

## Modelling freshwater Nitrogen and Phosphorus across South Asia

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Nitrogen is essential to life and is a vital nutrient for plant growth and food production, however, its natural cycle has been drastically altered by our activities. Nitrogen pollution is a growing threat to our health, ecosystems and freshwater water bodies. South Asia is one of the affected regions with levels of nitrogen pollution rapidly increasing. In this study, a regional-scale model of freshwater flow and macronutrients (N and P) has been developed for the whole of South Asia. The freshwater model of water quantity (flow) and water quality is based on an existing grid-based model formulation HMF-WA (Hydrological Modelling-Framework for West Africa: Rameshwaran et al. (2021)), coupled with a nutrient-routing approach developed for long-term and large-scale use (LTLS: Bell et al. (2021)). The model combines grid-based runoff-production schemes with a Kinematic Wave (KW) flow routing approach in order to estimate river flows and nutrient fluxes on a regular grid across the region. The model simulates spatially consistent river flows and macronutrient fluxes on a  $0.1^{\circ} \times 0.1^{\circ}$  grid (approximately  $10\text{km} \times 10\text{km}$ ) continuously across the whole domain. Nutrient inputs to rivers are derived using spatial datasets of land cover and spatiotemporal dominant nutrient sources which are atmospheric deposition, fertiliser application, livestock numbers and human population (Figure 1). Regional scale simulations driven by observed weather data are assessed against observed flows and water quality data before undertaking an analysis of the impact of projected future N scenarios including impacts of technology-based abatement measures and dietary change on pollution.

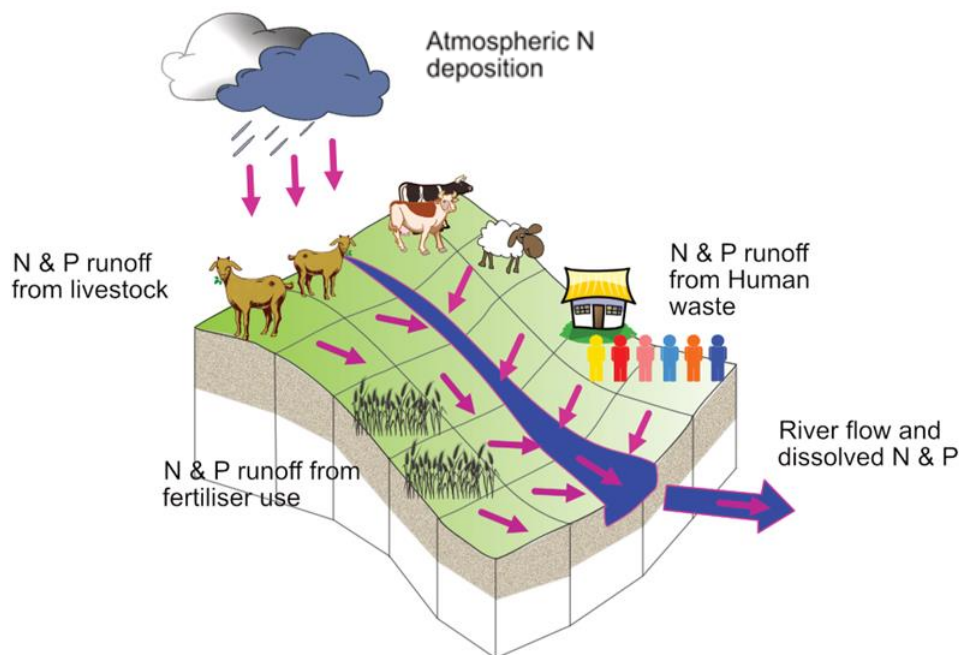


Figure 1. Introducing macronutrients (N&P) into South Asian hydrological modelling

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