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The fate of nitrogen in the urban area – the case of Zielona Góra, Poland

Human activity has significantly accelerated the reactive nitrogen cycle. The reasons for this situation include the fact that, due to the growing demand for food, naturally bound nitrogen from the atmosphere is insufficient to maintain the required intensity of agricultural production worldwide. This leads to massive use of mineral fertilizers produced via the Haber-Bosch process based on N2, which significantly alters the natural nitrogen cycle. Another element contributing to the alteration of the natural nitrogen cycle are emissions (losses) of nitrogen particularly from combustion and animal husbandry. Nitrogen emissions cause numerous negative environmental impacts, including air and water pollution, soil acidification, damage to biodiversity, and greenhouse gas emissions. This presentation presents the nitrogen flows in a city of 140,000 for two characteristic regions, urban and suburban, which are functionally related. Urban flows, for better quantification, are divided into two main areas: "urban agri-food chain" - including urban agriculture, households, trade, wastewater and waste, and "urban combustion chain" - comprising industry, combustion and air.The results showed that nitrogen flows are greatest along the agri-food chain. In addition to food imports in Zielona Gora amounting to about 30%, in the suburban area a significant share of N amounting to 41% is related to fertilizer imports. The remaining imports are in fuel, elctronics, textiles, plastics and paper. A higher share (45%) of the Nr imports to the agri-food sector is denitrified through wastewater treatment. Nr associated with combustion (mainly from vehicles) accounts for a much smaller share, with 22% of total Nr import. This overall picture is maintained also when specifically addressing the city center, with the exception of mineral fertilizer which plays a much smaller role.

Keywords: nitrogen, urban, circularity, air pollution, water pollution, nitrogen recovery from waste

Biography

My professional experience includes issues in the area of adverse pollution introduced into the environment as a result of anthropogenic activities.The main direction of my research is the analysis and optimization of systems for the treatment of waste and wastewater in order to minimize negative environmental impacts, including reactive nitrogen emissions, taking into account the goals of a closed-loop economy.

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