The effect of 'Double High Agriculture' on nitrogen losses from crop production to coastal waters in China

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Background

The agricultural system is not very nutrient efficient and large amounts of nitrogen (N) are lost to the environment. As a result, N losses to rivers have developed into a severe environmental pollution problem. Increasing river export of nutrients resulted in harmful algae blooms in the Bohai Gulf, Yellow Seas and South China Seas.

'Double High Agriculture' (DHA) management, which refers to systems with high nutrient use efficiency and high crop yield, seems as a promising strategy for Chinese agriculture. to meet the large food demand with less negative impacts on environment

Objective

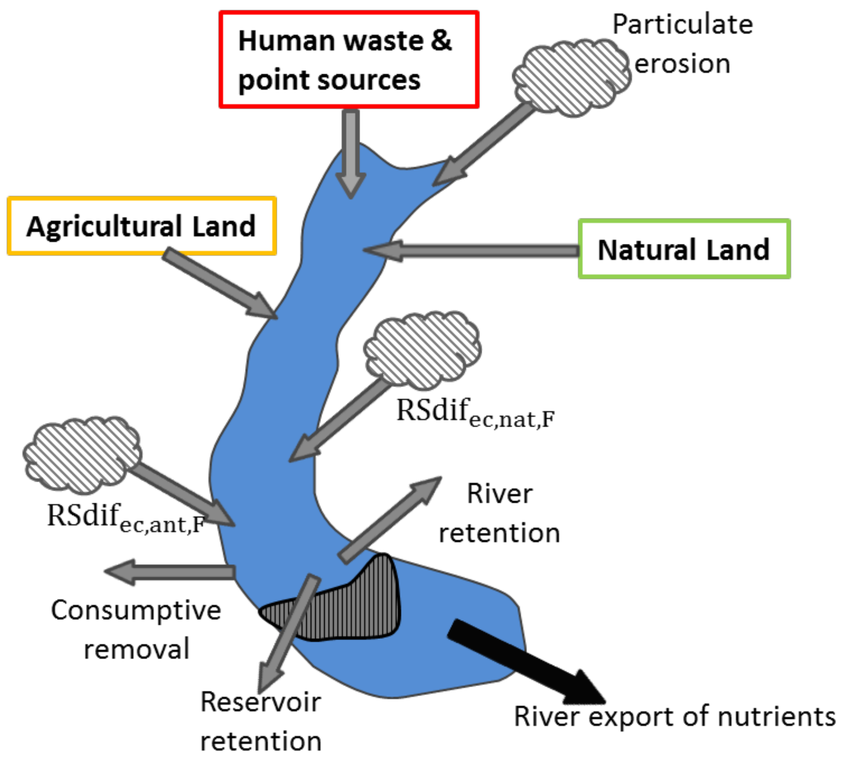
The aim of this study is to quantify the impact of "Double High Agriculture" on N losses to rivers and coastal waters in China in the future.

Methods

Model

We applied Global NEWS model quantified the river export of nutrients in dissolved organic N (DIN) and dissolved inorganic N (DON) for three seas: the Bohal Gulf, the Yellow Sea and the South China Sea for the year 1970, 2000 and 2050.

Global NEWS model



(Sources: Mayorga et al., 2010; Seitzinger et al., 2010)

Scenarios

We used the Global Orchestration (**GO**) scenario from Millennium Ecosystems Assessment as a reference scenario. GO assumes increasing food production for a growing population, leading to more synthetic fertilizer use and animal excretion.

We developed two **DHA scenarios:**

- The Integrated Soil-crop Systems Scenario (**ISSM**)
- ISSM with increased Manure Recycling (**ISSM-MR**)

Results

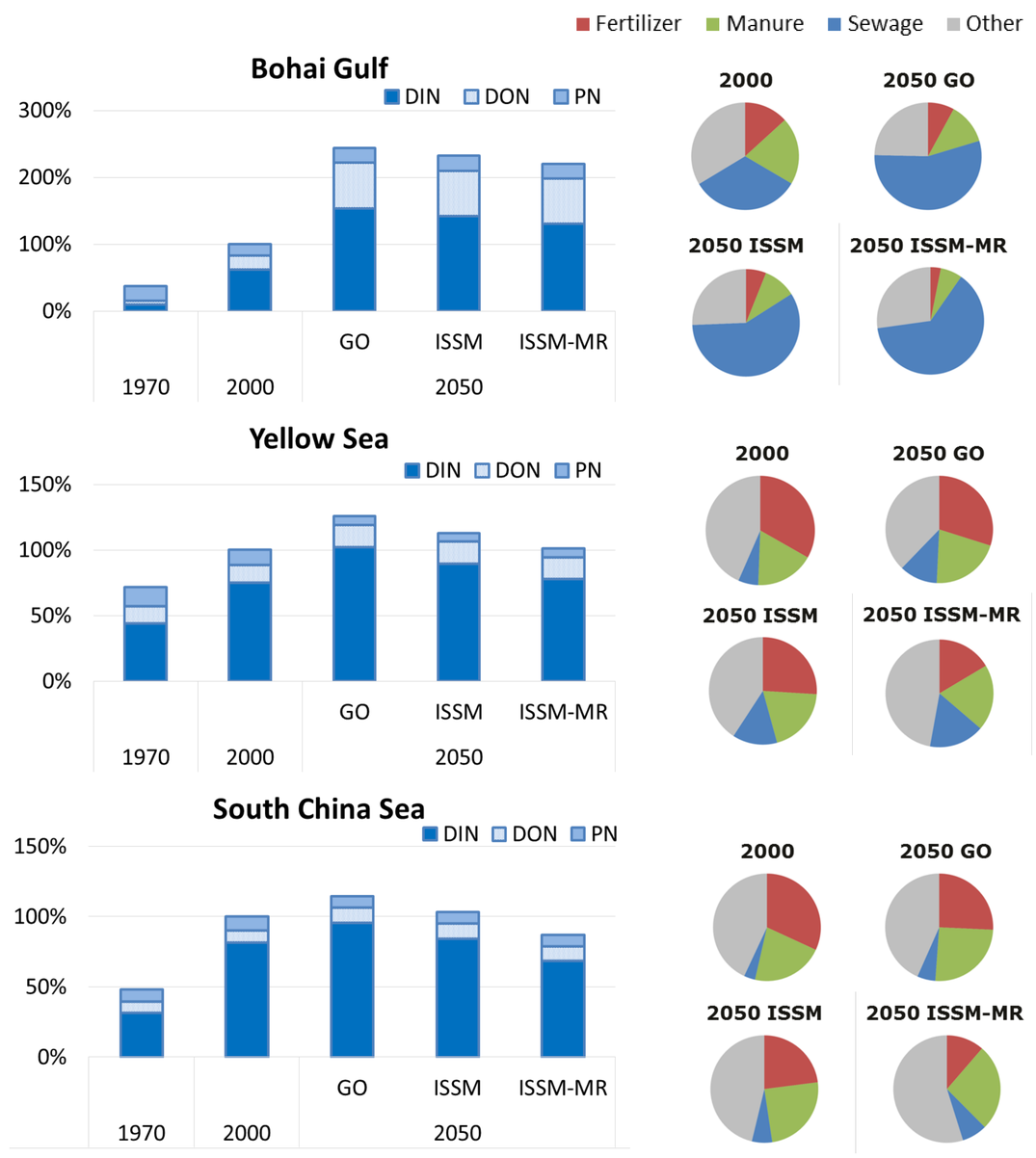


Figure 1. River export of total N and percentage of source attribution to total N.

Conclusions

- Chinese coastal waters are polluted because of increased nutrient export by rivers.
- By 2050, total N inputs to Chinese seas may be considerably higher than today.
- 'Double High Agriculture' management is a promising strategy to produce food with lower N losses to the environment. It may reduce N inputs to coastal waters, particularly when combined with manure recycling.

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