

Forecasting Climate Change Impacts on Urban Stream Biodiversity through Hydrodynamic Modelling and Machine Learning

From Knowledge
to Competitiveness

Portugal-US Partnerships 2026 Summit

Portugal
Program



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1. BACKGROUND & OBJECTIVES

Urban streams provide ecosystem services important for urban sustainability. However, they are subjected to multiple stressors that may interact with climate change.

Stressors:

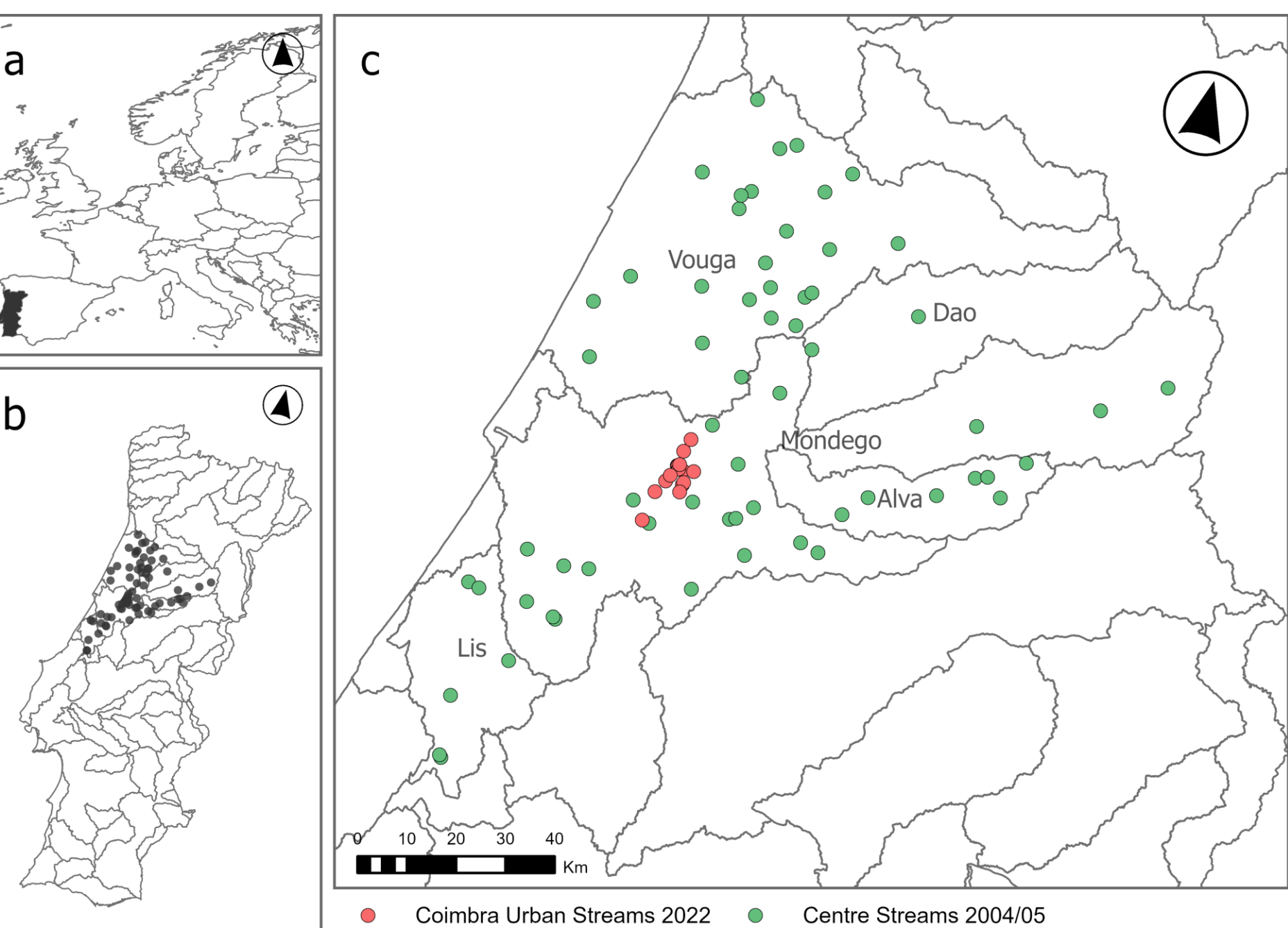
- Habitat degradation
- Riparian alteration
- Nutrient enrichment
- Altered flow regimes

Objective: Assess the response of urban stream macroinvertebrate communities to future climate projections.

Research question: Do anthropogenic pressures affect the biological response of urban streams to climate change?

2. STUDY AREA & DATASET

Training: 72 sampling sites
Case-Study: 14 urban streams



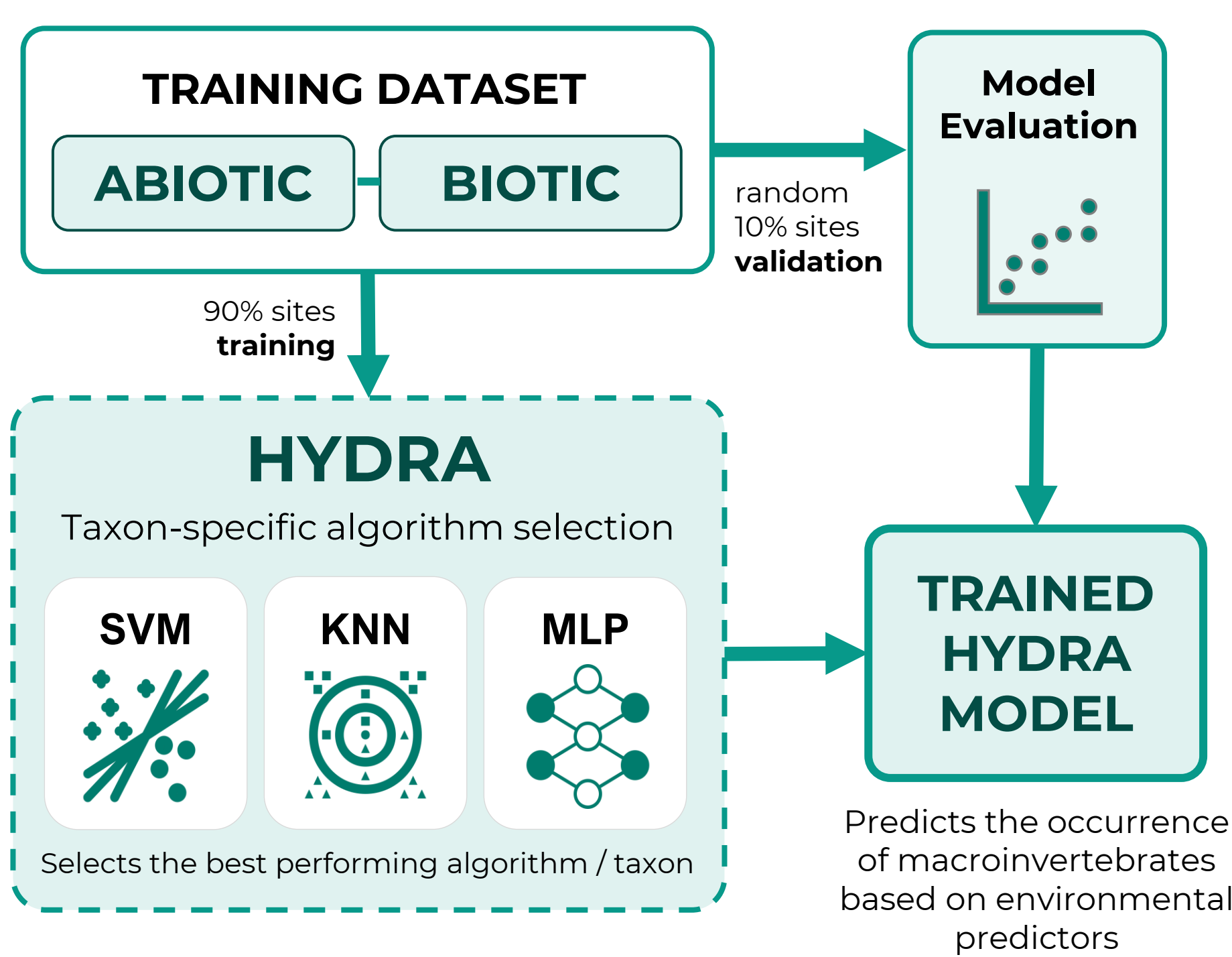
ABIOTIC
(41 predictors)
• Catchment characteristics
• Urban pressures
• Climate
• Flow

BIOTIC
Abundance of 142 benthic macroinvertebrate taxa

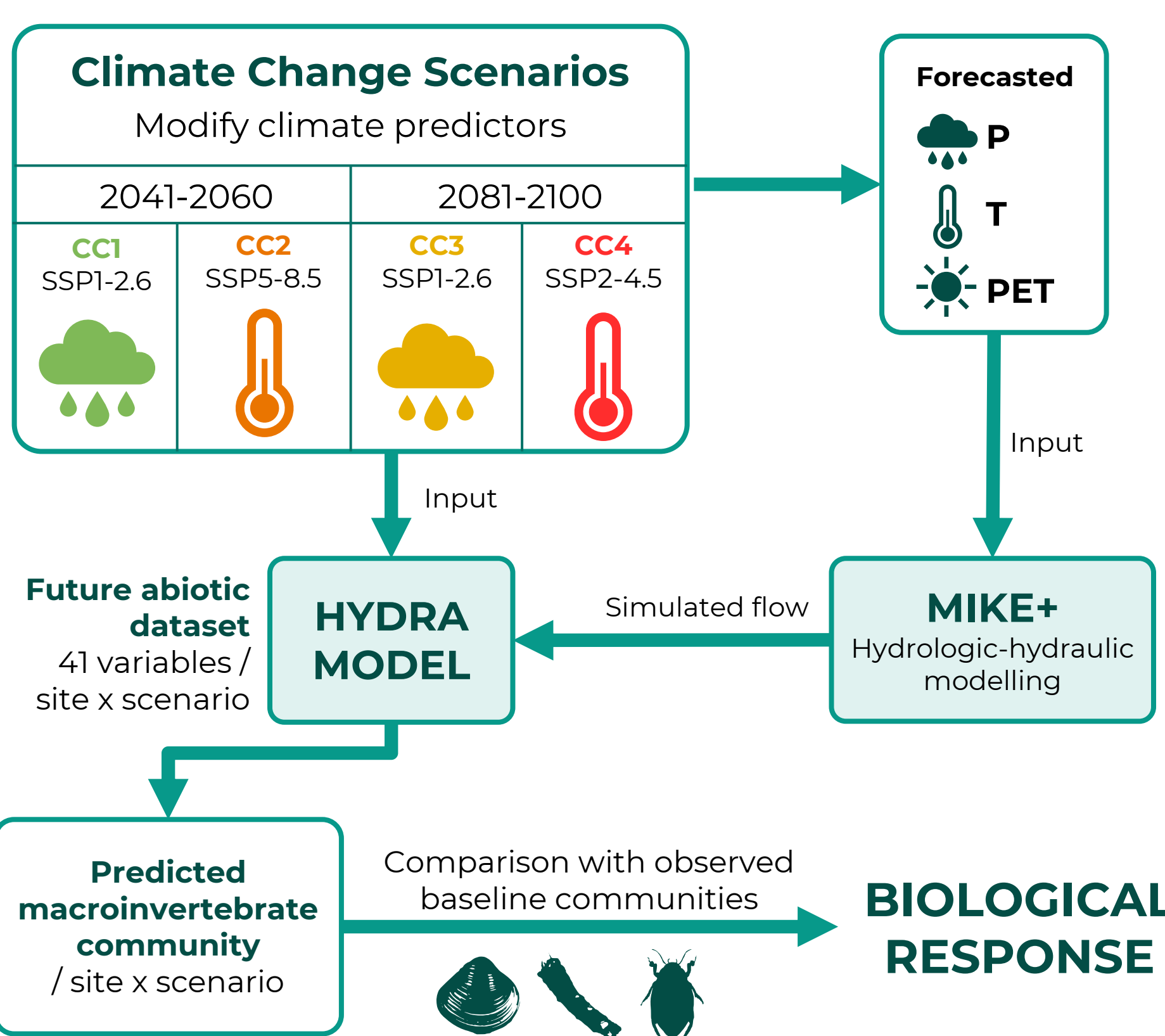


3. MODELLING FRAMEWORK

STEP I- Training & validation of HYDRA



STEP II- Climate Change Simulation

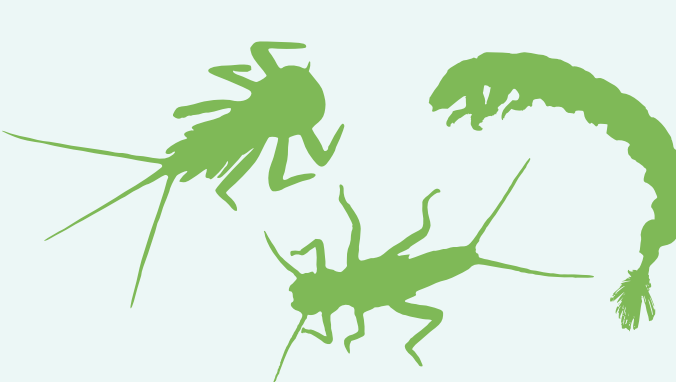


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Sustainable Cities

4. KEY RESULTS

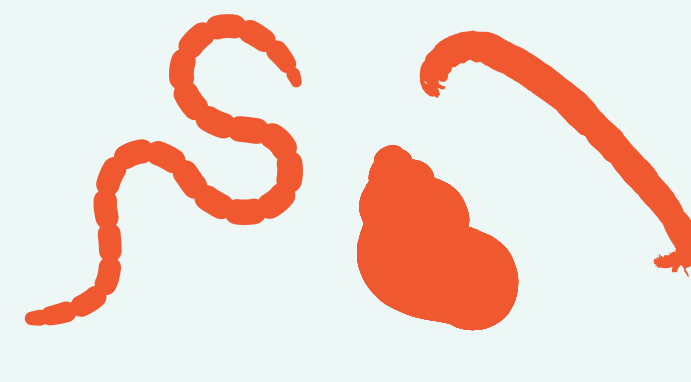
Changes in community composition

Taxa declining under climate change



- EPT taxa (sensitive)
- Cold-adapted taxa
- Flow-sensitive taxa

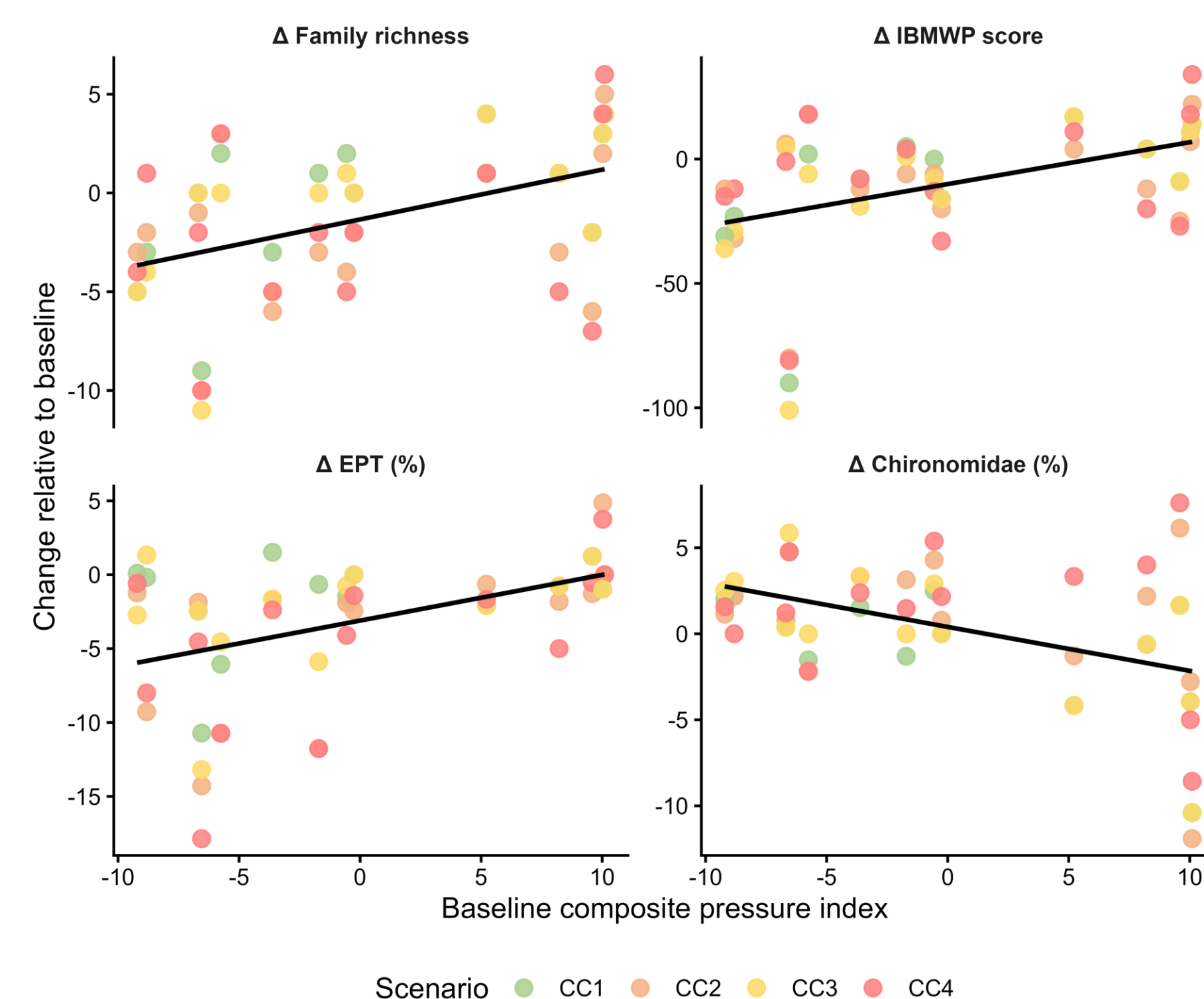
Taxa persisting or increasing



- Tolerant taxa
- Generalist taxa
- Associated with disturbed conditions

Declines in biological metrics

More pronounced in less urbanised streams



5. DISCUSSION

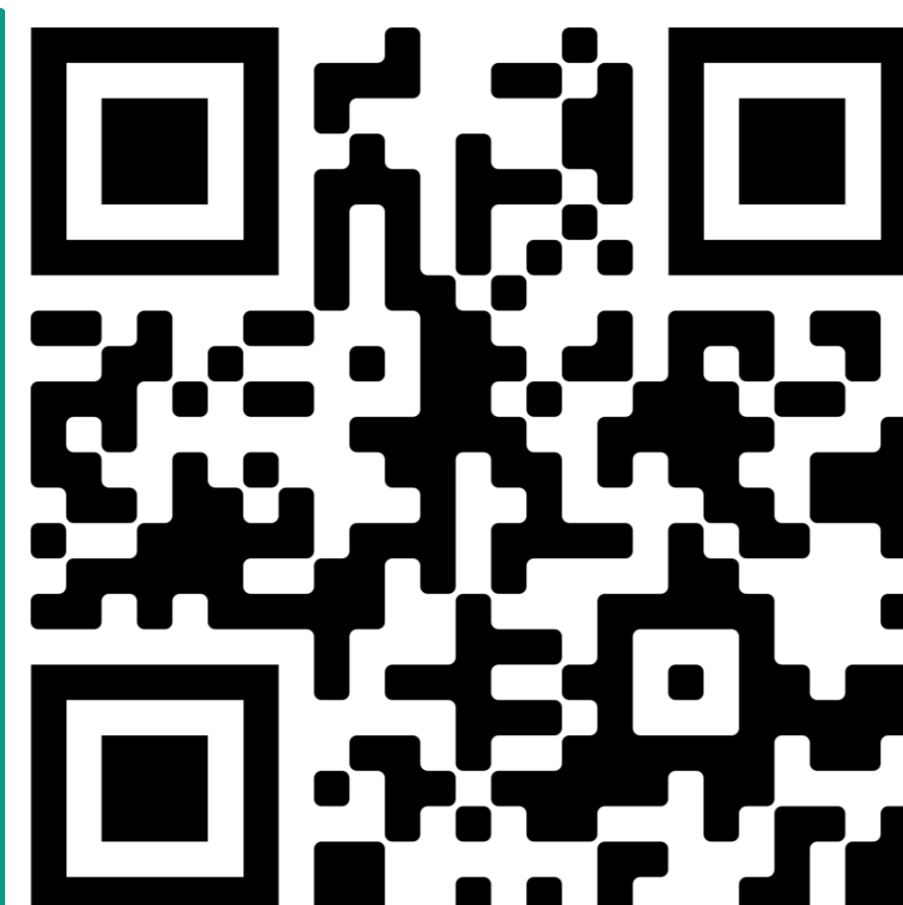


5. CONCLUSIONS

Although **less urbanised** streams were predicted to suffer greater losses under climate change, they still maintained **higher biological quality** than more impacted sites.

Healthier streams are more resilient to the effects of climate change

Conserving and restoring urban streams is essential to building **sustainable**, climate-resilient **cities** and preserving freshwater **biodiversity**.



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