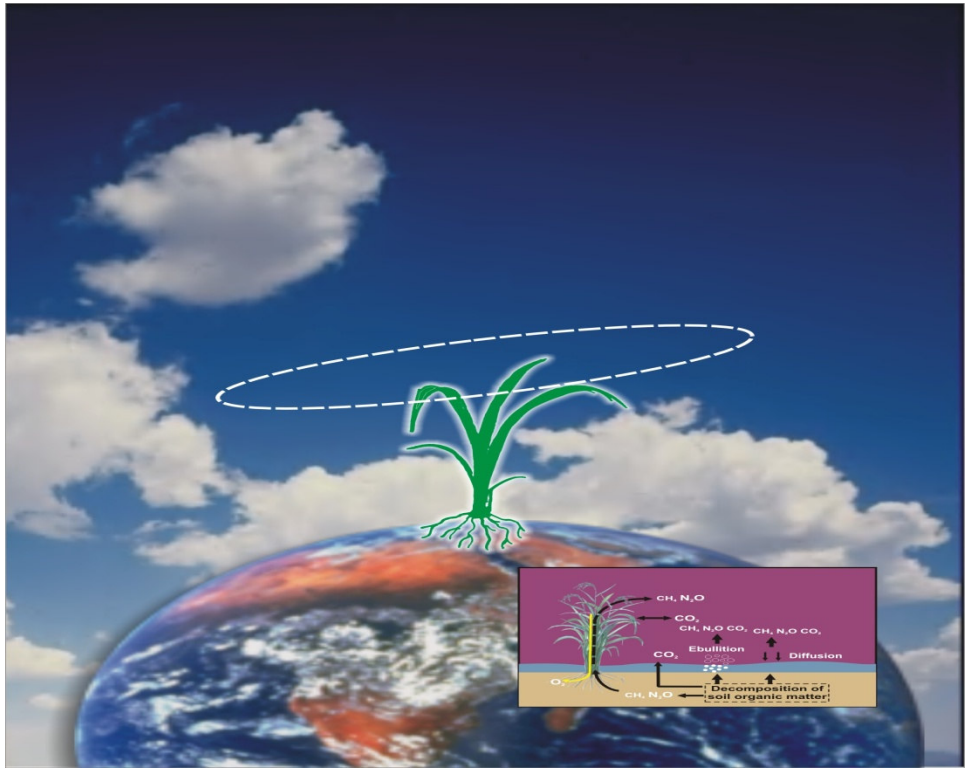
Greenhouse Gas Inventory for Indian Agriculture



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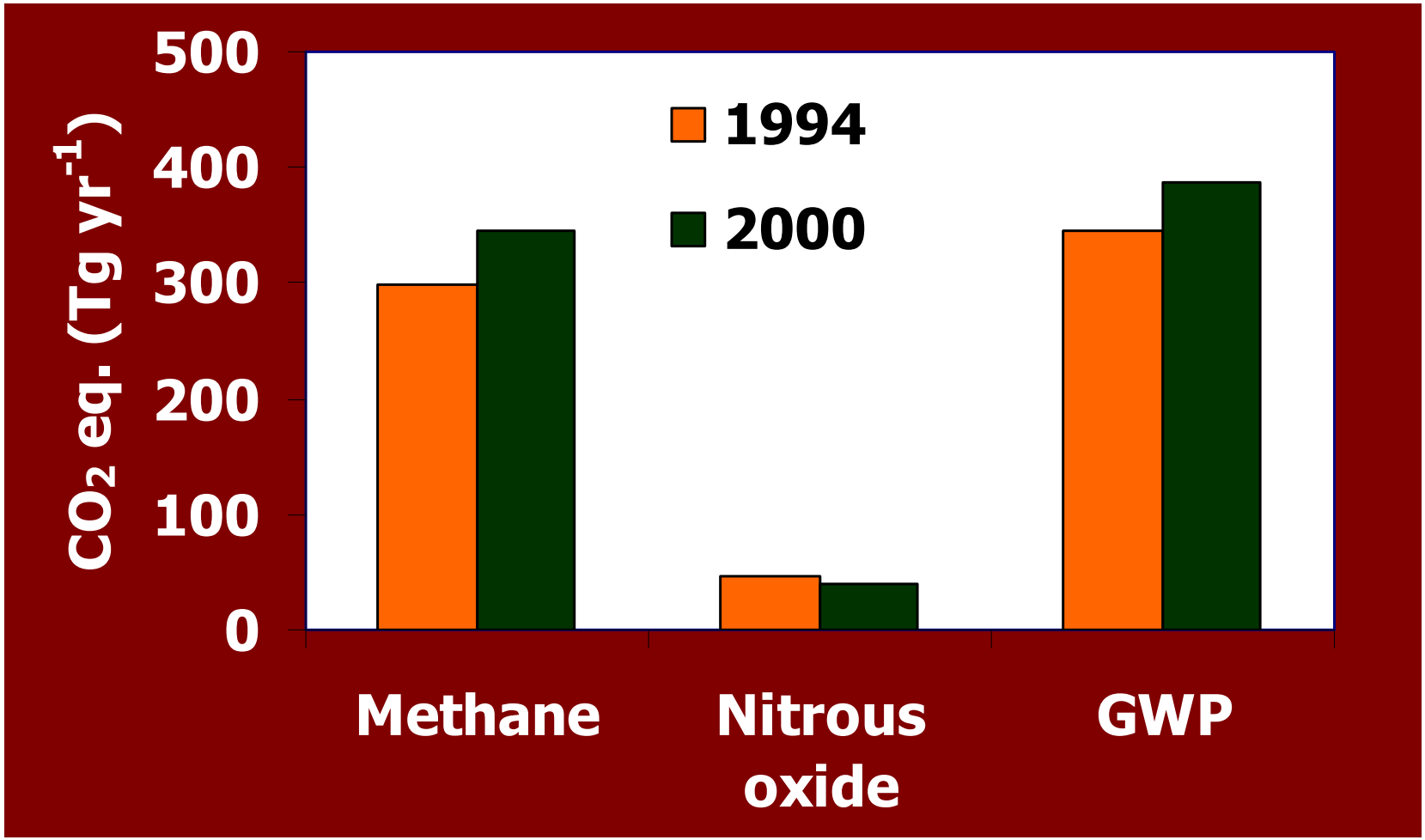
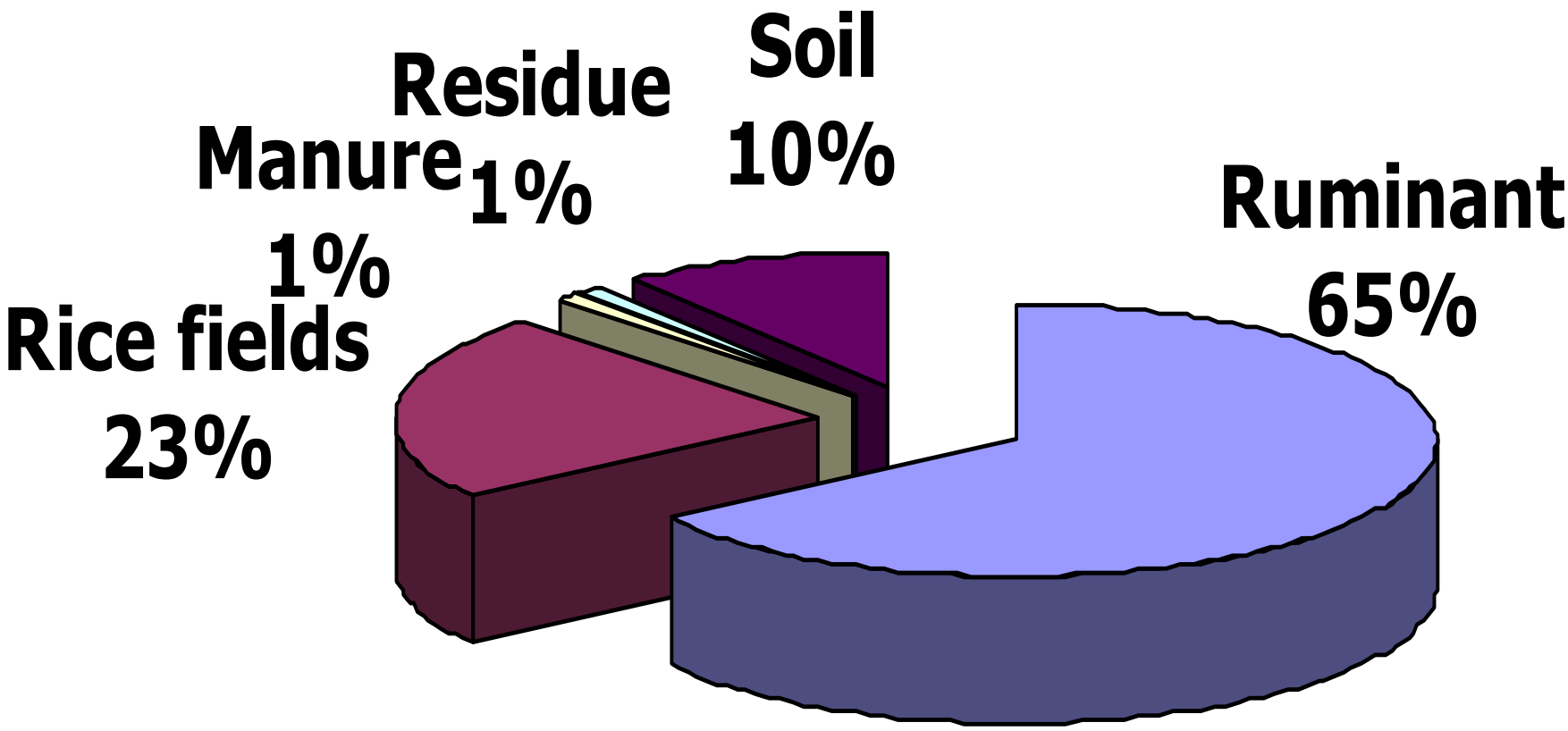
Greenhouse gas inventory for Indian agriculture for the year 2000

Source	CH_4 (Tg)	N_2O (Gg)	CO_2 eq. (Tg)
Ruminants	10.1	-	252.0
Rice cultivation	3.5	-	87.3
Manure management	0.1	0.1	2.5
Crop residue	0.2	4.0	4.9
Soil	-	132.3	39.4
Total	14.7	137.3	386.1

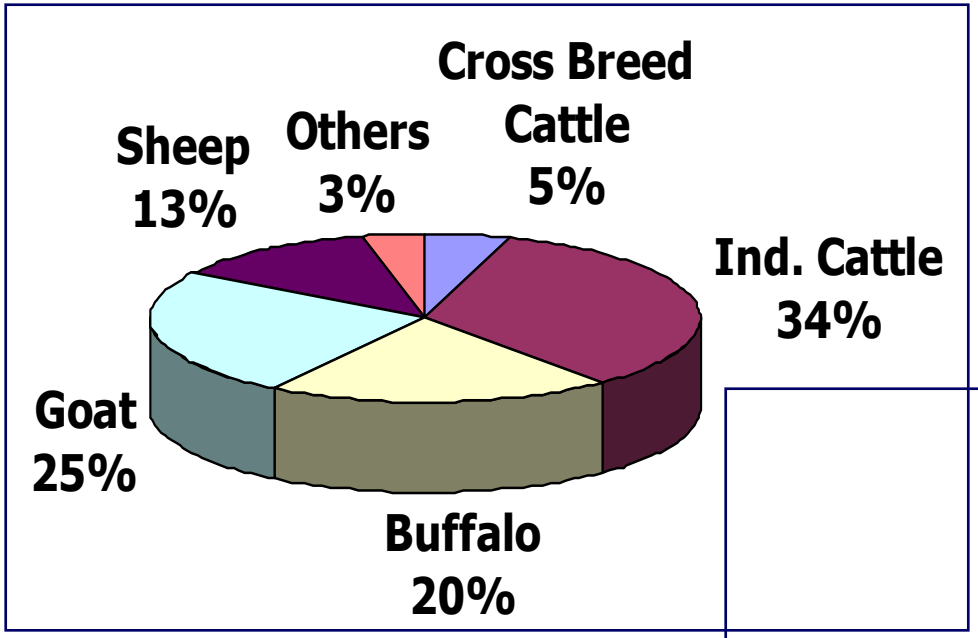
GHG Inventory for Indian Agriculture: Comparison between 1994 and 2000



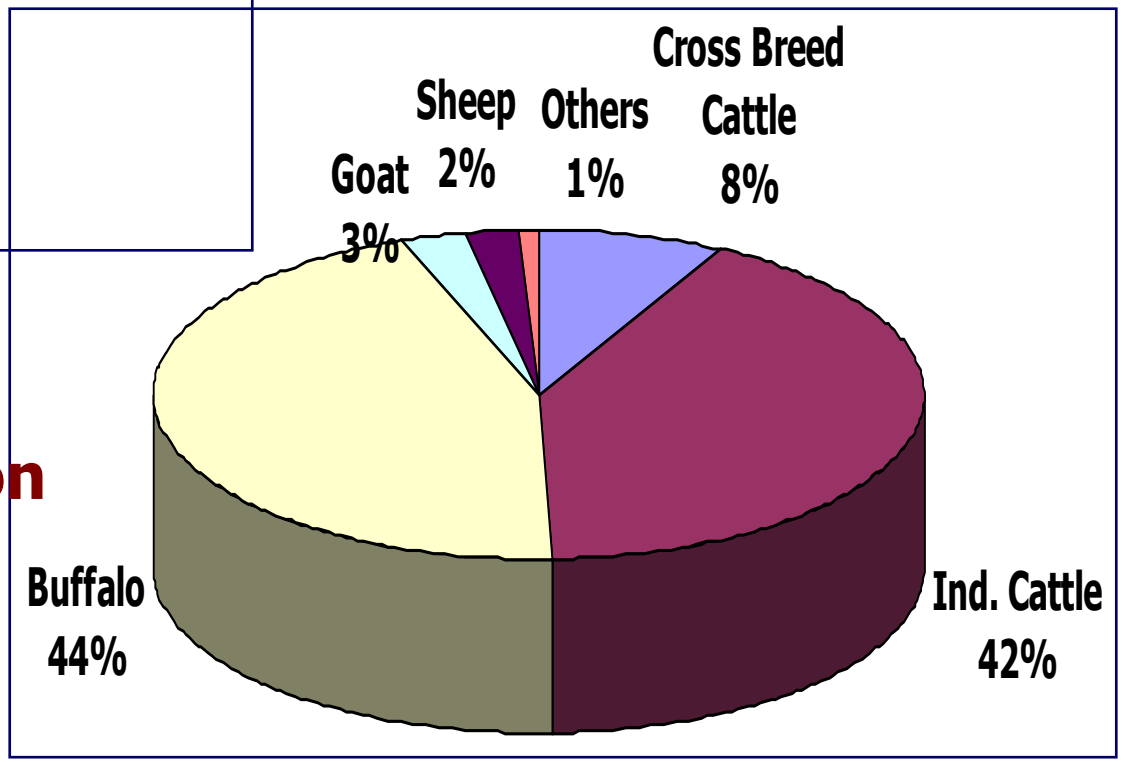
Relative GWP of various sub-sectors of agriculture in 2000



Population and methane emission from ruminants for the year 2000

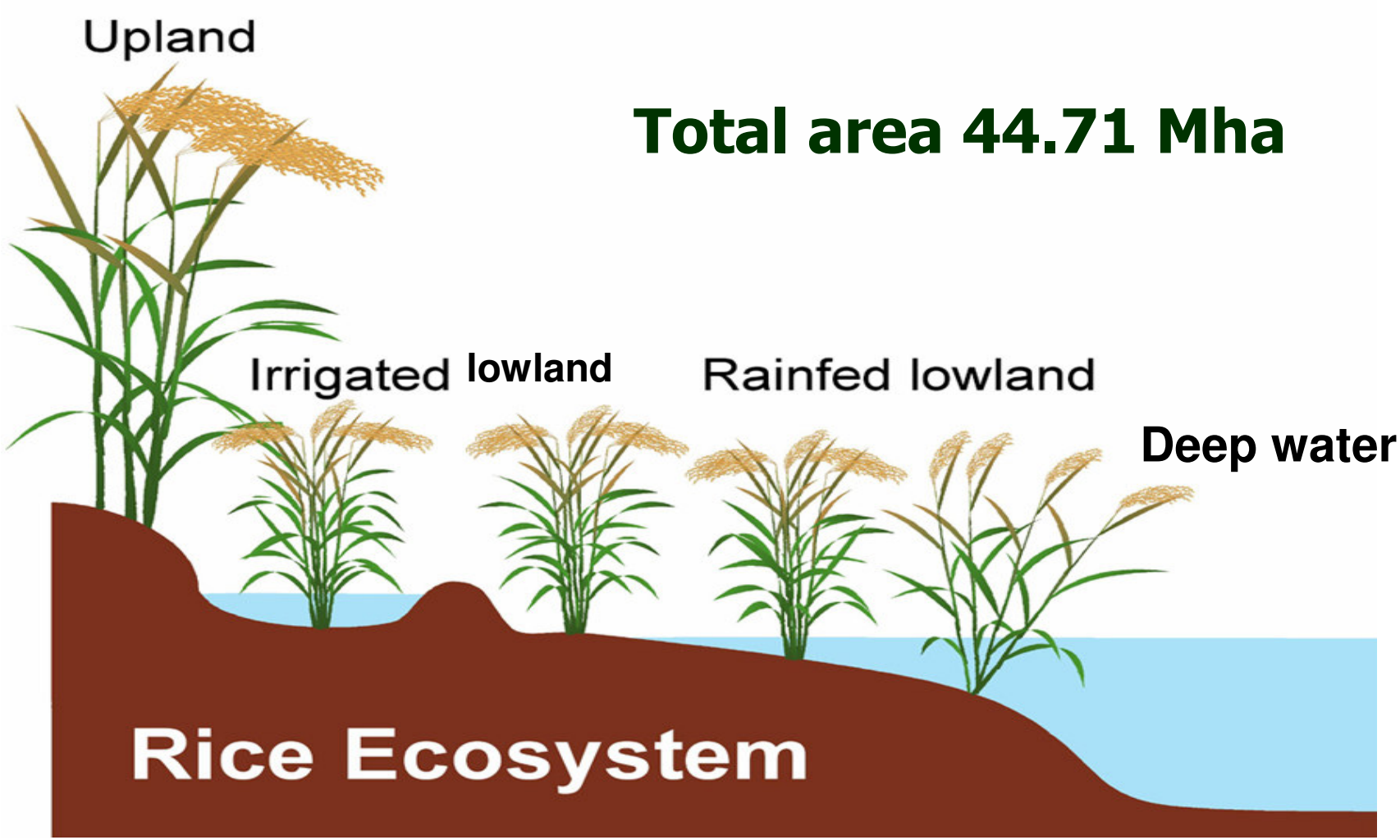


Ruminant population = 455 million



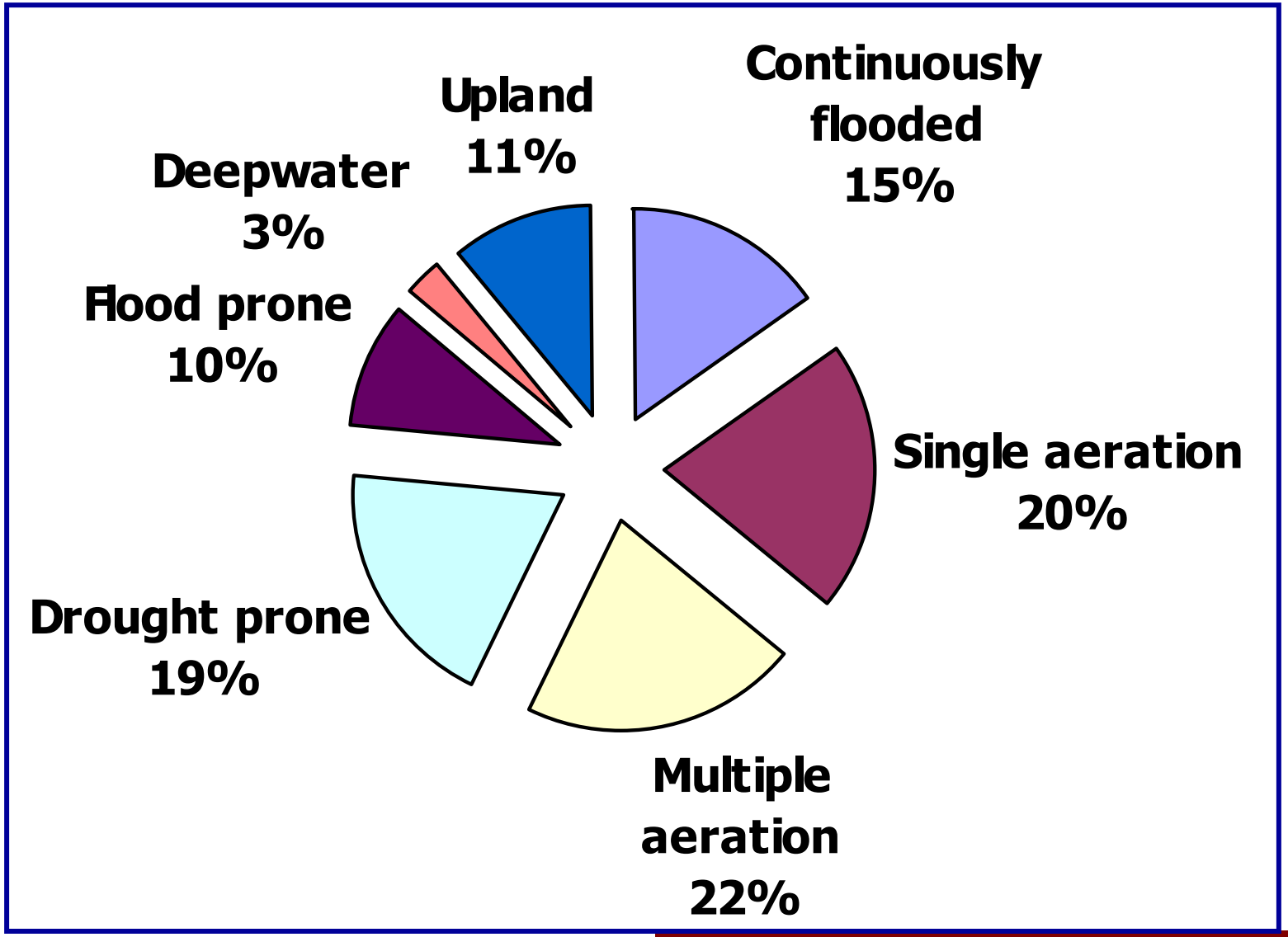
Methane emission = 10.08 Tg

Rice-ecosystems in India



Total area 44.71 Mha

Distribution of area under rice

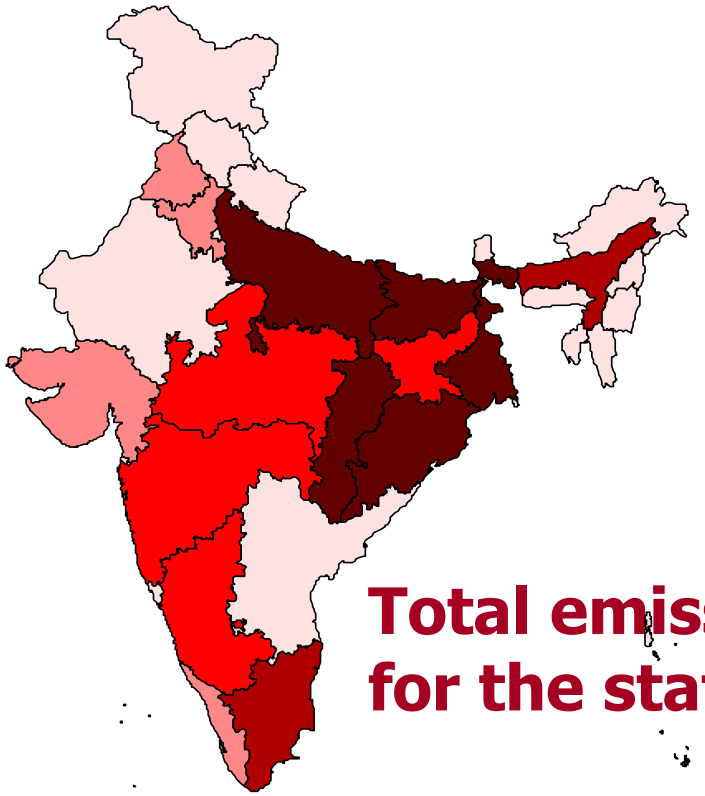


Total area 44.71 Mha

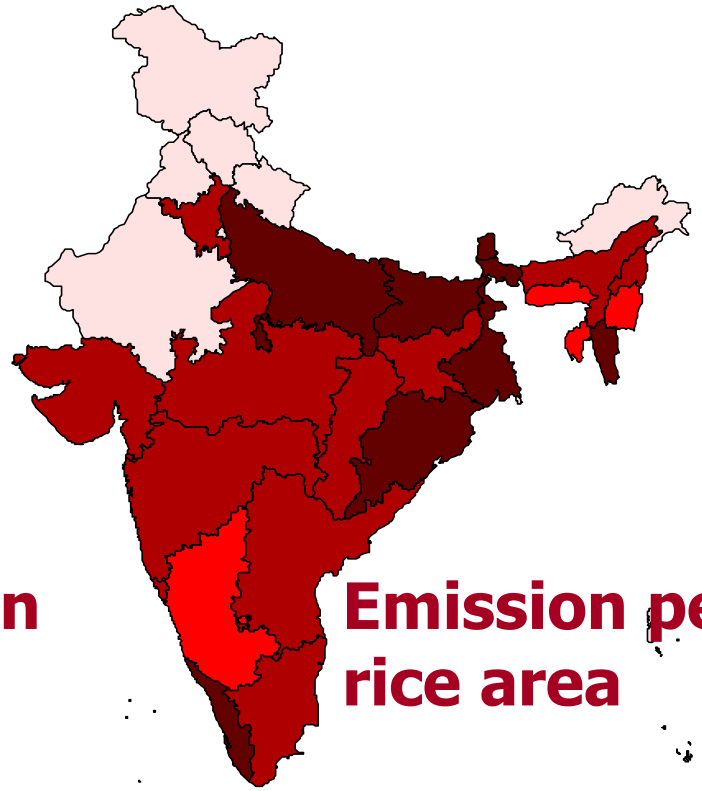
Emission coefficient and toal methane emission in various rice-ecosystems

Ecosystem	Water regime	Emission coeff. (kg ha^{-1})	Emission (Gg)
Irrigated	Conti. flooded	162.1	1111
	Single aeration	65.9	598
	Multiple aeration	18.4	175
Rainfed	Drought prone	65.9	570
	Flood prone	190.0	827
Deep water		160.0	218
Upland		0	0
Total			3499

Methane emission from rice in various states for the year 2000



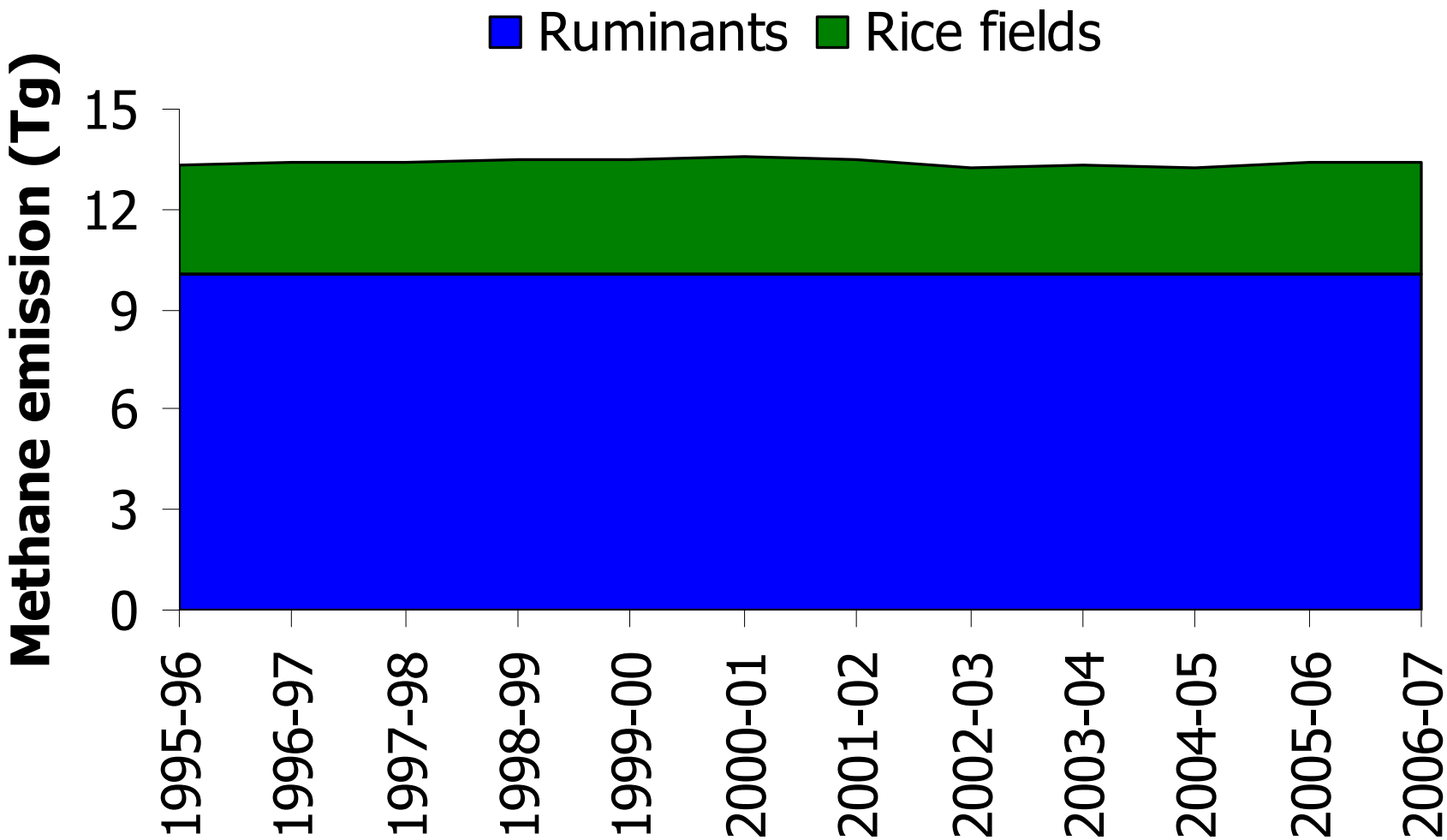
Total emission for the state



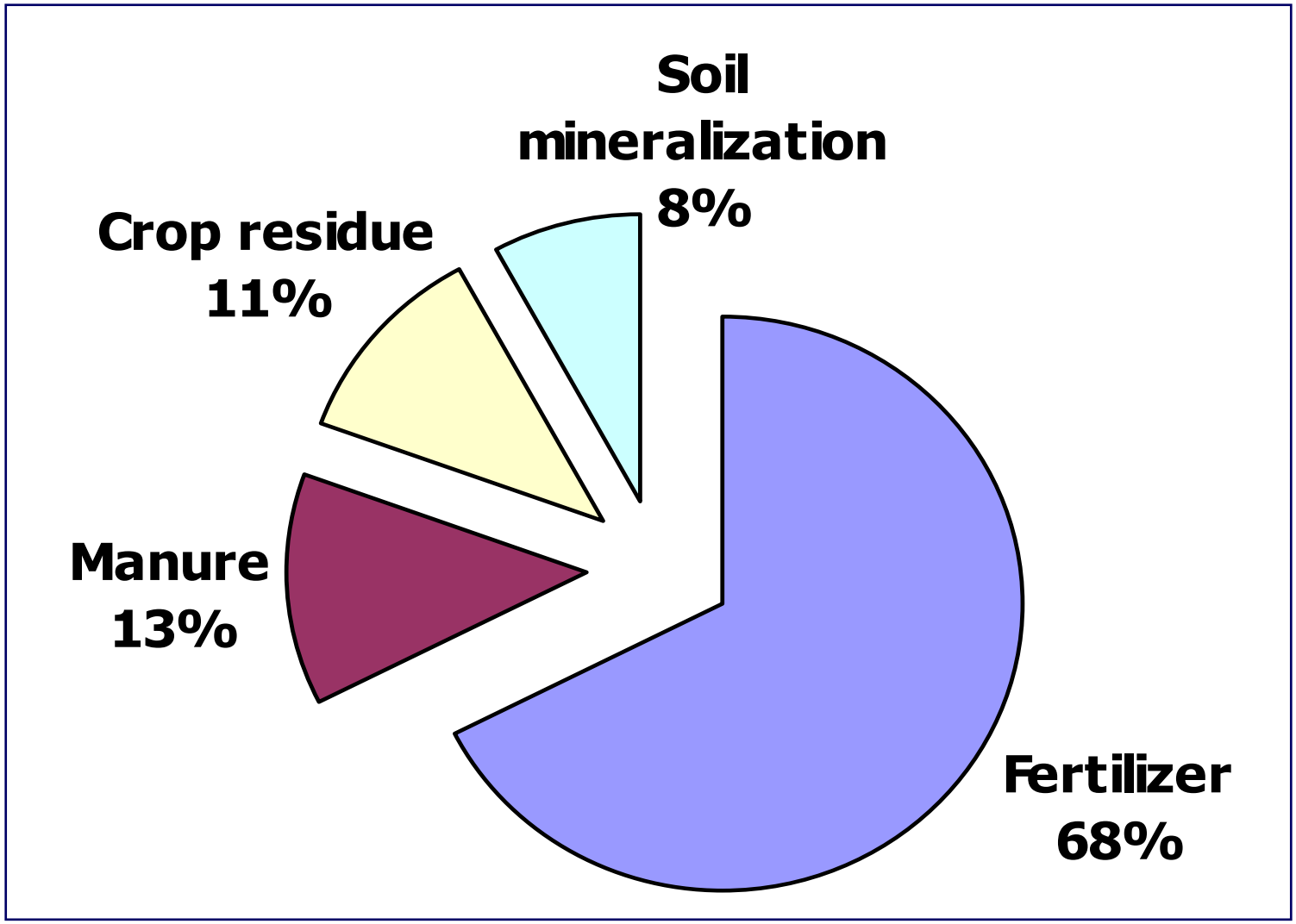
Emission per unit rice area

Legend	Total emission (Gg)	Emission (kg ha^{-1})
	<25	<20
	25-75	20-40
	75-125	40-60
	125-200	60-80
	>200	>80

Methane emission from rice fields during 1995-2006

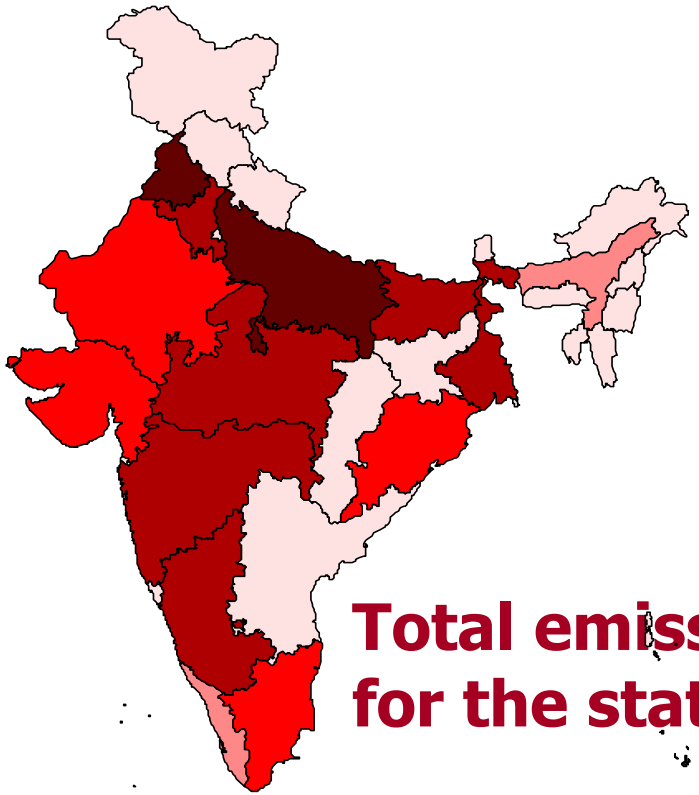


Contribution of different sources to N_2O emission

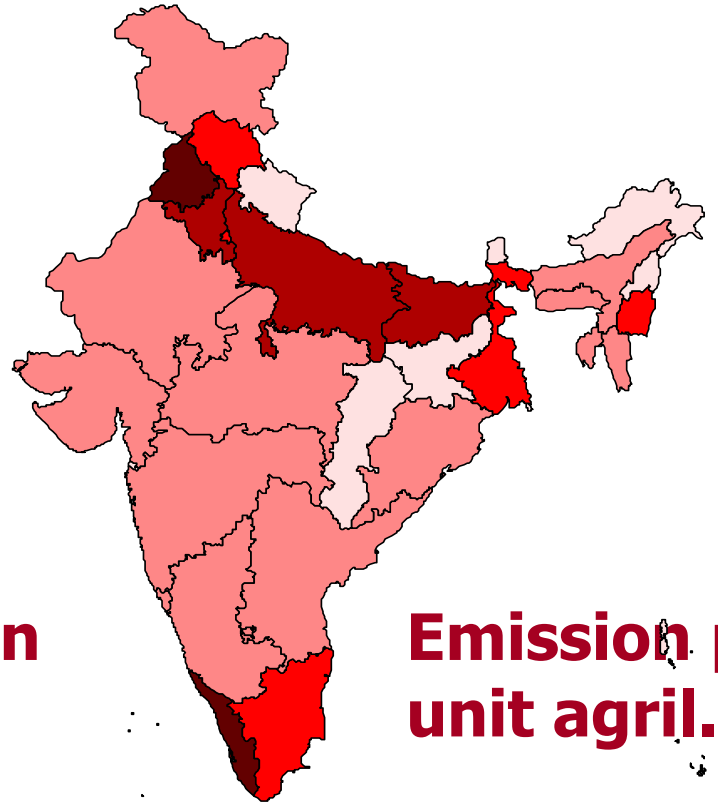


Total emission 132 Gg

Nitrous oxide emission from soil for year 2000



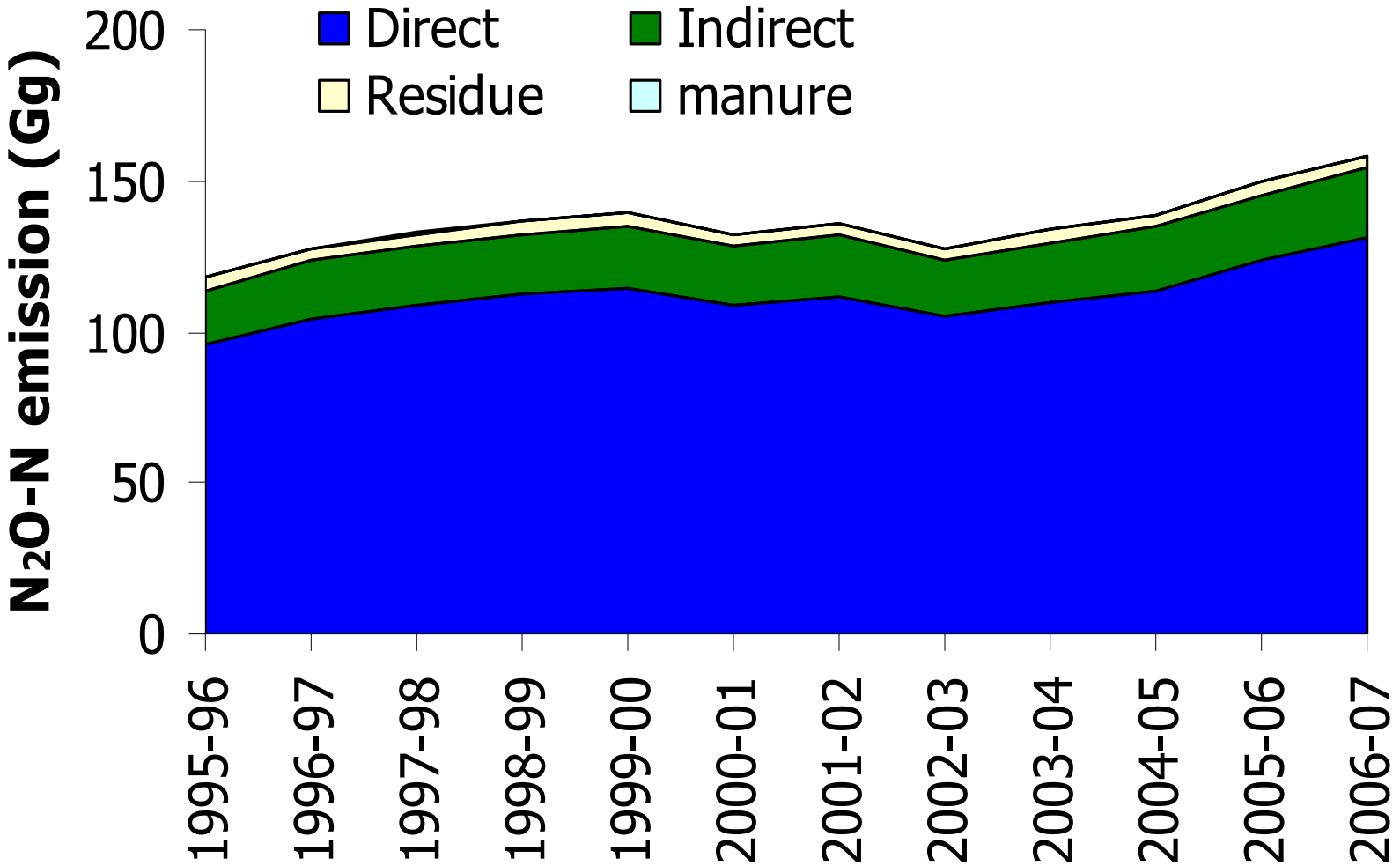
Total emission for the state



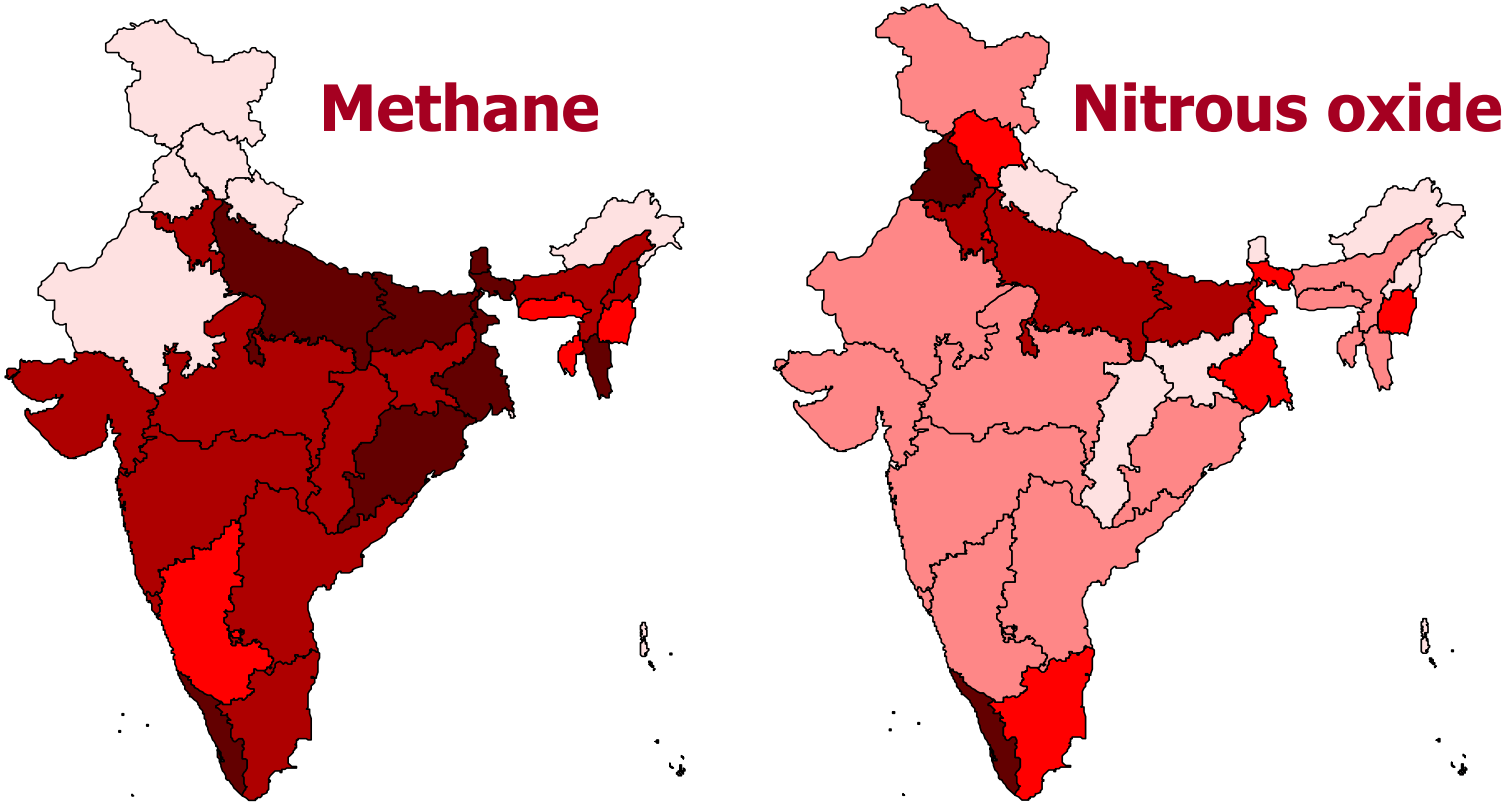
Emission per unit agril. area

Legend	Total emission (Gg)	Emission (kg ha^{-1})
	<1	<0.3
	1-3	0.3-0.8
	3-7	0.8-1.3
	7-14	1.3-1.8
	>14	>1.8

Nitrous oxide emission during 1995-2006



Comparison of methane and nitrous oxide emission from soil in different states



Legend	Methane (kg ha^{-1})	N_2O (kg ha^{-1})
	<20	<0.3
	20-40	0.3-0.8
	40-60	0.8-1.3
	60-80	1.3-1.8
	>80	>1.8

Methodology

- IPCC (2006) methodology followed
- Activity data for 1995 to 2007 compiled
- Emission coefficients developed and updated for different crops, crop residues and soils
- Emission coefficients for livestock and manure management updated
- Uncertainty calculated

Uncertainty in methane emission from rice fields

Rice Area	Area (M ha)	Std. Dev. (M ha)	Uncertainty (%)
Irrigated	24.7	0.7	3
Flood prone	3.8	0.4	11
Drought prone	9.7	0.8	8
Deep water	1.4	0.1	7
Emission coeff.	**Emission (kg ha^{-1})**	**Std. Dev. (kg ha^{-1})**	**Uncertainty (%)**
Cont. Flood.	174	36	21
Single aeration	72	17	24
Multiple aeration	25	10	40
Flood prone	178	25	14
Drought prone	72	12	17
Deep water	178	25	14

Uncertainty in nitrous oxide emission from soil

Source of N	N use (Gg)	Std. Dev. (Gg)	Uncertainty (%)
Fertilizer	10920.2	0	0
Manure	1.14	0.17	15
Crop residue	0.15	0.02	13
Soil N	5110.0	569.0	11
Emission coeff.	**Emission (% of N)**	**Std. Dev. (% of N)**	**Uncertainty (%)**
Fertilizer N	0.75	0.2	27
Volatilization	0.75	0.2	27
Leaching	0.63	0.2	32

Conclusions

- Indian agriculture emits 14.7 Tg methane and 0.14 Tg nitrous oxide.
- There is uncertainty (3-40%) in GHG emission particularly in emission coefficients.
- Need to strengthen GHG measurement and extrapolation with simulation model to reduce the uncertainties.
- Technologies such as conservation agriculture and feed management should be promoted to mitigate the emission.

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Thank You