The 8th Workshop on GHG Inventory in Asia
Emission Factor and Data Base (WGIA8-EFDB)

July 13-16, 2010

Vientiane, Lao PDR

Progress in National GHG Inventory in Myanmar

Prof. Khin Lay Swe

Pro-rector (Research and Academic Affairs)

Yezin Agricultural University

Progress in National GHG Inventory in Myanmar

- Estimation of Methane Emission from Flooded Rice Fields in Myanmar (Revised 1996 IPCC Guideline)
- Actual Methane Measurement
  - Study Trip to KMUTT, Thailand
  - Experiment sites in Myanmar
- N_2O Emission from Agricultural Soils
- N_2O Emission from Enteric fermentation
- N_2O Emission from Manure management
- GHG Emission from Crop Residue Burning

- Myanmar : Seven States – hilly regions, ethnic people
- Seven Divisions – plain areas, Bamar nationals

1. Northern Mountain
2. Western Mountains:

   2000-5800 m
3. Shan Plateau: >2000 m
4. Central Basin
5. Coastal Strips

19 45’ N, 96 12’ E

Total Area: 676,578 Km^2

Population: 58 millions

Significant regional variations: South-west monsoon rains

Coastal, Rakhine & Tanintharyi: 4000-6000 mm

Central : 500-1000 mm/ yr

Ayeyarwady: 2000-3000 mm

Shan : 1000-2000 mm

Estimation of Methane Emission from Flooded Rice Fields in Myanmar

2000 – 2001

Total harvested Rice area 6302,306 ha

- Irrigated Rice land = 1852,691 ha (29.4 %)
- Regular rainfed = 2432,690 ha (38.6 %)
- Drought-prone rainfed = 756,276 ha (12 %)
- Deep water Rice =1071,392 ha (17 %)
- Upland Rice = 189,069 ha (3 %)

Estimation of Methane Emission from Flooded Rice Fields in Myanmar

ADJUSTED DAILY EMISSION FACTOR

EFi = EFc • SFw • SFp • SFo • SFs,r

Rice Ecosystems	*EFc*	*SFw*	*SFp*	*SFo*	*EFi*
Irrigated Rice	0.13	0.52	1.0	1.6	**0.108**
Regular Rainfed Rice	0.13	0.28	0.68	1.6	**0.04**
Drought-prone Rainfed Rice	0.13	0.25	0.68	1.6	**0.035**
Deep Water Rice	0.13	0.31	1.0	1.6	**0.064**

Estimation of Methane Emission from Flooded Rice Fields in Myanmar

Rice Ecosystems	S_{FW}	S_{FP}	Scaling Factor for CH4 emission
Irrigated Rice	0.52	1	0.52
Regular Rainfed Rice	0.28	0.68	0.19
Drought-prone Rainfed Rice	0.25	0.68	0.17
Deep Water Rice	0.31	1	0.31

Rice Ecosystems	EF_C	Rice duration (days)	Seasonal Integrated Emission Factor (EF_I)
Irrigated Rice	0.13	110	14.3
Regular Rainfed Rice	0.13	140	18.2
Drought-prone Rainfed Rice	0.13	130	16.9
Deep Water Rice	0.13	170	22.1

Estimation of Methane Emission from Flooded Rice Fields in Myanmar

This spreadsheet contains Worksheet 4-2, in accordance with theRevised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

MODULE	AGRICULTURE
SUBMODULE	METHANE EMISSIONS FROM FLOODED RICE FIELDS
WORKSHEET	4-2
SHEET	1 OF 1
COUNTRY	MYANMAR
YEAR	2000 - 2001

Documentation box:

Parties are encouraged to provide relevant information used in the calculation and on data sources in this documentation box.

Total Rice Harvest Area 6302,306 ha

Irrigated 29.40%

Drought Prone Area 12%

Straw 1 ton/ha

Favorable/ Flood Prone Area 38.60%

Deepwater rice Area 17%

Cow dung 1.5 ton/ha

Estimation of Methane Emission from Flooded Rice Fields in Myanmar

			A		C	D	E
Water Management Regime			Harvested Area	Scaling Factor for Methane Emissions	Correction Factor for Organic Amendment	Seasonally Integrated Emission Factor for Continuously Flooded Rice without Organic Amendment	CH4 Emissions E = (A x B x C x D)/100
			(1000 ha)			(g/m2)	(Gg)
Irrigated	Intermittently Flooded	Multiple Aeration	1853	0.52	1.6	14.3	220.46
Rainfed	Flood Prone		2433	0.19	1.6	18.2	134.61
	Drought Prone		756	0.17	1.6	16.9	34.75
Deep Water	Water Depth 50-100 cm		1071	0.31	1.6	22.1	117.40
Totals			**6113**				**507.23**

CH4 Emissions From Rice Cultivation, 2000 = 507.23 Gg

Trends of CH_4 Emission from Rice Fields In Myanmar

Year	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Harvested Area (ha, 000)	6302	6412	6377	6528	6806	7384	8074	8011
CH_4 (Gg)	526	535.18	532.26	544.86	568.23	616.31	673.90	668.64
Increase %	1.745	-0.55	2.37	4.29	8.46	9.34	-0.78	

Average Annual Growth Rate (from 2000 to 2007) = 3.55

A Study Visit to King Mongkut's University of Technology Thonburi (KMUTT), Bangmod Campus and Ratchaburi Campus (4-8 May 2010)

- **Group Members**
- Prof. Dr. Khin Lay Swe, Pro-Rector (Research and AcademicAffairs), Yezin Agricultural University
- Dr. Nang Hseng Hom, Assoc. Professor, Dept. of Agricultural Botany, YAU
- Dr. Than Da Min, Lecturer, Dept. of Agronomy, YAU
- Ms. Aye Aye Aung, Deputy Supervisor, Pesticide Analytical Laboratory, Myanma Agricultural Service, MOAI

Activities of Study Visit to KMUTT, Thailand (4-8 May, 2010)

Lecture from Dr. Sirintornthep at Ratchaburi

Explanation by Dr. Savitri JGSEEand Earth System Science (ESS) KMUTT, Bangkok

Welcome Dinner by Prof. Kraiwood, the President of KMUTT

Activities of Study Visit to KMUTT, Thailand (4-8 May, 2010)

Demonstration for measurement of GHG from the crop residue burning at Ratchaburi Campus

Rice Straw Burning Measurement

Activities of Study Visit to KMUTT, Thailand (4-8 May, 2010)

Lecture on "Tower Monitoring Gas Exchange" by Asst. Prof. Dr. Amnat

A Visit to the Experiment Station in the forest of Rachaburi Campus

Activities of Study Visit to KMUTT, Thailand (4-8 May, 2010)

Methane gas collection from the field at Ratchaburi Campus

Measurement of Methane with Gas Chromatography at the Laboratory next to the experimental field

Activities of Methane Measurement at the Yezin Agricultural University, Myanmar (2009 Monsoon Rice)

YAU Campus, September, 2009
(Monsoon Rice)

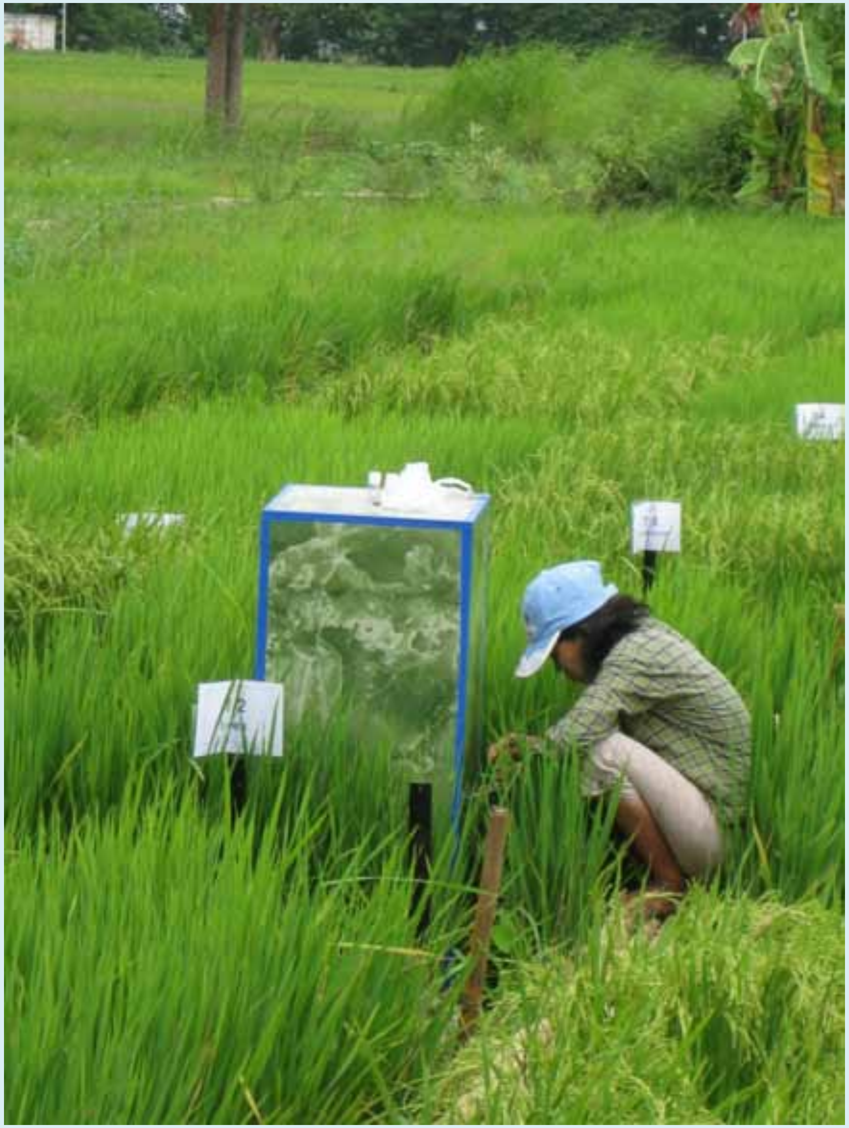
Final Year Students' Experiment: 3 different rice varieties
and 5 different fertilizer application

Activities of Methane Measurement at the Yezin Agricultural University, Myanmar (2009 Monsoon Rice)

Demonstration plots for students at
Hmawbi Campus, YAU
in Lower Myanmar

Activities of Methane Measurement at the Yezin Agricultural University, Myanmar

Summer Rice (April– July, 2010)



Methane Gas collection from Manaw-thuka rice variety

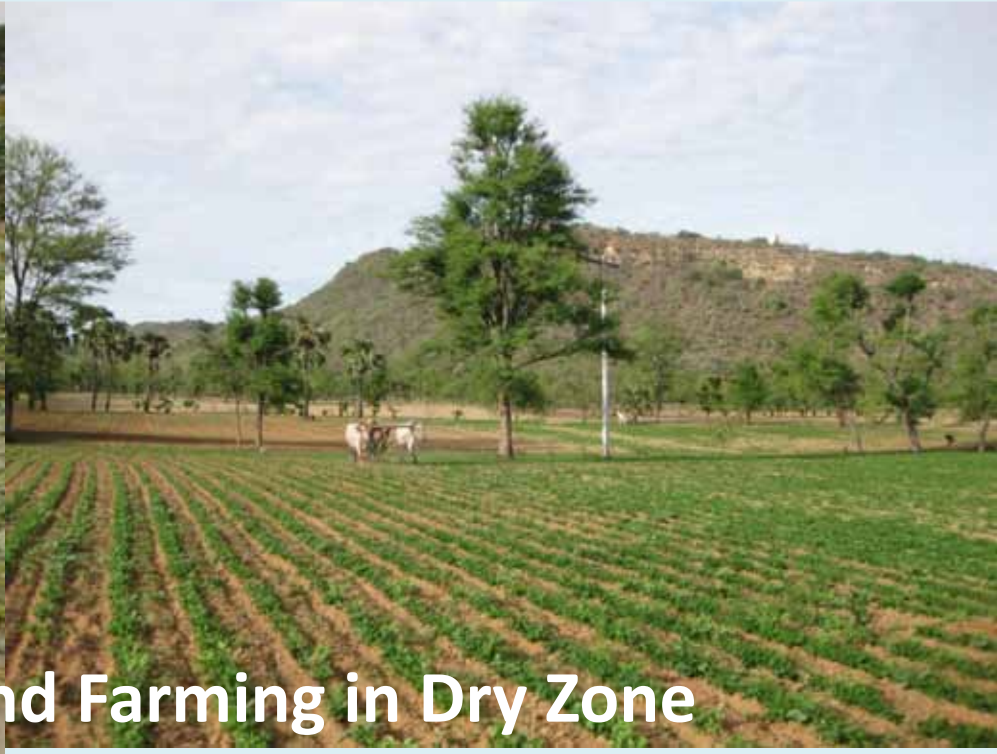
Actual Field Measurement of Methane Emission from Rice Fields at Yezin agricultural University, Myanmar

- Based on the actual measurement (Preliminary study) Emission Factors (FFs) in central Myanmar were:
  - For irrigated: 1.5 - 2 kg/ha/day
  - For rainfed: 0.1 – 0.2 kg/ha/day
- The 1996 IPCC default value = 2 kg/ha/day
- The Methane Project should be continued to generate **more reliable and accurate data from different regions**

N2O Emissions from Agriculture Soils (Tier 1)

$$N_2O_{Direct} - N = N_2O - N_{N\ inputs} + N_2O - N_{OS} + N_2O - N_{PRP}$$

Crop	Area (ha)	Total Urea (Kg , 000)	Urea N % (46%)	Cow dung (Kg ,000)	Manure N% (0.3%)
Rice	4285381	264837	121825,000	6428,072	19284,000
Other upland crops	7436,000	459545	211391,000	5577,000	16731,000

Commercial Upland Farming in Dry Zone

N2O Emissions from Agriculture Soils (Tier 1)

N_2O Emission from Agriculture Soils

Direct N2O Emission (Tier -1)

Year	N_2O – N SN (Kg/Yr)	N_2O – N OS (Kg/Yr)	N_2O – N PRP Kg/Yr	N_2O – N Total N Input	Direct N_2O Gg/Yr
1990	1779489	1291409	84916	3155814	4.96
1995	2258941	1689169	91155	4039265	6.35
2000	2665600	1974708	102741	4743048	7.45
2001	2754711	2034066	105579	4894356	7.69
2002	2799760	2068928	109079	4977766	7.82
2003	2942418	2143780	111404	5197602	8.17
2004	3105714	2236698	113849	5456260	8.57
2005	3369470	2367236	116628	5853334	9.20

N_2O Direct – N = N_2O-N N INPUT + N_2O-N OS + N_2O-N PRP

N_2O Emission from Managed Soils (Tier -1)

In-Direct N2O Emission (Tier -1)

Year	N_2O - L (Kg / yr)	ATD N (Kg / yr)	Total Indirect N_2O (Gg /Yr)	Direct N_2O Gg/Yr	Total N2O Emission Gg yr
1990	166464	405702	0.57	4.96	5.53
1995	213164	510625	0.72	6.35	7.07
2000	239089	578869	0.82	7.45	8.27
2001	245529	592871	0.84	7.69	8.53
2002	246382	599842	0.85	7.82	8.67
2003	257175	621114	0.88	8.17	9.05
2004	271444	648406	0.92	8.57	9.49
2005	299456	689438	0.99	9.20	10.19

N2O Emission from Enteric Fermentation and Manure management

Livestock Population Census

(in millions)

No.	Kind of Animal	2000-01
1	Cattle	10.98
2	Buffalo	2.44
3	Sheep & Goat	1.80
4	Pigs	3.97
5	Chickens	47.75

Methane Emission from Livestock

No	Kind of Animal	CH_4 Emissions	
		Enteric fermentation (Gg)	Manure management (Gg)
1	Cattle	305.43	17.11
2	Buffalo	83.78	5.39
3	Sheep	1.95	0.08
4	Goats	7.08	0.31
5	Horses	2.11	0.25
6	Mules and asses	0.10	0.01
7	Swine	3.97	27.82
89	Poultry	-	0.96
		404.43	**51.92**
	Total	**456.35**	

Demonstration Site for Biogas from Cow Dung Manure at Naypyitaw

Biogas from Cow Dung Manure

Electricity from Biogas Shwepay Village in Pyinmana Township

Estimation Of Greenhouse Gas Emissions from Crop Residue Burning

IPCC Tier 1

L fire = A•MB •Cf •Gef •10^{-3}

- **L fire = amount of greenhouse gas emissions from fire, tonnes**
- **A = area burnt, ha**
- **MB = mass of fuel available for combustion, tonnes ha-1.**
- **C_f = combustion factor, dimensionless (Table 2.6)**
- **G_{ef} = emission factor, g kg-1 dry matter burnt (Table 2.5)**

Harvest time of Summer Rice (June/July 2010)

Harvest time of Monsoon Rice , January/Feb. 2010

GHG Emission from Agriculture in 2000

		CH4 (Gg)	N2O (Gg)	CO Form fire (Gg)	Nox from fire (Gg)	CO2 Equalvalent (Gg)
1.	**CH4 Emission from rice field**	**507.23**				**10651.83**
2.	**Total Emission from Agricultural Managed Soils**		**8.27**			**2563.7**
	Direct N2O Emission from Agricultural Managed Soils		7.45			2309.5
	In-direct N2O Emission from Agricultural Managed Soils		0.82			254.2
3.	**Field Burning from Crop Residues**	**0.0238**	**0.0006**	**0.81**	**0.022**	**0.4998** **0.186** **0.81** **0.11**
Total Emission						**13217.1**

Emissions from Biomass Burning in Crop Land

TOTAL EMISSION

Year	CH_4 (Gg)	CO (Gg)	N_2O (Gg)	NO_x (Gg)
1990	0.0174	0.5913	0.0004	0.0161
1995	0.0214	0.7290	0.0006	0.0198
2000	0.0238	0.8100	0.0006	0.0220
2001	0.0249	0.8488	0.0006	0.0231
2002	0.0247	0.8430	0.0006	0.0229
2003	0.0255	0.8696	0.0007	0.0236
2004	0.0264	0.9003	0.0007	0.0245
2005	0.0282	0.9623	0.0007	0.0262

Assumption : Burning area of Sugarcane = 100%; Rice = 20%; Wheat = 85%; Maize = 35% of the total harvested area

Trend Analysis of CH_4 and N_2O Emissions from Agricultural Soils

Year	1990	1995	2000	2001	2002	2003	2004	2005	Ave. G. Rate %
CH_4 (Gg)	349.33	485.18	507.23	514.06	511.32	523.69	540.09	589.81	
CO_2 Equavalent	7335.9	10188.8	10651.8	10795.3	10737.7	10997.5	11341.9	12386.01	
Growth Rate %		38.89	4.54	1.35	-0.53	2.42	3.13	9.21	4.21
Total N_2O (Gg)	5.53	7.07	8.27	8.53	8.67	9.05	9.49	10.19	
CO_2 Equavalent	1715	2192	2564	2644	2687	2804	2943	3158	
Growth Rate%		27.84	16.97	3.12	1.63	4.36	4.95	7.30	4.73

Myanmar National GHG Inventory of Agriculture Sector in 2000

Sources	CH4 (Gg)	N20 (Gg)	Nox (Gg)	CO (Gg)	CO2 (Gg) Equavalent
Rice Cultivation	507.23				10651.83
Agricultural soils		8.27			2563.7
Agricultural residue burning	0.0238	0.0006	0.81	0.022	1.6058
Livestock sector	456.35				9583.35
Enteric fermentation	404.43				8316
Manure management	51.92				915
TOTAL					22800.486

GHG Emissions and Removals in Myanmar for the Year 2000

Source / Sink	CO_2 Emission	CO_2 Removal	Net CO_2 Emission	CO	CH_4	N_2O	Nox	CO_2 Equ. Total	CO_2 Equ.Net Emission
Energy Sector	7658.65		**7658.65**		5.62	0.28		**204.82**	7863.47
Industry Sector	248.59		**248.59**					**463.29**	463.29
Agriculture Sector				0.81	963.58	8.2706	0.022	**22800**	22800
Agriculture				0.81	507.23	8.2706	0.022	13216.63	
Livestock					456.35			9583.35	
Forestry Sector	33656.51	142221.2	**-108565**	2215.37	144.85	4.26	34.08	**6748.22**	-101816.48
Waste Sector					134.57			**2825.97**	2825.97
								TOTAL	**-67863.75**

Source: INC Report, 2010

Proposed activities for the Second National GHG Inventory in Myanmar

- Myanmar is late for the INC Report
- A National GHG Inventory in for the year 2000 is an important component of Myanmar **SNC** to UNFCCC, as it forms the basis for mitigation measures
- New emission factors for specific activities will be applied
- A long-term programme on the improvement of future GHG inventories will be developed
- We hope to receive the **technical and financial assistance from International organizations** in carrying out a National GHG Inventories for the future.


Thank You