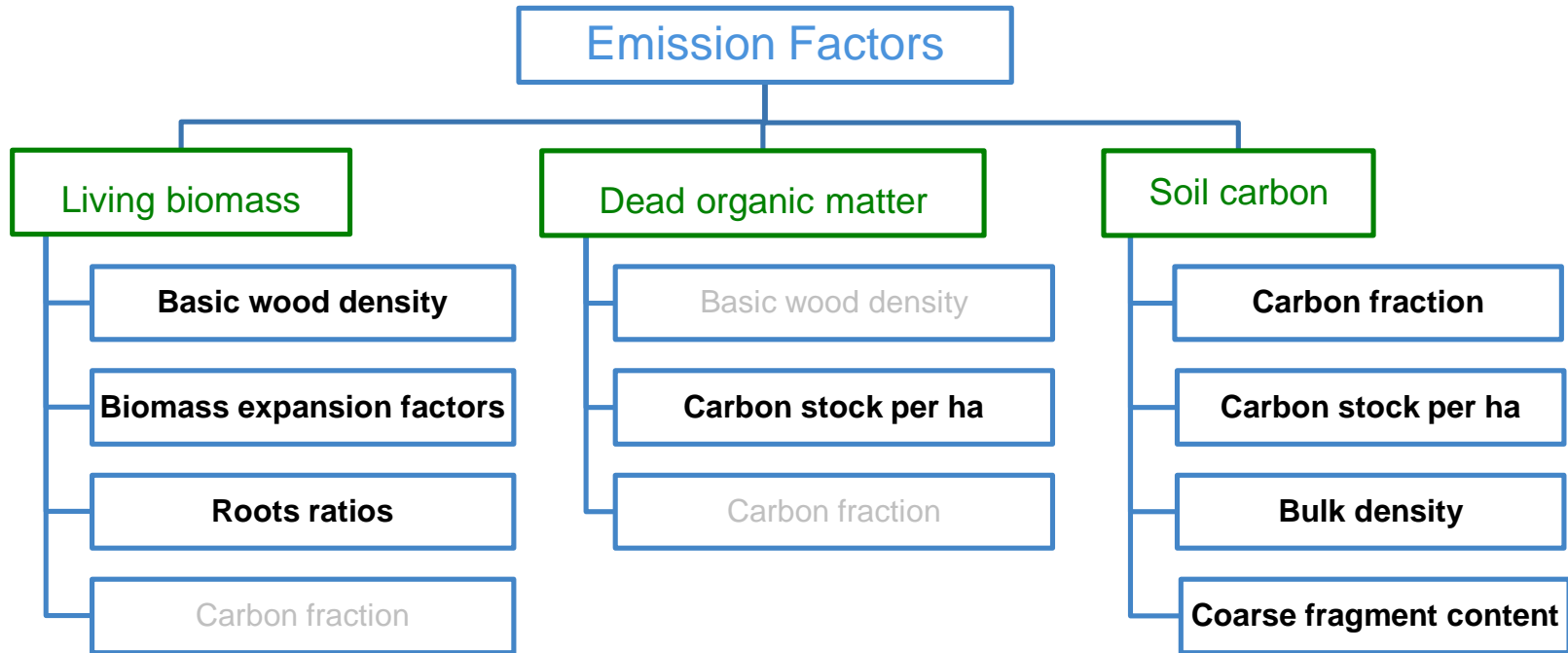
< Comparison of 2030 National GHG Mitigation Roadmaps >

Contents	GHG Inventory	NDC status	**AFOLU sector**	Improvement	Tracking progress
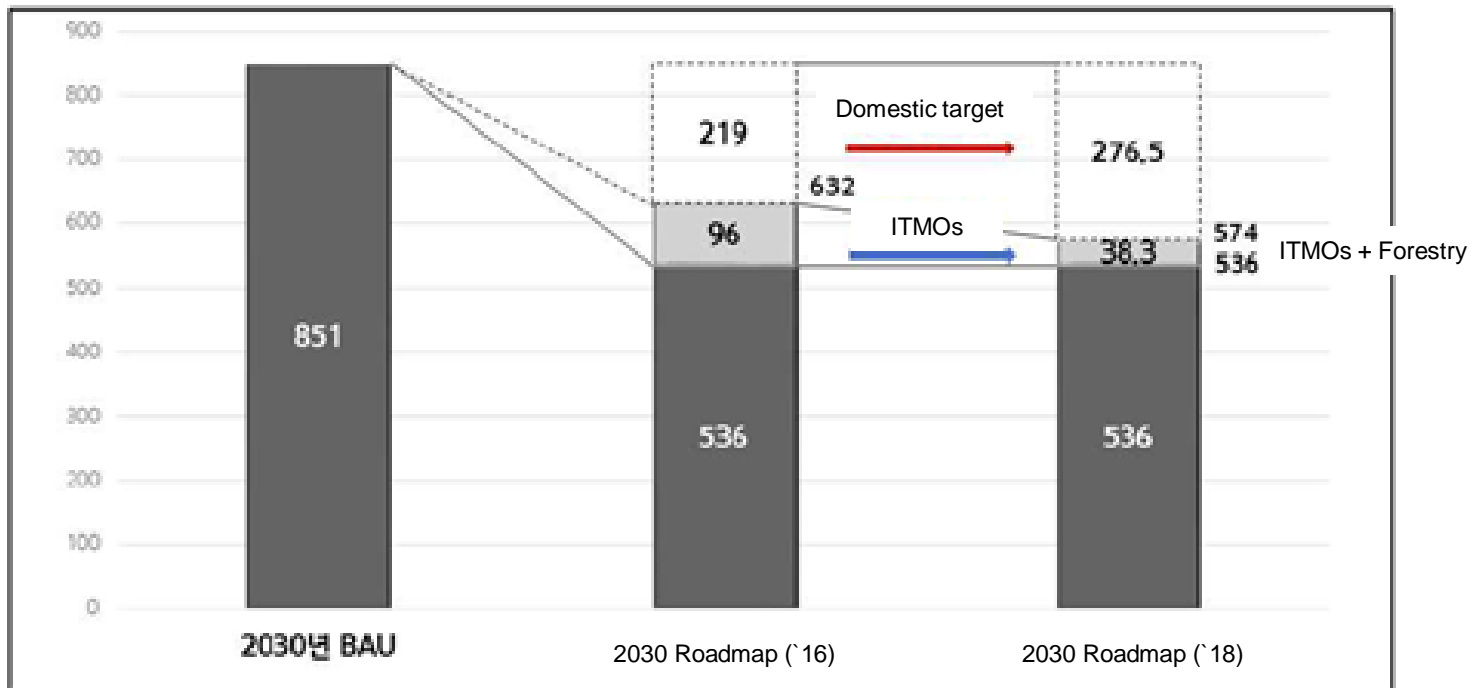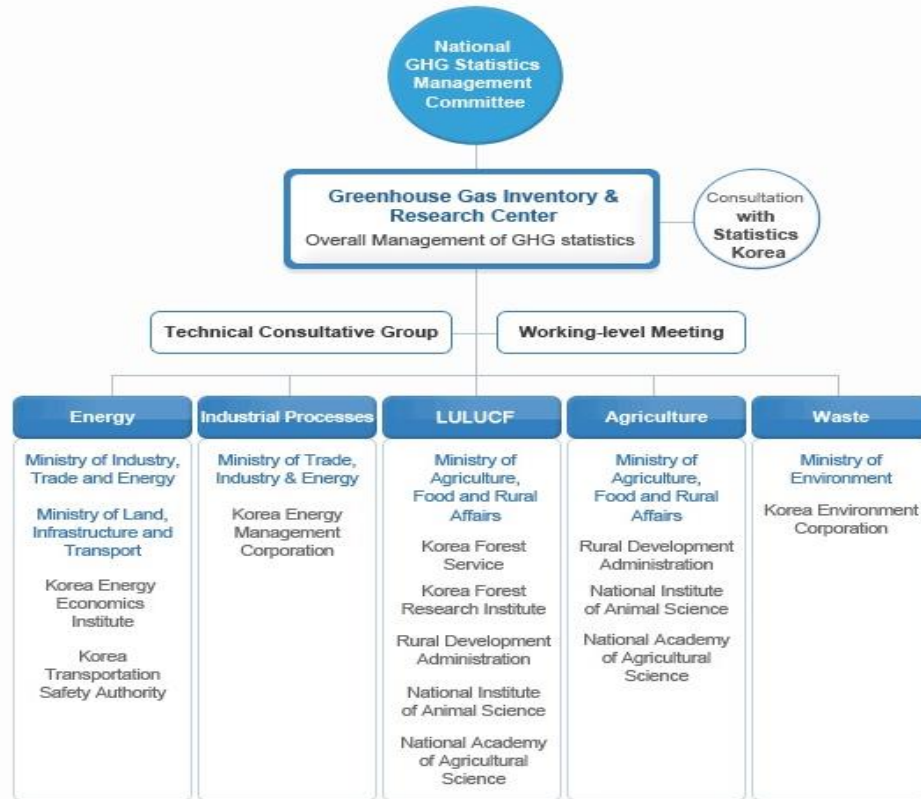
< Organization for GHG inventory of the ROK >

< Agriculture sector >

Land-use	Designated Institute
Agriculture	National Institute of Agricultural Sciences
Livestock/ Manure	National Institute of Animal Science

< LULUCF sector >

Land-use	Designated Institute
Forest land, Wetlands	**National Institute of Forest Science**
Cropland	National Institute of Agricultural Sciences
Grassland	National Institute of Animal Science
Settlements/ Other land	Korea Research Institute for Human Settlements

| Contents | GHG Inventory | NDC status | **AFOLU sector** | Improvement | Tracking progress |

❖ **Country-specific emission/removal factors**

```
                        Emission Factors
        ┌───────────────────────┼───────────────────────┐
  Living biomass          Dead organic matter          Soil carbon
```

Living biomass
- **Basic wood density**
- **Biomass expansion factors**
- **Roots ratios**
- Carbon fraction

Dead organic matter
- Basic wood density
- **Carbon stock per ha**
- Carbon fraction

Soil carbon
- **Carbon fraction**
- **Carbon stock per ha**
- **Bulk density**
- **Coarse fragment content**

| Contents | GHG Inventory | NDC status | **AFOLU sector** | Improvement | Tracking progress |

❖ **Country-specific emission/removal factors**

Classification	Tree Species	Basic wood density	BEF	Roots ratios
Conifers	*Pinus deniflora* in Gangwon	0.42	1.48	0.26
	Pinus deniflora in Central	0.47	1.41	0.25
	Larix kaempferi	0.45	1.34	0.29
	Pinus rigida	0.5	1.33	0.36
	Pinus thunbergii	0.48	1.52	0.29
	Pinus korainsis	0.41	1.74	0.28
	Crytomeria japonica	0.35	1.31	0.23
	Chamaecyparis obtusa	0.43	1.34	0.2
	Conifers	0.46	1.43	0.27
Non-Conifers	*Quercus variabills*	0.72	1.34	0.32
	Quercus acutissima	0.72	1.45	0.31
	Quercus mongolica	0.66	1.6	0.39
	Quercus serrata	0.66	1.55	0.43
	Quercus acuta	0.83	1.7	0.19
	Non-Conifers	0.68	1.51	0.36

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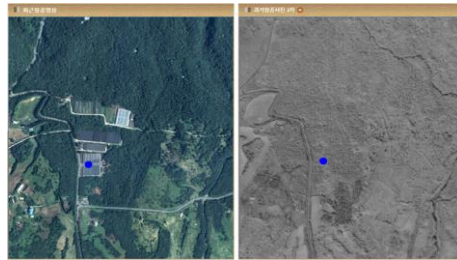| Contents | GHG Inventory | NDC status | **AFOLU sector** | Improvement | Tracking progress |

❖ **Recalculation for activity data**

- Difference in estimated forest growing stocks by NFI system

- Recalculation method : Overlap method
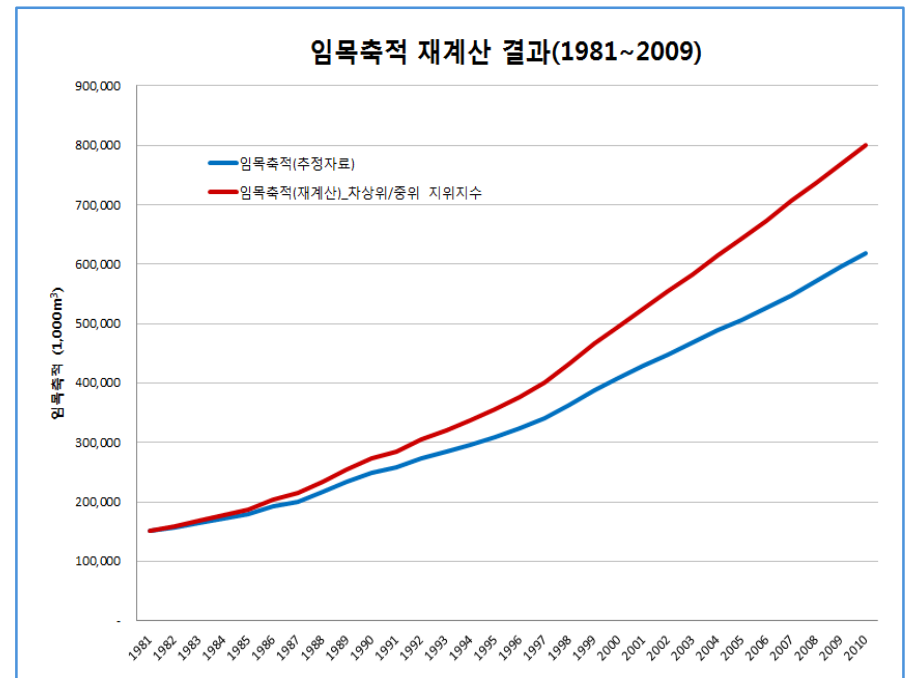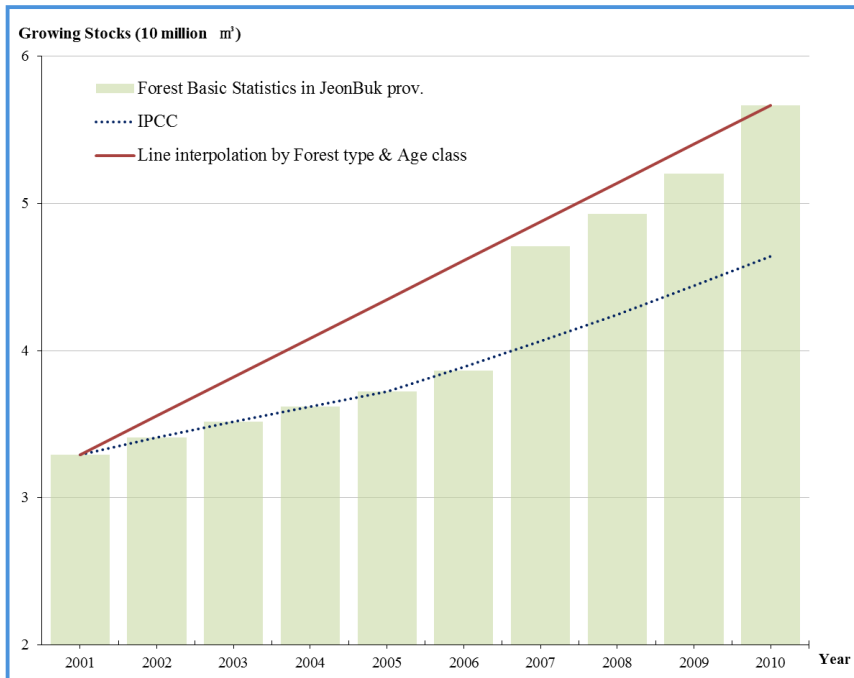
• **Land-use/cover change matrix**

– Data : GPS-based sample points, RS-data, GIS data, etc.
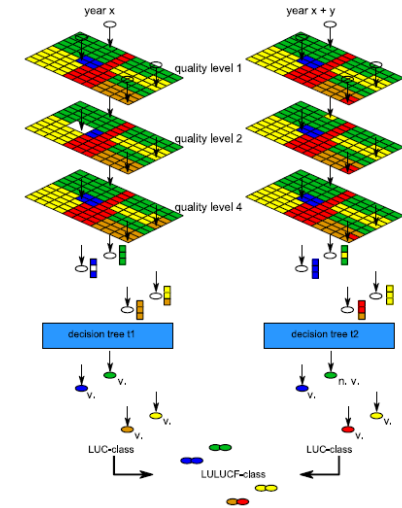
– Approach 3 : Point sampling vs. Wall-to-wall map


2010 year   1992 year

< Land-use classification in Jeju Island >

<Decision tree for land use classification in Germany >

• **Carbon assessment for carbon pool & Non-CO$_2$**

– DOM & SOM : Comparison of time-series data & Understanding of carbon cycle

– HWP : annual productions and half-lives by final products

– Non-CO$_2$ by forest fire : activity data (damaged area & volume by tree species)

| Contents | GHG Inventory | NDC status | AFOLU sector | **Improvement of GHG inventory** | Tracking progress |

• Uncertainty Assessment

- Objective : Identifying significant sources of uncertainty in the inventory *to help prioritise data collection and efforts to improve the inventory*.

- Tier 1 : Simple error propagation equation

- Tier 2 : Monte-Carlo simulation
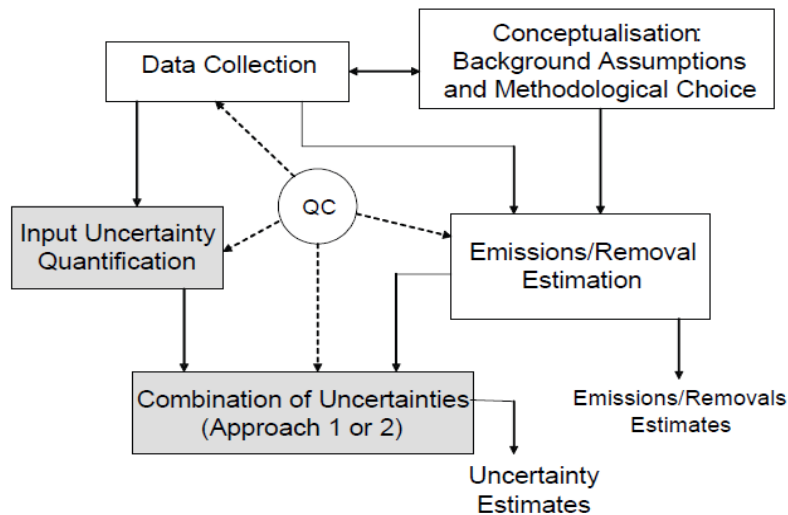
EQUATION 3.2
COMBINING UNCERTAINTIES – APPROACH 1 – ADDITION AND SUBTRACTION

$$U_{total} = \frac{\sqrt{(U_1 \bullet x_1)^2 + (U_2 \bullet x_2)^2 + ... + (U_n \bullet x_n)^2}}{|x_1 + x_2 + ... + x_n|}$$

Where:

U_{total} = the percentage uncertainty in the sum of the quantities (half the 95 percent confidence interval divided by the total (i.e., mean) and expressed as a percentage). This term 'uncertainty' is thus based upon the 95 percent confidence interval;

x_i and U_i = the uncertain quantities and the percentage uncertainties associated with them, respectively.

Source : IPCC 2006GL, Ch3

<Overall structure of a generic uncertainty analysis, *IPCC 2006 GL*>

Monte Carlo Simulation of Uncertainty Analysis
for
National Greenhouse Gas Inventories

- **Forest management cycle:**

Cutting → reforestation → tending → cutting

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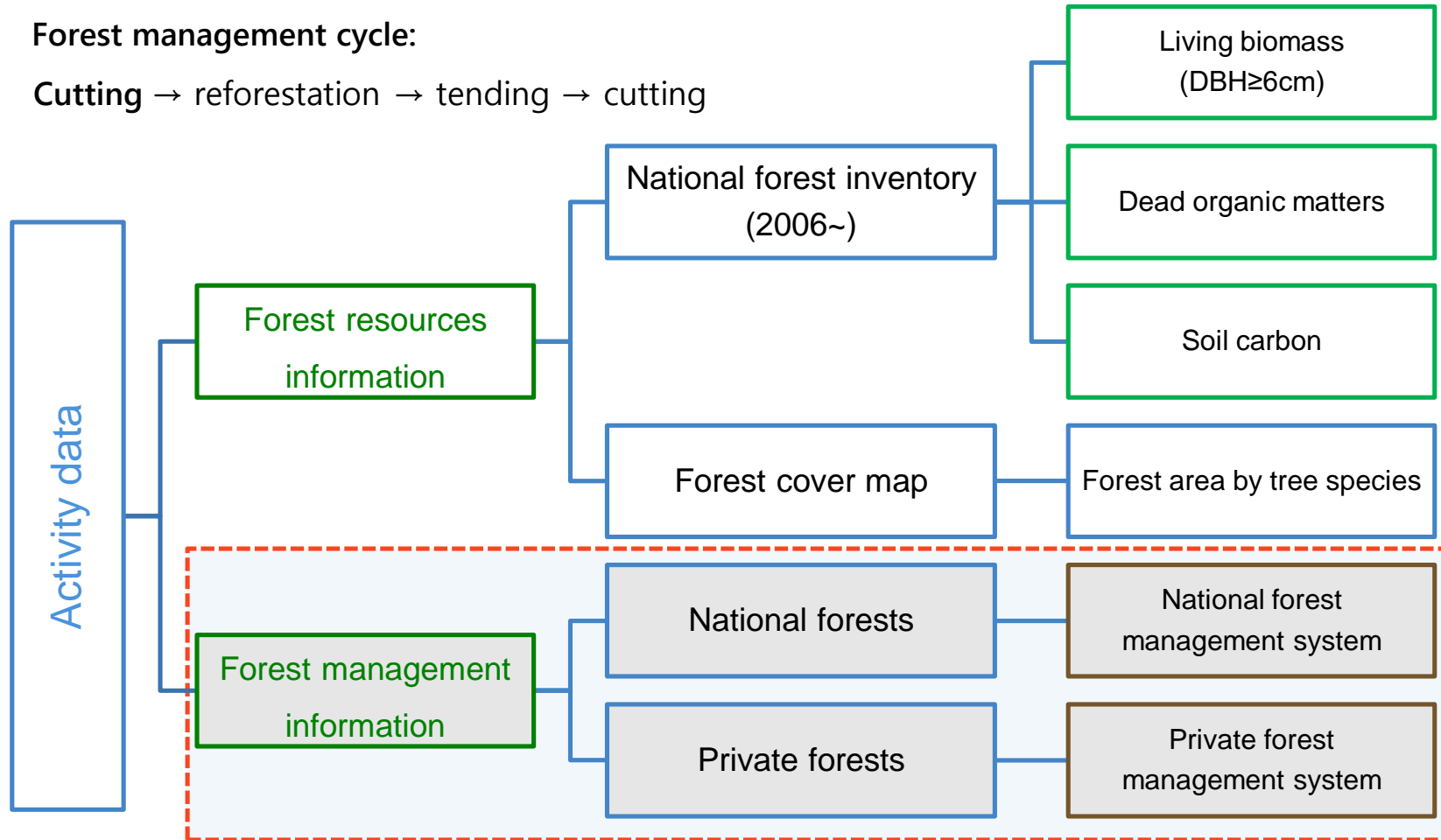
- Forest cover map : 1974 ~ 2010 (Scale 1:25,000, 3~10 years interval), 2013 ~ (Scale 1:5,000; 5 years)

- Change detection : Deforestation, Afforestation / Reforestation

1:25,000 임상도 | 1:5,000 임상도

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Contents	GHG Inventory	NDC status	AFOLU sector	Improvement	**Tracking progress**
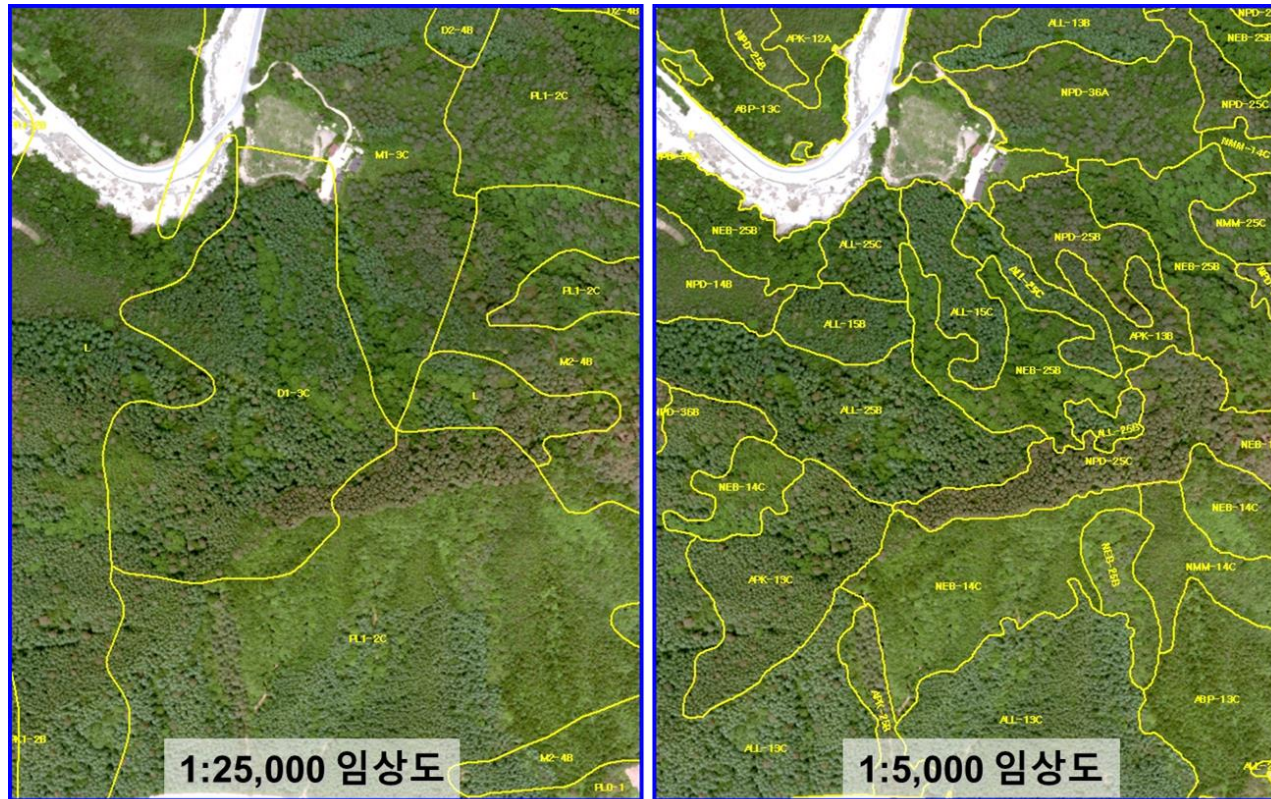
- Re-organization of National Forest Inventory System (since 2006)

Support to carbon inventory		1~4th NFI	5th NFI ~
Land-use		forest/non-forest	The 6 land-use categories
Carbon Pool	Living Biomass	O	O
	Deadwood	X	O
	Litter	X	O
	Soil	X	O
Uncertainty		X	O
Sample plot		Temporary plot	Permanent plot
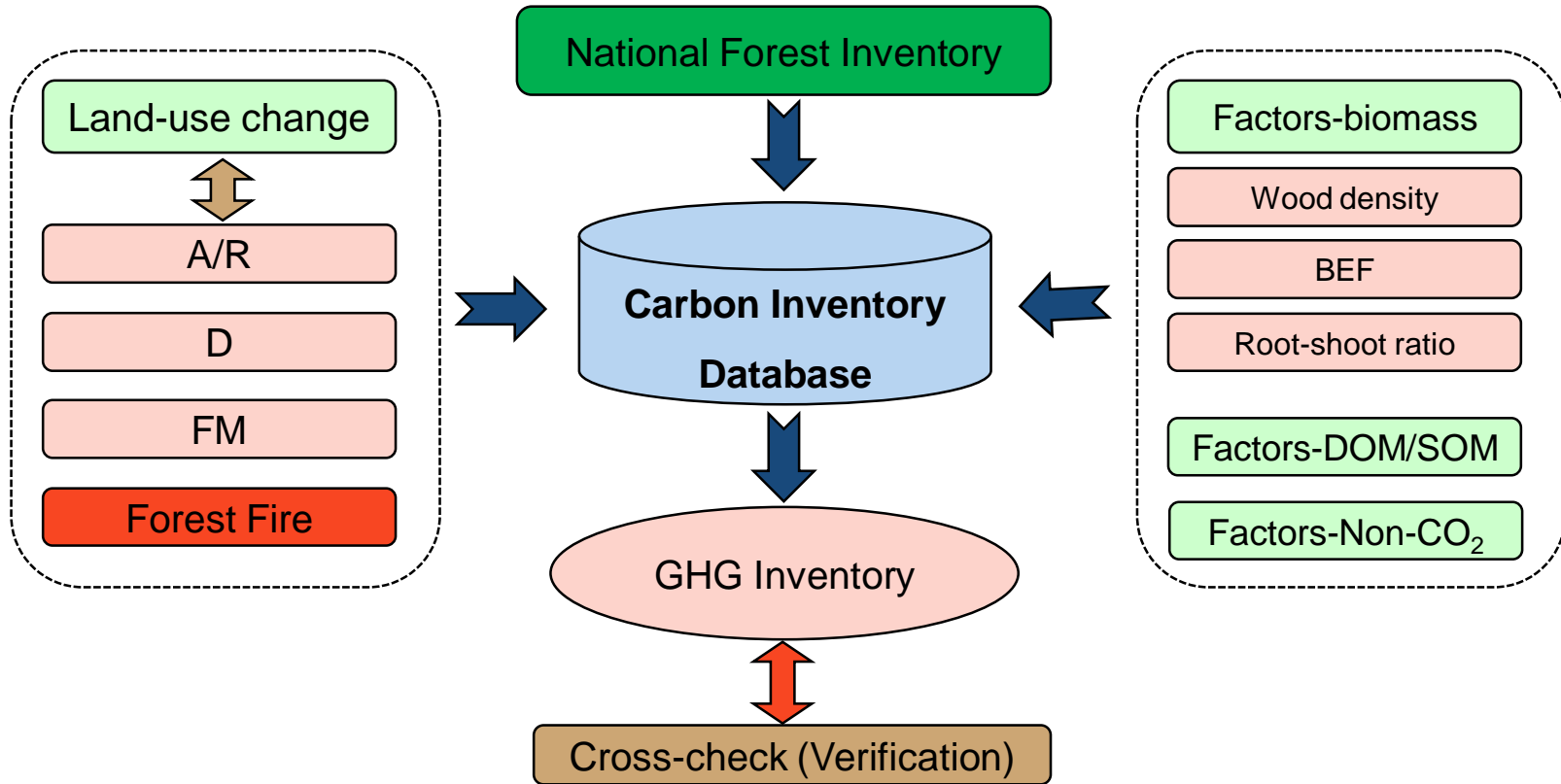
< Forest resource information system for GHG inventory >

| Contents | GHG Inventory | NDC status | AFOLU sector | Improvement | Tracking progress |

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Forest Resource Assessment

GHG Inventory in Forest sector

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Thank You!!

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