

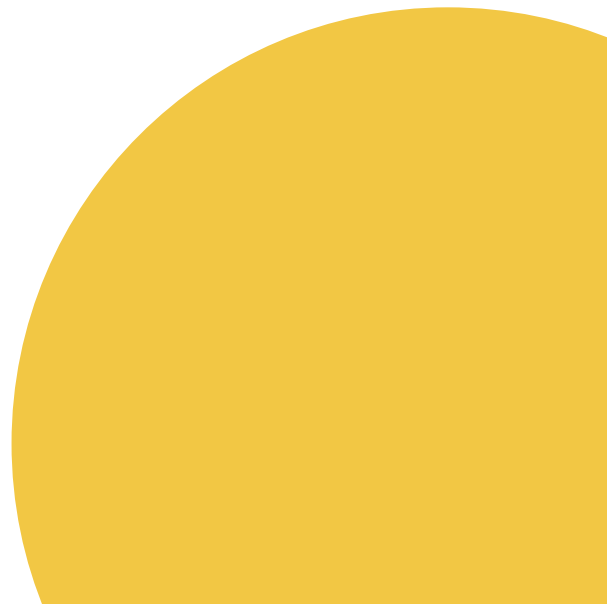


SUSTAINABLE INDIA TRUST

ANNUAL REPORT

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May 2023

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ACTIVITIES

1. Contributors from SIT pursued their contributions on INMS project including South Asian Nitrogen Assessment chapter and the International Nitrogen Assessment (INA) book being co-edited by Prof. Raghuram. SIT's efforts ensured that South Asia is the only region that contributed a comprehensive regional Nitrogen Assessment while other INMS regional partners contributed only 'demonstrations' covering smaller areas/activities.
2. Also pursued SIT's commitments under various aspects of the UKRI-GCRF-SANH Project. They attended dozens of project partner meetings online in this regard throughout the year. SIT's efforts with its partners in India/South Asia, UK and SACEP ensured that Nitrogen Policy Arena emerged as a much more prominent pillar of the SANH project than was originally envisaged. A prominent outcome of these efforts was a comprehensive South Asian Policy Report prepared for SACEP, which was approved by all the member countries of the region. Separate National Nitrogen Policy reports are being developed in each of the South Asian countries.
3. SIT successfully carried out its first independent project with United Nations Environment Programme (UNEP) under a Small Scale Funding Agreement (SSFA) on "Nutrient management of wastewater to prevent eutrophication in Delhi, India". This project is an outcome of a joint meeting of GPNM and GWWI partners held in Nairobi in 2019. He suggested that nutrient recovery from wastewater could support several joint activities between the two global partnerships, especially in the developing world. They could save precious nutrients needed in agriculture from becoming pollutants causing eutrophication, impacting human and livestock health, biodiversity and ecosystem services apart from climate change. The SIT project was developed with the help of Dr. Sangeeta Bansal and was implemented by her and two newly recruited post-doctoral Research Associates, Dr. Sarita Bansal and Dr. Prabhat Kumar Tanwar. Our project classified the 35 operating wastewater/sewage treatment plants (STPs) in Delhi/New Delhi into 5 technological categories. We studied the nutrient content in inlet and outlet water, apart from water quality in three large lakes into which the treated/untreated waste water is discharged and mapping the land use, land cover and anthropogenic activities. The project showed clearly that nutrient recovery was poor in most of the STPs, but Akshardham STP used MBBR technology to

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remove upto 90% of the major nutrients as well as other contaminants, making the treated water far more suitable for release to Yamuna or to rejuvenate lakes, rivulets and other water bodies.

4. Prof. Raghuram cochaired a session on Emerging Threats in Indian Agriculture, Biopiracy, IPR issues and presented his work on Research and Publishing Ethics in Plant biology as a speaker at the 43rd Annual Meeting of Plant Tissue Culture Association (India) & International Symposium On Advances In Plant Biotechnology And Nutritional Security, 28-30 Apr, NASC Complex, Pusa, New Delhi.

5. SIT members attended the plenary meeting of the SANH project online with all the South Asian and UK partners and discussed the progress and future work on various aspects of the project during 17-27 May 2022. Prof. Adhya and Prof. Raghuram led some of the sessions in line with their roles in the project.

6. Prof. Raghuram continued his public engagement on nitrogen and delivered a presentation on ‘Sustainable nitrogen management for sustainable agriculture and industry: Emerging science, technology & policy landscape’ at the AIPSN Conference, 6-9 Jun, 2022 in Bhopal. It was attended by a diverse range of people across the country involved with the science-society interface.

7. SIT members also contributed significantly towards the development of policy brief on “Synthetic Nitrogen in South Asia” through online SANH Work package 1.1 meetings held on 17th May 2022 and 10th June 2022. The idea of this brief was to assess the patterns of production, consumption, import and export of different nitrogenous fertilizers (Urea/DAP) used in South Asia over a longer period of time i.e., 1960 to 2019 to promote sustainable synthetic N management in the region. The brief is complete and ready for publication after final refinements.

8. SANH members Prof. Adhya and Dr. Sangeeta Bansal participated in Work package 1.1 in person meeting held immediately after COVID during 19-26 June in Dhaka, Bangladesh to discuss the work progress and delays happened during COVID time and future targets to complete the work towards development of the policy arena on sustainable N management in the South Asian region.

ACTIVITIES

9. SANH members Prof. Adhya and Dr. Sangeeta Bansal also attended the 2nd Sub-Regional Workshop on ‘South Asia Nitrogen Framework Policy’ under the SANH project during 20-22 June, 2022 in Dhaka, Bangladesh. Prof. Raghuram joined it online and delivered a presentation on ‘Sustainable nitrogen management in South Asia: Emerging science, technology & policy landscape. The joint SACEP and SANH regional report titled “Nitrogen Pollution in South Asia: Scientific Evidence, Current Initiatives and Policy Landscape” was also launched during this event.



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10. SIT members attended an online meeting with UNEP GPNM-GWWI partners on 1st July 2022 and presented the progress on the wastewater nutrient recovery project. The highlighted their interactions with the CEO and members of the Delhi Jal Board and various functionaries of the various STPs, and the timely agreement between the Jal Board and the GGS Indraprastha University

facilitated by Prof. Raghuram, which ensured the smooth access to various restricted sites for samples and data collection.

11. Prof. Raghuram completed his term as the Chair of the International Nitrogen Initiative in July 2022 and handed over the Charge to David Kanter of New York University after three and half years. Despite the COVID-19 pandemic affecting many activities of the INI, he championed the India-led Sustainable Nitrogen Management resolution (UNEA4/14), ensured smooth functioning of the INMS project and championed INI's role in it. He expanded INI with a regional office in Oceania and rotated the unrepresented countries as regional heads of INI in North America, Latin America, South Asia, East Asia and West Europe, enhanced women scientists' role as Directors/Deputies, steered the 8th INI conference and its Berlin Declaration in association with the German govt and its Environment agency. He continues as the Chair Emeritus in the Steering Committee of INI for 3 more years.

12. Prof. Tapan Adhya demitted office of the Regional Director of INI in South Asia. However, SIT continues to engage with the South Asian partners on nitrogen through SANH. His tenure contributed to the expansion of the INI footprint and activities and in carrying forward the SCON's historic role Indian N Assessment to the SIT's role in South Asian Nitrogen Assessment. This was aided by the INMS and



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SANH Projects, expanding the engagement with South Asian research partners as well as regional intergovernmental coordination through SACEP. As the South Asian Nitrogen Centre was independently set up under SCON and is currently under SIT, it can continue to develop its activities independent of INI.

13. SIT members Dr. Sangeeta Bansal and Dr. Prabhat Kumar also attended the workshop on “Micro plastics: A Global Pollutant” organized by Toxic Links on 14th July 2022 at India International Centre, New Delhi. The main objective was to explore the opportunities to integrate the idea of micro plastics, an emerging water pollutant, in ongoing SIT projects on water and waste water management in Delhi.

14. As a part of SIT’s continued engagement on nitrogen/nutrients with various stakeholders, Prof. Raghuram delivered a presentation at a corporate webinar organized by the Gurugram office of the US firm Jacob Engineering on the topic ‘From sustainable nitrogen management to nutrient management for sustainable development: Opportunities for global environmental leadership’ on 29 Jul, 2022.

15. Prof. Raghuram, Tapan Adhya and Dr. Sangeeta Bansal attended the XXI International Nitrogen Workshop between 24-28 Oct. in Madrid, Spain. Prof. Raghuram delivered a Keynote lecture on his research regarding ‘Crop improvement for nitrogen use efficiency’. Prof. Adhya made an oral presentation entitled ‘Reactive-N in South Asia – Strategies for Sustainability and Reducing Waste’. Dr. Sangeeta Bansal presented the results from SIT’s ongoing UNEP project on nutrient recovery from wastewater in Delhi. A major outcome of this trip was that India could win the bid for the 9th International Nitrogen Conference of the INI. This bid was developed by Prof. Umesh Kulshrestha from JNU and Prof. Raghuram from SIT and GGSIPU. Another important outcome was to facilitate the scientific cooperation between Indian and Romanian governments to work together as co-chairs of the UNEP Working Group on Nitrogen, which was eventually announced by UNEP in early 2023. SIT is proud that its trustees have contributed their bit to the Indian global environmental leadership on nitrogen through UNEP..

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Prof. Raghuram giving a keynote lecture at the XXI International Nitrogen Workshop between 24-28 Oct. in Madrid, Spain.

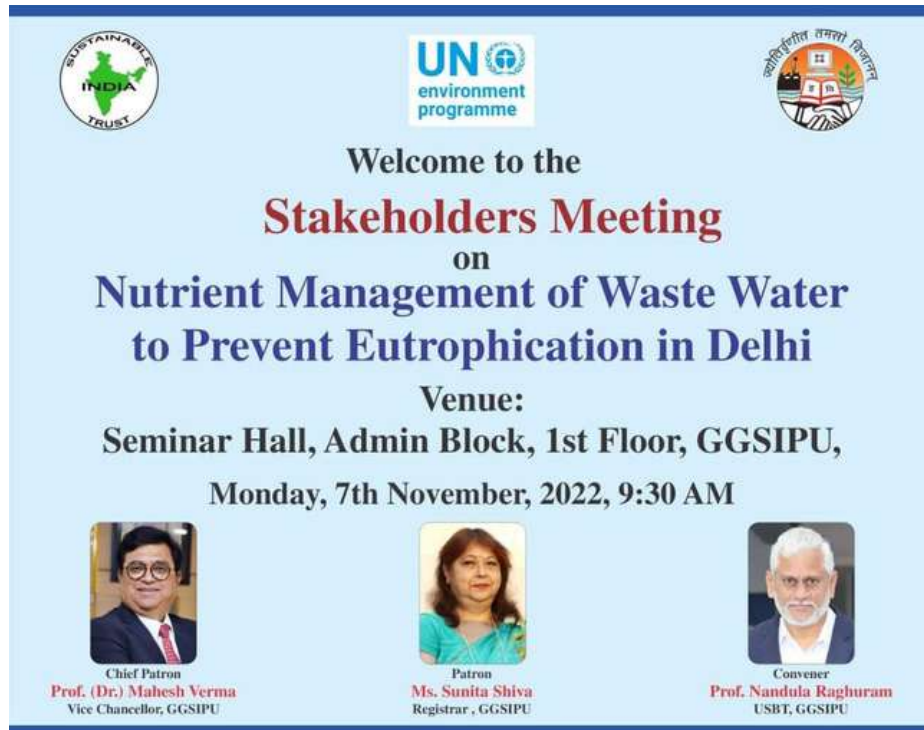
ACTIVITIES

16. As a part of SIT's continued engagement on science-led policy development with various stakeholders, Prof. Raghuram delivered a presentation at a seminar organized by the Jawaharlal Nehru Teachers Association on 03 Nov., at JNU, New Delhi on the topic 'Science in the era of Sustainable Development Goals: Challenges and Opportunities'. He emphasized the role of civil society in general and SIT in particular in overcoming disciplinary, institutional and ideological barriers to bring the fruits of scientific research to inform governance and to help the society in its transition towards sustainable development.

17. Prof. Raghuram delivered a presentation on the 'Roadmap for sustainable self-reliance in Indian agri: Restore legume-based rotations, link up green white and blue revolutions with grey revolution' at the DSF-AIPSN National Convention on self-reliance held during 12-13 Nov at New Delhi. This has triggered discussions on the sustainable options of crop diversification and their interface with science, policy and civil society.

18. SIT organized a Stakeholder Meet on 07 Nov in which Prof. Raghuram and Dr. Sangeeta Bansal present the findings from the UNEP project on 'Nutrient management of wastewater to prevent eutrophication in Delhi'. The event was organized at GGSIP University in hybrid mode and was chaired by its Vice Chancellor, Padmashri Prof. Mahesh Verma. It was attended by many of its faculty members from multiple schools and from TERI University, UNEP officials including GPNM/GWWI personnel, representatives from the Delhi Jal Board and its STPs, Delhi Pollution Control Board, Union Ministry of Environment, Forests and Climate Change, among others. The presentations were followed by a panel discussion and the event was well received by all the stakeholders. The meet highlighted the opportunities for synergies between sustainable water management and nutrient management in view of Delhi's laudable expansion of sewage treatment capacities in recent years. The follow-up meetings with the UNEP staff have raised hopes of another project to carry forward this work with more STPs across wider areas of Delhi covering wet and dry seasons to produce more robust results.

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The poster features three logos at the top: Sustainable India Trust (SIT) on the left, UN Environment Programme (UNEP) in the center, and GGS Indraprastha University on the right. The main text reads: 'Welcome to the Stakeholders Meeting on Nutrient Management of Waste Water to Prevent Eutrophication in Delhi'. Below this, the venue is listed as 'Seminar Hall, Admin Block, 1st Floor, GGSIPU, Monday, 7th November, 2022, 9:30 AM'. At the bottom, three portraits are shown with their respective titles: Chief Patron Prof. (Dr.) Mahesh Verma, Patron Ms. Sunita Shiva, and Convener Prof. Nandula Raghuram.

Chief Patron
Prof. (Dr.) Mahesh Verma
Vice Chancellor, GGSIPU

Patron
Ms. Sunita Shiva
Registrar, GGSIPU

Convener
Prof. Nandula Raghuram
USBT, GGSIPU



Stakeholder Meet organized by Sustainable India Trust (SIT) on 07 Nov in which Prof. Raghuram and Dr. Sangeeta Bansal present the findings from the UNEP project on 'Nutrient management of wastewater to prevent eutrophication in Delhi' at GGSIPU, New Delhi

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19. SIT personnel Prof. Raghuram, Prof. Adhya and Dr. Sangeeta Bansal participated in the annual SANH workshop at Male', Maldives, during 27 Nov to 02 Dec 2022. They exchanged project results and further strengthened our research partnerships with colleagues across South Asia. Dr. Sangeeta Bansal presented a poster on “Ecosystem Health Report Card: A valuable tool to control nitrogen pollution in urban wetlands” to show the importance of these cards to guide the management authorities to adopt apt policy decisions for urban lake conservation. Further, the event also provided opportunity for discussions on regional intergovernmental coordination on nitrogen with the DG and officials of SACEP, apart from the Indian representatives deputed by the MoEFCC. More importantly, this event provided an opportunity to present the Prof. YP Abrol Memorial Awards for excellence in sustainable nitrogen management.



Images: SIT at Male', Maldives, 27 Nov 2022 to 01 Dec 2022

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Ecosystem Health Report Card: A valuable tool to control Nitrogen pollution in urban wetlands

Sangeeta Bansal, Sarita Bansal, Prabhat Kumar, N. Raghuram
Sustainable India Trust, SANC, F-4, NASC Complex, Pusa, New Delhi- 110012, INDIA



Background of the study

- Wastewater with N_r (NO₃ and NH₄) is the main driver of eutrophication in urban wetlands. In Delhi, 3330 Million Litres per Day (MLD) of wastewater is generated of which 918 MLD is discharged untreated in inland water bodies polluting them heavily.
- Ecosystem Health Report Card (EHRC) can act as a valuable tool to guide improved policy actions to curb the rising N_r pollution in urban wetlands of Delhi.

Objective of the study

- To develop EHRC for the Hauz Khas lake to regulate N loading into the lake via waste water
- Policy analysis to integrate scientific EHRC intervention into policy actions to conserve the Hauz Khas lake.

Methodology

Study Site: Hauz Khas Lake, Delhi

Ecosystem Health Report Card (EHRC)

EHRC provides a transparent, timely and geographically distinct assessment of N_r across different regions of a water body using hydrological or socioeconomic indicators, combined into a single composite index of health.

Grading System: Overall Health Grading System: Zone-wise Health

Health Level	Color	Health Category	Health Description
100-100%	Green	A	100% Health: Best water quality and biological health indicates most optimal quality of water in the water body.
80-100%	Light Green	B	80% Health: Good water quality and biological health indicates good quality of water in the water body.
60-80%	Yellow	C	60% Health: Fair water quality and biological health indicates fair quality of water in the water body.
40-60%	Orange	D	40% Health: Poor water quality and biological health indicates poor quality of water in the water body.
20-40%	Red	E	20% Health: Very poor water quality and biological health indicates very poor quality of water in the water body.
0-20%	Dark Red	F	0% Health: Worst water quality and biological health indicates worst quality of water in the water body.

Policy Analysis

Distribution of Indian Policies (2016)

Parameters used to locate direct policies for lake conservation:

- Treatment of waste water and its reuse
- Reduction of nitrogen/phosphorus pollution
- Safe and pollution free of treated waste water
- Strategic water allocation including control of carbon taxes
- Check compliance the compliance of national standards for safe reuse and disposal of treated waste water in water bodies
- Control % of treated waste water used currently and proposed to enhance in future
- Household pricing scheme for generating reuse and recycling of treated waste water
- Prohibit impact on water scarce demand basins
- Financial support or circular economy approach to enhance the existing treatment facility
- Support to update and adopt new treatment technologies
- Target Delhi specifically

Results

LULUC Analysis

Region-wise variations in water quality/N_r species

Best Policy Selection for Lake Conservation

Policies targeting the lake conservation

Policy	Impact	Scope	Relevance
1. National Urban Sanitation Policy (2008)	Positive	Large	High
2. Policy Statement for Abatement of Pollution (1991)	Positive	Large	High
3. National Policy on Public Health of Treated Water (2011)	Positive	Large	High
4. National Water Policy (2012)	Positive	Large	High
5. National Conservation and Management Rules (2017)	Positive	Large	High
6. National River Conservation Directorate (1996)	Positive	Large	High
7. Environment Protection Act (1986)	Positive	Large	High
8. Water Pollution Control and Amended Act (1987)	Positive	Large	High
9. Lake Water Reuse Act (2016)	Positive	Large	High
10. Jal Shakti Abhiyan Urban Water Conservation Act (2019)	Positive	Large	High
11. National Environmental Protection Act (1986)	Positive	Large	High
12. National Environmental Protection Act (1986)	Positive	Large	High
13. The National Water Reuse under the National Action Plan on Climate Change (2008)	Positive	Large	High
14. National Lake Conservation Plan (2008)	Positive	Large	High
15. Draft National Water Framework Bill (2016)	Positive	Large	High

EHRC: HAUZ KHAS LAKE

(a) Overall health

(b) Zone-wise health

Conclusions

- The EHRC showed that the discharge of untreated/partially treated sewage or mixing of treated with untreated sewage is the main source of pollution in surface water bodies of Delhi.
- Four policies including National Policy on Safe Reuse of Treated Water (2021), Water (Prevention and Control of Pollution) Act (1974), Delhi Water Board Act, (1998) and Jal Shakti Abhiyan/Urban Water Conservation Act (2019) are best available policies which can be amended easily to conserve Hauz Khas lake and other Urban wetlands of Delhi.
- This study also represents one of the best example to show how to integrate field based scientific intervention into suitable policy actions and to effectively utilize large scale policy national databases (like SANH database) to solve localized problem.

Acknowledgements

Valuable support from UNEP, GGSIP University, Delhi Jal Board, Delhi Development Authority and Delhi University to complete the work is high appreciated. Assistance from our working teams of SIT and SANH (all WP 1.1. members) is also greatly appreciated.

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The poster presented by SIT's Project Officer, Dr. Sangeeta Bansal at Male', Maldives, 27 Nov 2022 to 01 Dec 2022

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20. Prof. Raghuram represented SIT and the Indian civil society in the GPNM Steering Committee meeting chaired by Prof. Ramesh Ramachandran from NCSCM, Chennai. UNEP played an important role as the secretariat for GPNM and executive agency of the INMS project in enabling the governments to take charge of the newly constituted Working Group on Nitrogen, paving the way for India and Romania to lead it as its Co-Chairs.

21. Prof. Raghuram and Prof. Adhya attended the 3rd meeting of the prestigious high level inter-ministerial National Nitrogen Steering Committee held at NCSCM, Chennai. This meeting made major progress on many fronts, including the decision to build synergies with the UNEP Working Group on Nitrogen, accepting the National Nitrogen Policy Report prepared by Prof. Adhya, Prof. Raghuram and others under the SANH Project, endorsing India's hosting of the 9th International Nitrogen Conference of INI in New Delhi, Revisiting Fertilizer Recommendations based on evidence from crop trials and supporting the establishment of Centre of Excellence at GGSIPU, New Delhi, Identification of Nodal agencies for each key sector for nitrogen management in India and agenda building on Sustainable Nitrogen Management during Indian Presidency of G20.

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22. Prof. Raghuram visited the Hyderabad Municipal Water Supply and Sewerage Board (HMWSSB) on 1st and 3rd Feb 2023 and discussed with its officials on the opportunities for nutrient recovery and recycling from wastewater into agriculture, horticulture and to revive urban water bodies in the overall transition towards sustainable city. He also made a presentation to the senior engineers/managers of all the STPs of Hyderabad on the findings from the UNEP project of SIT in Delhi and the opportunities for replicating it in Hyderabad. This generated considerable interest and led to the development of a broader partnership involving SIT, Guru Gobind Singh Indraprastha University, Indian Institute of Rice Research and Prof. Jayashankar Telangana State Agriculture University. It is a matter of great pride that this effort was spearheaded by the SIT.

23. Prof. Raghuram had a meeting followed by lunch with Dr. Tessa Goverse from UNEP at its India office in New Delhi on 16 Mar 2023. They identified synergies between UNEP and India in view of the Indian leadership in GPNM, Nitrogen Working Group and SIT to build on the India-led UN resolution (UNEA 4/14) on sustainable nitrogen management. Some parts of this meeting were also attended online by Prof. Purvaja Ramachandran and the Delhi staff of UNEP. This led to a meeting organized by Atul Bagai, the India head of UNEP with Prof. Raghuram and Shri NPS Gangwar of the MoEFCC, to brief him on the Indian regional and global leadership initiatives on nitrogen and the potential to use the N2024 conference for furthering these initiatives.



PUBLICATIONS



Plant Nutrition and Food Security in the Era
of Climate Change

2022, Pages 47-72



Chapter 3 - Crop nitrogen use efficiency for sustainable food security and climate change mitigation

[Bhumika Madan](#), [Aakansha Malik](#), [Nandula Raghuram](#)

nature india

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COMMENT | 16 November 2022

Recycling crop and animal waste is a win for green farming

Restoring links between farming processes and livestock rearing can reduce air and water pollution, and help farmers meet rising costs

[Nandula Raghuram](#)

IOP Publishing

Environ. Res. Lett. 17 (2022) 045028

<https://doi.org/10.1088/1748-9326/ac5c17>

ENVIRONMENTAL RESEARCH LETTERS

LETTER



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Long-term trends of direct nitrous oxide emission from fuel combustion in South Asia

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