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Agricultural pollution in Indian Interstate Trade Network

Shekhar Goyal¹, Raviraj Dave², Udit Bhatia³, and Rohini Kumar⁴

¹Indian Institute of Technology Gandhinagar, Earth science, gandhinagar, India (goyal_shekhar@iitgn.ac.in)

²Indian Institute of Technology Gandhinagar, Civil Engineering, gandhinagar, India (dave_raviraj@iitgn.ac.in)

³Indian Institute of Technology Gandhinagar, Civil Engineering, gandhinagar, India (bhatia.u@iitgn.ac.in)

⁴Department Computational Hydrosystems (CHS) Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany (rohini.kumar@ufz.de)

Humanity's contemporary challenge in achieving global food security is sustainably feeding the rising global population. Intensive agricultural practices have powered green revolutions, helping nations attain self-sufficiency. However, these fertilizer-intensive methods and exploitative trade systems have created unsustainable agrarian systems. To probe the environmental consequences on production hubs, we map the fate of Nitrogen and Phosphorus in India's interstate staple crop trade over the recent decade. Here, we analysed the spatiotemporal evolution of physical and virtual nutrient flow within India's interstate agricultural trade network, examining the environmental load on key production regions, assessing the sustainability of domestic wheat and rice trade systems in light of nutrient surplus, and providing policy recommendations for environmentally sustainable food security. Our examination of the cereal crop trade reveals that the Nation's food bowls contributing significantly towards domestic food security are sacrificing their environmental goals by becoming pollution-rich and water-poor. Our study emphasises policies focusing on redistributing funds from agricultural subsidies that aggravate environmental disparity to those incentivising sustainable production. The findings could offer a foundation for designing and exploring alternate trade network configurations that aim for environmental sustainability without compromising food security goals.