

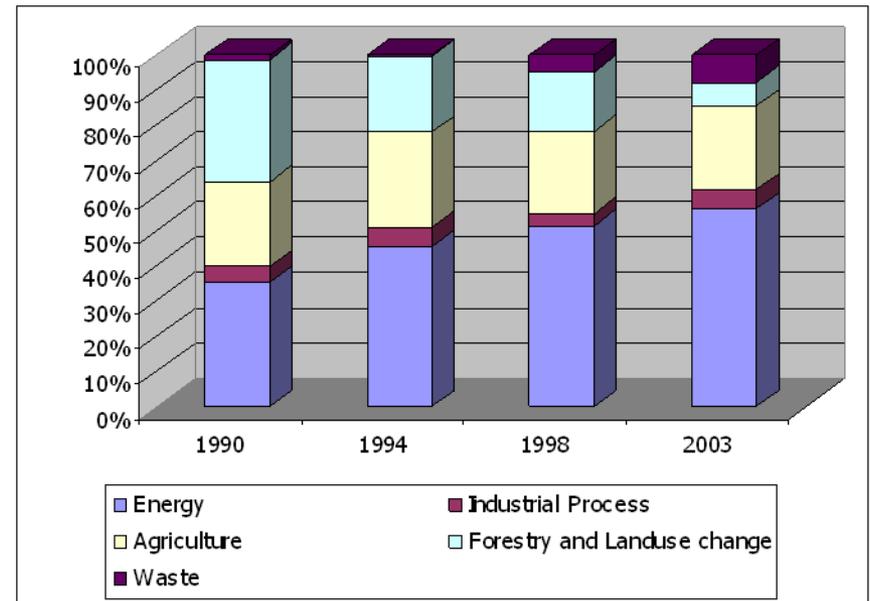
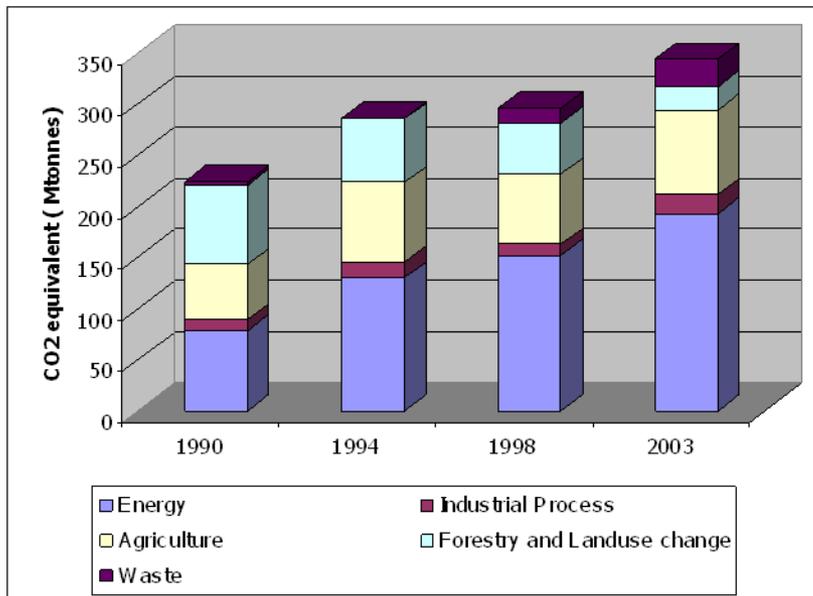


Experiences on Disaggregated Activity Data Acquisition for Greenhouse Gas Inventory in Waste and Agricultural Sector

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Thai National GHG Inventories



1990 : ALGAS

1994 : INC

1998 : Min. of Natural Resources

2003 : Min. of Energy

Nature of sector

Waste Sector

- SWDS
- Activity data by population/ actual data at sites
- EF : default
- Waste model

Agricultural Sector

- Rice field emission
- Activity data is annually reported by cultivation area
- EF : varied by cultivation practice
- GIS-Based

Understanding IPCC waste model

- 1996 IPCC GL : Mass balance and FOD
 - 2006 IPCC GL : Combined MB and FOD
 - Activity data ---MB
 - Emission factor ----k value
 - More convenience and more reliable
 - Allow for disaggregate level of data depend on each country historical data
-

Waste model

- Major sheet in waste model
- Parameter
 - DOC : waste composition
 - DOC_f : 0.5
 - Methane generation rate constant (k) : multiphase
 - Delay time : 6 months
 - Fraction of methane : 0.5
 - Oxidation factor : 0



Waste model

- Major sheet in waste model
- MCF
 - Unmanaged shallow : 0.3
 - Unmanaged deep : 0.8
 - Managed : 1
 - Managed semi aerobic : 0.5
 - Uncategorized : 0.6
- Distribution of waste by waste management types

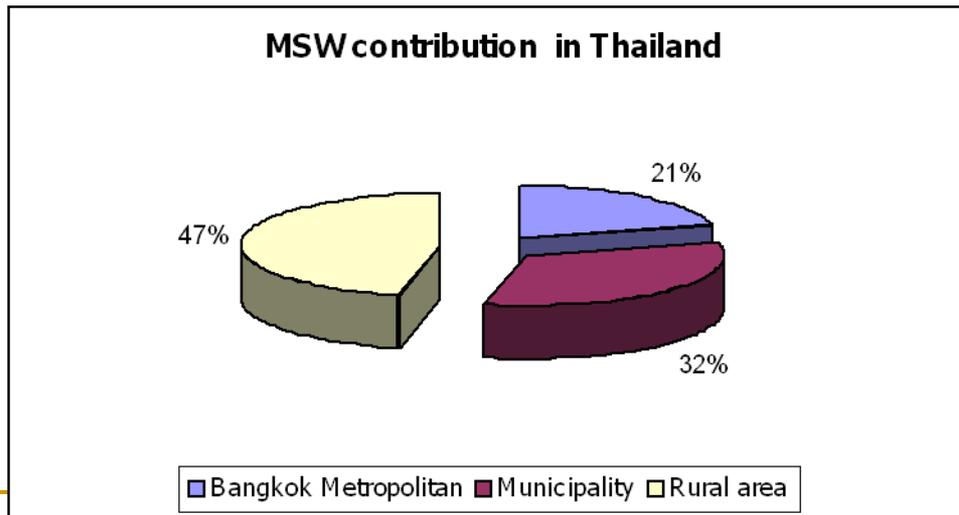


Waste model

- Major sheet in waste model
 - Activity
 - Total MSW
 - Population
 - Waste generation rate
 - % to SWDS
 - Composition of waste go to SWDS
-

MSW in Thailand

- Total MSW in 2005 = 39211 TPD
 - Bangkok metropolitan = 8,201 TPD
 - Municipality = 12,685 TPD
 - Rural area = 18,205 TPD



Decrease from
last year 1.8 %

MSW Treatment in Thailand

- 104 Sanitary landfills (94 in operation)
- 3 Incinerations
- 3 Combined technology
- 7 dump sites

- Coverage of 43 % of MSW treated in municipality

คำอธิบายสัญลักษณ์



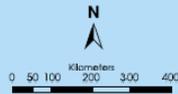
โรงงานเตาเผาขยะมูลฝอย



สถานที่ฝังกลบขยะมูลฝอย
อย่างถูกหลักสุขาภิบาล



สถานที่กำจัดขยะมูลฝอยโครงการใหม่
ปีงบประมาณ 2548 (กำลังก่อสร้าง)



Characteristic of Landfill

■ Size of landfill

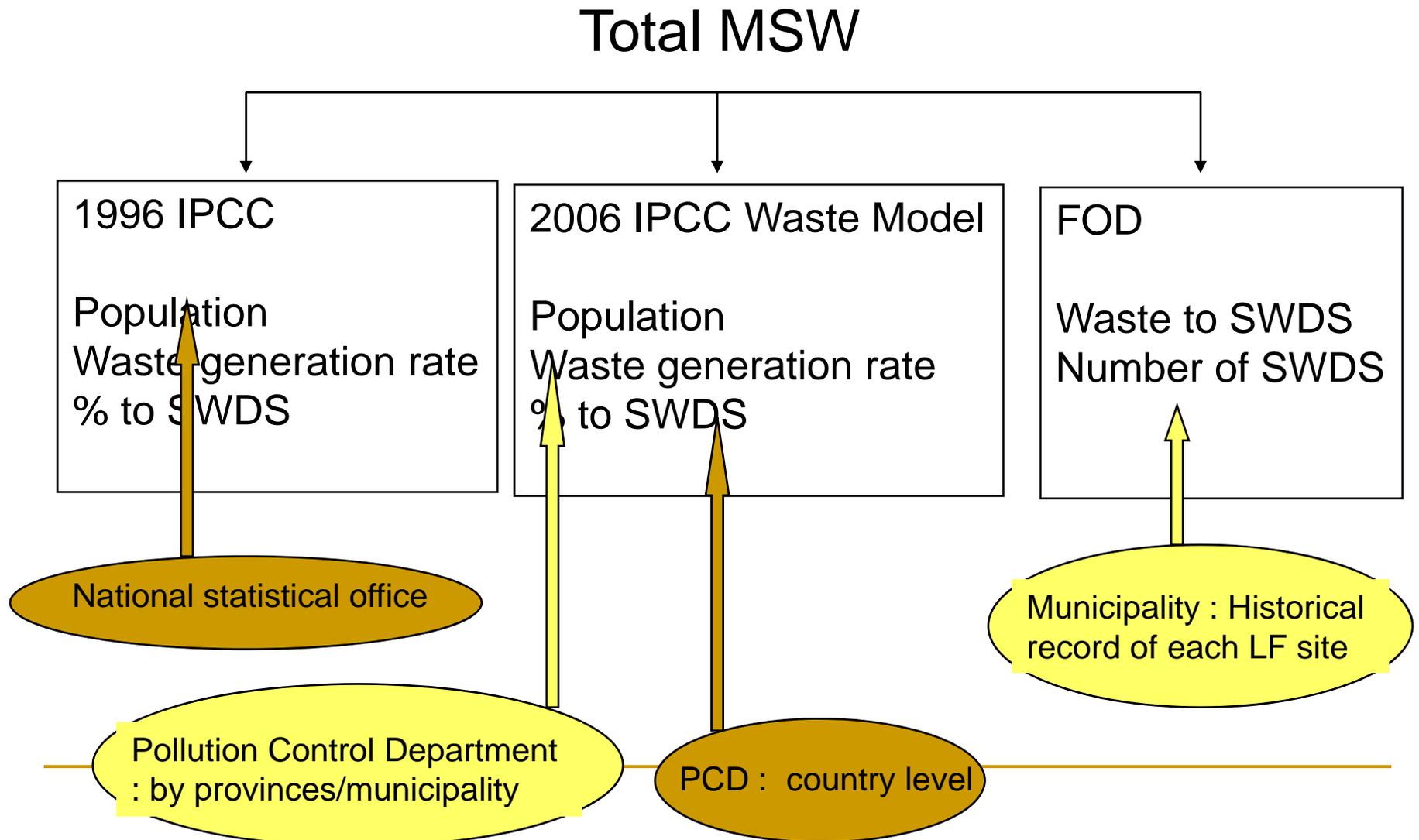
- 4-50 TPD = 53 sites
- 50-100 TPD = 26 sites
- 100-200 TPD = 9 sites
- > 200 TPD = 6 sites

■ MCF

- 0.3 = 51 sites = 54 %
- 0.6 = 17 sites = 18 %
- 0.8 = 26 sites = 28 %



Source and level of Activity Data



Activity Data

Waste composition

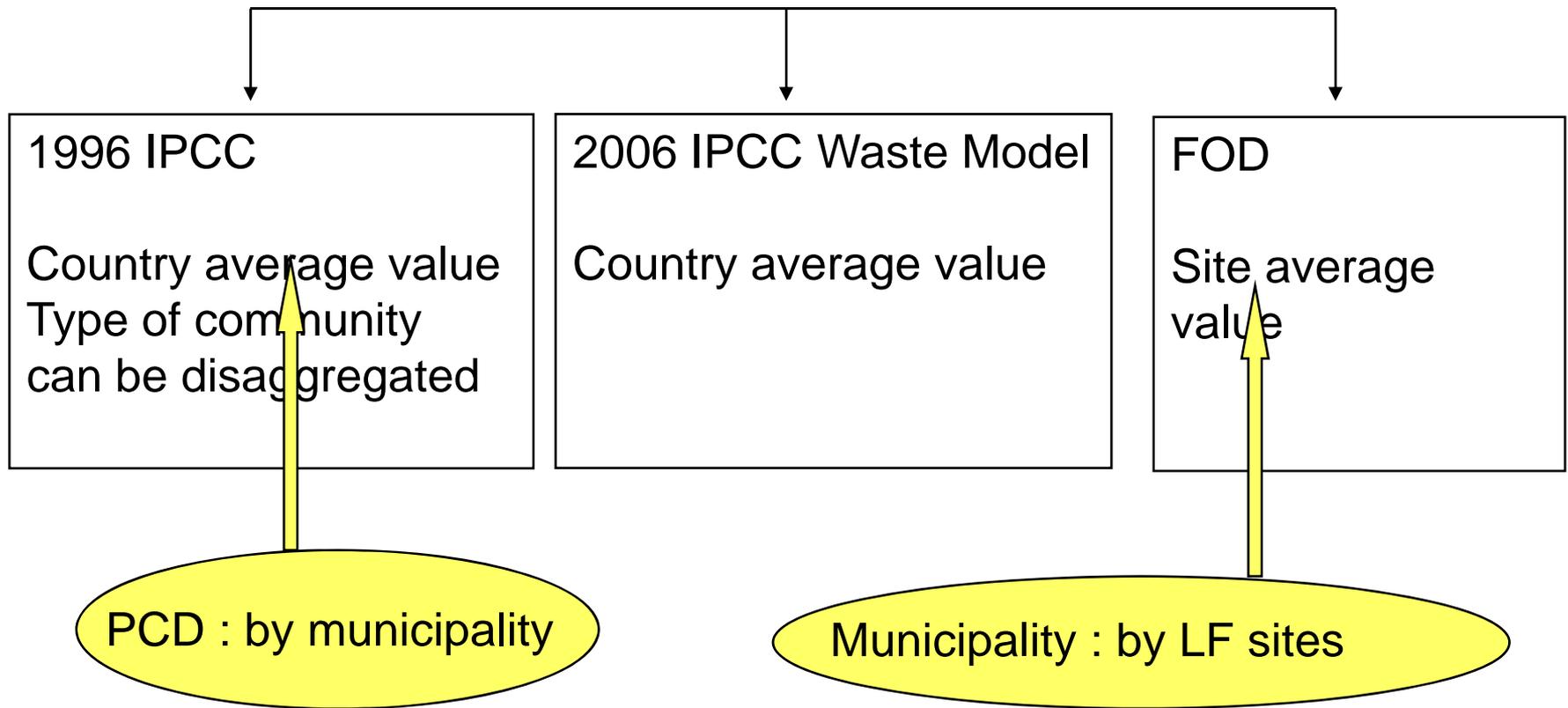


Table 4.4 Summary of input parameters for methane emission inventory

	Landfill sites	Tipping rate (tpd)	Open year	MCF	Waste characteristics (%)			
					Food	Paper	Wood	Textiles
1	Chaingrai	80	1995	0.8	45.00	10.00	10.00	2.00
2	Huaycrai	13	1998	0.3	15.00	10.00	10.00	5.00
3	Waingphang	8	2004	0.3	33.00	17.75	11.90	3.12
4	Maehongson	15	2002	0.3	36.67	11.67	11.67	6.67
5	Phayao	35	2003	0.3	66.16	14.75	1.31	1.31
6	Phrae	35	2001	0.3	22.00	28.40	22.21	4.02
7	Sukothai	34	2001	0.3	40.00	15.10	20.20	2.00
8	Nan	38	2000	0.3	43.67	12.77	0.27	2.92
9	Utharadit	40	2003	0.8	67.33	6.20	0.66	0.55
10	Pitsanulok	91	1999	0.3	68.59	2.53	0.89	1.51
11	Pichit	26	2000	0.3	39.00	13.85	4.47	5.48
12	Nakornsawan	100	1994	0.8	54.53	10.03	4.03	1.88
13	Uthaitanee	36	2001	0.3	70.77	3.37	0.60	0.50
14	Maesod	50	1999	0.8	37.59	13.42	9.47	4.35
15	Thaklee	22	2003	0.3	54.53	10.03	4.03	1.88

Example of SWDS database

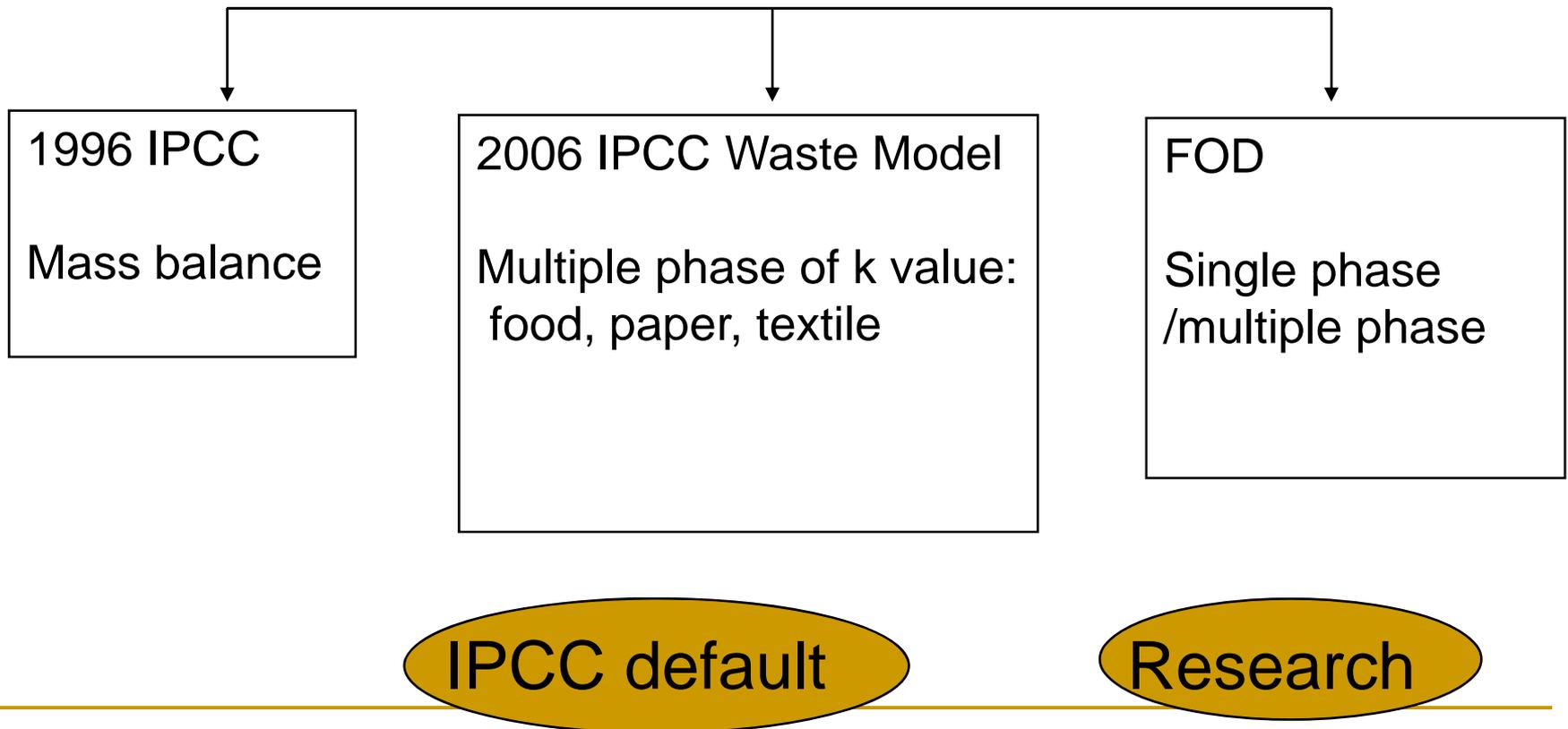
จังหวัด	ชื่อเทศบาล	องค์ประกอบของขยะมูลฝอย (ร้อยละโดยน้ำหนัก)										
		เศษอาหาร	กระดาษ	พลาสติก	แก้ว	โลหะ	ยาง/หนัง	ผ้า	ไม้/ไม้ไผ่	หิน/กระเบื้อง	อื่นๆ	
นครนายก	1. ทม.นครนายก	65.09	7.18	22.69	0.72	1.12	0.36	0.53	-	-	231	100.00
	2. ทต.ท่าช้าง	50.00	10.00	10.00	5.00	5.00	0.00	0.00	15.00	5.00	0.00	100.00
	3. ทต.บ้านนา	40.00	15.00	10.00	5.00	5.00	5.00	7.00	10.00	3.00	0.00	100.00
	4. ทต.เกาะหวาย	50.00	25.00	5.00	2.00	1.00	2.00	3.00	10.00	1.00	1.00	100.00
	5. ทต.อรัญญิก	-	-	-	-	-	-	-	-	-	-	0.00
		205.09	57.18	47.69	12.72	12.12	7.36	10.53	35.00	9.00	3.31	400.00
	เฉลี่ย	51.27	14.30	11.92	3.18	3.03	1.84	2.63	8.75	2.25	0.83	100.00

จังหวัด	ชื่อเทศบาล	จำนวน ครัวเรือน	ประชากร (คน)	ปริมาณ ขยะมูล ฝอย	อัตราการ เกิดขยะ
นครนายก	1. ทม.นครนายก	6,062	17,564	1546	0.88
	2. ทต.ท่าช้าง	232	915	0.56	0.61
	3. ทต.บ้านนา	1,496	6,016	602	1.00
	4. ทต.เกาะหวาย	559	2,165	1.36	0.63
	5. ทต.อรัญญิก	*	2,691	1.61	0.60
	เฉลี่ย	8,349	29,351	2,501	0.85

Example of waste composition data base

Emission factor

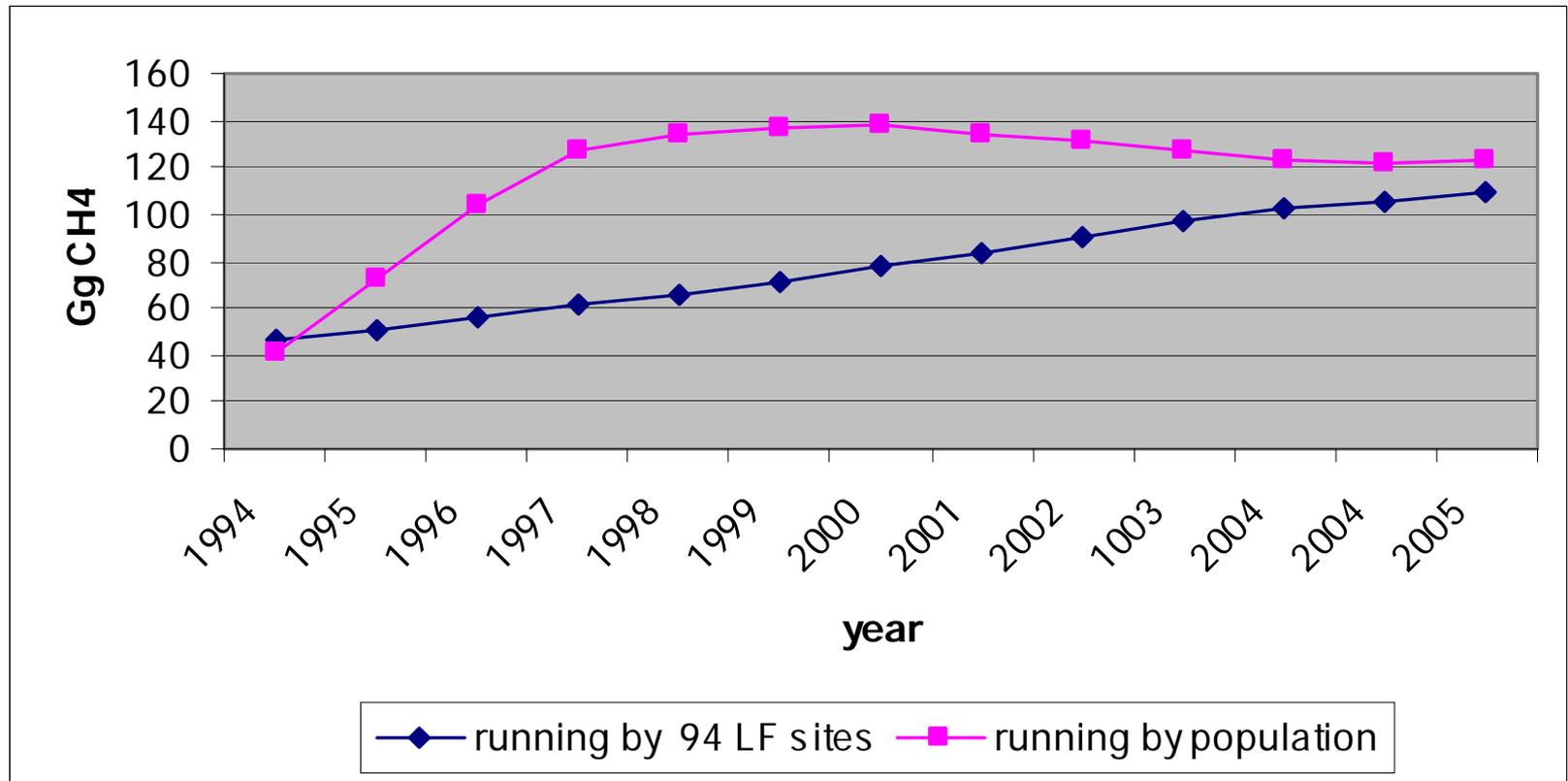
Methane generation rate constant



Running Waste Model

- **Population** - 48 % rural area
 - Waste generation – average 0.64 kg/cap/d
 - MCF – from site information
 - Waste composition – country average
 - K value – IPCC defaults
 - Recovery - 0
- **Actual waste in place in SWDS sites**
 - MCF – from site information
 - Waste composition – by each site
 - K value – IPCC defaults (multi phase)
 - Recovery - 0

Comparison of methane estimation



Summary for Waste Sector

- Historical data is very important the longer, the more reliable result.
 - Uncertainty can be reduced by using appropriate disaggregate level of activity data
-

Disaggregated activity data in rice field

- Emission is estimate by area* EF
 - EF are varied by type of cultivation
 - Uncertainty is very high
 - Plantation area can be achieved by
 - Annual national statistical report recorded by local authority collected by Ministry of Agriculture
 - GIS map
-

Disaggregated level of cultivation area

- Up land, low land,
- Rain fed, irrigated system
- Organic and chemical fertilizer application



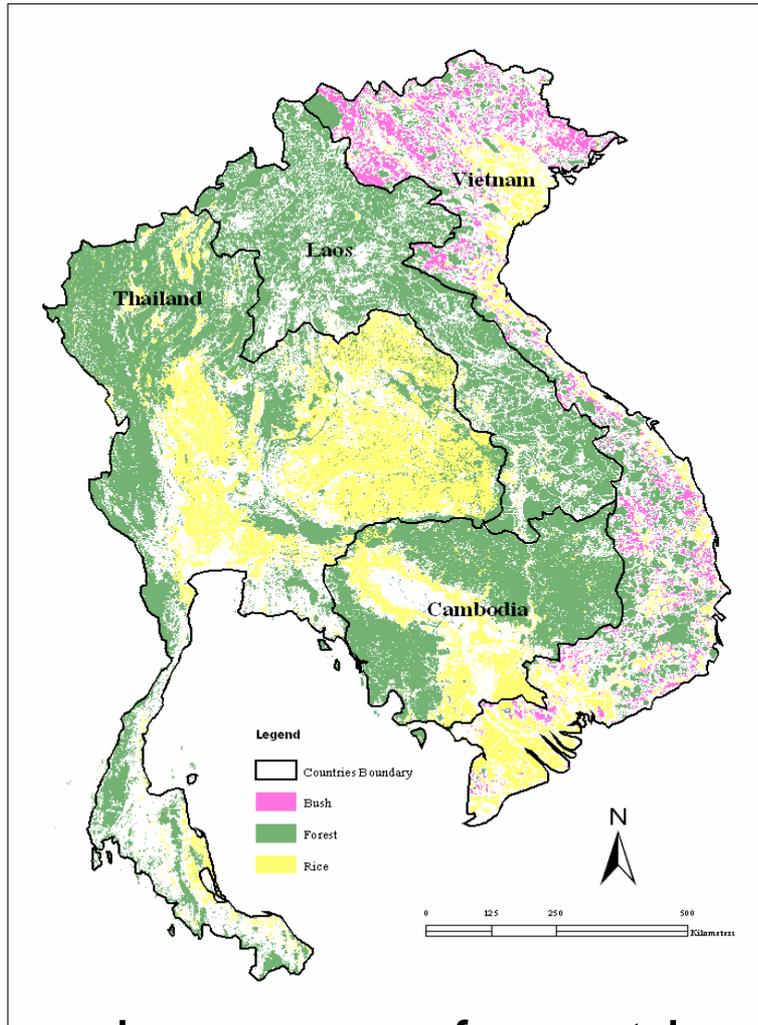
Estimate by statistical report

Table 3.2 Methane Emission Factors for Different Water Ecosystem and Organic Amendment

Category	Sub-category		Scaling factors for rice ecosystem	Correction factors for organic amendment	Emission factors kg CH ₄ /ha/day
Major rice					
Upland	Rainfed	–	0	1	0
	Irrigated	Continuously flooded + OM	1	2	3.120
		Continuously flooded	1	1	1.560
Low land	Rainfed	Flood prone	0.8	2	1.248
		Flood prone + OM	0.8	1	2.496
		Drought prone	0.4	1	0.624
		Drought prone + OM	0.4	2	1.248
	Deep water	Water depth > 100 cm	0.6	1	0.936
Second rice	Irrigated	Continuously flooded + OM	1	2	3.120

Key EF = 1.560 kg CH₄/ha/day

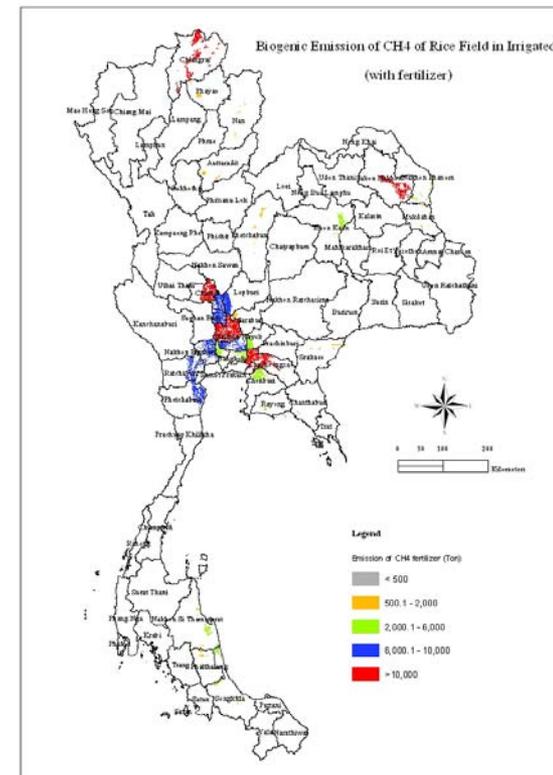
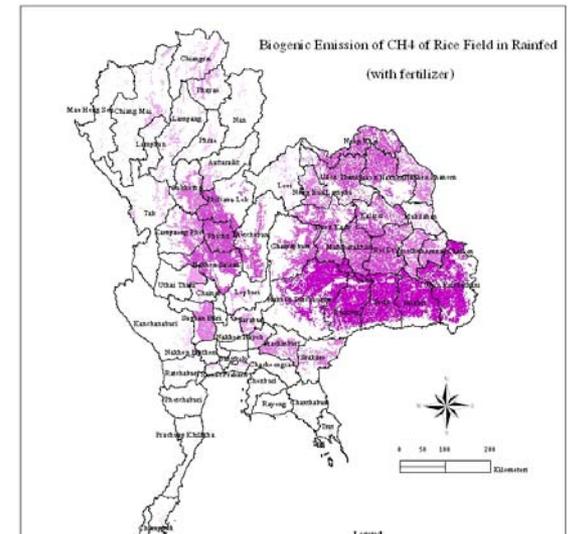
Estimate by GIS-based



Land-use map of countries of the MRBSR (2000)

Source : APN Project -Towprayoon

Rainfed



irrigated

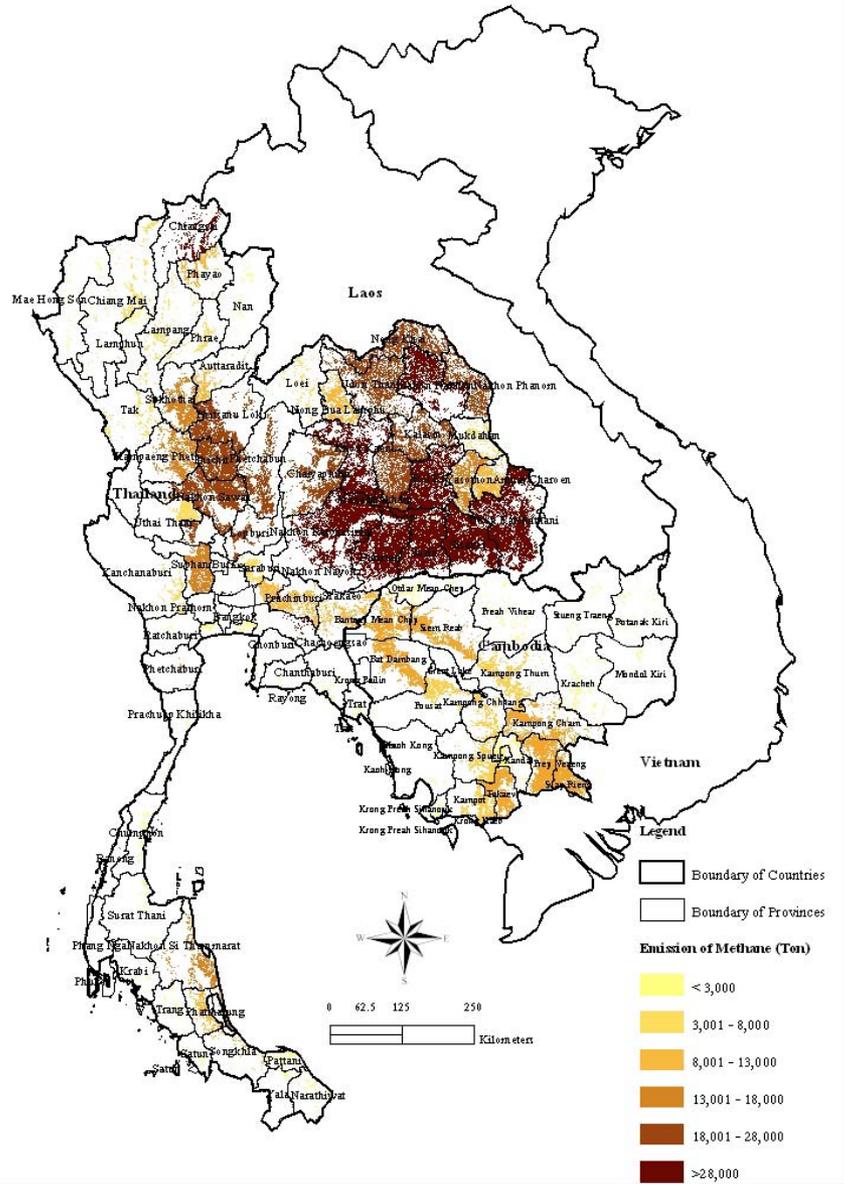
GIS-Based

Table 8. Estimated emission of CH₄ and N₂O from rice paddy in Thailand

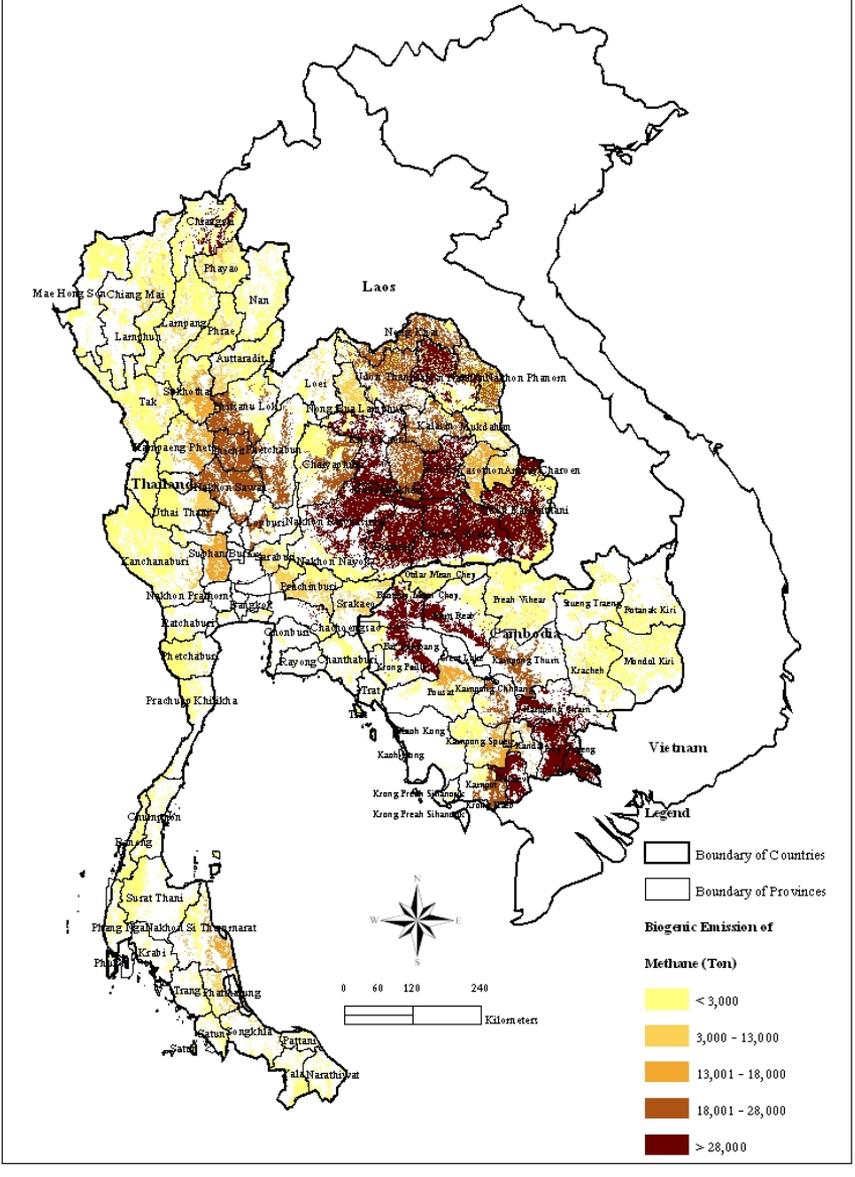
Rice Field	Area ($\times 10^6$ m ²)	Emission Factor (mg/m ² /day)		Biogenic Emission from Rice Field (Ton)	
		CH ₄	N ₂ O	CH ₄	N ₂ O
Irrigated first crop	14,686.34	97.623	0.2937	172,046.99	517.61
Irrigated second crop	14,686.34	97.623	0.2937	172,046.99	517.61
Rain-fed	130,393.82	45.71	0.2937	715,236.19	4,595.60
Total				1,059,330.17	5,630.82



Emission of Methane from Rice Field in Rainfed in Thailand and Cambodia 2005



Biogenic Emission of Methane of Rice Field and Forest in Thailand 2005



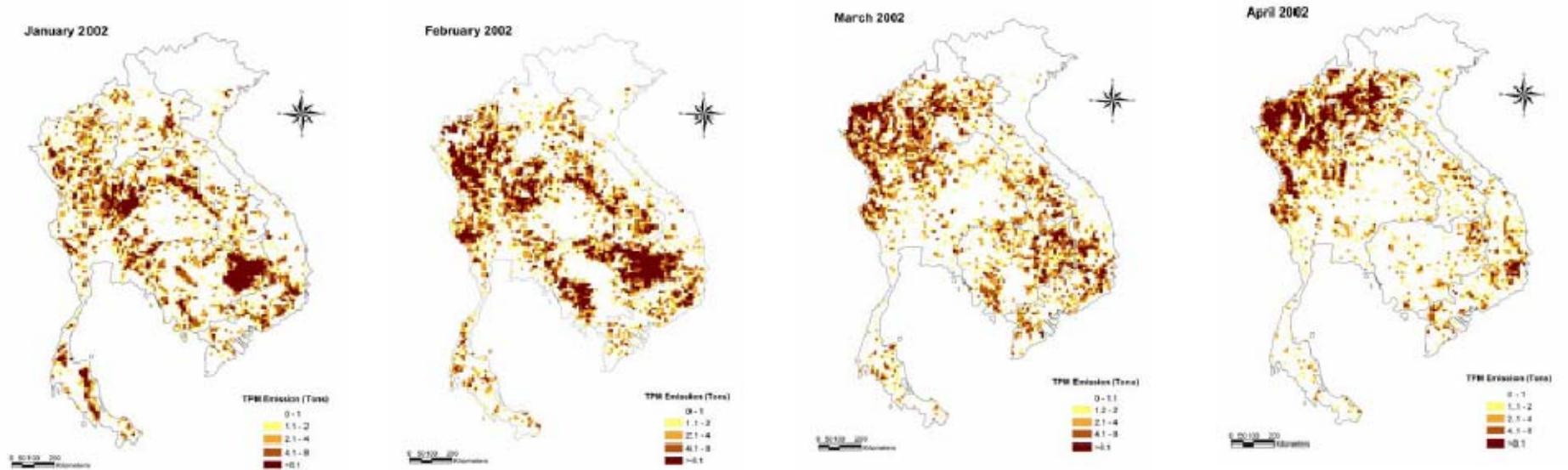


Figure 6. Maps of monthly CO emissions in the MRBSR during January-April 2002

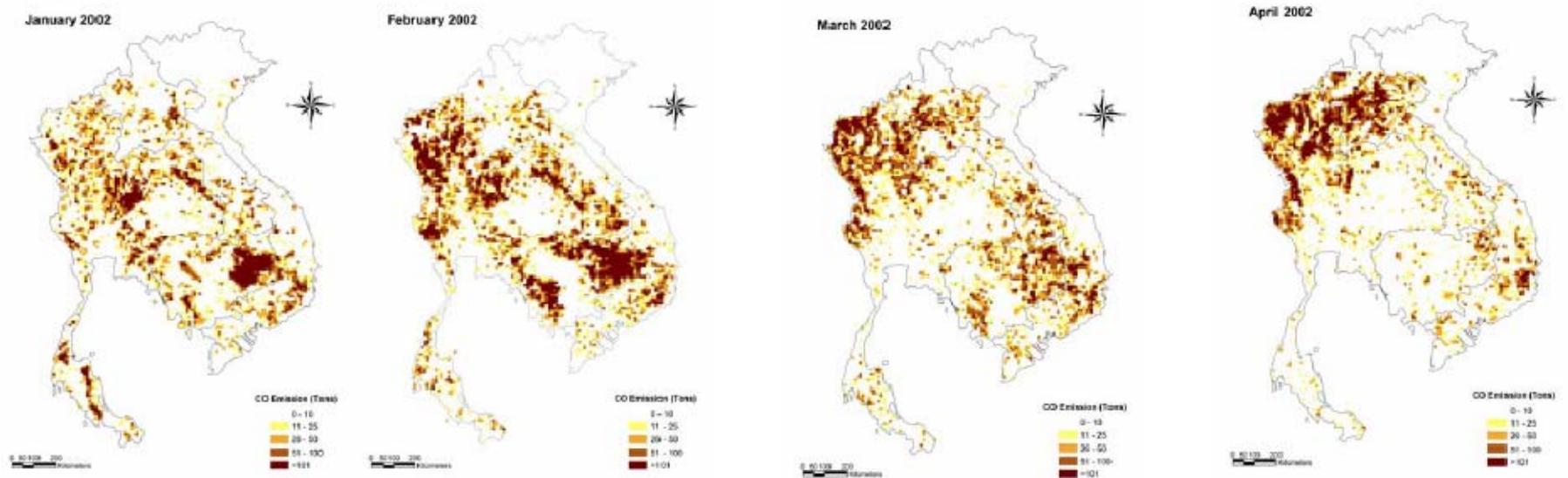


Figure 7. Maps of monthly TPM emissions in the MRBSR during January-April 2002

Comparison

INC

- EF :
- rainfed system = 0.6-2.49 kgCh4/ha/day
- Irrigated system = 1.56-3.1 kgCh4/ha/day
- Using scaling factor and collection factor
- Total emission = 2110 Gg CH4

GIS base

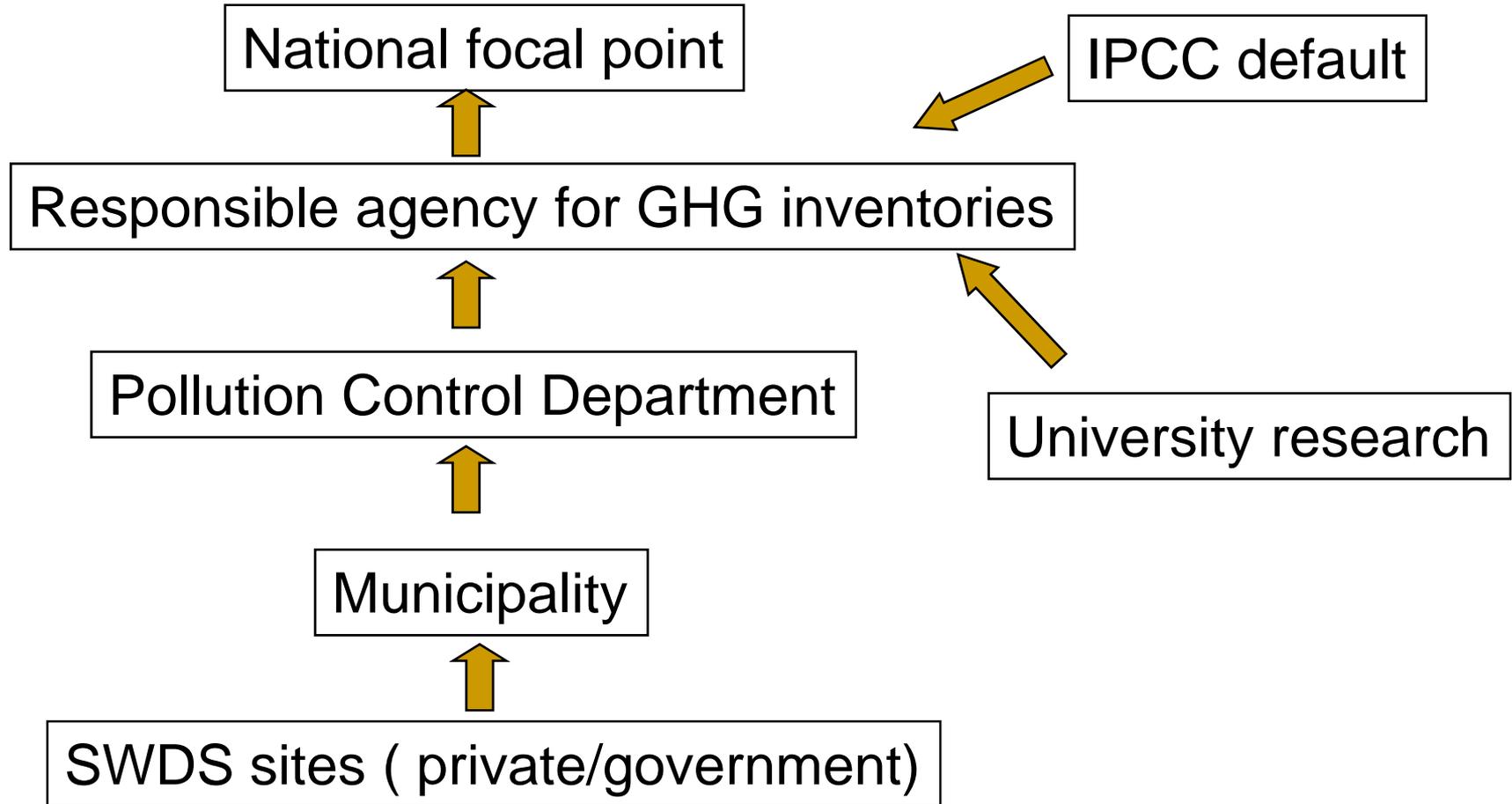
- EF = 0.7321 kgCh4/ha/day for rainfed and 1.56 kgCh4/ha/day for irrigated
- Total emission = 1059 Gg CH4

Summary of Agricultural Sector

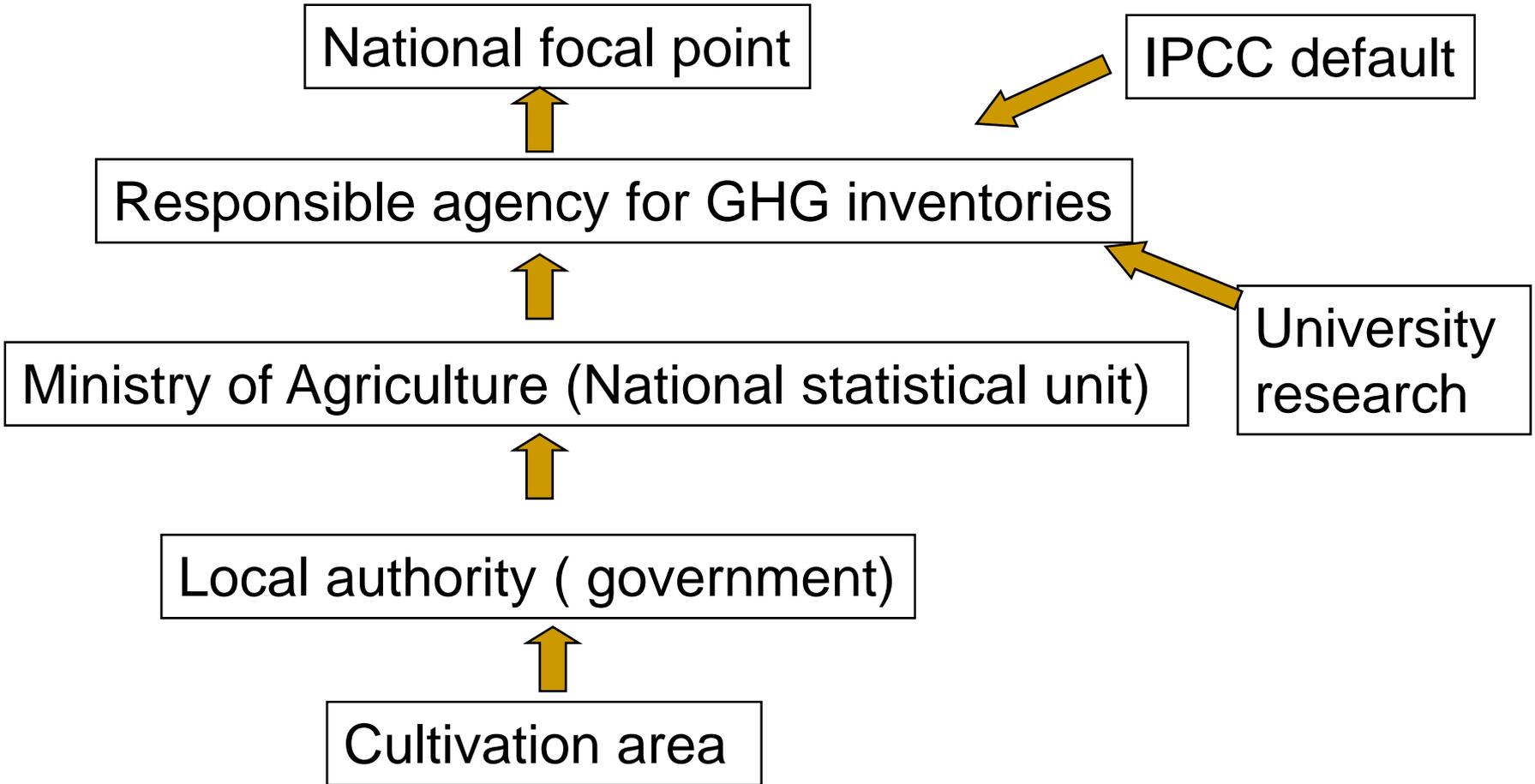
- Disaggregated EFs are important to reduce uncertainty
- Spatial information can be used in substitute of statistical report to see the overview emission in term of area. However comparison need to be done



Institutional arrangement for waste sector (SWDS)



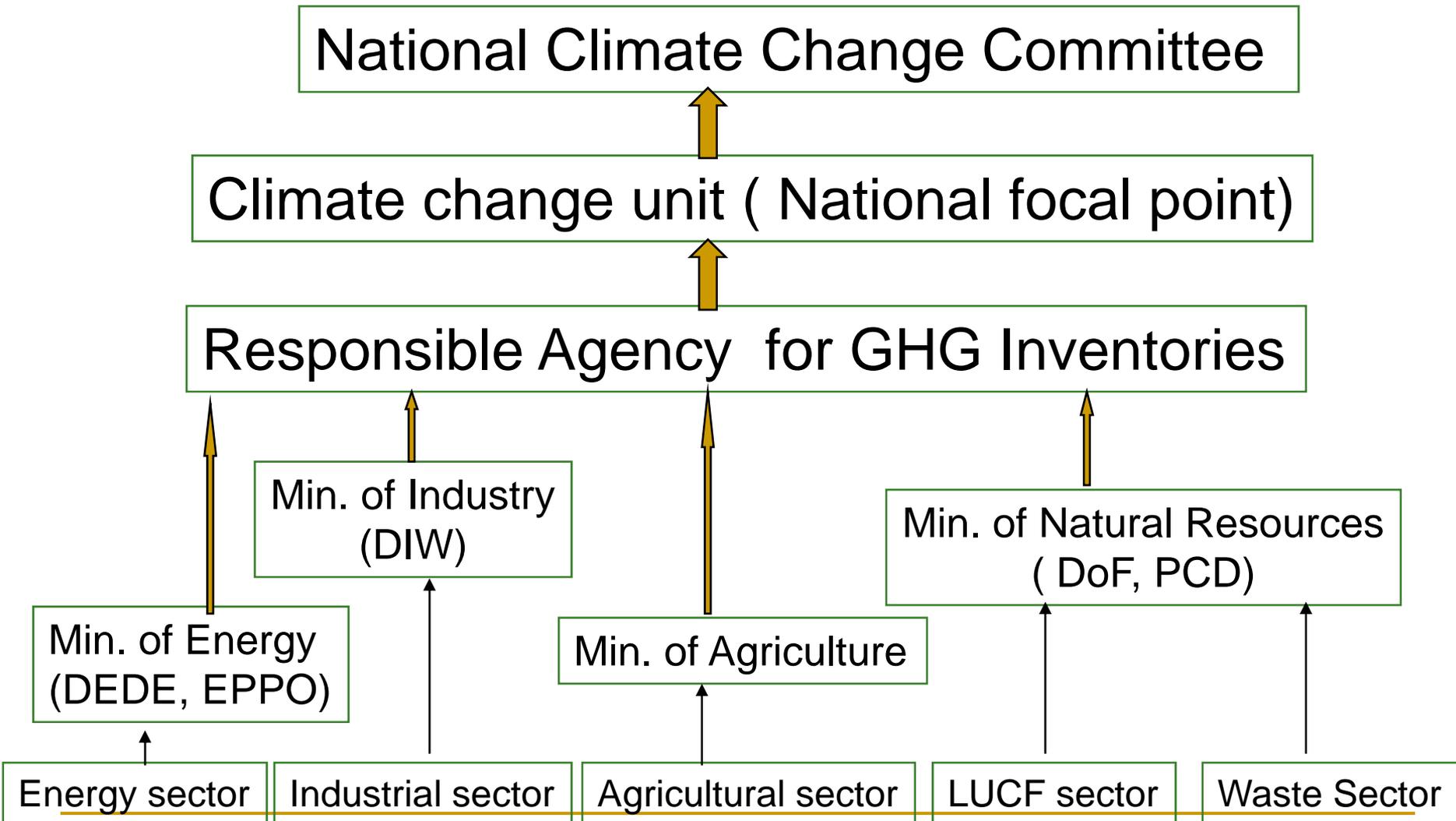
Institutional arrangement for agricultural sector (rice field)



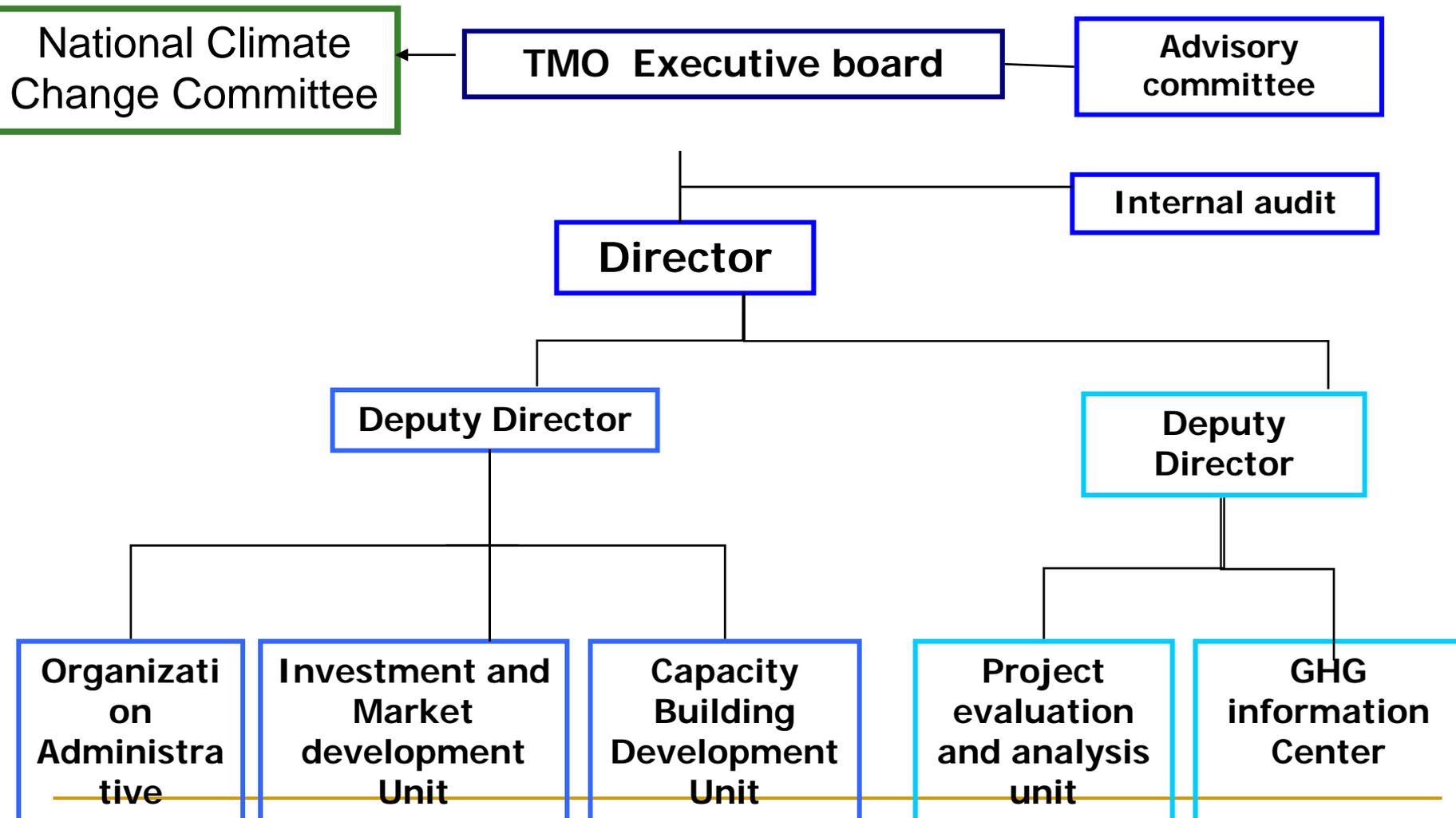
Barrier of data acquisition

- No central unit for achieving national data
 - Many Authorized institutes involved
 - Reporting is not systematic
 - Bureaucratic
 - Personal contact
-

Structure of National GHG Inventories



Structure of Thailand Greenhouse Gas Management Organization



Thank you for your attention

