Development of National GHG Inventory: INDONESIA

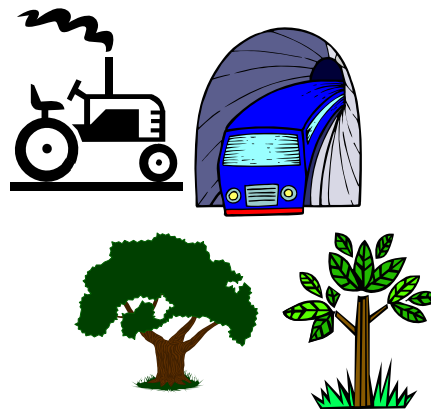Rizaldi Boer (Bogor Agricultural University)
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Outline of Presentation

- Overview
- National System for Developing National GHG Inventory
- Effort to improve the inventory
- Global program for improving GHG inventory

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OVERVIEW

National GHG Inventory

- **Each non-Annex I Party <u>shall communicate</u> to the COP a national inventory of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol, to the extent its capacities permit (Article 4.1a and Article 12 .1a)**

- **Non-Annex I Parties <u>shall</u> <u>estimate</u> national GHG inventories for the year 1994 for the <u>initial</u> national communication or alternatively <u>may</u> <u>provide</u> data for the year 1990. For the <u>second</u> national communication, non-Annex I Parties <u>shall</u> estimate national GHG inventories for the year 2000. The <u>LDC</u> Parties <u>could</u> estimate their national GHG inventories for years at their discretion.**

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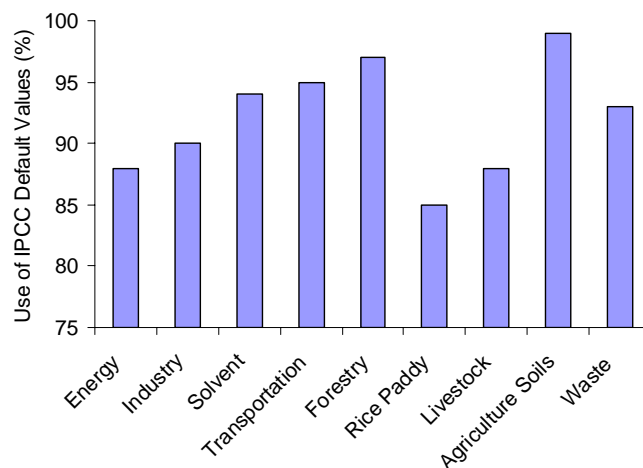
National GHG Inventory

- **Non-Annex I Parties <u>should</u> <u>use</u> the *Revised 1996 IPCC Guidelines* for national GHG Inventories.**
- **Parties <u>may</u> <u>use</u> different methods (*tiers*) included in the Guidelines, giving priority to those methods which are believed to produce the most accurate estimates, depending on national circumstances and availability of data. As encouraged by the IPCC Guidelines, Parties can also use national methodologies where they consider these to be better able to reflect their national situation, provided that these methodologies are consistent, transparent and well documented.**

1994 INDONESIAN GHG INVENTORY
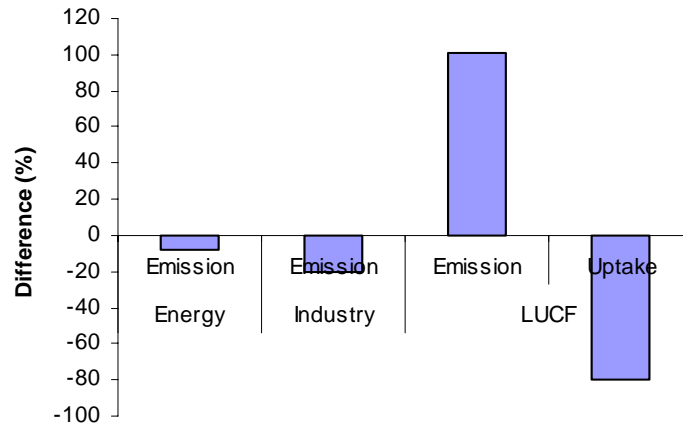
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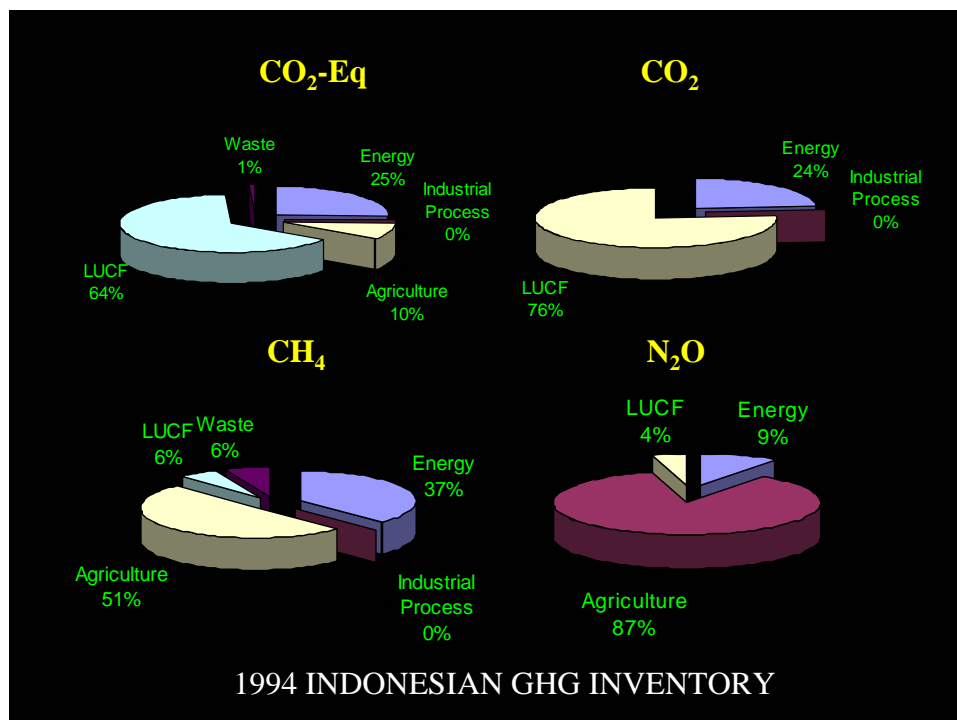
Problems

- National system for developing GHG inventory has not been well developed.
  - No effective and efficient system for managing activity data of related sectors for the development of the inventory
  - No system for checking the reliability of the inventory
  - Most of emission factors used are IPCC default values. However, data on these are becoming more available especially for some sectors (e.g. agriculture-rice paddy and LUCF)
- The certainty level of the estimates for most sectors were considered low, in particular LUCF.

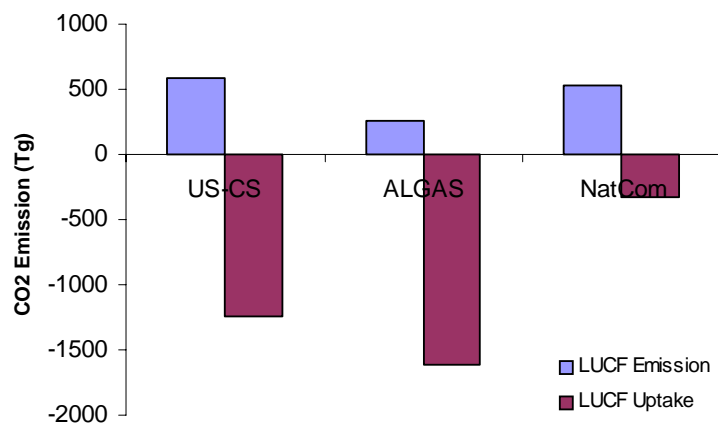**The use of IPCC Default Values in Developing the 1994 GHG Inventory**
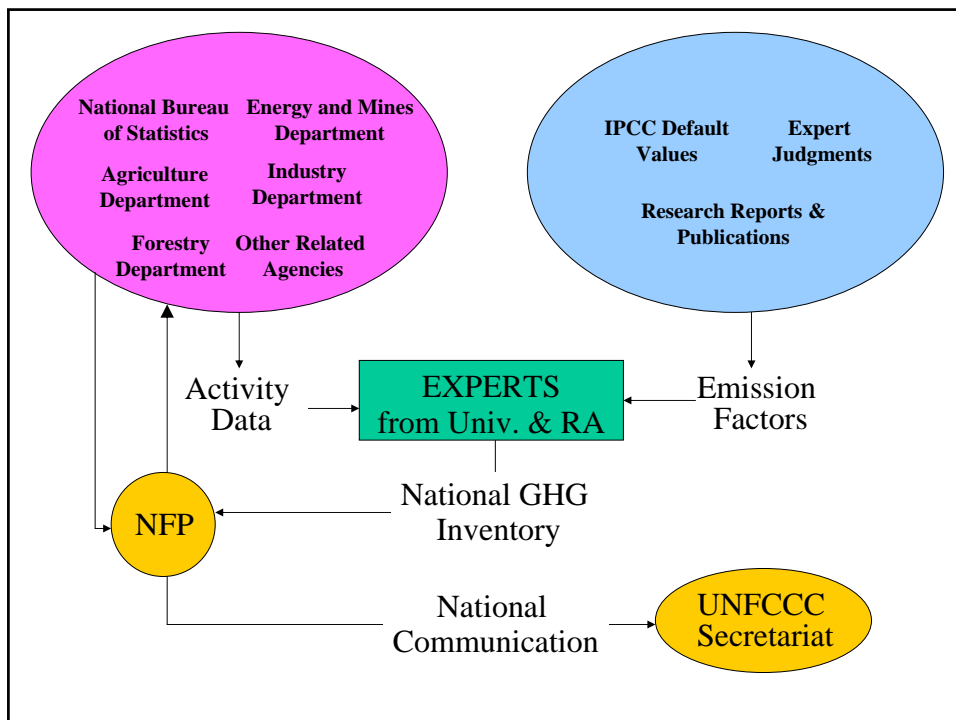
Most of local values were based on expert Judgments

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The Difference of CO2 emission estimate between ALGAS and NatCom Report

CO2 emission estimate from LUCF from three studies

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National System

National Bureau of Statistics   Energy and Mines Department

Agriculture Department   Industry Department

Forestry Department   Other Related Agencies

IPCC Default Values   Expert Judgments

Research Reports & Publications

Activity Data → EXPERTS from Univ. & RA ← Emission Factors

National GHG Inventory → NFP

NFP → National Communication → UNFCCC Secretariat

EFFORTS TO IMPROVE THE INVENTORY

- ENERGY SECTOR
- INDUSTRIAL SECTOR
- AGRICULTURE SECTOR
  - Rice Paddy
  - Livestock
  - Agriculture Soils
- FORESTRY SECTOR
- WASTE

ENERGY AND INDUSTRIAL SECTOR

- Level of certainty of the activity data from energy and industrial sector are considered as high in comparison to non-energy sectors, as most data published in the National Statistics of these sectors were from private companies which have good data management system.

- Efforts to develop local emission factors for these sectors are not recorded as well as for waste

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AGRICULTURE SECTOR

Improvement of Emission Factors

- Methane for Rice Paddy:
  – Ample research activities on mineral soils conducted by Research Agencies in collaboration with IRI
  – Limited number of research activities on organic soils (Bogor Agricultural University, JSPS-Hokkaido University and Univ of Gottingen-Germany). Indonesia has about 22 millions ha of peat land and will be used for agriculture development.

Some of Research Results

Means and standard deviation of CH_4 and CO_2 emissions rates from rice field in inland, transitional and coastal peat soils of Central Kalimantan (mg m^{-2} h^{-1})

Gases	Age of crops	Berengbengkel (inland)		Sampit (transitional)		Samuda (coastal)	
		Mean	Stdev	Mean	Stdev	Mean	Stdev
CH_4	0 WAP	6.38	0.32	6.20	0.61	6.14	0.23
	4 WAP	7.38	0.51	6.77	0.11	6.90	0.57
CO_2	0 WAP	66.61	0.87	61.98	3.74	60.49	3.57
	4 WAP	74.60	3.48	72.82	4.32	76.96	4.63

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AGRICULTURE SECTOR

Improvement of Emission Factors

- Methane for livestock
  - Limited number of research activities on developing methane EF from Rumen. Small number of research activities is on going at IPB (Bogor Agricultural University)

AGRICULTURE SECTOR

Improvement of Emission Factors

- N_2O from Agriculture Soils
  - Limited number of research activities on developing N_2O EF from agriculture soils. (Agriculture Research Agencies, Impact Centre for Southeast Asia)

FORESTRY SECTOR

Priority data domains	Importance
Converted forest area per forest type	*3*
Growth rate of forest and vegetation types (including plantations)	*3*
Forest typology (biomass-based, floristic, ecology, climatic, administrative)	*3*
Wood harvest (legal + illegal, half-life time by use)	2.5
Biomass of each forest and vegetation type	*2.5*
Root biomass per vegetation / land use land cover type	2.2
Wood to biomass expansion factor, allometrics	2.2
Abandoned land: area + growth rate (increment)	1.7
Soil C stock (including organic soils + LU impacts)	1.1
On-site (in situ) burning	0.5

FORESTRY SECTOR
Approaches to Estimate MAI, Abovegroud Biomass

Diameter class (D in cm)	Mean number of stems/ha	Volume of stem (V in m³)[1]	Total Volume of stem (m³/ha)	Diameter after growing (Dg in cm)[2]	Volume of stem after growing (V in m³)[1]	Total Volume of stem (m³/ha)	Volume increment (m³ ha⁻¹ yr⁻¹)[3]
(1)	(2)	(3)	(4)=(2)x(3)	(5)=(1)+Di	(6)	(7)=(2)x(6)	(8)=(7)-(4)
14.50	249.4	0.087	21.8	14.82	0.093	23.1	
24.50	104.1	0.347	36.1	24.91	0.362	37.7	
34.50	50.2	0.852	42.8	34.93	0.880	44.2	
44.50	22.2	1.662	36.9	44.92	1.704	37.8	
54.50	10.4	2.831	29.4	54.90	2.887	29.9	
64.50	5.2	4.407	22.7	64.92	4.484	23.1	
70.00	3.6	5.464	19.7	70.47	5.560	20.1	
			209.3			215.9	**6.5**

[1]Allometric equation for estimating volume of wood is $V=0.00007771D^{2.267}$, and
[2]$Di=0.000006D^3 - 0.0008D^2 + 0.0335D - 0.0178$ ($R^2=48\%$). [3]Using BEF of 1.5 (Ruhiyat, 1995) and wood density of 0.6, the mean annual biomass increment of logged-over forest was about 5.9 t ha⁻¹ yr⁻¹

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FORESTRY SECTOR

Another approaches

- $MAI_{LoF}=((WV_{VF}-WV_{LoF})/Rotation)*WD*BEF$
  - wood volume of virgin (WV_{VF}) and logged-over (WV_{LoF}) forests
  - WD wood density and BEF Biomass expansion factor (1.5 for natural forest: Ruhiyat, 1995)
- $MAI = (SY * CF * BEF)/(Age of stand)$
  - SY stand yield in m^3
  - CF correction factor: ratio between stand yield table and observed data collected through forest inventory
- Allometric equations: To estimate volume of wood (database) and total biomass
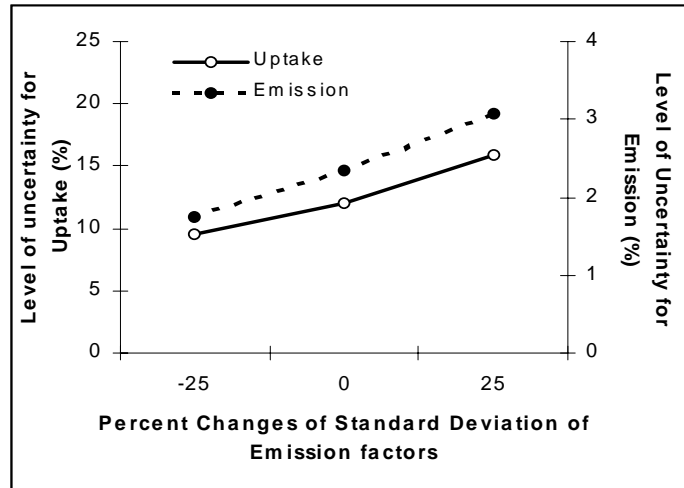
FORESTRY SECTOR

Uncertainty Analysis: Jambi case in 1992

AD

• x = Emission

EF
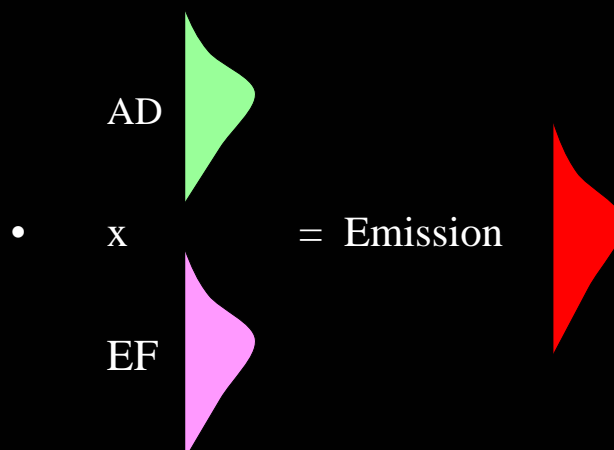
FORESTRY SECTOR

Impact of Changing Standard Deviation of MAI on level of Uncertainty

FORESTRY SECTOR

Level of uncertainty depending on

- the complexity of LULUCF (number of land use categories)
- size of area under study
- resolution of images ~ area estimates of LULUCF
- method of averaging MAI, Biomass density (non-weigthed or weigthed mean)

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FORESTRY SECTOR
Future Works

- Assessing the impact of changing resolution of satelite image on:
  - area estimates
  - above ground biomass estimates ~ allometric equations, expansion factor (rules: as simple as possible)
  - Level of uncertainty of C-emission and C-uptake estimates ~ cost effectiveness
- Development of model for estimating MAI from available information such as LQI (soil+climate information) ~ e.g. Patterson Index
- Development of more effective and efficient procedures for estimating AD and EF

GLOBAL PROGRAM

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UNDP-GEF Enabling Activity: Regional Proposal for Improving GHG Inventory (Pending ?)

- Giving greater attention to procedures for *selecting* and *prioritising* emission factors and other appropriate data required for the inventory;
- Placing more emphasis for *identifying* and *testing cost-effective methods* for data collecting appropriate to national circumstances;
- Giving priority to *publishing* research on emission factors so that the results can be validated and contribute to the IPCC process;
- Considering ways of *establishing* and *strengthening* national institutional arrangements for archiving and updating national inventories;
- Strengthening *data sharing* and information exchange of regional data through workshops and regional centres;
- Developing an *integrated training package* that considers all aspects of data collection, including incentives for their collection, data management and other procedural matters related to data quality.

PDF Component Activities:

- Phase I
- Assessment of current information taken from inventories of initial National Communications and data gathered through the Support Programme
    - Development of a procedure for selecting and prioritizing emission factors and data to be improved from among different sectors
    - Assessment of cost of different methods of data collection and management
    - Development of consensus for the elements of a common approaches for implementation such as reducing uncertainty and common bias, procedure for selecting and prioritizing data for collection etc.
- Phase II
    - Testing and revising the common approach before implementation

Global Program

- ***Component 1: Emission factors and appropriate data gathering.*** Criteria under the common approach :
  - magnitude and contribution of GHG emissions and removals for a given source or sink at the national level;
  - the sensitivity of the calculation estimates to the proposed data, including an assessment of the extent to which the uncertainty of the estimate will be improved through more accurate emission factors and other data;
  - the relevance of the source/sink and the sector of the inventory to meet national priorities;
  - the feasibility of implementing abatement measures, including technology transfer, for a given sector;
  - the availability of low-cost data collection methods, including standard or internationally-accepted methods.

Global Program

- ***Component 2: Strengthen national arrangements for archiving, updating and managing of greenhouse gas inventories****. Specific Activities for this component:*
  - *archiving* of relevant national data (i.e., activity data, emission factors, conversion factors) for several years;
  - *identifying* data sources and national experts that have been involved in inventory preparation in a national database;
  - *periodic updating* of inventories in a cost-efficient manner;
  - *comparing* inventories across years in order to identify trends in emissions and removals;
  - *documenting* the selection process of national activity data, emission factors, and other conversion factors used in inventory preparation process;
  - *documenting* methodologies and assumptions used; and
  - *validating* conversion of units and other data.

Global Program

- ***Component 3: Training for the implementation of good practices for preparing national inventories and dissemination of the underlying data.*** There are three main activities in this component
  - Those which address scientific methodology, such as the IPCC Guidelines and Good Practices;
  - Disseminate data under Component 1
  - Relate to institutional structures and data management under Component 2
- ***Key features of national data arrangements include***:
  - A flexible system taking into account national circumstances as well as the requirements of UNFCCC and IPCC guidelines.
  - National experts would be responsible for the information entered into the national data system. Records of any changes to the system would be registered.