UNESCO-IWRA ONLINE CONFERENCE
17-19 JANUARY 2023
3RD IN THE IWRA ONLINE CONFERENCE SERIES

Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Multiple pollutants in rivers from wastewater: synergies and trade-offs in future pollution control

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19 January 2023

9:40 CET time

unesco
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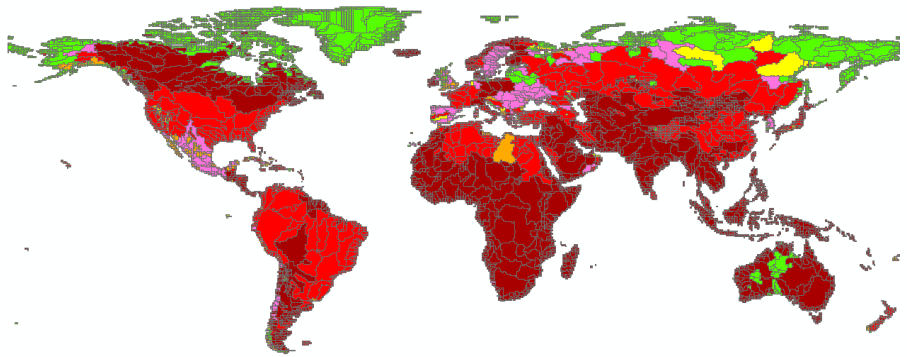
IWRA International Water Resources Association

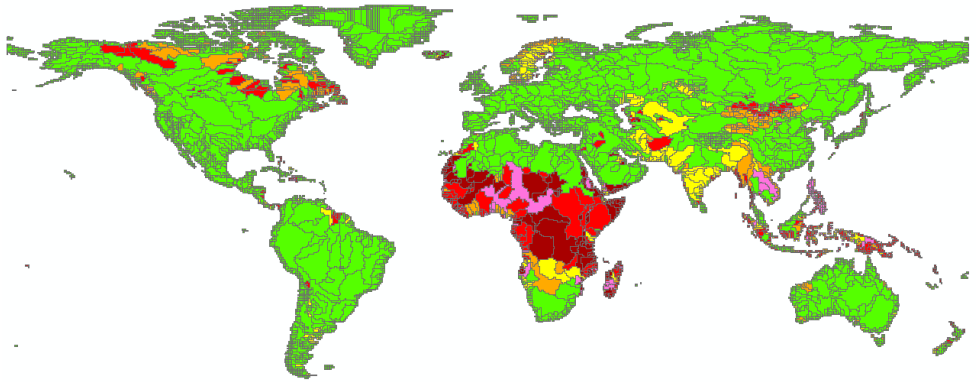
Key messages for the 21st century

1. **Wastewater** is expected to be a common source of multiple pollutants in rivers

2. **More sewage connections** may result in **more pollutants** in many rivers worldwide (trade-off)



3. **Better wastewater treatment** may **reduce pollutants** in many rivers worldwide (synergy), except for Africa



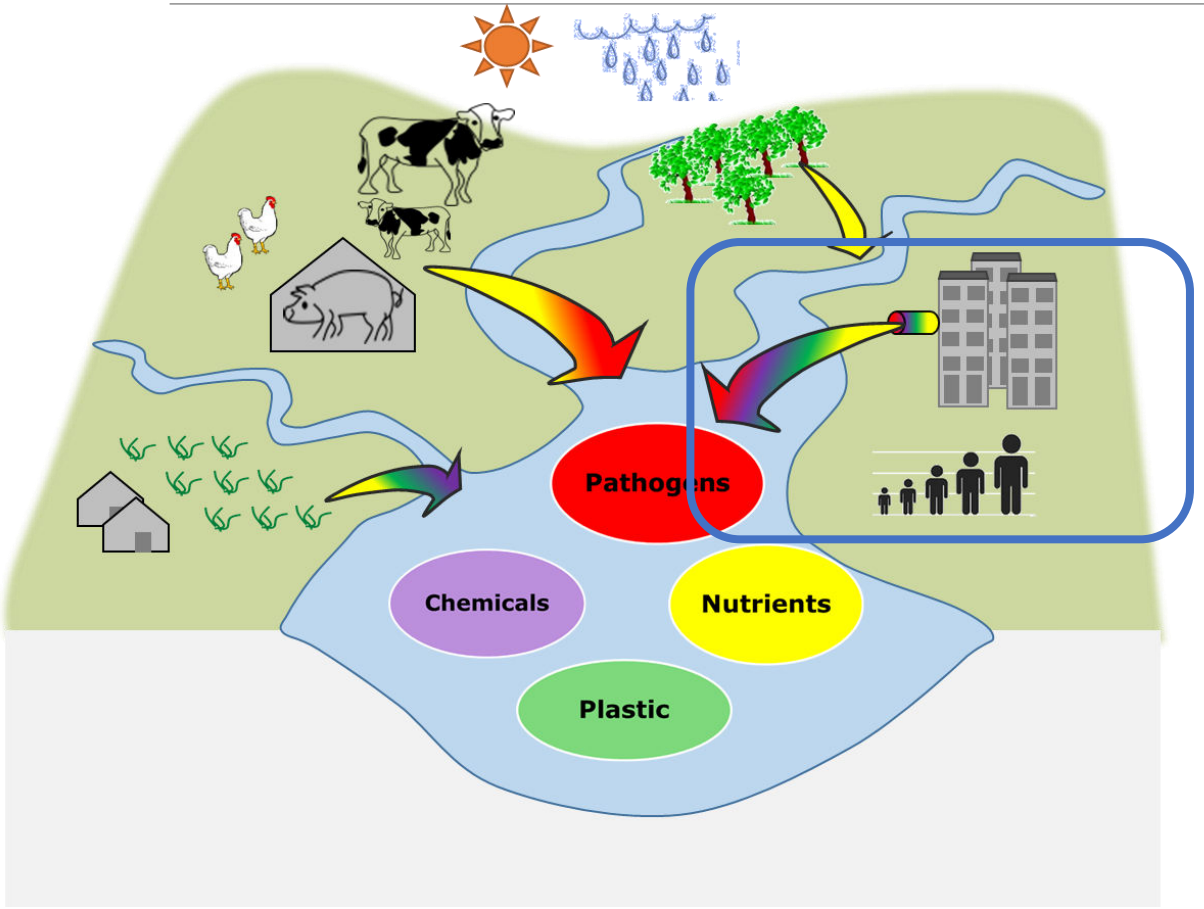
Multiple pollutants in rivers

Cocktails of emerging pollutants

Combined impacts on nature and society

Website:
https://www.wur.nl/en/Research-Results/Chair-groups/Environmental-Sciences/Water-Systems-and-Global-Change-Group/Research-1/Water-Quality/The-MARINA-models.htm

Wastewater is expected to be a common source of multiple pollutants



In the 21st century:

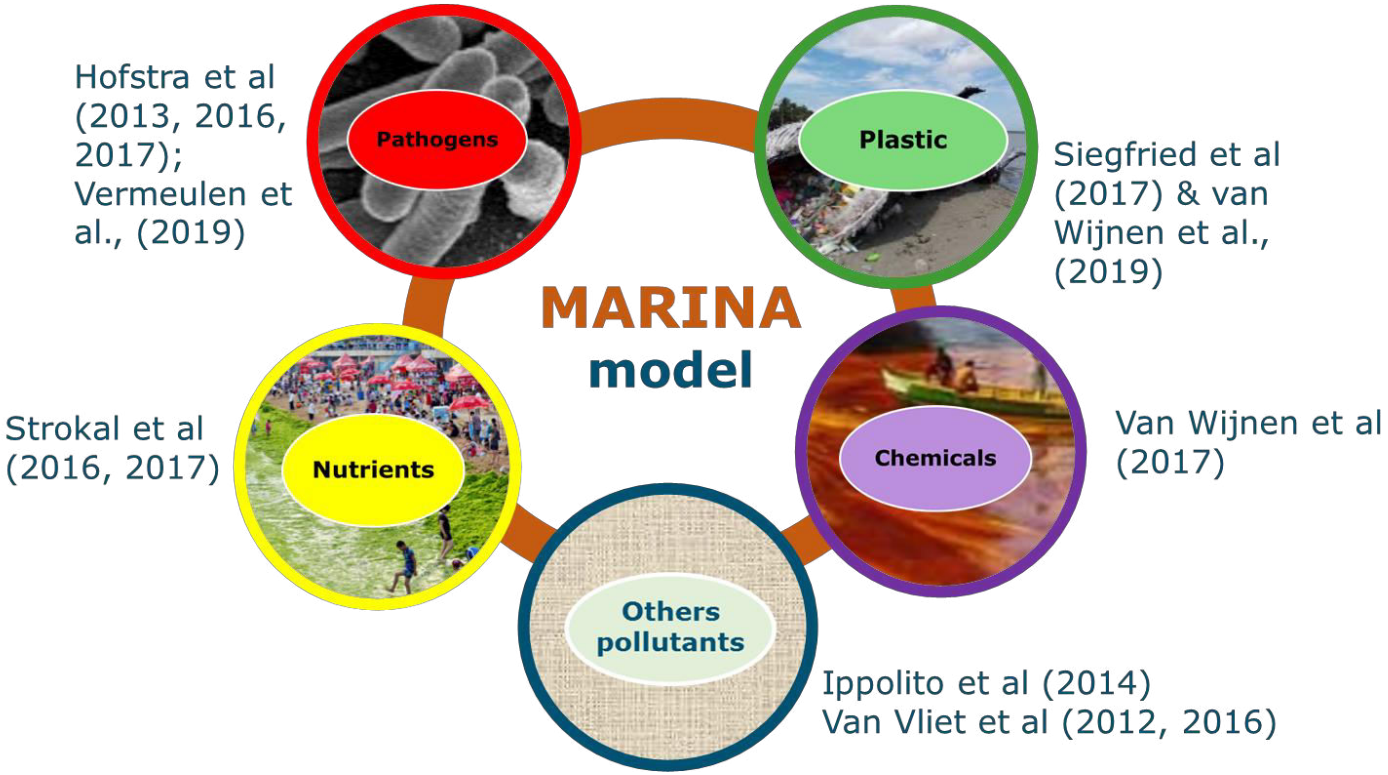
- > 2/3 of global population will be urban
- More sewage connections
- More pollutants entering sewage systems

Examples:

- Pathogens (feces and urine),
- Nutrients (feces and urine),
- Microplastics (e.g., car tyres, personal care products)
- Chemicals such as triclosan (antibacterial agent in soap)
- ....

Strokal et al (2021) *npj Urban Sustainability*, doi.org/10.1038/s42949-021-00026-w
Li et al (2022) *Water Research*, doi.org/10.1016/j.watres.2021.117906

MARINA: Models to Assess River inputs of pollutaNts to seAs

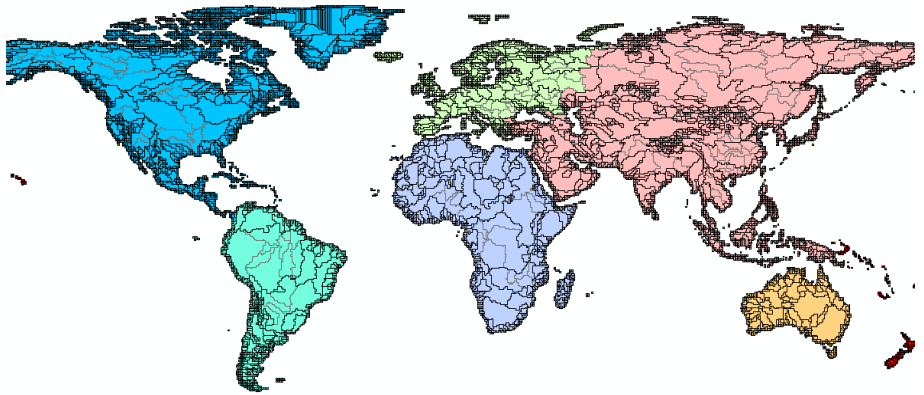


Models: evaluated for multiple pollutants

Model inputs: e.g., population, wastewater treatment, sewage connections

Model outputs: e.g., pollutants in rivers by source and sub-basin

Model application: > 10,000 river sub-basins



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MARINA: **M**odels to **A**ssess **R**iver inputs of pollutaNts to se**A**s

MARINA models are used to better understand

- **Pollution hotspots and their sources**
- **Synergies and trade-offs in pollution control (scenario analyses)**

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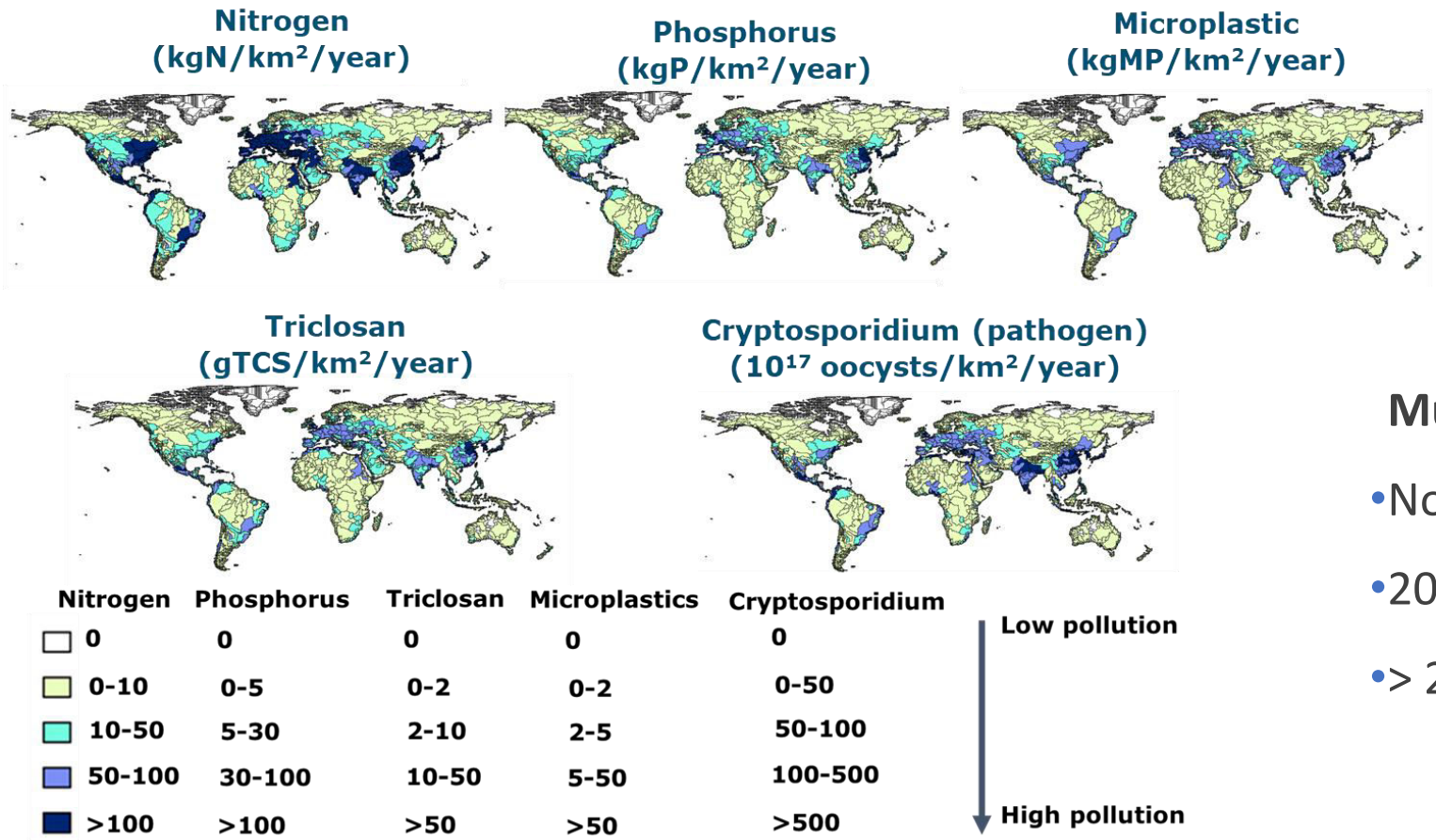
Two scenarios

The basis: Shared Socioeconomic Pathways (SSPs)

	Economy first (based on SSP5)	Sustainability (based on SSP1)
Population growth	Low	Low
Urban population growth	High	High
Expansion of sewerage	High	High
Implementation of advanced wastewater treatment technologies	Slow	Fast

Five pollutants in rivers from sewage systems in the year 2010



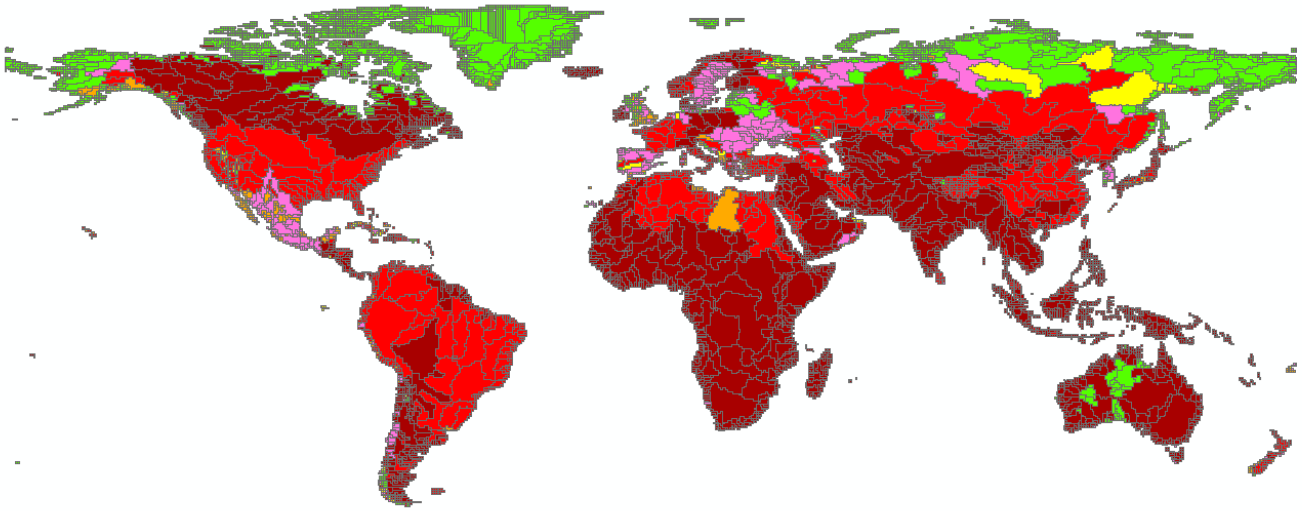
Multi-pollutant hotspots:

- North America, Europe and South Asia
- 20% of the global land area
- > 2/3 of the global population

Future trends – “Economy first” scenario

Future trends – "Economy first" scenario

Changes in river pollution during 2010-2050

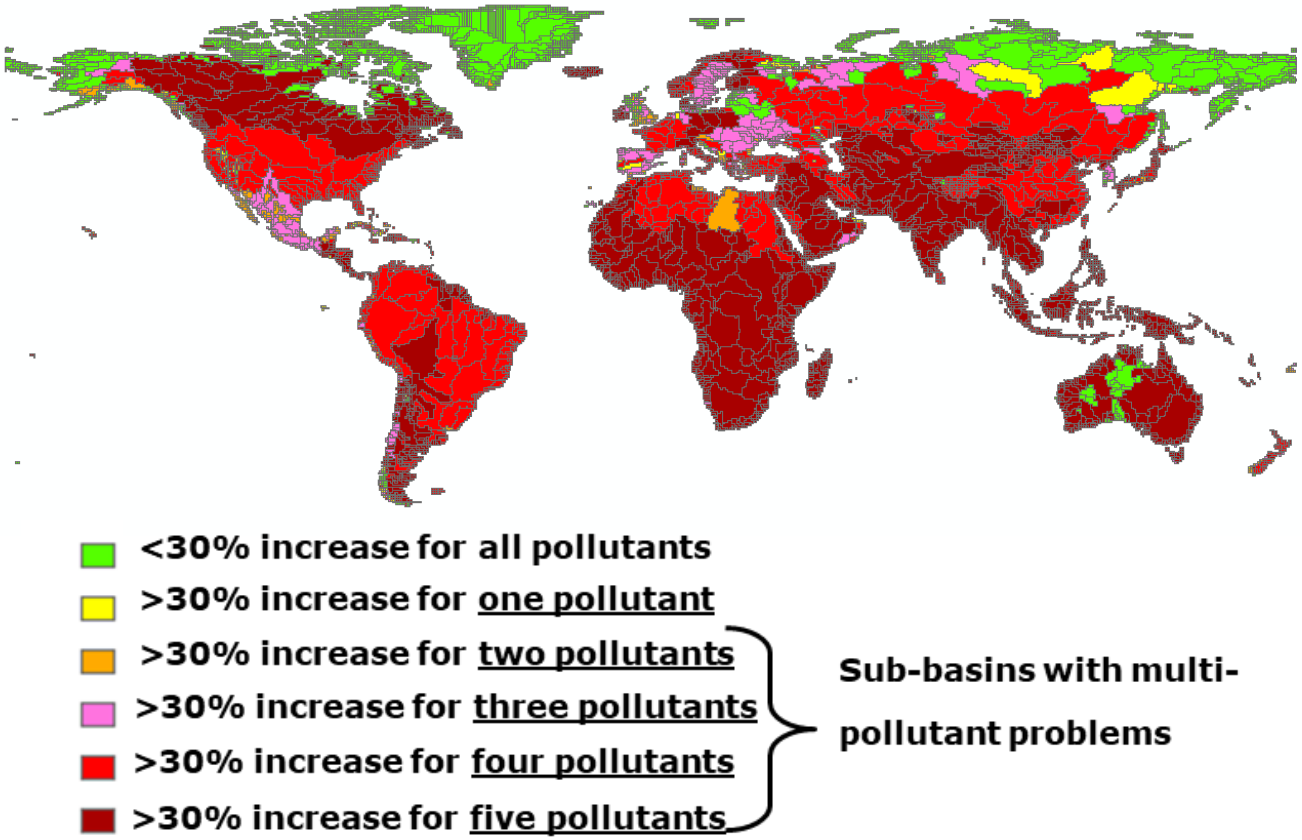


- <30% increase for all pollutants
- >30% increase for one pollutant
- >30% increase for two pollutants
- >30% increase for three pollutants
- >30% increase for four pollutants
- >30% increase for five pollutants

Sub-basins with multi-pollutant problems

Future trends – "Economy first" scenario

Changes in river pollution during 2010-2050



More sewage connections may result in more pollutants in many rivers worldwide (trade-off)

Future trends – "Sustainability" scenario

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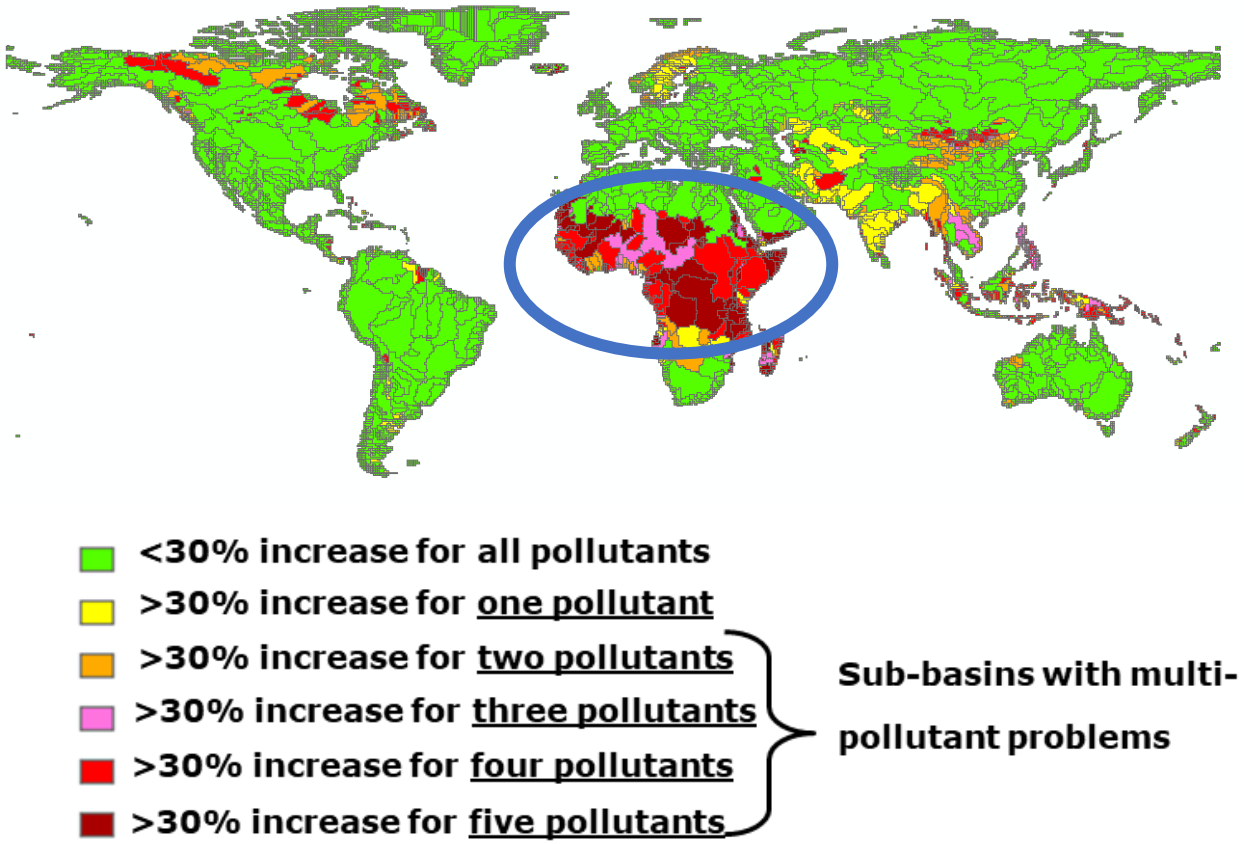

Better wastewater treatment may reduce pollutants in many rivers worldwide (synergy), except for Africa

For Africa:

- It will be challenges to reach urban-associated pollution levels of 2010 in the future
- Rapid increase in population

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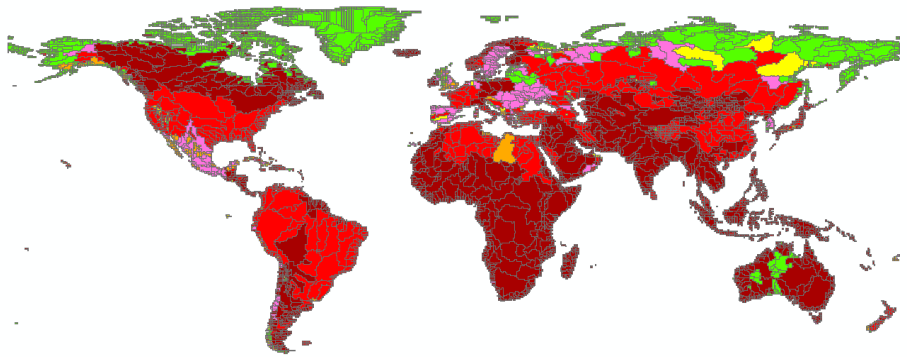

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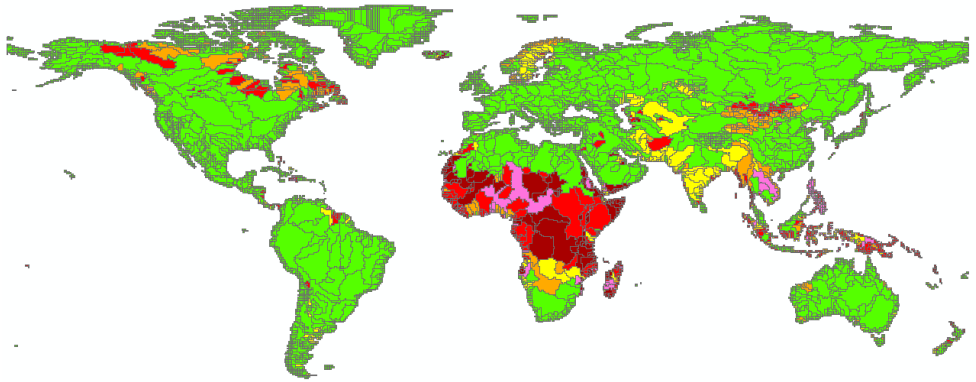

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Thank you for your attention!

The MARINA team

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