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THE ROLE OF LIVESTOCK IN NITROGEN POLLUTION OF LARGE RIVER BASINS: A MACHINE LEARNING-BASED ASSESSMENT

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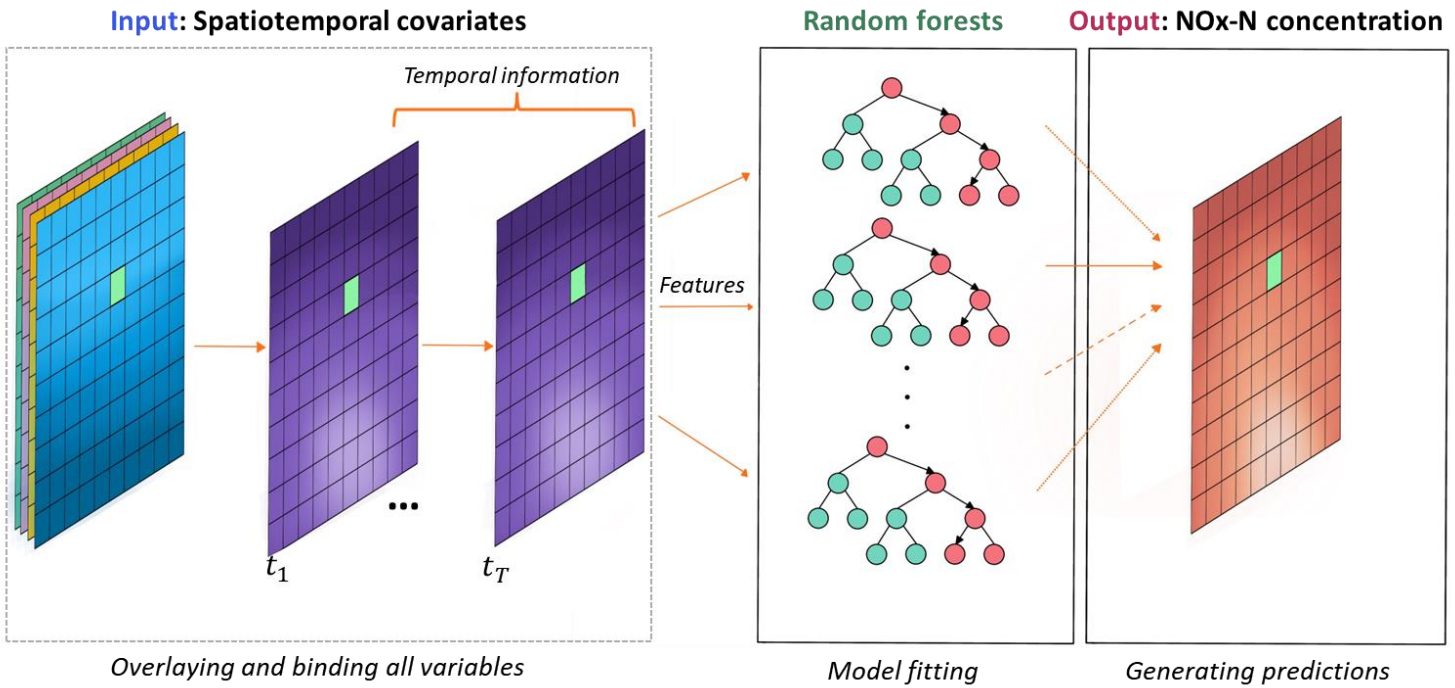
MOTIVATION/SIGNIFICANCE

Anthropogenic nitrogen fluxes into surface freshwater bodies significantly impair water quality (WQ), pose serious health hazards, and create critical environmental threats.

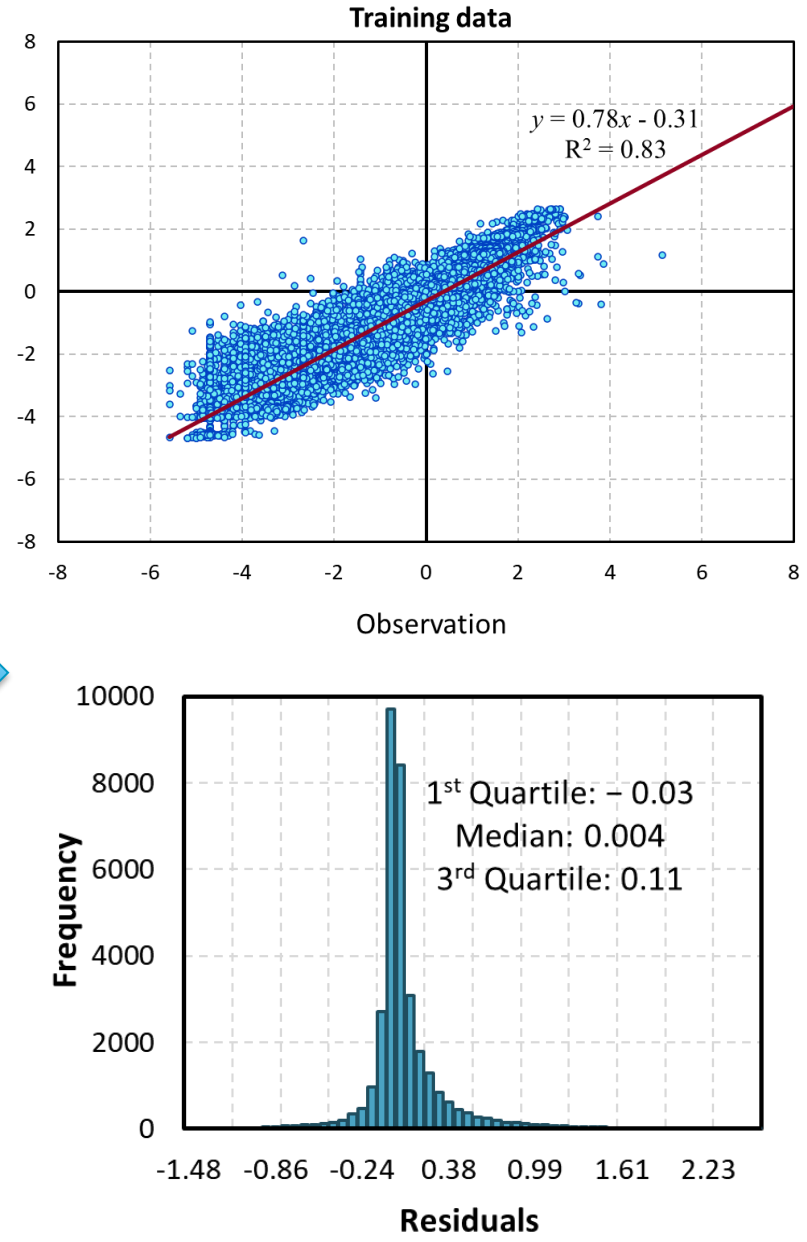
Despite being essential for food security, poverty reduction, health and well-being improvement, livestock can cause nitrogen pollution in aquatic ecosystems.

ML methods have shown to offer immense potential for solving geoscientific problems, but methods have not been widely utilized to provide spatially explicit (gridded) estimates of WQ indicators at global scale. Based on our observation, almost all ML models are lumped in space.

METHODOLOGY



A schematic representation of the proposed spatiotemporal random forest model.



Performance of the random forest model for predicting NOx—N concentrations

KEY FINDINGS

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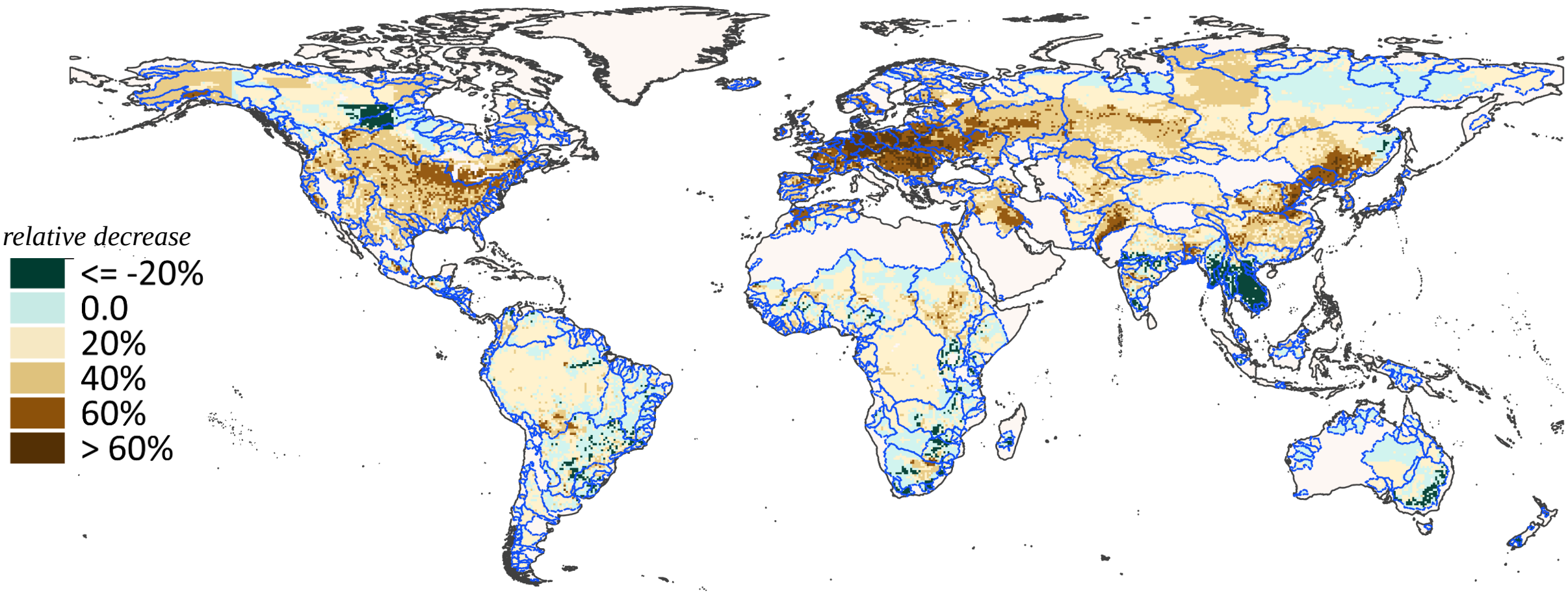
$$\%\ \textbf{decrease in N} = \frac{N_{with\ livestock} - N_{without\ livestock}}{N_{with\ livestock}}$$



Min: -30% Mean: 13 % Max: 70%

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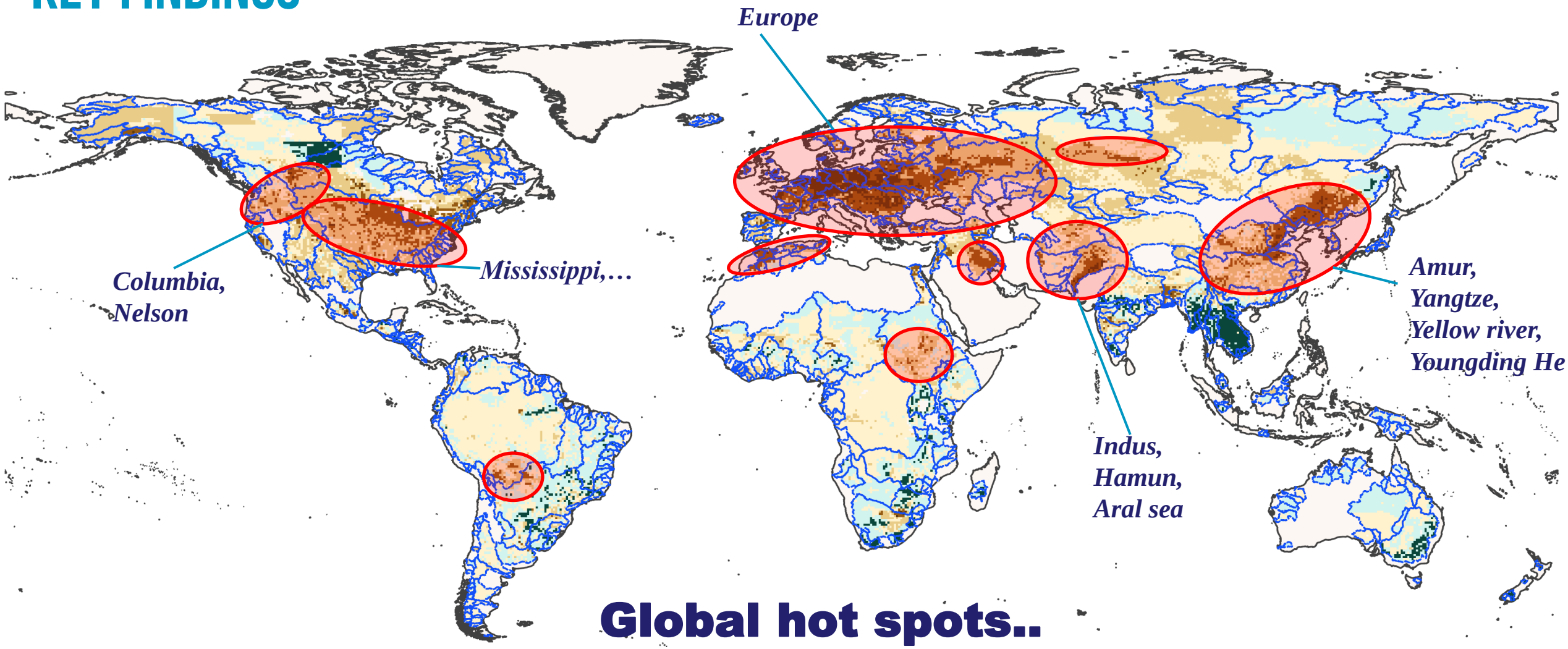
KEY FINDINGS



Global hot spots..

CONCLUDING REMARKS..

We built a space-time random forest model for simulating nitrogen concentration in 115 major river basins of the world (at a 0.5-degree spatial resolution and with a monthly time step).

Our results confirmed that, globally, cattle density, nitrogen fertilizer application, temperature, precipitation, and pig population are the most influential predictors of nitrogen pollution of the river systems.

We found that during 1992-2010 the average increase in nitrogen concentrations due to livestock was about 15% globally. Importantly, model results also indicate that at some large basins livestock population is responsible for more than 50% of raise in the levels of nitrogen.

We identified global livestock ‘‘hot spots’’ where high nitrogen loading to waterways may be expected.

THANK YOU

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REFERENCES

Sheikholeslami, R. and Hall, J.: The role of livestock in nitrogen pollution of large river basins: A machine learning-based assessment, EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-8223, https://doi.org/10.5194/egusphere-egu22-8223, 2022

Sheikholeslami, R., & Hall, J. W. (2021, December). A machine learning approach to identifying the key factors influencing global water quality. In AGU Fall Meeting 2021. AGU.