

Emissions from Agriculture Sector in 2000, SNC Lao PDR

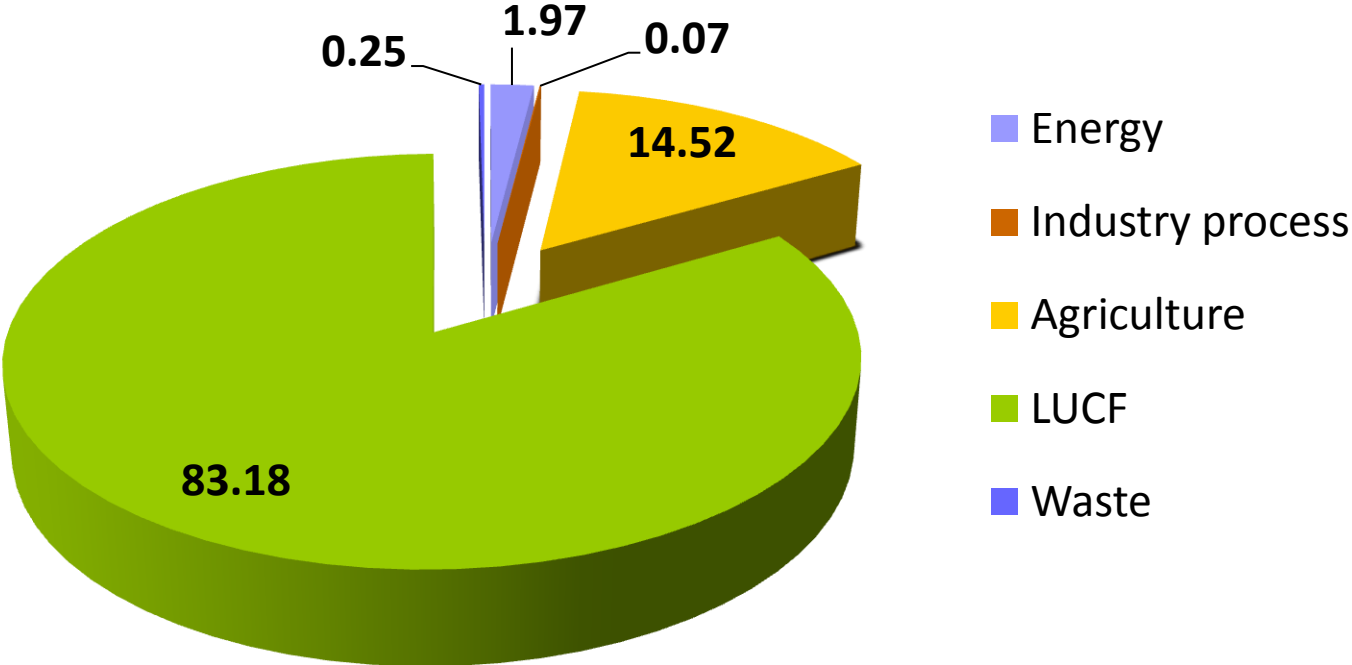
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Total Emissions in Laos in 2000

Total Emissions
52,856.61 Gg of CO₂eq

Emissions by Sectors (%)



Scope and Methodologies for the Inventory for Agriculture Sector

Greenhouse gas source and sink categories	CH4 (Gg)	N2O (Gg)	NOx (Gg)	CO (Gg)	NMVOCs (Gg)	SOx (Gg)
4. Agriculture						
A. Enteric fermentation	T1, D	-	-	-	-	-
B. Manure management	T1, D	-	-	-	-	-
C. Rice cultivation	T1, D	-	-	-	-	-
D. Agricultural soils	-	T1, D	-	-	-	-
E. Prescribed burning of savannahs	T1, D	T1, D	T1, D	T1, D	-	-
F. Field burning of agricultural residues	T1, D	T1, D	T1, D	T1, D	-	-
G. Other (please specify)	NE	NE	NE	NE	NE	NE

4.A. Enteric Fermentation-CH4

4.B. Manure Management-CH4

Livestock Type	Number of Animals	Emissions Factor for Enteric Fermentation (kg/head/yr)	Emissions from Enteric Fermentation (t/yr)	Emissions Factor for Manure Management (kg/head/yr)	Emissions from Manure Management (t/yr)	Total Annual Emissions from Domestic Livestock (Gg)
	A	B	$C = (A \times B)/1000$	D	$E = (A \times D)/1000$	$F = (C + E)/1000$
Dairy Cattle	140	56	7.84	27	3.78	0.01
Non-dairy Cattle	986,860	44	43,421.84	2	1,973.72	45.40
Buffalo	1,007,000	55	55,385.00	3	3,021.00	58.41
Sheep	28,000	5	140.00	0.21	5.88	0.15
Goats	72,000	5	360.00	0.22	15.84	0.38
Swine	1,101,000	1	1,101.00	7	7,707.00	8.81
Poultry	12,028,000	0	0.00	0.023	276.64	0.28
Totals			100,415.68		13,003.86	113.42

4.B. Emissions from AWMS-N2O

1. Nitrogen Excretion for AWMS-Daily Spread

Livestock Type	Number of Animals	Nitrogen Excretion Nex (kg//head/(yr))	Fraction of Manure Nitrogen per AWMS (%/100) (fraction)	Nitrogen Excretion per AWMS, Nex (kg N/yr)
	A	B	C	D = (A x B x C)
Non-dairy Cattle	986860	40	0.69	27,237,336.00
Dairy Cattle	140	60	0.5	4,200.00
Poultry	12028000	0.6	0.3	2,165,040.00
Sheep	28000	12	0.5	168,000.00
Swine	1101000	16	0.76	13,388,160.00
Others(buffalo)	1007000	40	0.9	36,252,000.00
Others (goat)	72000	12	0.5	432,000.00
			Total	79,646,736.00

4.B. Emissions from AWMS-N₂O

2. Nitrogen Excretion for AWMS- Pasture Range and Paddock

Livestock Type	Number of Animals	Nitrogen Excretion Nex (kg//head/(yr))	Fraction of Manure Nitrogen per AWMS (%/100) (fraction)	Nitrogen Excretion per AWMS, Nex (kg N/yr)
	A	B	C	D = (A x B x C)
Non-dairy Cattle	986860	40	0.31	12,237,064.00
Dairy Cattle	140	60	0.5	4,200.00
Poultry	12028000	0.6	0.7	5,051,760.00
Sheep	28000	12	0.5	168,000.00
Swine	1101000	16	0.24	4,227,840.00
Others (buffalo)	1007000	40	0.1	4,028,000.00
Others(goat)	72000	12	0.5	432,000.00
			Total	26,148,864.00

4.C. Rice Cultivation

Water Management Regime		Harvested Area (1000 ha)	Scaling Factor for Methane Emissions	Correction Factor for Organic Amendment	Seasonally Integrated Emission Factor for Continuously Flooded Rice without Organic Amendment (g/m ²)	CH ₄ Emissions (Gg)
		A	B	C	D	$E = (A \times B \times C \times D)/100$
Irrigated (Intermittently Flooded)	Multiple Aeration	110	0.2	2	16	7.04
Rainfed	Flood Prone	510	0.8	2	16	130.56
Totals		620				137.60

4.D. Agricultural Soils

Sub. 1A. Manure Nitrogen Used

Total Nitrogen Excretion (kg N/yr)	Fraction of Nitrogen Burned for Fuel (fraction)	Fraction of Nitrogen Excreted During Grazing (fraction)	Fraction of Nitrogen Excreted and Emitted as NO_x and NH_3 (fraction)	Sum (fraction)	Manure Nitrogen Used (corrected for NO_x and NH_3 emissions), F_{AW} (kg N/yr)
A	B	C	D	$F = 1 - (B + C + D)$	$F = (A \times E)$
105,795,600	0	0.02	0.2	0.78	82,520,568.00

4.D. Agricultural Soils (cont)

Sub.1B. Nitrogen Input from Crops Residues

Production of non - N - Fixing Crops (kg dry biomass/yr)	Fraction of Nitrogen of non - N - Fixing Crops, (kg N/kg dry biomass)	Production of Pulses and Soybeans (kg dry biomass/yr)	Fraction of Nitrogen in N- Fixing Crops, (kg N/kg dry biomass)	One minus the Fraction of Crop Residue Removed From Field, (fraction)	One minus the Fraction of Crop Residue Burned (fraction)	Nitrogen Input from Crop Residues, F_{CR} (kg N/yr)
A	B	C	D	E	F	$G = 2 \times (A \times B + C \times D) \times E \times F$
406,210,000	0.02	4,925,000.00	0.03	0.45	0.55	3,089,245.50

4.D. Agricultural Soils (cont)

1. Direct Nitrous Oxide Emission from Agriculture Fields- Excluding Cultivation of Histosols

Type of N input to soil	Amount of N Input (kg N/yr)	Factor for Direct Emissions EF ₁ (kg N ₂ O-N/kg N)	Direct Soil Emissions (Gg N ₂ O-N/yr)
	A	B	C = (A x B)/1 000 000
Synthetic fertilizer (F _{SN})	105,498,149.40	0.0125	1.32
Animal waste (F _{AW})	82,520,568.00	0.0125	1.03
N-fixing crops (F _{BN})	-	-	0.00
Crop residue (F _{CR})	3,089,245.50	0.0125	0.04
		Total	2.39

4.D. Agricultural Soils (cont)

2. Direct N₂O Emission from Cultivation of Histosols

	Area of Cultivated Organic Soils F _{OS} (ha)	Emission Factor for Direct Soil Emissions EF ₂ (kg N ₂ O–N/ha/yr)	Direct Emissions from Histosols (Gg N ₂ O–N/yr)	Total Direct Emissions of N ₂ O (Gg)
	D	E	F=(D x E)/1 000 000	G = (C+F)[44/28]
Total	NE	0	0.00	3.75

4.D. Agricultural Soils (cont)

3. N₂O Soil Emissions from Grazing Animals: Pasture Range and Paddock

Animal Waste Management System (AWMS)	Nitrogen Excretion $N_{ex(AWMS)}$ (kg N/yr)	Emission Factor for AWMS EF_3 (kg N ₂ O–N/kg N)	Emissions Of N ₂ O from Grazing Animals (Gg)
	A	B	$C = (A \times B)[44/28]/1\ 000\ 000$
Pasture range and paddock	26,148,864.00	0.02	0.82

4.D. Agricultural Soils (cont)

4. Indirect Nitrous Oxide Emissions from Fertilizer and Nitrogen in Atmospheric Deposition of NH₃ and NO_x

Type of Deposition	Synthetic Fertilizer N Applied to Soil, N _{FERT} (kg N/yr)	Fraction of Synthetic Fertilizer N Applied that Volatilizes Frac _{GASFS} (kg N/kg N)	Amount of Synthetic N Applied to Soil that Volatilizes (kg N/kg N)	Total N Excretion by Livestock NEX (kg N/yr)	Fraction of Total Manure N Excreted that Volatilizes Frac _{GASM} (kg N/kg N)	Total N Excretion by Livestock that Volatilizes (kg N/kg N)	Emission Factor EF ₄ (kg N ₂ O–N/kg N)	Nitrous Oxide Emissions (Gg N ₂ O–N/yr)
	A	B	C = (A x B)	D	E	F = (D x E)	G	H = (C + F) x G /1,000, 000
Total	117,220,166	0.1	11,722,016.6	107,677,200	0.2	21,535,440	0.01	0.33

4.D. Agricultural Soils (cont)

5. Indirect N₂O Emission from Leaching

	Synthetic Fertilizer Use N_{FERT}	Livestock N Excretion N_{EX}	Fraction of N That Leaches $\text{Frac}_{\text{LEACH}}$	Emission Factor EF_5	Nitrous Oxide Emissions From Leaching	Total Indirect Nitrous Oxide Emissions	Total Nitrous Oxide Emissions
	(kg N/yr)	(kg N/yr)	(kg N/kg N)		(Gg N ₂ O-N/yr)	(Gg N ₂ O/yr)	(Gg)
	I	J	K	L	$M = (I + J) \times K \times L / 1\,000\,000$	$N = (H + M)[44/28]$	$O = (G + C + N)$
Total	117,220,166	105,795,600	0.3	0.025	1.67	3.15	7.72

4. E. Prescribed Burning of Savannahs

1. Quantity of Living and Dead Biomass Burning

Area Burned by Category (specify) (k ha)	Biomass Density of Savannah (t dm/ha)	Total Biomass Exposed to Burning (Gg dm)	Fraction Actually Burned	Quantity Actually Burned (Gg dm)	Fraction of Living Biomass Burned	Quantity of Living Biomass Burned (Gg dm)	Quantity of Dead Biomass Burned (Gg dm)
A	B	$C = (A \times B)$	D	$E = (C \times D)$	F	$G = (E \times F)$	$H = (E - G)$
4.72	4.9	23.13	0.8	18.50	0.9	16.65	1.85

4. E. Prescribed Burning of Savannahs (cont)

2. Total Carbon Release from Savannah Burning

Fraction Oxidised of living and dead biomass		Total Biomass Oxidised (Gg dm)	Carbon Fraction of Living & Dead Biomass	Total Carbon Released (Gg C)
	I	Living: $J = (G \times I)$ Dead: $J = (H \times I)$	K	$L = (J \times K)$
Living	0.8	13.32	0.45	5.99
Dead	1	1.85	0.4	0.74
Total				6.73

4. E. Prescribed Burning of Savannahs (cont)

3. Total Emissions from Savannah Burning

Total Carbon Released (Gg C)	Nitrogen-Carbon Ratio	Total Nitrogen Content (Gg N)	Emissions Ratio	Emissions (Gg C or Gg N)	Conversion Ratio	Emissions from Savannah Burning (Gg)
		$N = (L \times M)$		$P = (L \times O)$		$R = (P \times Q)$
			0.004	0.27	16/12	CH ₄ 0.04
			0.06	4.04	28/12	CO 0.94
6.73	0.006	0.40		$P = (N \times O)$		$R = (P \times Q)$
			0.007	0.00	44/28	N ₂ O 0.00
			0.121	0.05	46/14	NO _x 0.02

4.F. Field Burning of Agriculture Residues (cont)

2. Total Carbon and Nitrogen Release from Biomass of Rice and Maize Burning -

Crops	Carbon Fraction of Residue	Total Carbon Released (Gg C)	Nitrogen-Carbon Ratio	Total Nitrogen Released (Gg N)
	I	J = (H x I)	K	L = (J x K)
Rice	0.4144	51.23	0.014	0.72
Maize	0.4709	1.98	0.02	0.04
Total:		53.22		0.76

4.F. Field Burning of Agriculture Residues (cont)

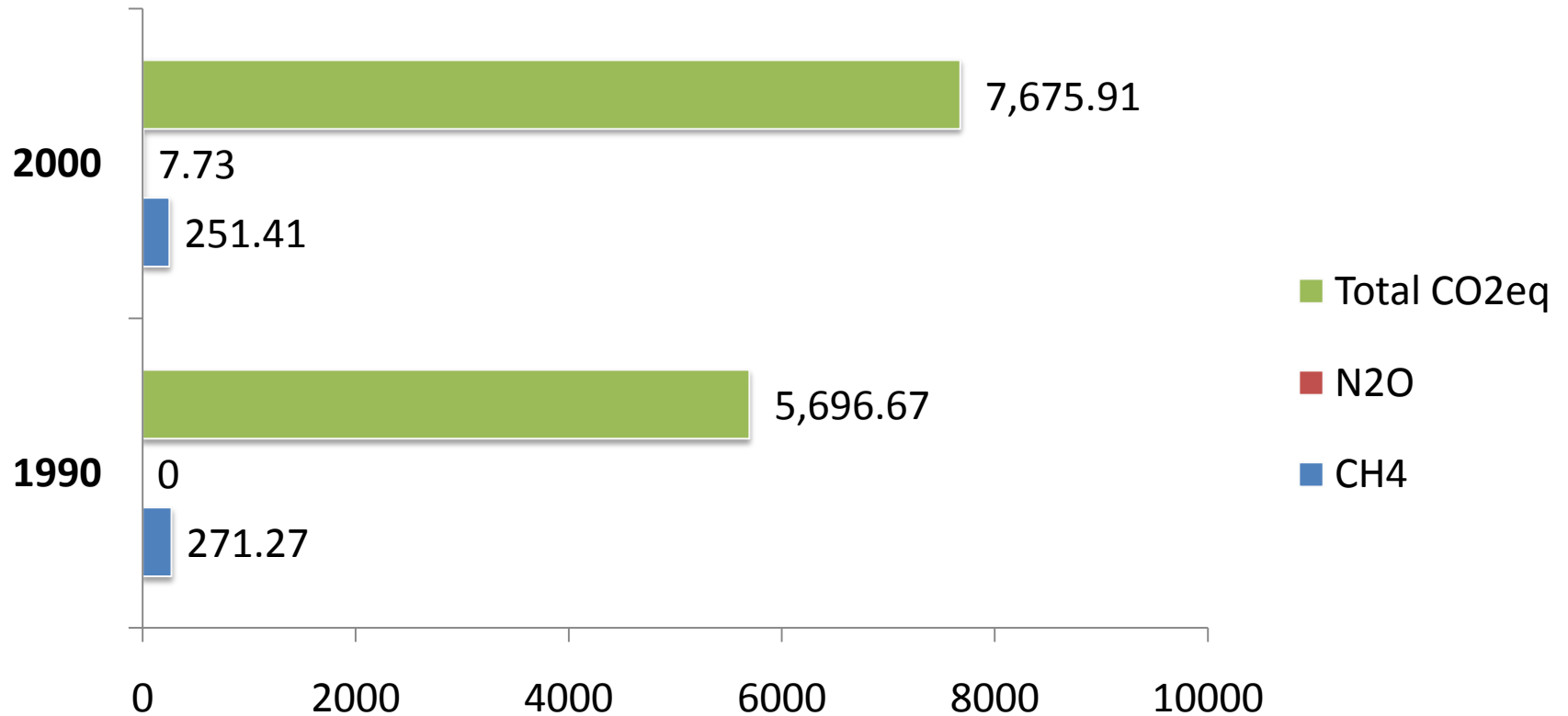
3. Total Emissions from Burning of Agriculture Residues

	Emission Ratio	Emissions (Gg C or Gg N)	Conversion Ratio	Emissions from Field Burning of Agricultural Residues (Gg)
	M	N = (J x M)	O	P = (N x O)
CH ₄	0.005	0.27	16/12	0.35
CO	0.06	3.19	28/12	7.45
		N = (L x M)		P = (N x O)
N ₂ O	0.007	0.01	44/28	0.01
NO _x	0.121	0.09	46/14	0.30

Summary of Emissions from Agriculture Sector

Greenhouse gas source and sink categories	CH4 (Gg)	N2O (Gg)	NOx (Gg)	CO (Gg)	NMVOCs (Gg)	SOx (Gg)	CO ₂ eq (Gg)
4. Agriculture	251.41	7.73	0.32	8.39	-	-	7,675.91
A. Enteric fermentation	100.42	-	-	-	-	-	
B. Manure management	13.00	-	-	-	-	-	
C. Rice cultivation	137.60	-	-	-	-	-	
D. Agricultural soils	-	7.72	-	-	-	-	
E. Prescribed burning of savannahs	0.04	0.00	0.02	0.94	-	-	
F. Field burning of agricultural residues	0.35	0.01	0.30	7.45	-	-	
G. Other (please specify)	-	-	-	-	-	-	

Emissions Trend, 1990 to 2000



A low-angle photograph of two tall palm trees against a clear, bright blue sky. The trees are slender with textured, greyish-brown trunks and dense, green fronds at the top. The tree on the left is taller and more vertical, while the one on the right is shorter and leans slightly to the right. A red rectangular box is overlaid on the lower part of the image, containing the text "Thanks You" in white.

Thanks You