

# Increasing future human-induced nitrogen exports to rivers and sea in the Zambezi river basin

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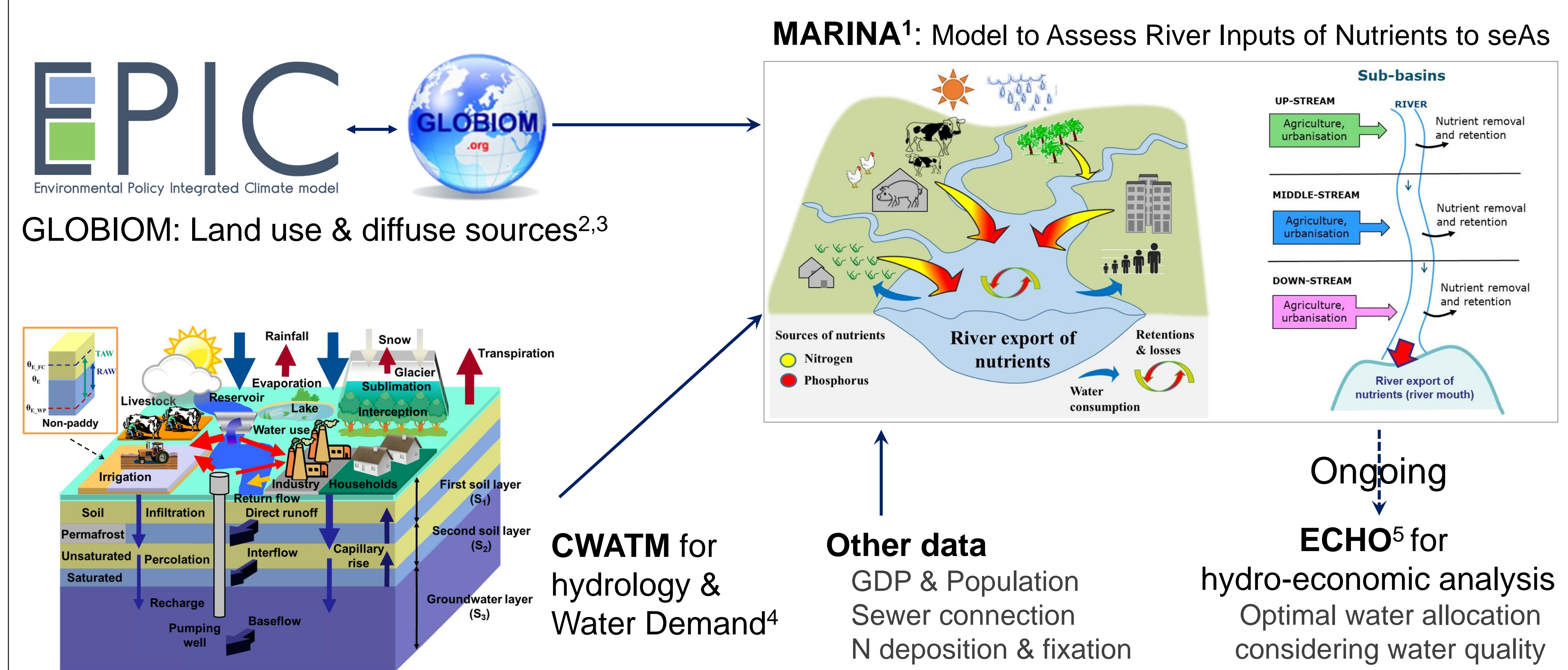
## Background

- **Nutrient enrichment** in African water bodies has been frequently reported and leads to water security challenges in the past decades.
- Rapid **population growth** and increasing food and water demand projected in Africa will result in substantial increases of anthropogenic nutrient inputs to the aquatic environments.
- Such increases may deteriorate African water bodies and threaten future **water security**.
- ❖ In this work, we assess the **status and future changes** of nitrogen (N) sources, associated inputs to rivers and export to sea, based on **global and regional scenarios**.

## Linking with in-house models to build up a N export model

Multi-model coupling towards water availability assessment including water quantity and quality.

### Nitrogen export model as part of Water-Land-Energy integrated modeling framework



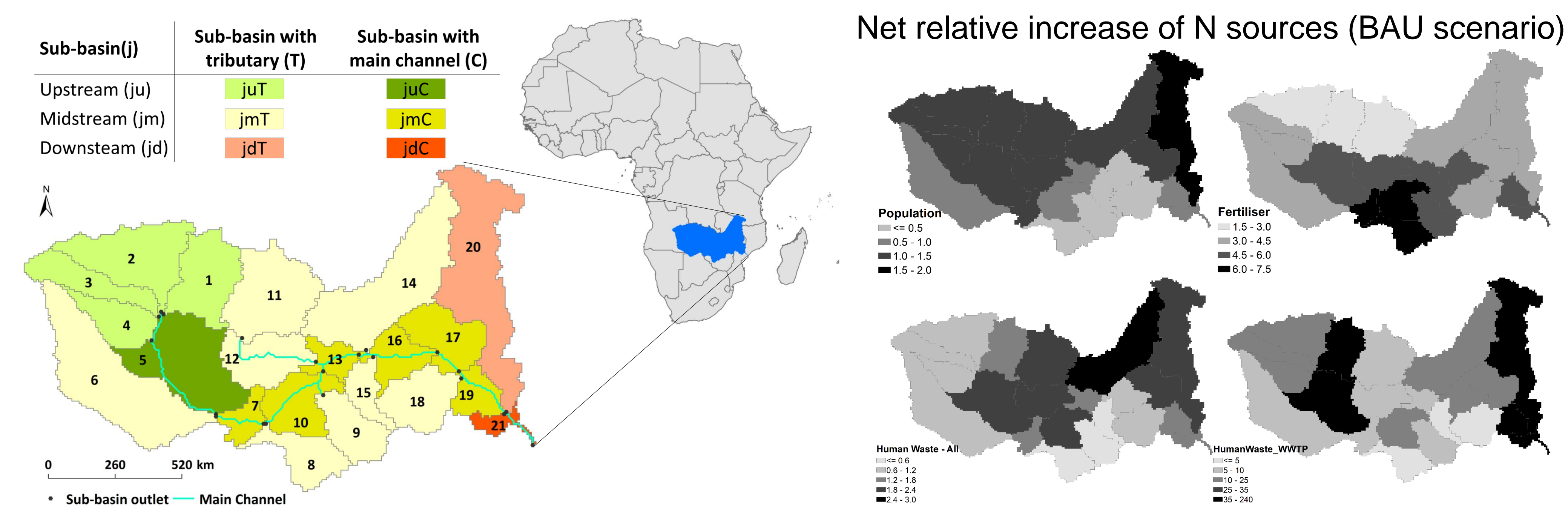
- Current (2010) → Future projection (2050)
- **Business-as-usual (BAU) scenario:** global climate (Representative Concentration Pathways, RCPs) and socioeconomic (Shared Socioeconomic Pathways, SSPs) projection as the basis line (RCP6.0-SSP2)
  - Co-developed **regional scenarios** through **stakeholder engagement**
    - RS1:** BAU + Environment as first priority
    - RS2:** BAU + Economy as first priority
    - RS3:** BAU + Society as first priority

## References

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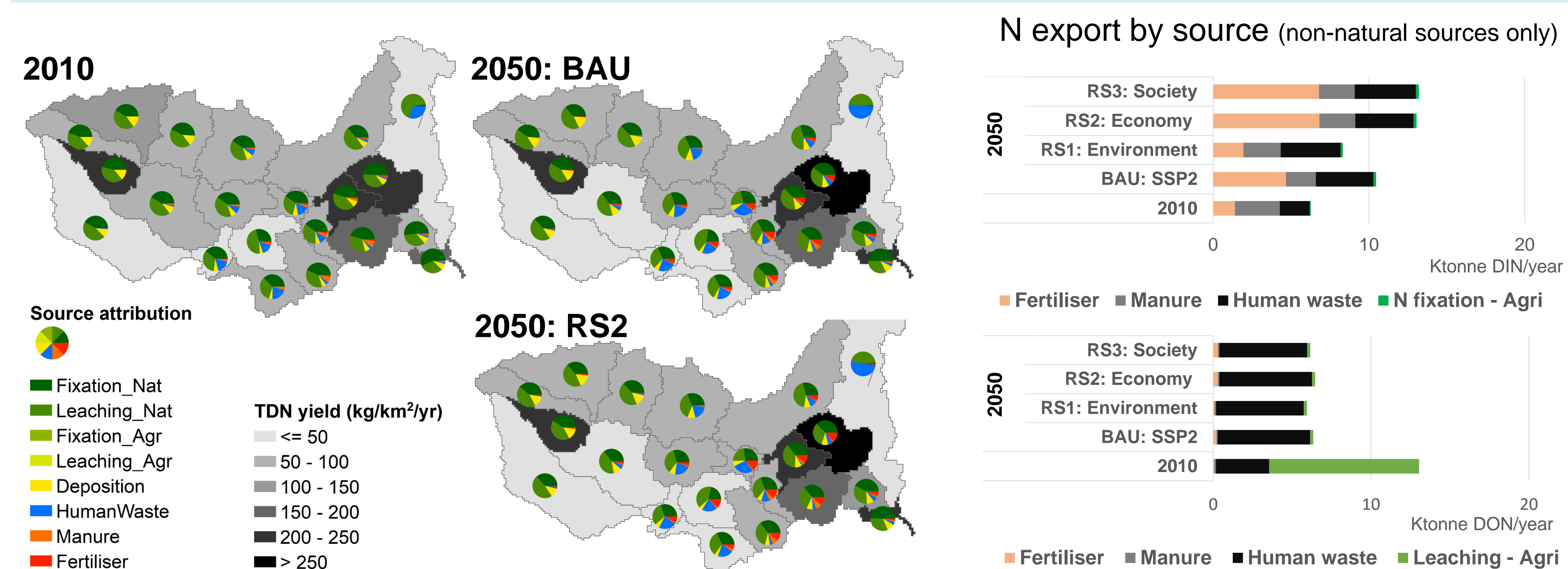
## Zambezi basin: basin characteristics and N sources

- Fourth largest transboundary basin (1.4 million km<sup>2</sup>) in Africa draining through 8 countries.



- Population will double by 2050 with fast urbanization, especially in Malawi.
- This will lead to considerable increases in N sources from wastewater and fertilizer use.

## N export to sea: spatial variability and source attribution



- N export to sea and its future changes are highly **variable in space**, dominated by **natural sources** with increasing contribution from **human activities**.
- Climatic/hydrological changes and human water use can significantly alter N export pattern.
- **Source control** and **climate adaptation** in the regional context are both needed to minimize further N-induced deterioration of water bodies and ensure regional water security.

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