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# **Assessment of Riparian Ecosystems for Sustainable Management in the Face of Climate Change: A Practical and Interdisciplinary Approach**

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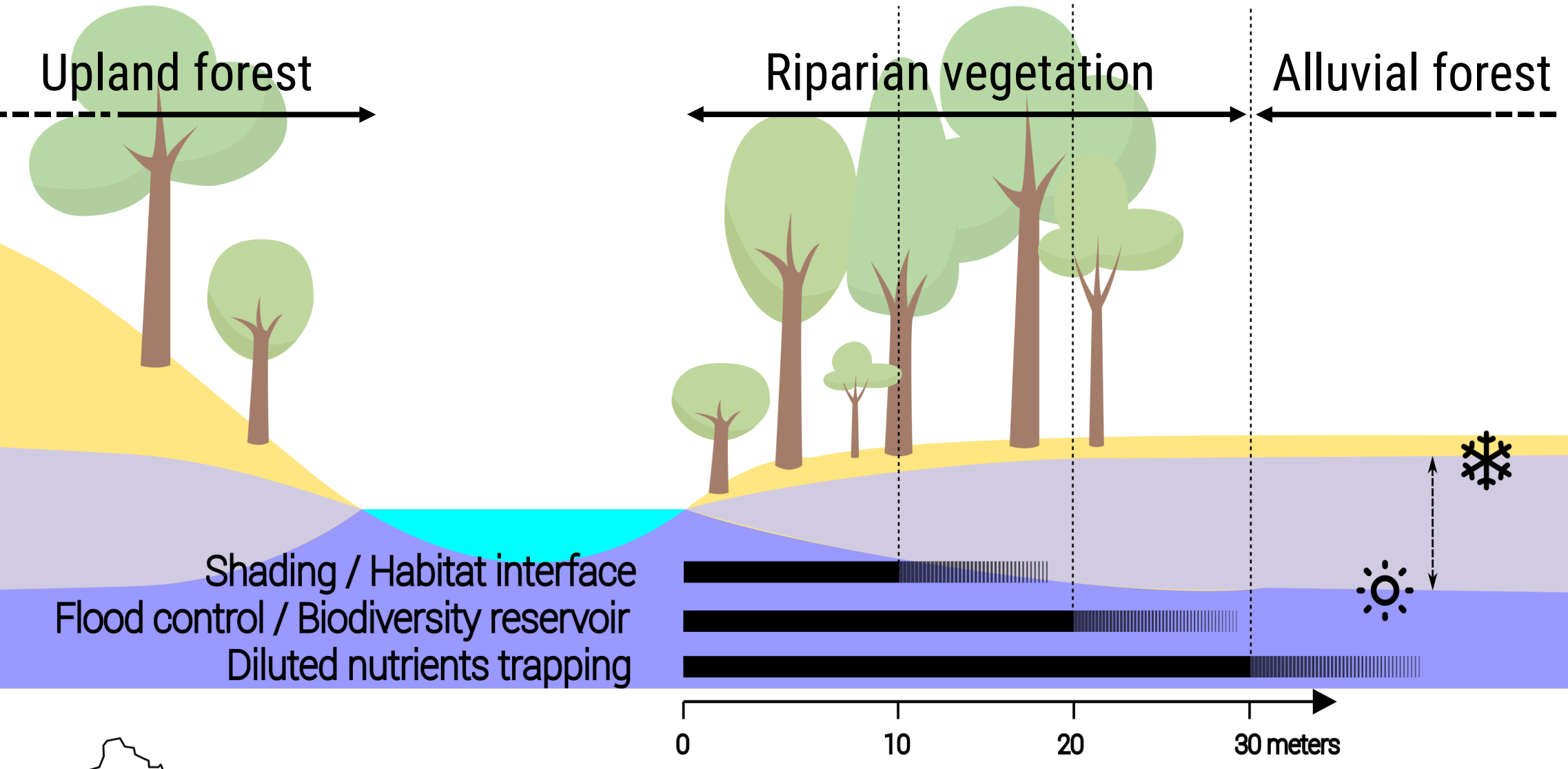
# Interdisciplinary multiscale nested framework for riparian zones: a decision-making tool

Study case from the SAGE Loire en Rhône-Alpes

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**Riparian zones**, defined as the vegetation between the river channel and upland forest (or up to 30 m), are key components of hydrosystems, providing **essential ecosystem services**. Increasingly threatened by global change, they remain poorly characterized and unevenly managed. To preserve these services, riparian zones are **high-priority targets** for short- and medium-term restoration. This study integrates specific objectives across three hierarchical spatial scales.



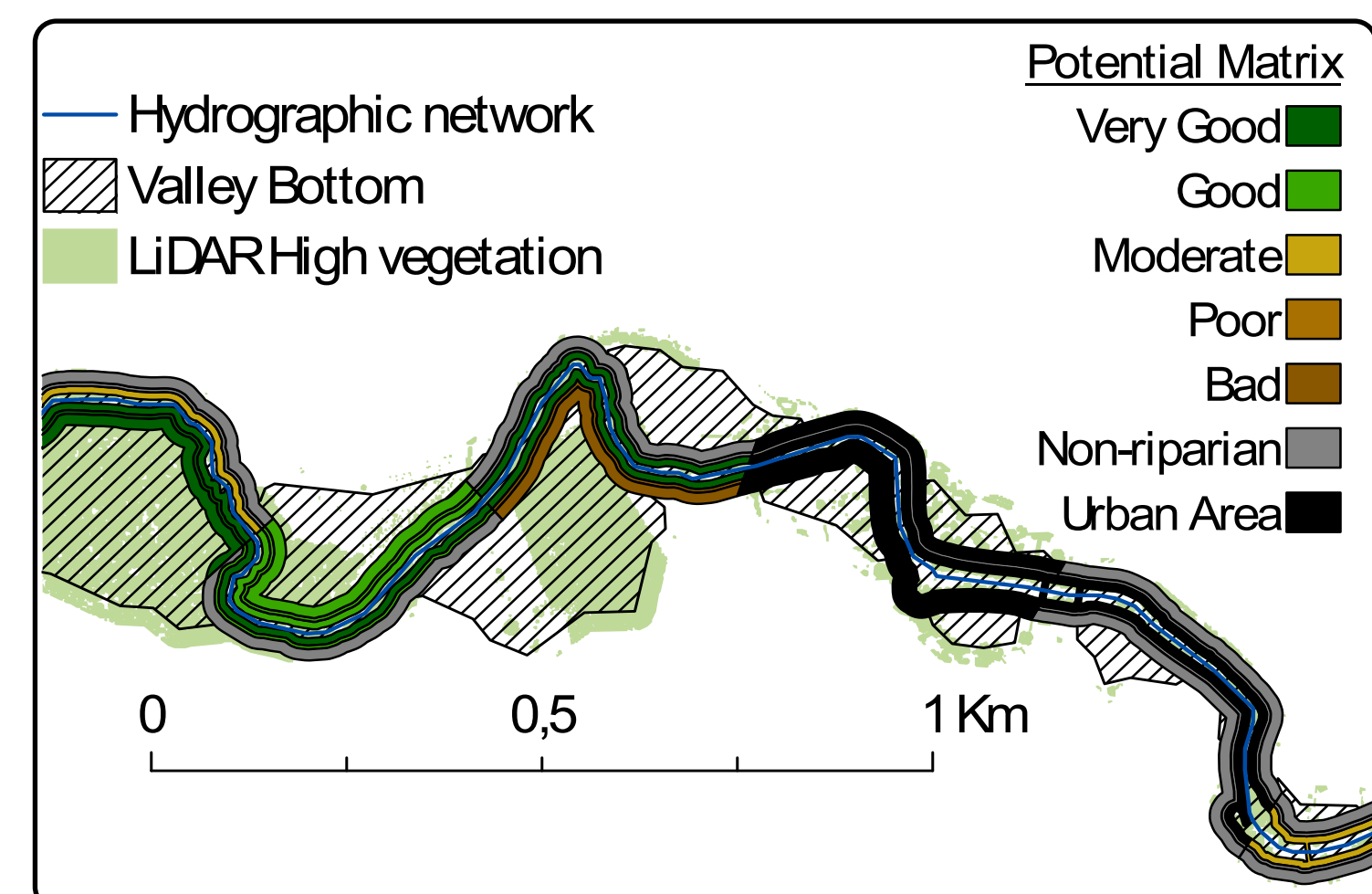
From developing catchment scale riparian vegetation characterization to propose a prioritization map.

To sub-catchment scale integration of detailed vegetation data improving hydrological modeling.

To functional assessment of riparian trees supporting reach scale application.

## Riparian pre-evaluation matrix – catchment scale

Valley bottoms highlight potential areas for riparian vegetation, based on classified LiDAR data. A matrix-based approach retains the most degrading factor over 500-meter stream reaches and is structured using index-based buffer zones (0–10 m, 10–15 m, 15–30 m).



### Results

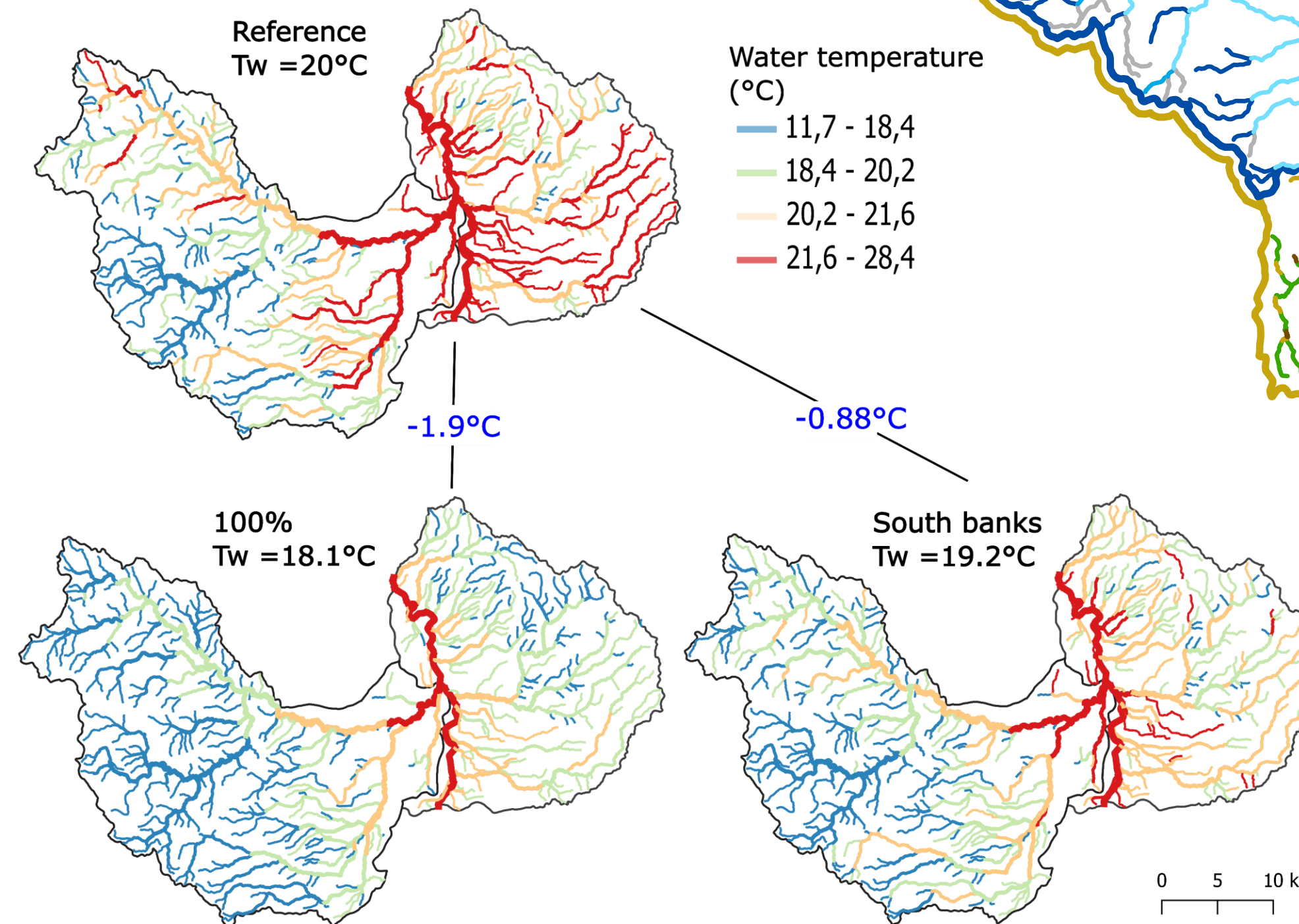
- The matrix identified **hotspots** of potential degradation, especially in agricultural and urban interfaces.
- The aggregated result over lines shows potential areas **suited for restoration**.
- Vegetation density** extrapolated from LiDAR but **not integrated** in the matrix due to imprecisions between units (hedges/corridors vs dense forest).

## Shading function of riparian vegetation – sub-catchment scale

Extraction of height and density parameters using Canopy Height Model (CHM), validated with field measurements. Three scenarios tested (scorching day): 0% vegetation, 100% coverage, and 100% coverage on south banks (realistic scenario).

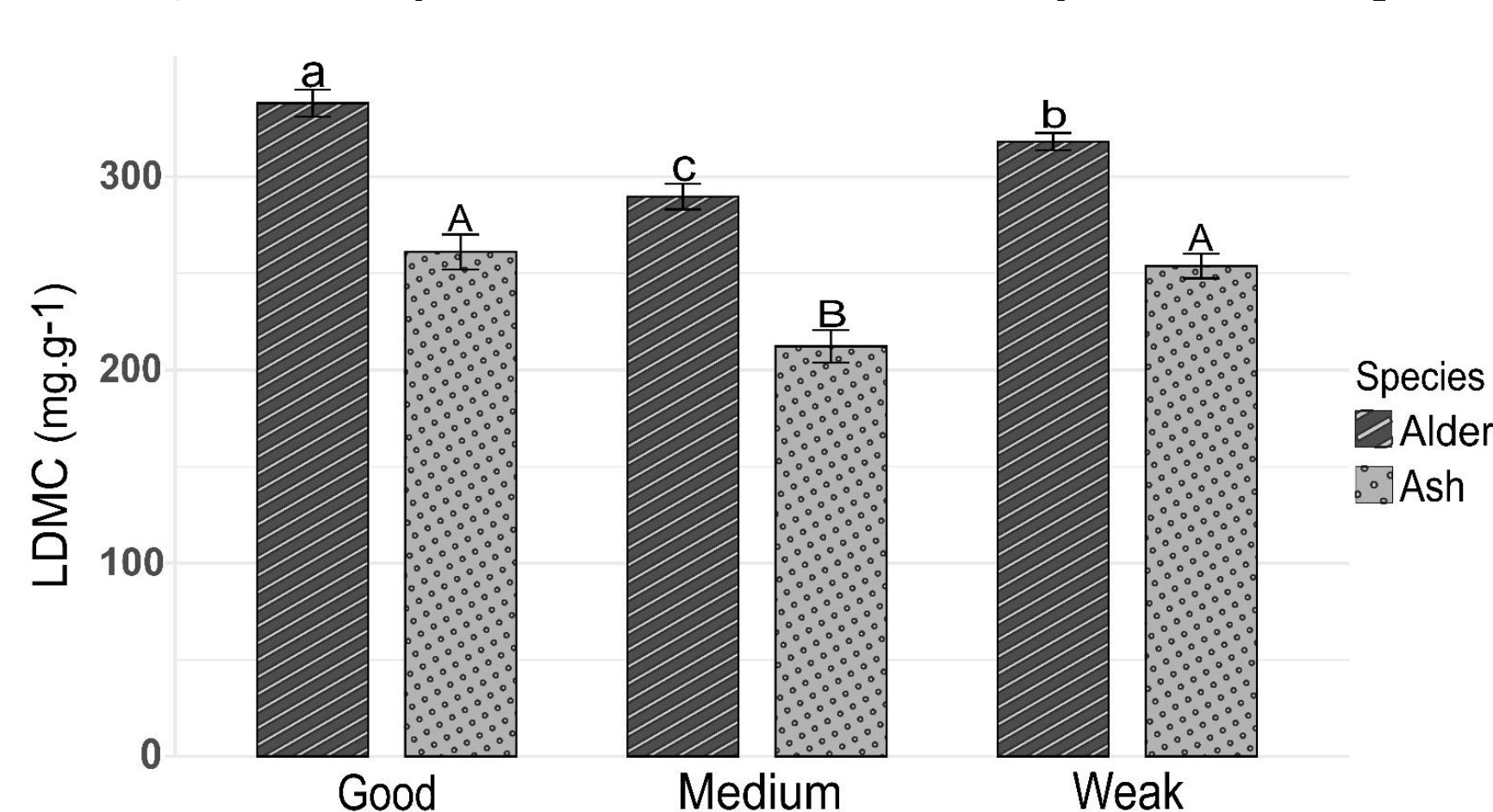
### Results

- Fine integration of **riparian vegetation improves T-NET** and provides an **operational tool** to estimate vegetation height and density.
- Short discontinuities** (~160 m) can induce **significant** local temperature.
- Realistic **southern bank** vegetation scenario **effectively lowers** water temperature.



## Functional assessment of riparian vegetation – reach scale

Focus on LDMC per IBCR classes for both species for may 2025

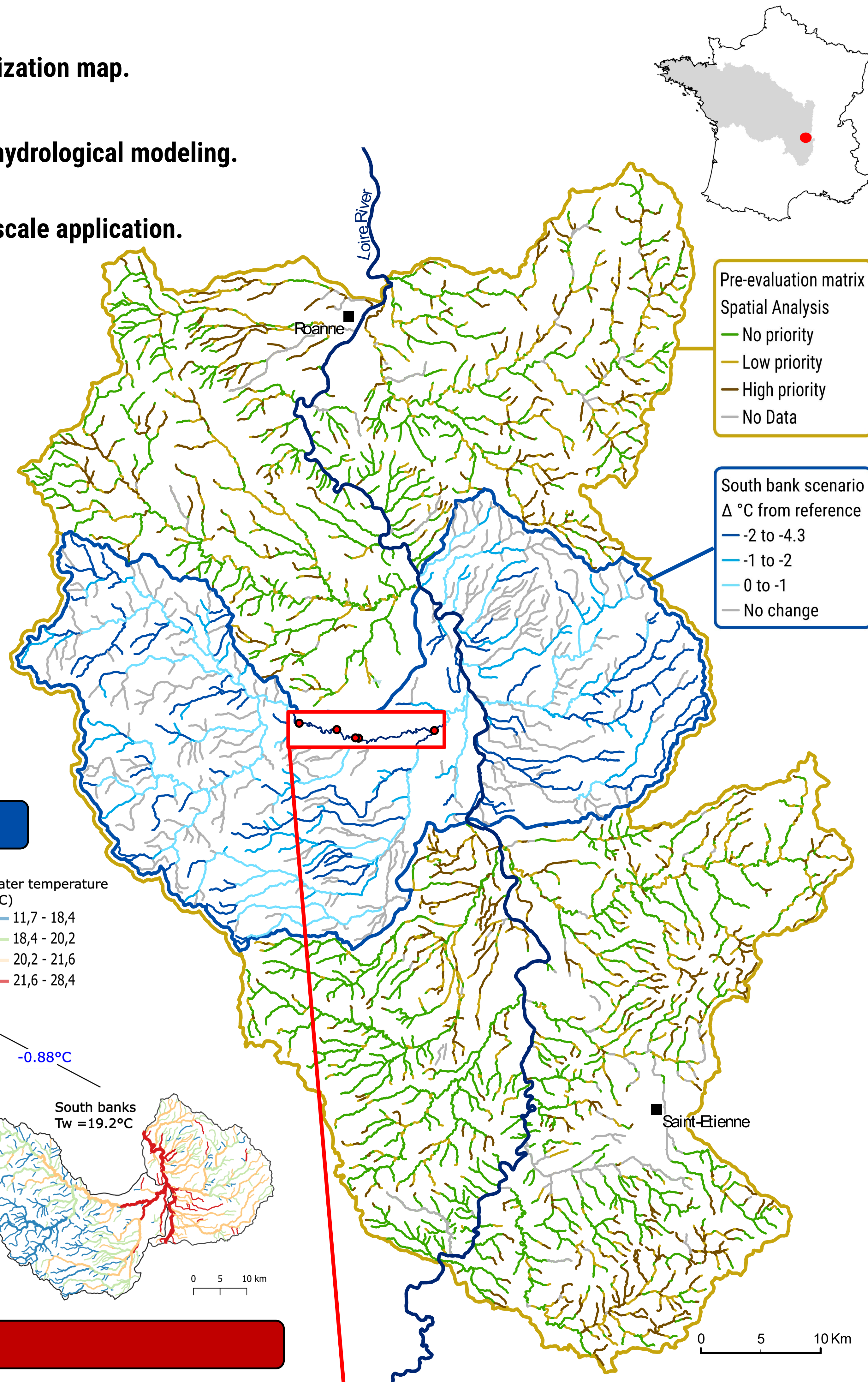


Assessment tools include the Index of Riparian Biodiversity and Connectivity (IBCR – 500 m/10 m), riparian functionality (RipaScan – 150 m/15 m) and land cover analysis.

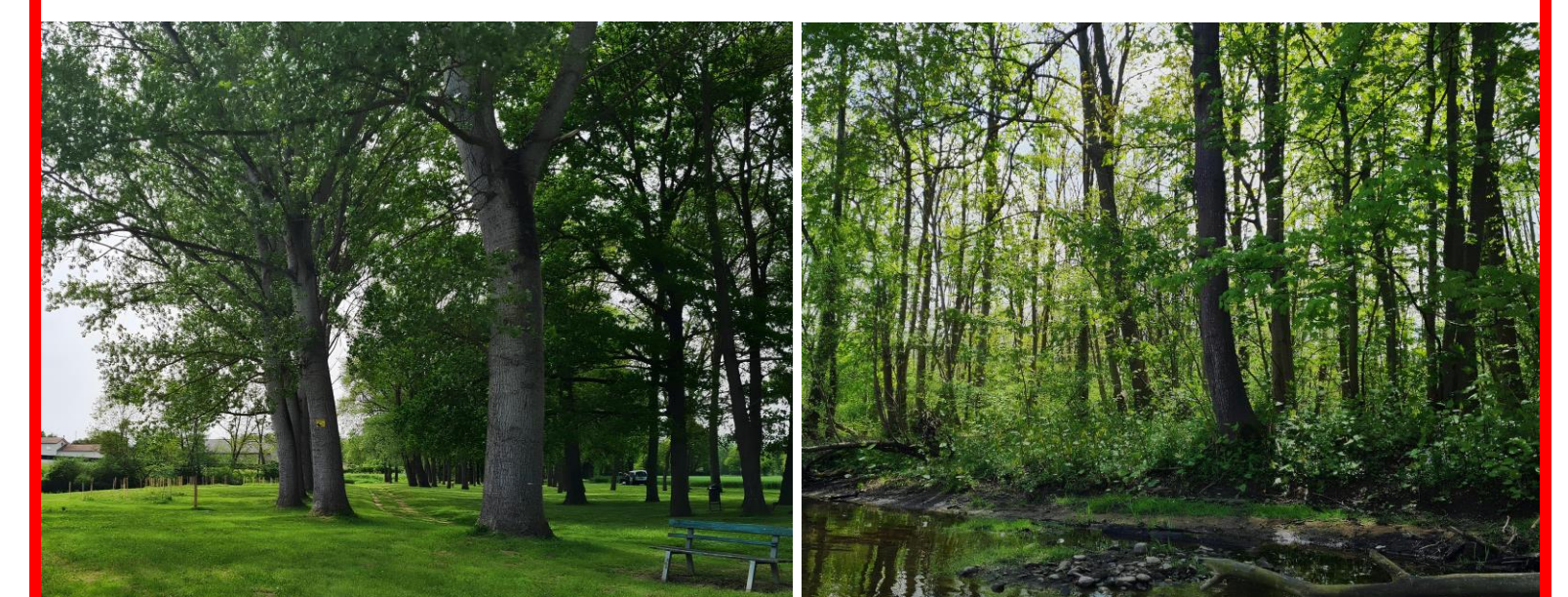
Functional traits, such as Leaf Dry Matter Content (LDMC), were measured on 10 riparian trees per species - Alders and Ashes - and site.

### Results

- Assessment tools **do not represent** tree functioning.
- Assessment tools provide **heterogeneous descriptions**: land cover lacks sufficient detail, and only 2 out of 5 IBCR status levels align with RipaScan classifications.



Low functionality | High functionality



Same tree functioning

**Interdisciplinary, multiscale, hierarchical approach** to guide riparian restoration:

- Pre-evaluation matrix** (on open data) highlights riparian **vegetation cover gaps**.
- Identify **preferential restoration** actions to **enhance shading**. (e.g., filling vegetation gaps, prioritizing southern banks)
- Assessment tools overlook **tree functioning**, **essential** for restoration outcomes.

Data visualisation:



Bowler *et al.*, 2012, Environmental Evidence  
DOI: 10.1186/2047-2382-1-3  
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DOI: 10.1016/j.jenvman.2017.02.034  
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DOI:10.1093/biosci/biaa041

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\* All team members contributed to the development and design of the scientific poster

⚠ Data gaps hinder coordination | 📄 Sociological and policy survey | 🔄 Upscaling methods (e.g., thermal infrared)