A deep dive into better understanding nitrogen impacts

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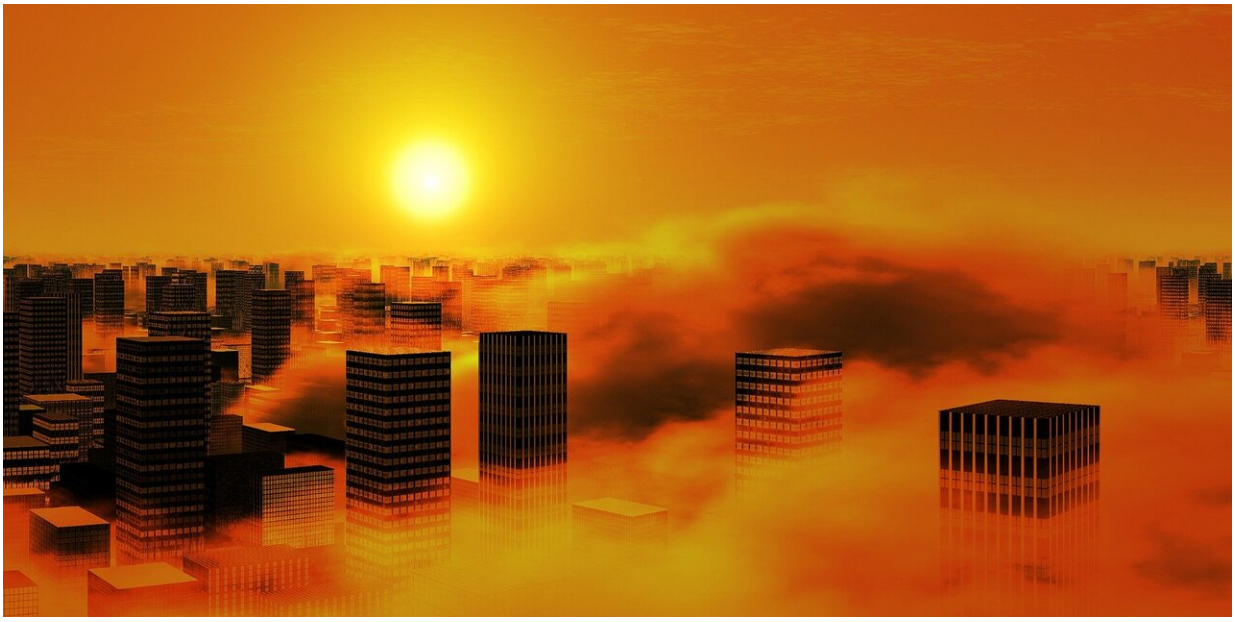

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A key atomic building block for all living organisms and one of the most abundant elements in the galaxy, nitrogen is an essential part of our ecosystem. But for our ecosystem to function, nitrogen-based compounds must cycle through air, water, and soil in a delicate balance among the other organic chemical drivers of life.

Human activity significantly disrupts the natural balance of nitrogen,

posing a threat to the health of both terrestrial and aquatic life. Bearing that in mind, *Atmospheric and Oceanic Science Letters* (AOSL) published a special issue on May 21, 2020 dedicated to the topic, bringing together a collection of 13 papers that explore the cascading consequences of rising levels of nitrogen in circulation.

The biggest human driver of nitrogen emissions into the air is food production. The global agriculture sector depends on ammonia-based fertilizers to prime the soil each season to grow new crops. Rain and artificial irrigation sweep much of the nitrogen-based fertilizer away, landing it in lakes and oceans, doing damage to aquatic ecosystems.

Biofuels and fossil fuels combustion also release enormous amounts of nitrogen into the atmosphere. Controlled burns to prepare land for crop farming, also known as biomass burning, leads to a host of quality of life issues, one of the most notable of which is the visible reddish haze urban dwellers refer to as 'smog'. Atmospheric nitrogen is eventually returned to land via rainstorms, but emissions often far outpace the Earth's natural ability to cleanse the air. That ongoing cycle of excess nitrogen continues to drive the trend of reduced biodiversity, especially in oceans.

Yuepeng Pan, Ph.D, AOSL editor and scientist with Institute of Atmospheric Physics at the Chinese Academy of Sciences, said the special issue titled "Reactive nitrogen in the air: Emissions, Process, Deposition and Impacts," advances the scientific community's understanding of atmospheric transport of nitrogen and all its consequences. "It is imperative that we continue to better understand the flow of nitrogen compounds in and out of the atmosphere so policymakers can deliver more effective interventions," Pan said.

The AOSL series suggests that a next generation of studies on nitrogen deposition should further consider the impact of ammonia, considering increasing emissions from livestock waste, fertilizers, and fossil fuel

combustions. Previous papers derived their data mostly from field experiments involving spraying nitrogen solution onto soils and thus largely ignored the direct impacts of ammonia.

Though top emitter China has succeeded in decreasing nitrogen output over the last five years, worldwide emissions continue to grow. That, Dr. Pan says, is cause for concern among the scientific community. Without further research and actionable interventions, more damage to ecosystems will likely occur. "We've set the stage for further global research collaboration on this urgent issue," Pan said.

More information: Yuepeng PAN, Toward a better understanding of cascading consequences of atmospheric reactive nitrogen along its transport pathway, *Atmospheric and Oceanic Science Letters* (2020). DOI: 10.1080/16742834.2020.1750752

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