



Sri Lanka Nitrogen Policy Report Summary: Scientific Evidence, Current Initiatives and Policy Landscape

This summary provides an overview of the full UKRI GCRF SANH policy report for Sri Lanka (2022). This report is the first of its kind providing a necessary step to understanding the current nitrogen policy landscape for Sri Lanka within the broader South Asian context. It highlights the issues and challenges around nitrogen pollution and management, with recommendations for action.

INTRODUCTION

- **Nitrogen is essential for life, but nitrogen in its reactive form (N_r) in excess can cause severe harm to people and the environment.** Excess reactive nitrogen (N_r) is a significant issue globally and for South Asia.
- Multiple sectors including agriculture, transportation, industry, and energy sectors have increased their share of nitrogen pollution and related greenhouse gas (GHG) emissions due to growing anthropogenic demands.
- **Five principal threats of nitrogen pollution** are to water quality, air quality, greenhouse-gas balance, soil quality, ecosystems and biodiversity.
- **Managing nitrogen is essential for international climate change mitigation. Nitrous oxide (N_2O) has 300 times more warming potential than CO_2 .** Addressing climate change by reducing greenhouse gas (GHG) emissions is a key priority in international politics.
- **South Asia is a global hotspot for N_r emissions** for the main nitrogen compounds: nitrogen oxide, nitrous oxide and ammonia, with emission levels above global averages.
- **Nitrogen pollution can be managed directly or indirectly** by legislation, financial or regulatory measures taken by governments. Government and non-government measures can support and encourage efficient nitrogen management, and hence, minimize the negative impacts.
- **The management of reactive nitrogen is a major issue of international policy, yet information about nitrogen policies at national levels is scarce.** There is a limited understanding of the policies, the issues addressed, and the types of instruments used, and how existing policies might impact nitrogen pollution.

UKRI GCRF SOUTH ASIA NITROGEN HUB (SANH)

- **SANH aims to tackle the nitrogen challenge by bringing together experts from leading research organizations from across South Asia and the UK.** The hub focuses on four main areas: i) building the nitrogen policy arena for South Asia; ii) finding nitrogen solutions; iii) improving understanding and awareness of key nitrogen threats; iv) integrating information on regional nitrogen flows and impacts in south Asia.
- The South Asia Co-operative Environment Programme (SACEP) and SANH undertook an initial **South Asian regional assessment of nitrogen emissions and policy and created [a database of 966 nitrogen-relevant policies from South Asia](#).**
- **Drawing on that database, this SANH national report outlines the implications of these findings for Sri Lanka.** The country report is the first of its kind to provide a national overview on the extent of nitrogen-related policies for Sri Lanka.

ENVIRONMENTAL IMPACT OF REACTIVE NITROGEN IN SRI LANKA

- There is an information gap on reactive nitrogen's effects on the environment and human health in Sri Lanka. However, it is undeniable that Sri Lanka's nitrogen emissions are rising, and numerous environmental problems are being increased as a result of it.
- In Sri Lanka, many of the critical environmental and health impacts from N_r pollution are linked to poor air and water quality.
- **Both nitrogen oxides (NO_x) and ammonia (NH_3) are air pollutants that contribute to inhalable particulate matter ($PM_{2.5}$).** Previous studies report the significant impact of N_r induced air pollution in subjecting Sri Lankan citizens to respiratory illnesses.
- Vehicle (petroleum) and thermal power plant emissions alone are shown to contribute 60% of the country's air pollution (Ranaraja et al., 2019).





Colombo

- Many sources show that the quality of ground and surface water bodies in Sri Lanka has deteriorated beyond the WHO's tolerable limit of 10 parts per million of NO_3^- (Marambe and Nissanka, 2019).
- Nitrate enrichment has caused coral bleaching in Sri Lanka by raising the acidity in seawater. Overall, eutrophication in fresh and coastal waters, triggered by N_r sources, has become a major problem in Sri Lanka.
- **Climate change, influenced by reactive nitrogen emissions, directly impacts arable agriculture on which many of the population is dependent.**
- Heavy rainfall events have become more frequent in upcountry regions of the country where intensive vegetable farms are concentrated (Punyawardena et al. 2013a).
- A higher variability in the rainfall in *Yala* season (one of the two cropping seasons in Sri Lanka; March to September) has increased over time, suggesting that it can even lead to shifting of agro-ecological boundaries that were previously defined based on the major climatic factors (Eriyagama et al. 2010; Punyawardena et al., 2013b).
- The recent spells of droughts have also brought devastating impacts on agricultural livelihoods and on the food security status of the country (FAO and WFP, 2017).

NITROGEN-RELATED POLICY ANALYSIS FOR SRI LANKA

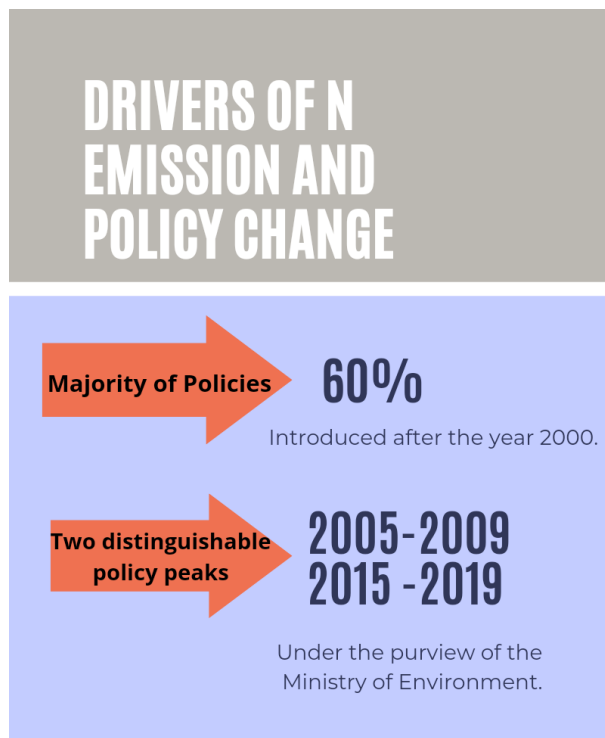
- For Sri Lanka, **115 directly and indirect nitrogen-related policies**, were collected, contributing 12% to the SANH South Asia policy database.
- **All nitrogen-related policies collected were classified** based on certain characteristics. Classifications include: environmental sink¹; sector; sub-sector; policy type; pollution source type; impact direction; relevance; and impact scope.
- **The policy type classification indicates the type of policy instruments that are incorporated within a particular policy.** A single policy may have multiple policy type characteristics, which indicate a more comprehensive approach. **For Sri Lanka, there were 178 classifications from the 115 policies, and 42 policies (37%) had more than one policy type identified.** 'Framework' policies were the most common policy type (57%).



¹ Sinks reflect the environmental aspect at risk (under threat) from N_r .

- **Sector-wise the most common classification was for ‘multiple’ sectors at 32%.** This is an advantageous policy characteristic indicating an understanding that multiple sectors have roles to play in N_r management. Agriculture-oriented policies were also fairly common (15%) compared to other single-sector focused policies.
- **For environmental sinks, the most common classification was where ‘multiple’ sinks had been included in the policy text (30%).** This could be regarded as a favourable policy characteristic, indicating that N_r environmental impacts have been considered. The most common single sink orientated policies were for Ecosystem (17%) followed by Water (10%).
- **Seven policies (6%) were classified as having low relevance and/or low impact scope and were omitted (from further analysis, leaving 108 policies of medium-high impact and relevance.** They are assumed to have a greater impact on how N_r enters the environment. Those policies identified to have a lower relevance and/or impact scope should not be considered as irrelevant and via amendments could be better adapted to mitigate N_r waste.
- **Over half of the policies (63%) were identified as having a potentially positive impact on N_r management,** as they were mostly environmentally orientated policies. Policies classified as mixed/neutral (33%) indicate to varying degrees dual goals for economic development and the environment. **Policies with a potentially negative impact direction (4%), i.e., those that risk promoting N_r waste, were small in number.**
- **Policies that address multiple sinks and/or sectors (with integrated objectives), identify pollution sources, and contain multiple policy types are well placed to confront the multidimensional challenges of nitrogen management.** From Sri Lanka there are nine policies (8%) that hit all of these criteria.

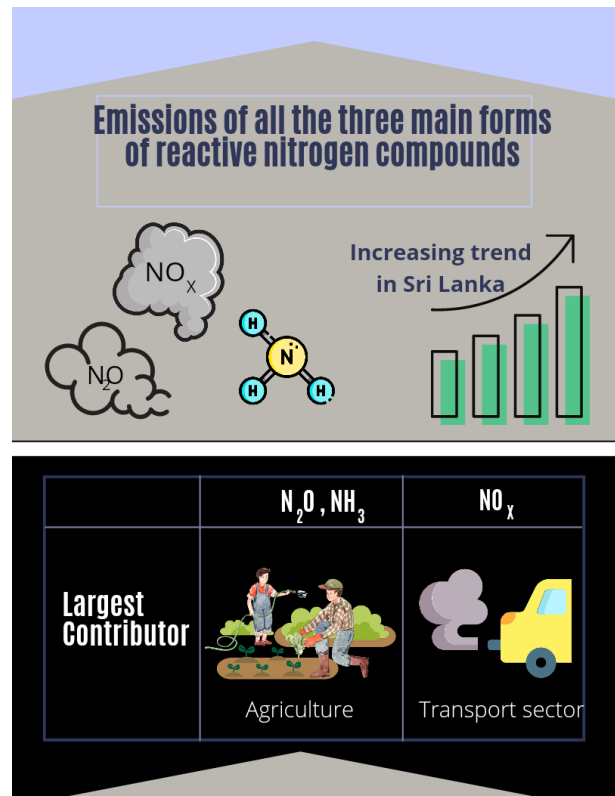
TRENDS AND DRIVERS OF REACTIVE NITROGEN EMISSIONS



- **There is a clear surge of N_r policies in Sri Lanka within the first two decades of the new millennium.** Nearly 60% (68 policies) of the policies have been introduced within the aforementioned period. Further, of the 72 policies with positive impact direction, 49 (68%) have been introduced after the year 2000.
- **Recent governments have taken several positive policy initiatives to curb N_r pollution caused by agriculture, industrial, and other sectors in Sri Lanka.**
- Emissions from all three nitrogen compounds,² ammonia (NH₃), nitrogen oxides (NO_x), and nitrous oxide (N₂O), have been increasing over time in South Asia and Sri Lanka. **These results highlight that current policy efforts have not yet been able to stabilise or reduce N_r emissions.**
- N_r emission levels will continue to increase unless further policy action is taken at multiple levels.

² Note: EDGAR v5.0 Global Air Pollutant Emissions data sourced from Crippa et al (2019a); EDGAR v5.0 Greenhouse Gas Emissions data sourced from Crippa, et al. (2019b).

- A range of sectors, including agriculture, transport, energy, and waste, can be considered policy priorities in Sri Lanka due to the amount of N_r emissions produced and the rate of increases.
- **Nitrogen oxides (NO_x) in Sri Lanka are the fastest rising N_r compound**, particularly since the year 2000 increasing by +43% from 2000 and 2015. **For ammonia (NH_3) and nitrous oxides (N_2O) the emission levels in Sri Lanka have been increasing steadily** since the 1970s.
- Agriculture has been by far the largest contributor of N_2O and NH_3 emissions in Sri Lanka over the last two decades. Agriculture contributed 67% of ammonia (NH_3) emissions in 2018.
- **Power industry, waste, transport and other sectors were somewhat more minor contributors (relative to agriculture) to ammonia (NH_3) and nitrous oxides (N_2O).** However, emissions from these sectors are increasing rapidly. For example, the power industry increased ammonia emissions by +393% from the year 2000 to 2018.
- **For nitrogen oxides (NO_x) the main contributor is from the transport sector, more specifically road transport**, which contributed heavily to NO_x emissions in the year 2018. The transportation sector has grown significantly in recent decades, causing emissions of nitrogen oxides (NO_x) to rise (+76% from 2000 to 2018).
- **The second largest contributor to NO_x emissions in Sri Lanka is the energy sector.** As per the data of 2018, energy sector contributed to 26% of nitrogen oxide (NO_x) emissions in Sri Lanka.



NEEDED ACTIONS

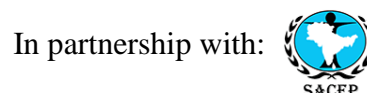
- **Action is needed in emerging sectors, considering relative changes in N_r emissions. Different sectors contribute to the emission of N_r compounds in various ways and are growing at different rates.** The overlap in contributing sectors to different compounds indicates areas where integrated policies are necessary to avoid pollution swapping and promote coordinated actions.
- **As well as addressing nitrogen management systematically, such policies should also be accompanied by direct actions, such as 'core' policies, that contain regulatory and economic policy instruments.** In Sri Lanka, 56 policies were highly related to nitrogen, but only a few of these specifically referenced nitrogen or its compounds. Setting quantifiable and enforceable constraints on N production and consumption in nitrogen-related policy is recommended.
- **Existing policies can also be adapted to deal more directly/effectively to deal with nitrogen management by referring explicitly to nitrogen pollution itself, and ideally specifying the relevant N_r compounds.**
- **For policies with high nitrogen management relevance amendments to specify pollution source type and the risk of nitrogen waste would be advantageous.** Only a small number (9%) of directly nitrogen relevant policies (from a total of 115) determined pollution source types. Such policies indicate potentially useful examples for N_r management.
- **Sector based policies would benefit from ensuring that they directly, or via other connected policies, consider the potential risks, or options to mitigate negative N_r impacts referring to one or more**

environmental sink. A substantial proportion (28%) of Sri Lanka’s nitrogen relevant sector-based policies have not referenced any sinks.

- **To deal with N_r pollution better, it is necessary to have policies that consider multiple sectors and sinks and policy instruments.** Currently, nine policies meet this criterion to some degree. Although not all policies would need to be integrated in this manner, a policy gap is visible.
- **A large fraction of Sri Lanka’s population (40%) rely on agriculture for a living. This sector is also a core contributor to national N_r emissions.** Fertilizers play a vital role but much fertilizer inputs are wasted with the main source as ‘Direct N₂O Emissions from managed soils’. Sustainable alternatives are available. Such methods have the potential to save considerable revenue, maintain soil and human health.
- Policies could more effectively minimize nitrogen waste in traditional farming systems if such policies have provisions to integrate science-based modern technologies with time-tested indigenous knowledge.
- Integrated policies promoting environmental stewardship could be identified as a policy priority. Such policies will enable agro-ecological region and social-ecological system specific research and extension to improve nitrogen efficiencies across different farming systems in the country.
- In the face of the current economic crisis, Sri Lankan agriculture sector is more likely to face drastic changes (e.g., bringing more land under farming to increase domestic production of food), Thus, it is very critical to amend existing policies or introduce new policies to meet the new challenges and ensure **food security while minimizing pressure on the environment.**
- **The development of National Action Plans are advised in the United Nations Environment Assembly (UNEA-5) new resolution on sustainable nitrogen management which was led by the Sri Lankan government.** Sri Lanka’s leadership role will continue to be crucial to strengthen regional/international commitments in support of UNEA-5.2 and preparing for UNEA-6 to manage nitrogen sustainably.
- **Further in-depth research on these N_r relevant policies is necessary, to assess, amongst other aspects, their impact.** SANH will continue to analyse N-relevant policy and engage with SACEP member states to broker a better understanding.
- **Science-based decision-making is crucial to move towards N_r sustainability. SANH and SACEP are working with South Asian governments to supporting this regional effort to build the scientific evidence on nitrogen management and help strengthen Sri Lanka’s contributions to tackle the nitrogen challenge.**

Nissanka, S.P., Jayaweera, A., & Yang A. (2022). *Nitrogen Policy Report: Sri Lanka*. South Asia Nitrogen Hub (SANH): Peradeniya, Sri Lanka, and Edinburgh, UK

To see the full report please contact: spn@agri.pdn.ac.lk



The South Asian Nitrogen Hub (SANH) is a UKRI GCRF funded research partnership that brings together 32 leading research organisations and project engagement partners from South Asia and the UK. SANH is working towards enabling South Asia to ‘adopt and champion a strategic approach to nitrogen management as a key step towards the Sustainable Development Goals’. SANH aims to provide relevant scientific insights identify barriers to change and demonstrate the economic benefits of tackling nitrogen. <https://sanh.inms.international/>