



INMS Component 3: Developing regional assessments of nitrogen management

South Asia Demo region
Activity 3.1b (Developing areas with excess Nitrogen)
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Collaborators

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INMS-5 Meeting



South Asian Region

1. Context of the region

South Asia Demo site: characteristics of the region

1. Huge diversity of soil types, water availability, climate, socio-economic and governance factors both within and between countries of South Asia implying contrasting situations in terms of N management.
2. While the smaller, irrigated areas are characterized by intensive fertilizer usage, there is only a little applied in the larger, rainfed areas.
3. Usable N is lost to ground water and surface water bodies through agricultural run offs, sewage, animal and human excreta, and also into the air due to emission of reactive N compounds from agricultural soils, livestock, sewage dumps, residue burning, vehicular and industrial emissions and industrial waste

1. Context of the region

2. Known nitrogen threats & benefits

In the selected countries of Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, the main factors influencing the N flows are:

- a) the strong agricultural activities, using organic and synthetic N fertilizers;
- b) the huge amount of cattle excreta generated by the enormous cattle population;
- c) the high amount of municipal solid waste produced at the densely populated regions; and
- d) the strong N exchange over the thickly vegetated cropping regions.

In terms of N flows and cycling in the environment, these factors make these countries a coherent region.

2. Nitrogen budget: Analysis of nitrogen sources and fates, by sector (Tasks 3.1.1-3.1.3)

1. Budget approach – brief overview

1. Data collection for creation of database on reactive-N flow in different sectors of the economy of the participating countries like (a) Agriculture, (b) Waste, (c) Transport, (d) Energy, (e) Industry, (f) Atmospheric deposition, (g) Aquatic ecosystem and coastal pollution. We are not using any model and these are straightforward analysis. We seek the help of INMS modeling group for proper fitting of data
2. Data are being collected since 1961 or almost from the year when N-fertilizer use began. Most of the datasets from India, Bangladesh and Pakistan are collected from local recorded databases, and a few others are collected from FAOSTAT
3. We are in the process of analyzing inputs, outputs, fluxes from different sectors across South Asia.

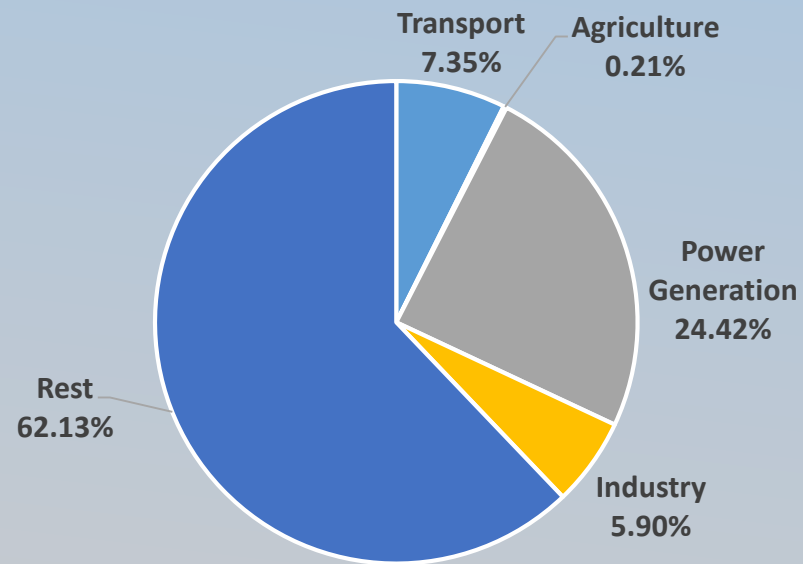
Table : N₂O emission (Gg/year) in South Asia, 2000-2010

Country	2000	2010	% Change
Afghanistan	9.58	13.87	45
Bangladesh	49.85	62.12	25
Bhutan	0.61	0.65	7
India	499.71	639.28	28
Maldives	0.04	0.08	120
Nepal	13.58	16.56	22
Pakistan	98.73	128.03	30
Sri Lanka	4.96	5.48	11
Total SA	677	865	28

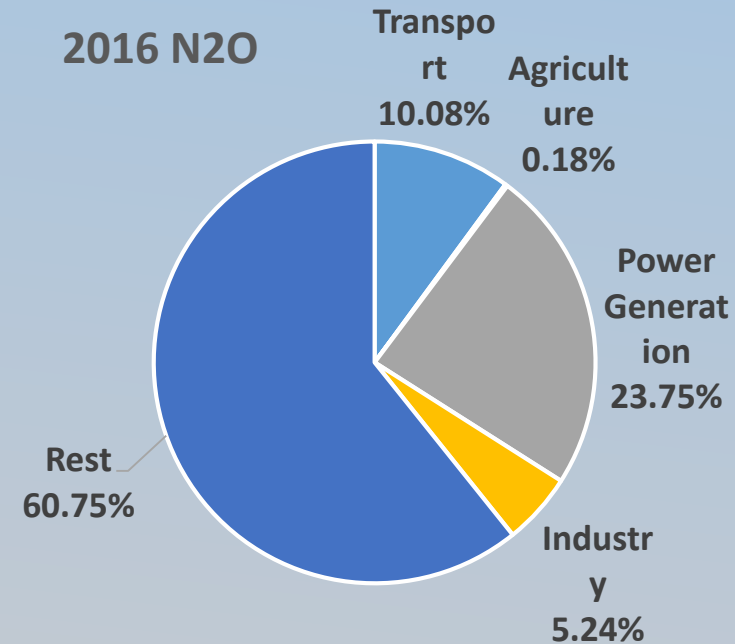
Source: SACEP Briefing document. 2020

N₂O emission by sector in India in 2008 and 2016 in India

2008 N₂O

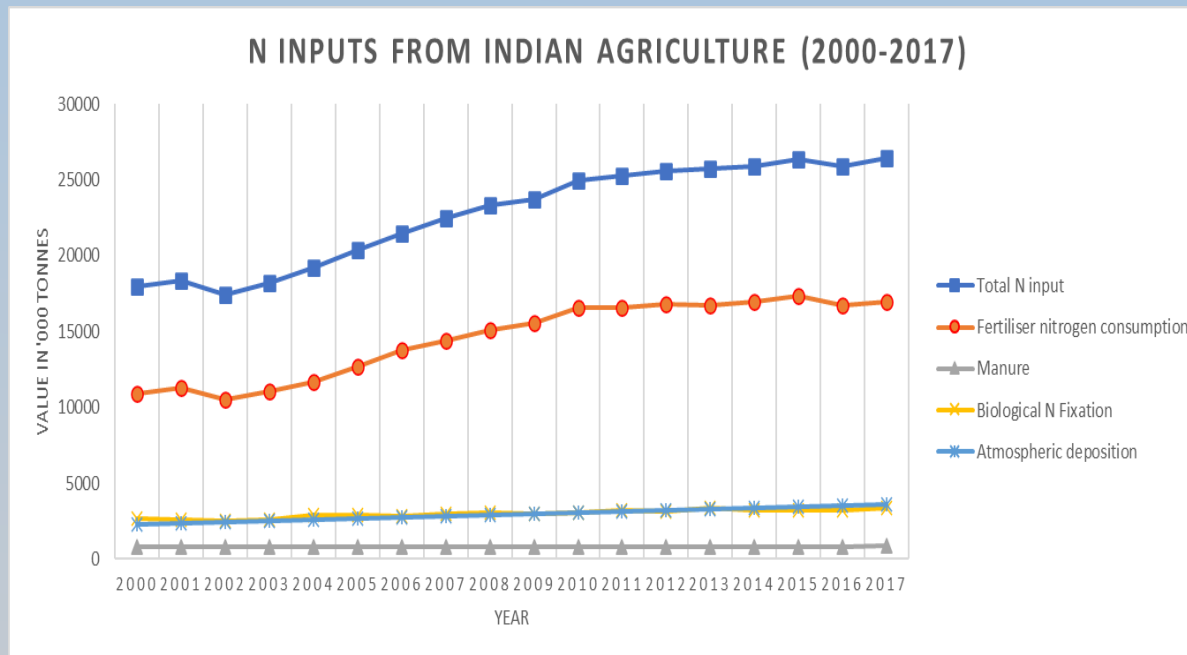


2016 N₂O

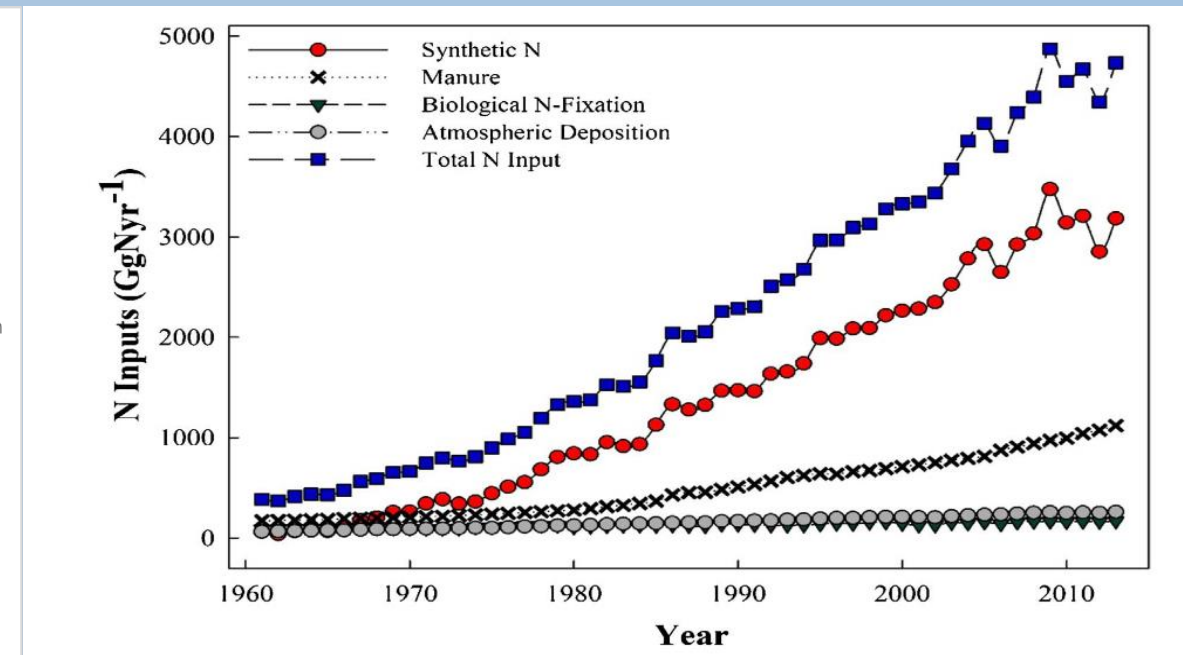


2. Nitrogen budget: Analysis of nitrogen sources and fates, by sector

N input to Agriculture sector



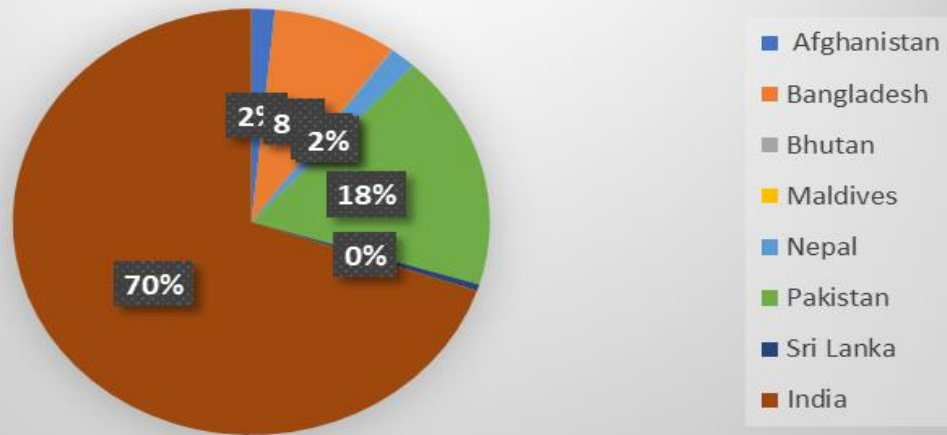
India



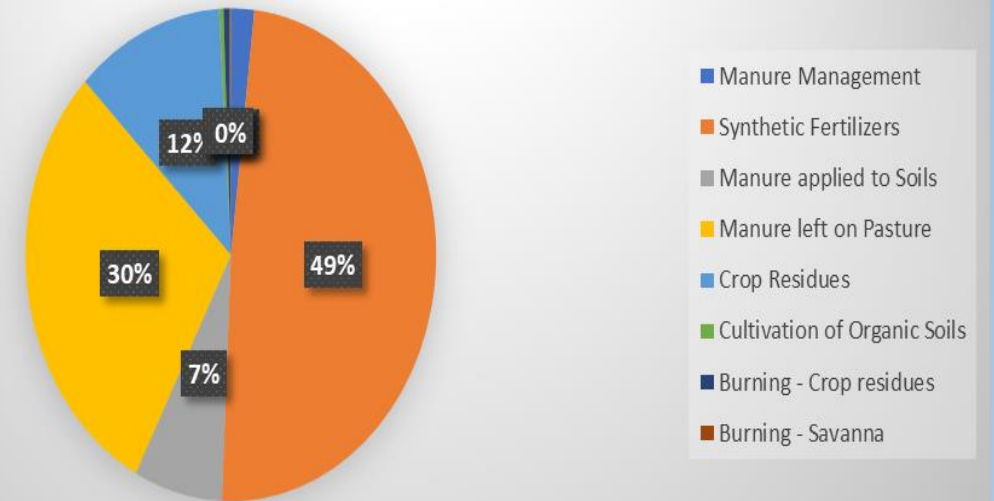
Pakistan

N fertiliser use & Nitrous oxide emissions

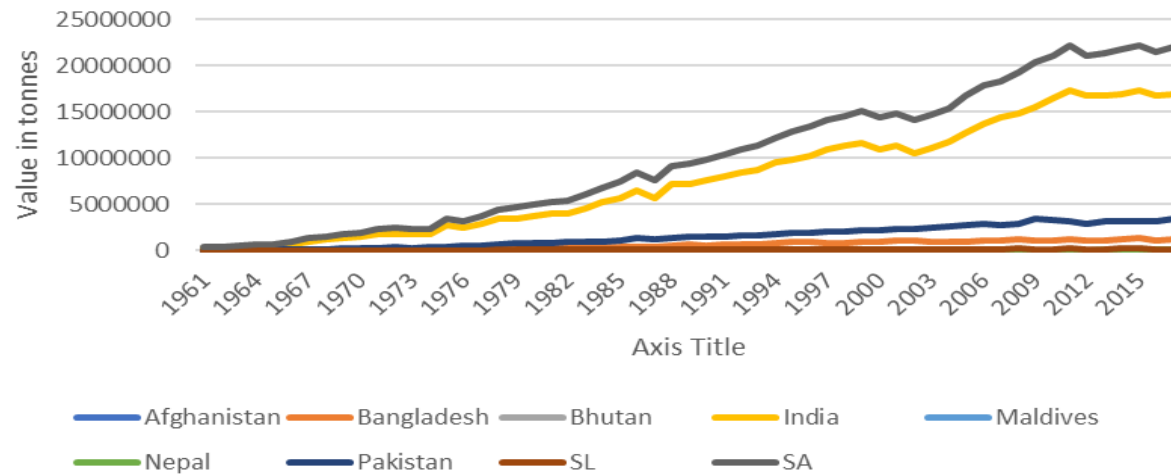
Nitrous oxide emissions from agriculture - 2017



N2O emissions from agri-sector in India in 2017

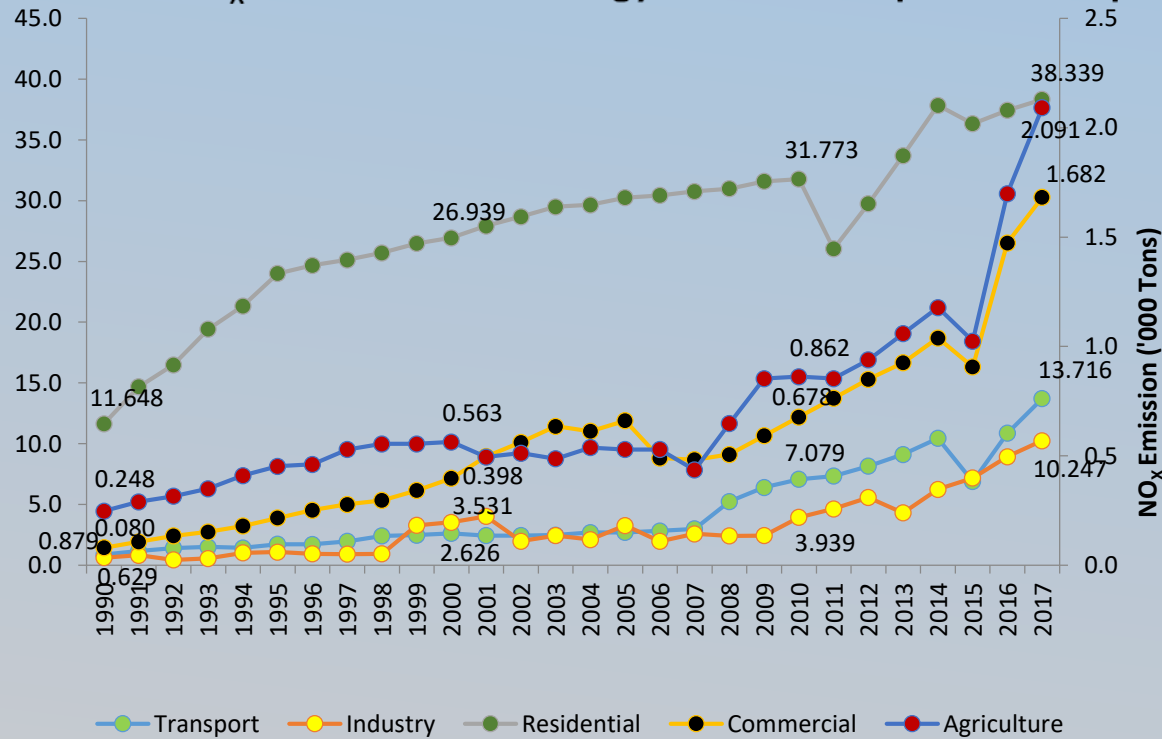


N fertiliser consumption in South Asia (1961-2017)



Sector wise NO_x Emission from energy usage in Nepal

Sectorwise NO_x emissions from Energy: Fuel consumption for Nepal



Sectorwise % contribution to NO_x emissions from Energy: Fuel consumption for Nepal during 1990-2017

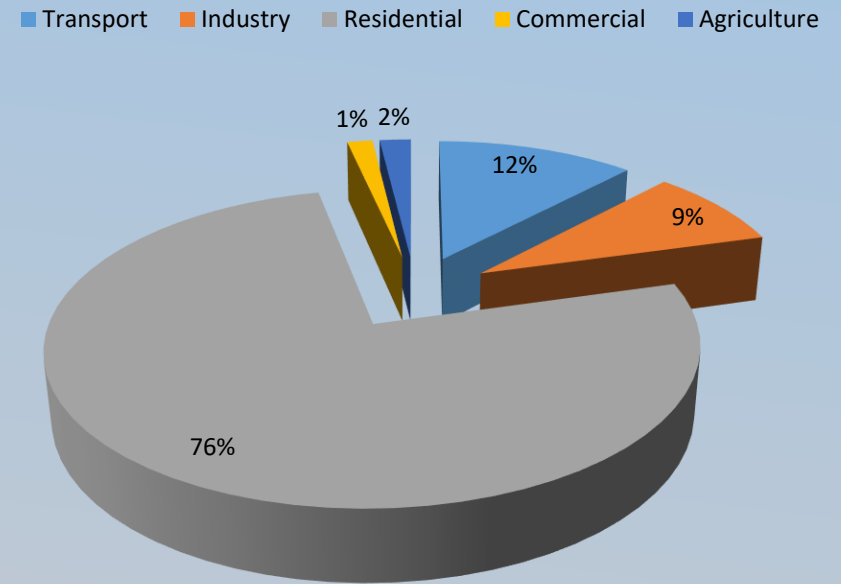


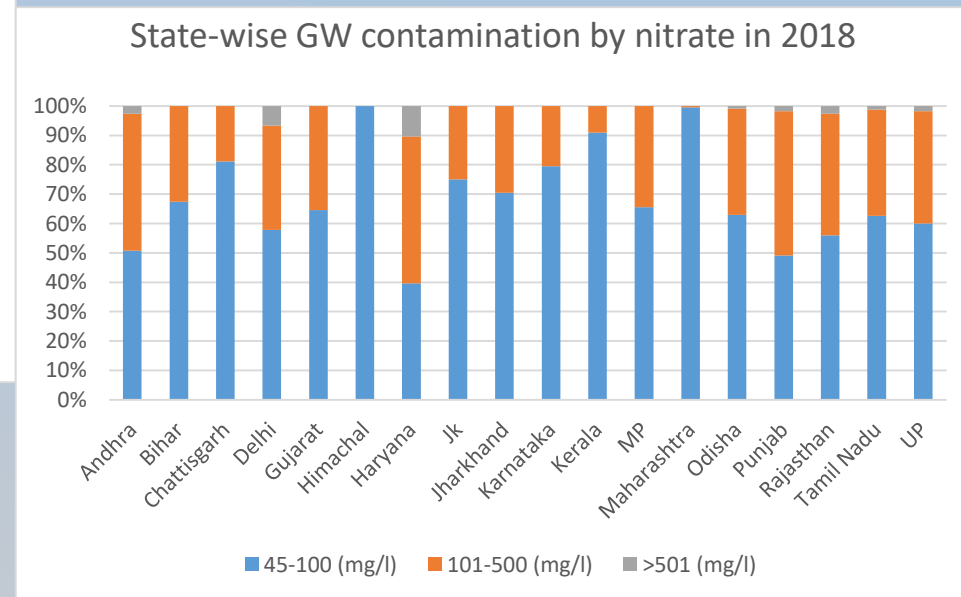
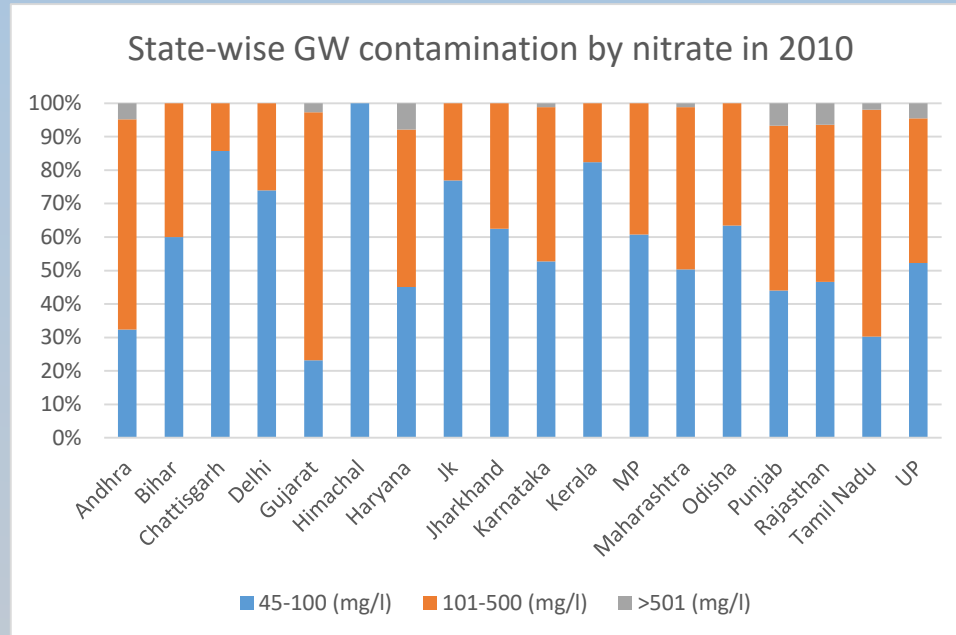
Table 3.1: NO_x emission (Gg/year) in South Asia, 2000-2010

Country	2000	2010	% Change
Afghanistan	25	63	157
Bangladesh	167	400	139
Bhutan	4	5	31
India	5319	8178	54
Maldives	2	8	257
Nepal	46	61	34
Pakistan	700	956	37
Sri Lanka	125	164	32
Total SA	6388	9836	54

3. Description of region in relation to agreed performance indicators

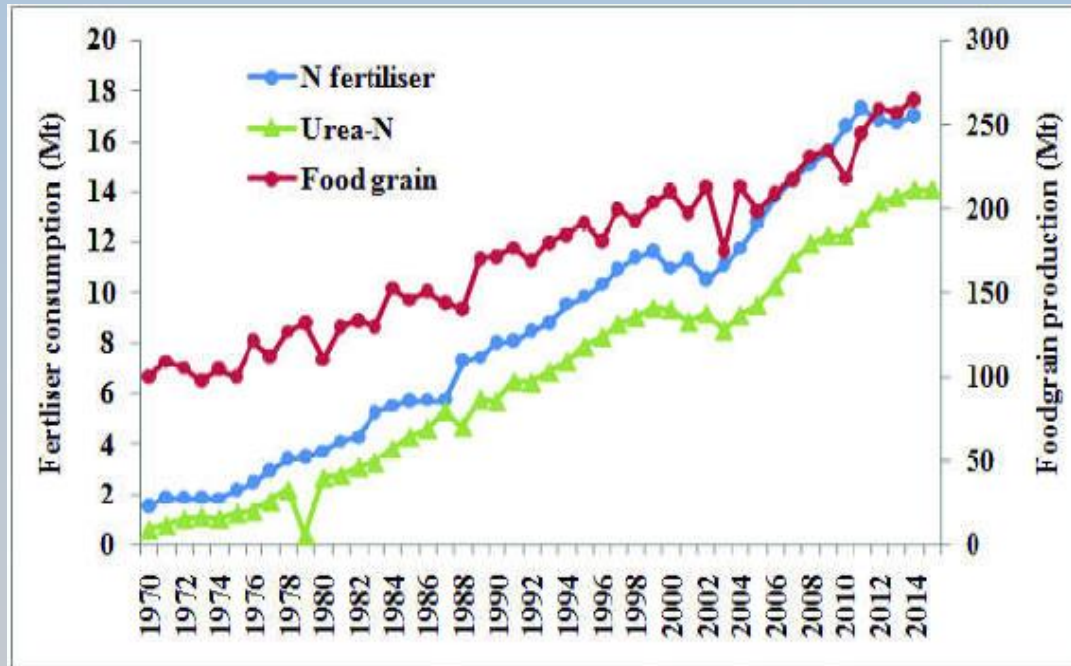
S. No.	Country Name	Year	NATCOM Value	Present Study	Remarks
1	Bhutan	2000	0.01	0.003	Values observed in the present study are almost similar to NATCOM-BHUTAN Values and hence, results are acceptable with country data.
2	Nepal	2000	2.00	1.07	Underestimated with UN /IEA data due to differences in data source and emission factors. Needs further rectification with country data.
4	Bangladesh	2005	0.48 excluding biomass	1.40 including fuel wood consumption	Present study values are acceptable as the emissions are almost equal to NATCOM values after reducing the emissions due to fuel wood consumption (1.40-0.94 = 0.46).
4	Pakistan	1994	0.61	2.29	Little high emissions have been observed in the present study due to differences in Data source or emission factors used.

Nitrate contamination in the groundwater in India in 2010 and 2018

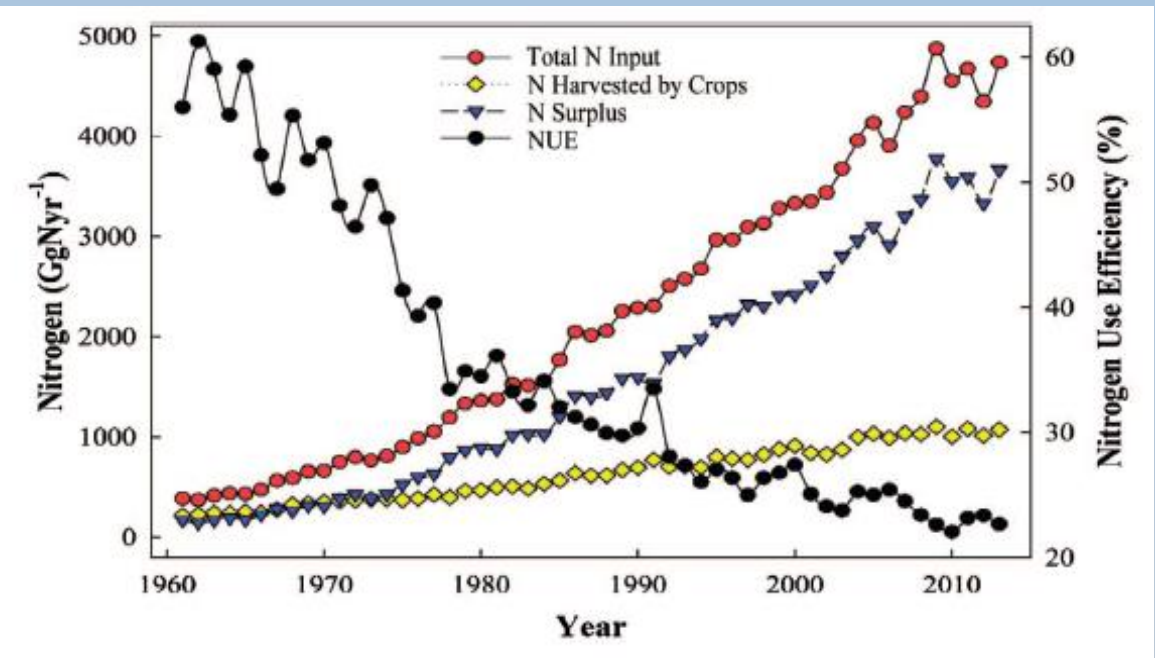


3. Description of region in relation to agreed performance indicators

1. NUE analyses



Relationship between food grain production, N fertiliser and urea consumption in India



Historical changes in NUE (%), N surplus, and N utilization in crop production in Pakistan

4. Options for, progress in and barriers to better nitrogen management (Tasks 3.1.7-3.1.8/A1.6)

Current situation, major barriers and options to overcome them

- Highlights of promising actions
- Status of barriers survey (A1.6)

Table : Preliminary numbers of nitrogen-relevant interventions by South Asian governments

Country	Legislation	Regulations	Policy statements	Other	Total
Afghanistan	6	1	13	1	21
Bangladesh	3	1	6	1	11
Bhutan	1	4	5	0	10
India	3	10	5	1	19
Maldives	0	1	8	0	9
Nepal	2	1	8	0	11
Pakistan	2	3	5	2	12
Sri Lanka	7	10	5	0	22
Total SA	24	31	55	5	115

Source: FAOLEX listings (<http://www.fao.org/faolex/en/>) corroborated and updated by partners of SANH

Publications and output

1. Major part of database collection has been completed, especially for Agriculture, Energy and Transport. We are yet to complete data collection on waste, coastal pollution and atmospheric depositions.
2. Colleagues have participated in the drafting of INMS guidance documents, like barrier analysis, common methodology, and database management etc.
3. Submitted publications to scientific journals by colleagues from Bangladesh (reactive N status) and India (atmospheric deposition modeling)
4. Submitted abstracts for INI 2020 conference (Total of 5)

5. Future look (potential scenarios)

-Based on current regional policies and practices, what can we anticipate as the key three-scenarios of N management for the region

- a. Policy initiative on halving nitrogen wastes by 2050 through SACEP and N-resolution through initiatives of India and Sri Lanka
- b. Providing input for policy documents by influencing country governments

-How the scenarios contribute to the INMS agenda, including global modeling

- a. We, as a demo region are committed to provide data input through global modelling

Thank you