

Sources of nitrogen in rivers worldwide

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Abstract

We analyse sources of nitrogen (N) in rivers worldwide in a spatially explicit way. For this, we link three global models. Today, many rivers are polluted. Over half of global N in rivers is from anthropogenic sources with large spatial variabilities. In the future, rivers may be more polluted. We explore linkages between sustainable development goals (SDGs) and pollution sources. Reductions in river pollution (SDG6, 14) call for sustainable human activities (SDG2, 11) under global change (SDG8, 13).

Keywords: sources, nitrogen, sustainable development goals, rivers

1. Introduction

Excess nitrogen (N) in rivers causes environmental impacts. We analyse sources of total dissolved N (TDN) in rivers worldwide. We explore linkages between sustainable development goals (SDGs) and pollution sources. This can support the search for effective solutions to achieve SDGs.

2. Methods

We quantify annual TDN inputs to rivers of 10,226 sub-basins. For this, we expand the MARINA model (Stokal et al., 2019) with diffuse sources: a Model to Assess River Inputs of Nutrients to seAs. The global version quantifies point-source inputs of TDN to rivers: sewage, manure discharges, open defecation.

For diffuse sources, we use outputs from two global models: MAGPIE (Model of Agricultural Production and its Impact on the Environment) and VIC (Variable Infiltration Capacity). MAGPIE (Bodirsky et al., 2012) provides inputs

for diffuse sources (e.g., fertilizers, manure, residues). VIC (Liang et al., 1996) provides runoff. We explore future trends and link them to SDGs.

3. Results and Conclusions

Globally, around 110 Tg of TDN entered rivers in 2010 (Figure 1). Over half of this amount was from anthropogenic diffuse sources. However, the share of these sources differ largely among sub-basins. For example, point sources were important for Chinese sub-basins whereas anthropogenic diffuse sources for European sub-basins. In the future, rivers may be more polluted. Reductions in river pollution (SDG6, 14) call for sustainable human activities (SDG2, 11) under global change (SDG8, 13) (Figure 1B as example).

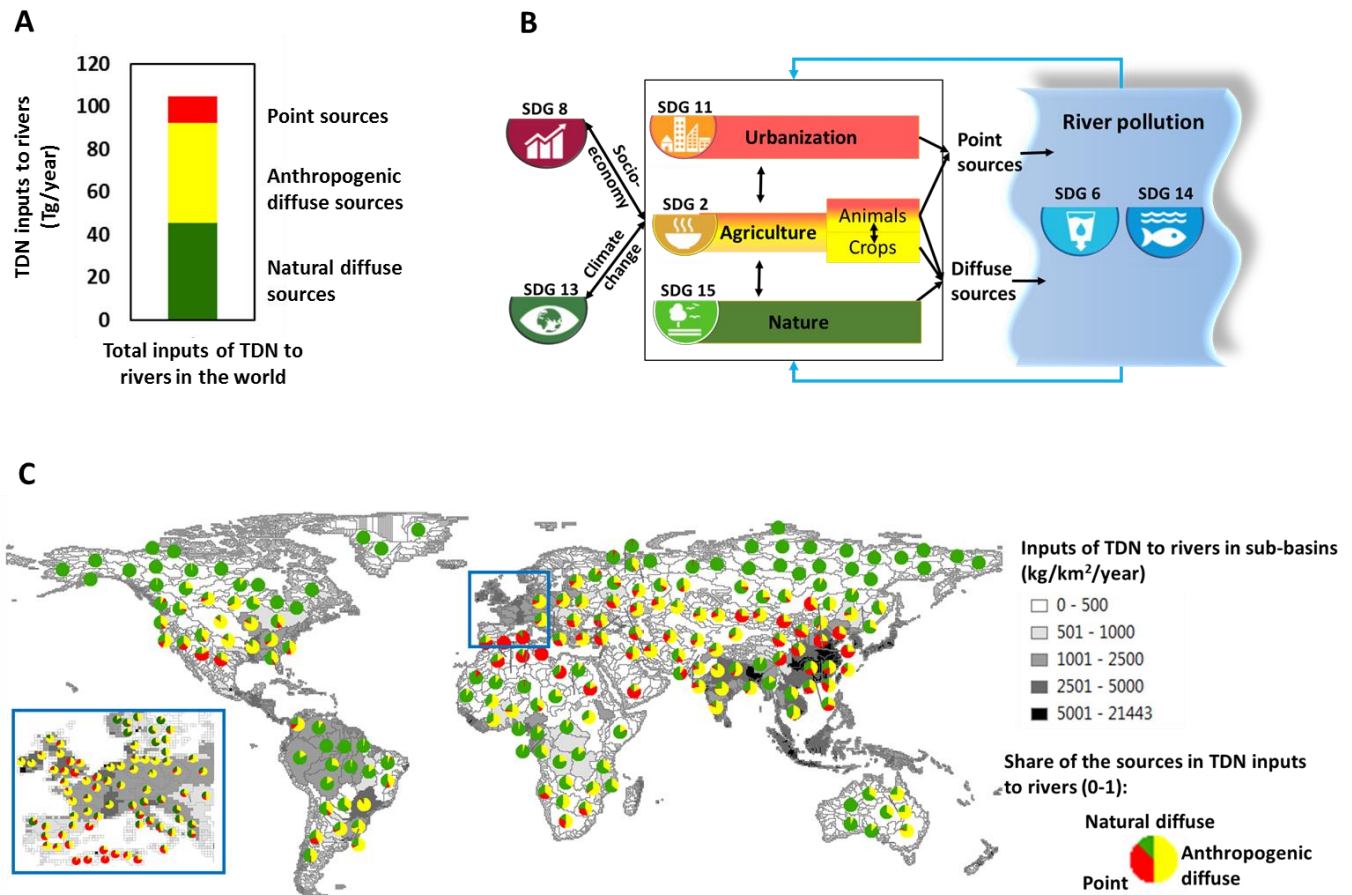


Figure 1. (A): Global inputs of total dissolved nitrogen (TDN) to rivers by source in 2010 (Tg/year). (B): Examples of linkages between sustainable development goals (SDGs) and pollution sources. (C): TDN inputs to rivers in sub-basins (kg/km²/year) and the share of sources in these inputs for selected rivers (0-1). See methods.

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