I.S. RIVERS
INTEGRATIVE SCIENCES
RECHERCHES ET ACTIONS

D7 | Riparian environments. To revegetate or not to revegetate? That's the question

Unlocking **vegetation age** estimation and the identification of **biogeomorphic effects of floods** in a braided river

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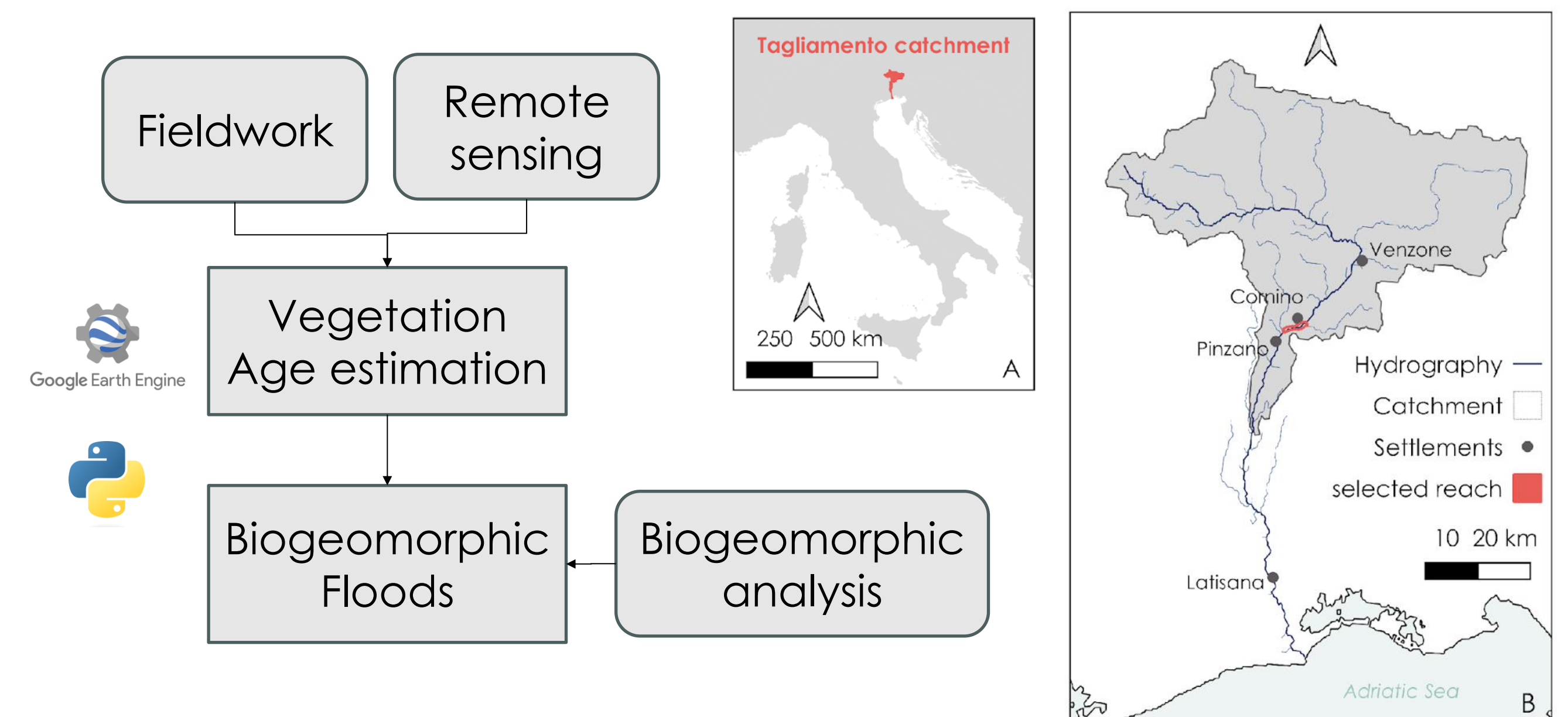3 University of Lyon, EVS UMR 5600-CNRS, Ecole Normale Supérieure de Lyon, France

Abstract

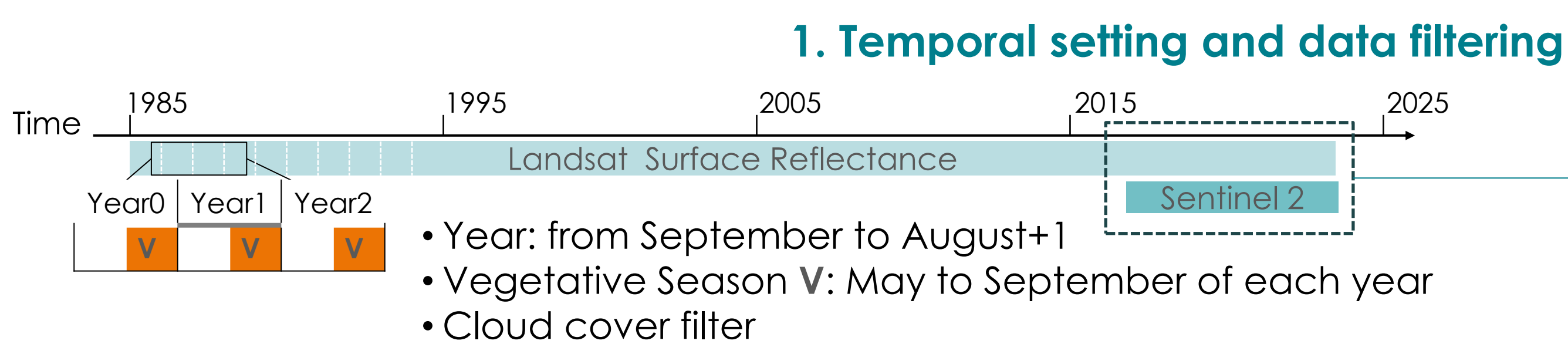This study investigates the integration of remote sensing and cloud computing:
1) To estimate **vegetation age**
2) To gain insights on **biogeomorphic effects of floods** in braided rivers.

**Case study: Braided reach of the Tagliamento River, Italy**

A novel algorithm reconstructs vegetation age dynamics at the pixel scale. The analysis of historical flood data reveals the role of intermediate flood events in vegetation erosion and recruitment.

Vegetation Age Algorithm

1. Temporal setting and data filtering

- Year: from September to August+1
- Vegetative Season **V**: May to September of each year
- Cloud cover filter

2. Riverine Macro-Units in each Vegetative Season and Vegetation changes (Loss/Growth) automatic detection

MacroUnits
- Vegetation
- Sediment
- Water

Veg Loss
Veg Growth
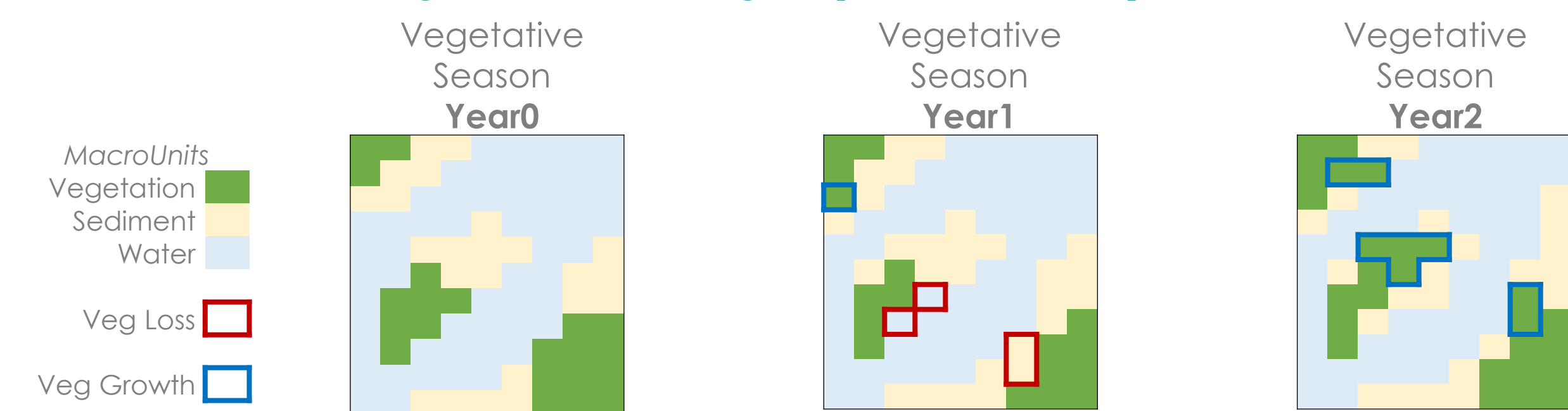
Use of representative images of the vegetative season given by the combination of all available Landsat images. Macro-Units classification is based on multispectral indexes (NDVI, MNDWI) and includes image segmentation and thresholding techniques.

3. Choice of observation time for the computation of Vegetation Age and of Vegetation Turnover

Vegetation Age at Year2 (years)

Vegetation Turnover at Year2 (switches*)
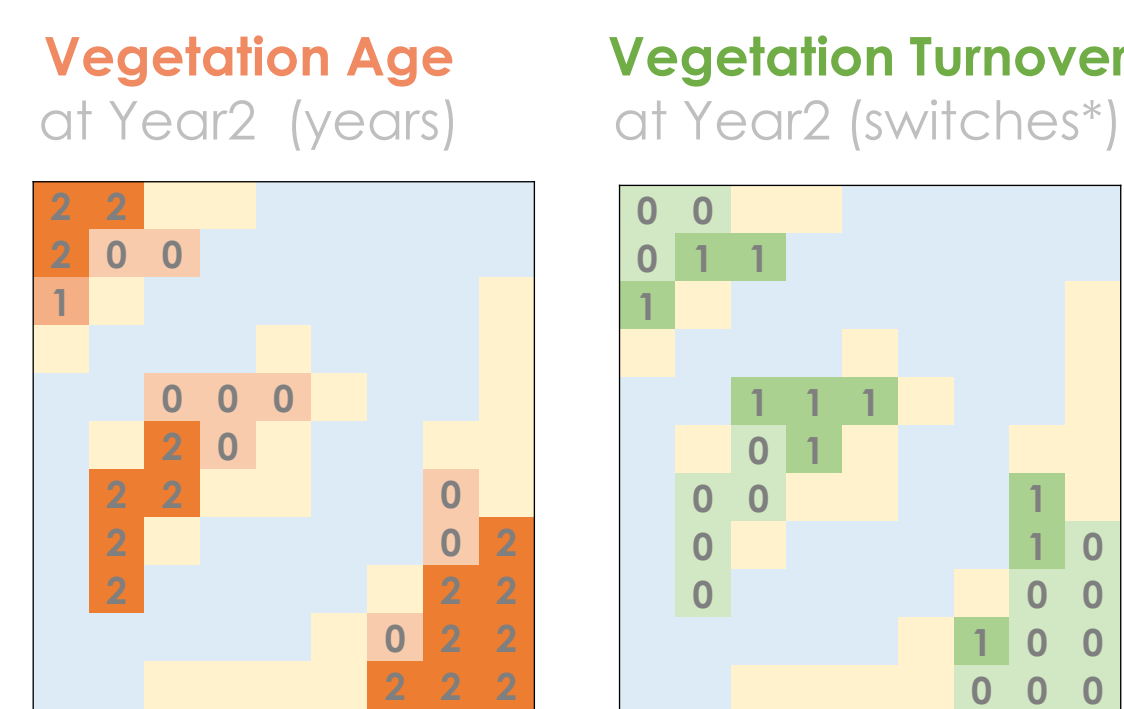
*Vegetation Turnover: Number of time (switches) each pixel faces **Vegetation Growth**

Metrics are selected for specific objectives:
- **Age**: for long temporal trajectories and dynamics
- **Turnover**: for behavior in the context of such multi-threaded river systems
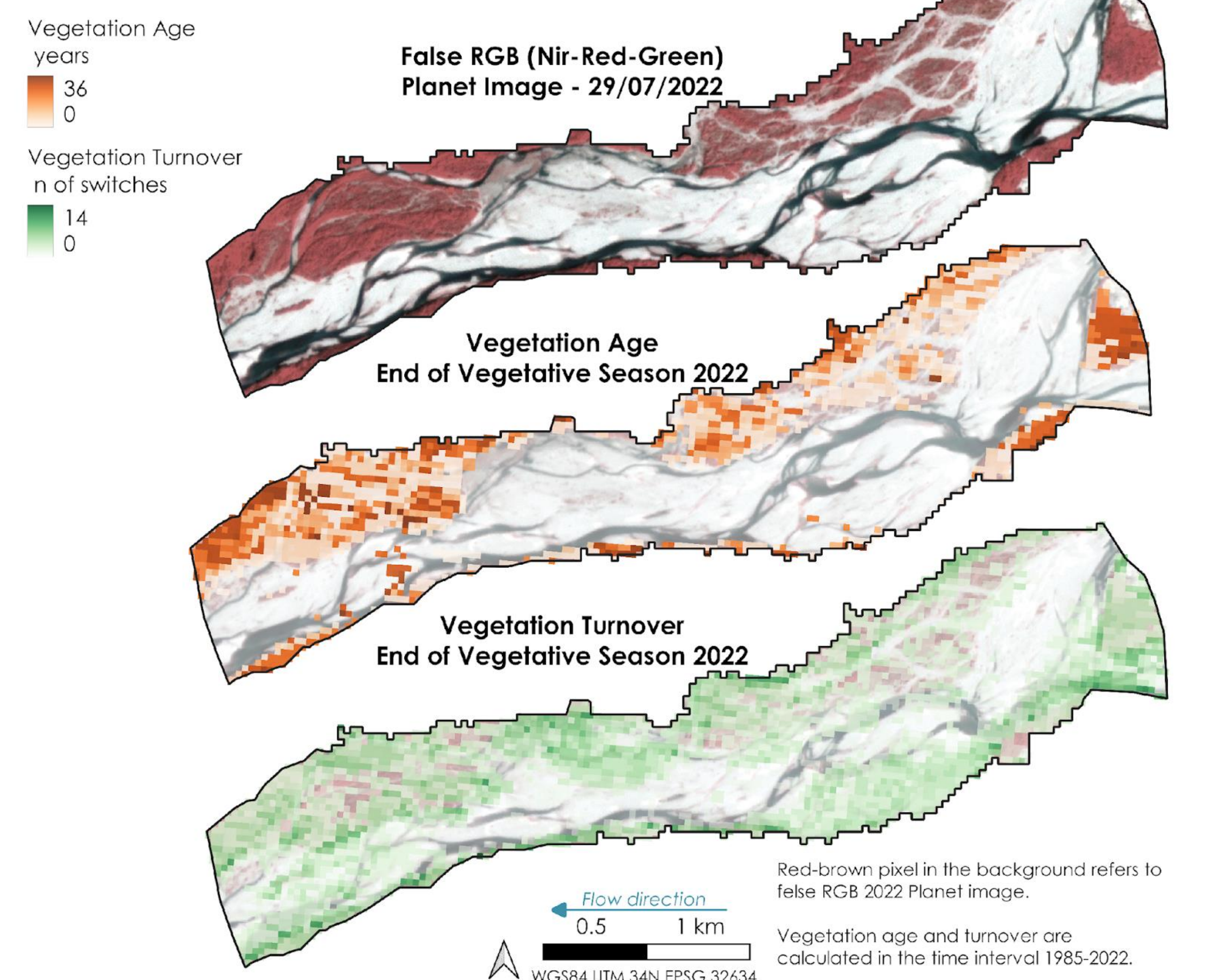
4. Accuracy and data alignment

	Temporal resolution (days)	Veg Age Temporal accuracy (years)	Spatial Resolution (m)	Spatial Accuracy
Landsat	15	7*	30	≈ 20%**
Sentinel 2	5	3*	10	≈ 20%***

* Fieldwork and dendrochronology
** Accuracy assessment with Planet images
***(Bozzolan et al., 2023)

→ Spatial resampling
→ Temporal overlap analysis (2017-2024): Landsat and Sentinel 2 temporal accuracies alignment after 2017
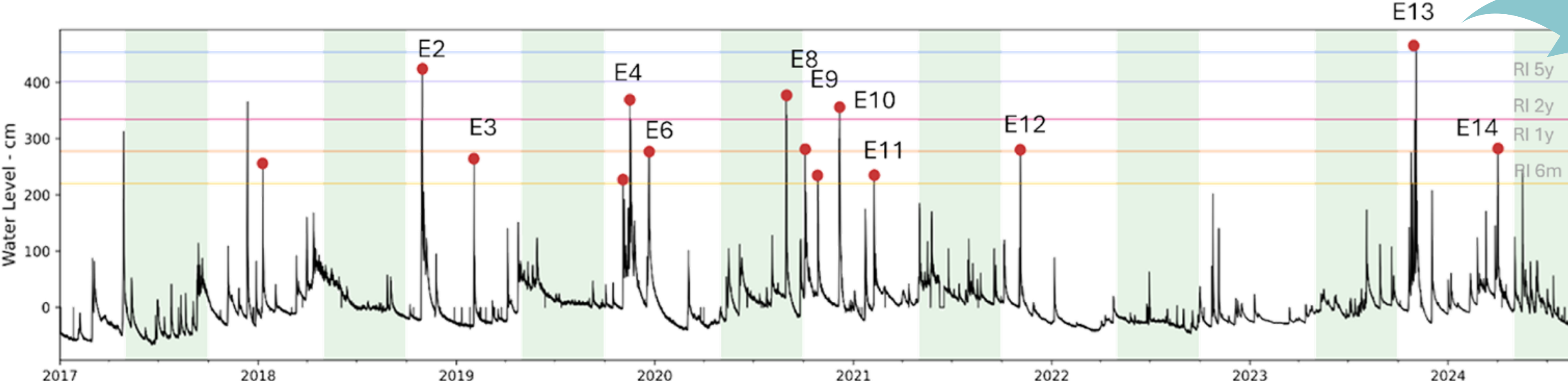
5. Output — Vegetation Age: Tagliamento (IT)

Vegetation Age years — 36 / 0

Vegetation Turnover n of switches — 14 / 0

False RGB (Nir-Red-Green) Planet Image - 29/07/2022

Vegetation Age End of Vegetative Season 2022

Vegetation Turnover End of Vegetative Season 2022

Flow direction — 0.5   1 km

WGS84 UTM 34N EPSG 32634

Red-brown pixel in the background refers to false RGB 2022 Planet image.

Vegetation age and turnover are calculated in the time interval 1985-2022.

Biogeomorphic effects of floods

2019-2024
● flood events with a recurrence interval (RI) ≥ 6 months
vegetative season

Per each event
Duration
Magnitude
Peak value
Days since the last event (WoO)

Eroded vegetation (E) age
Reference vegetation (R) age
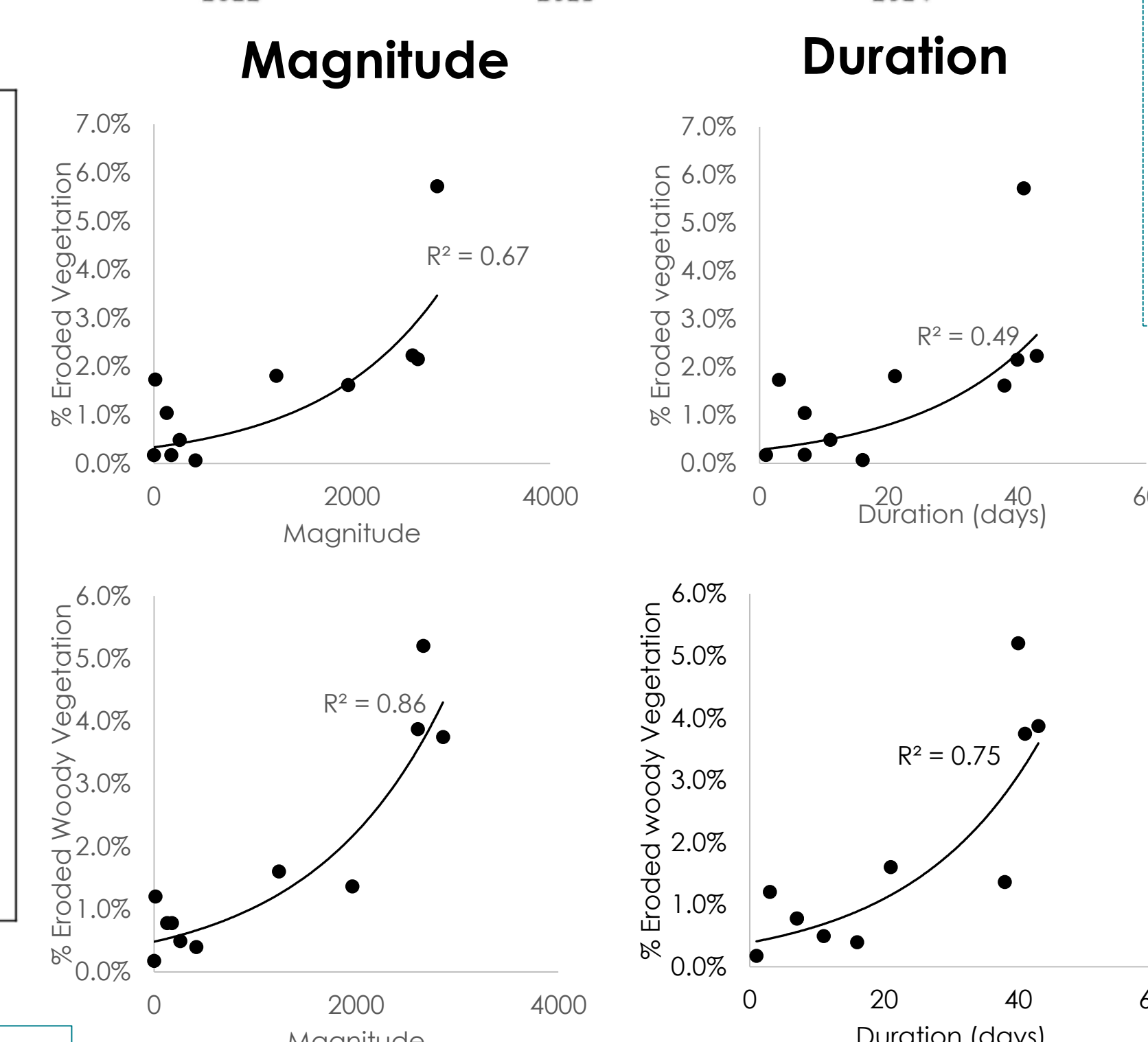E/R vegetation extent (%)
E/R young(<7) and woody (>7) vegetation

Tagliamento water level – Venzone gauging station

E13

Eroded vs. Reference Vegetation Age distribution for each analysed flood event

Eroded Vegetation Flood Magnitude — Low / High
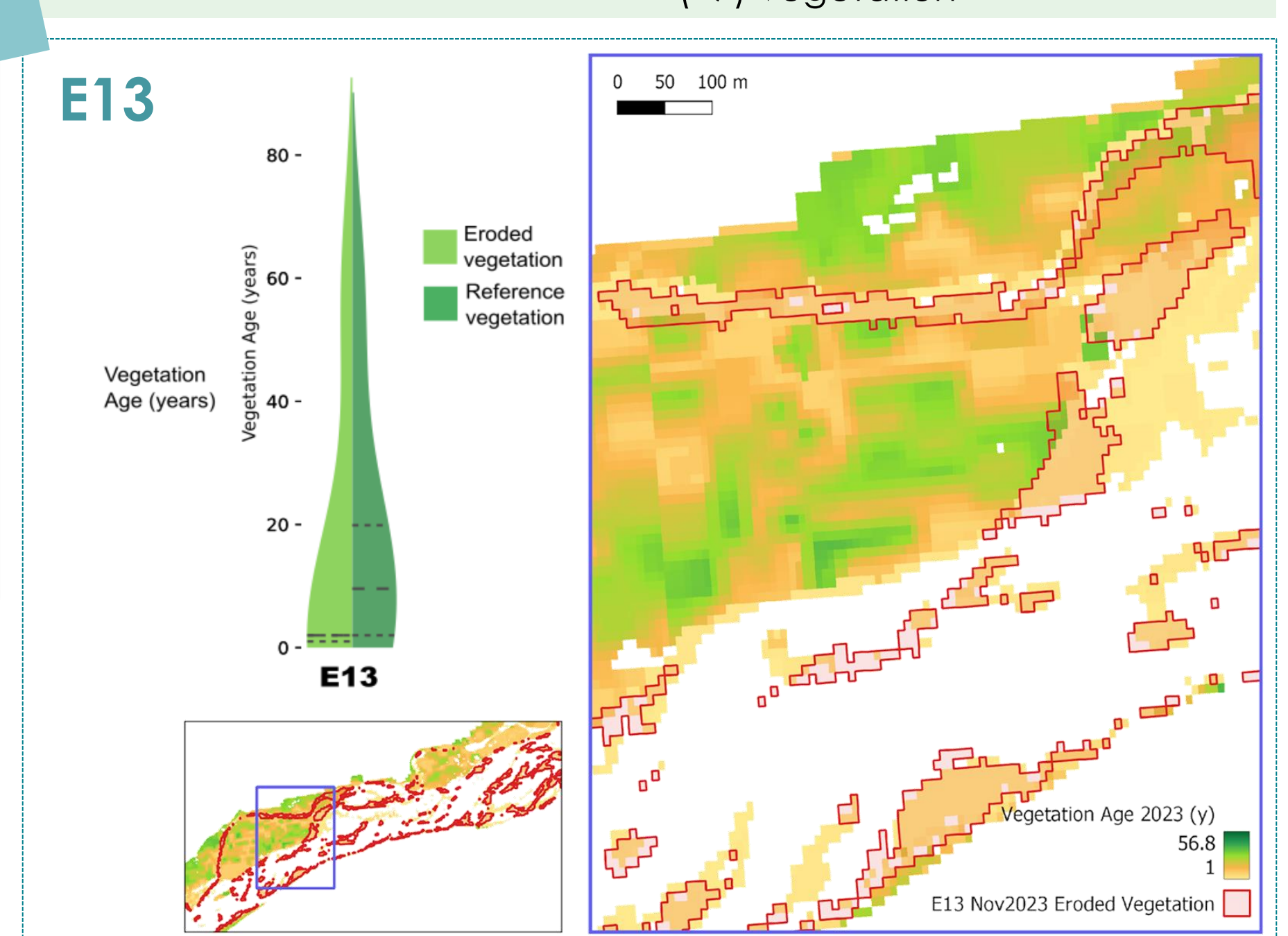Reference Vegetation Vegetation WoO — Low / High
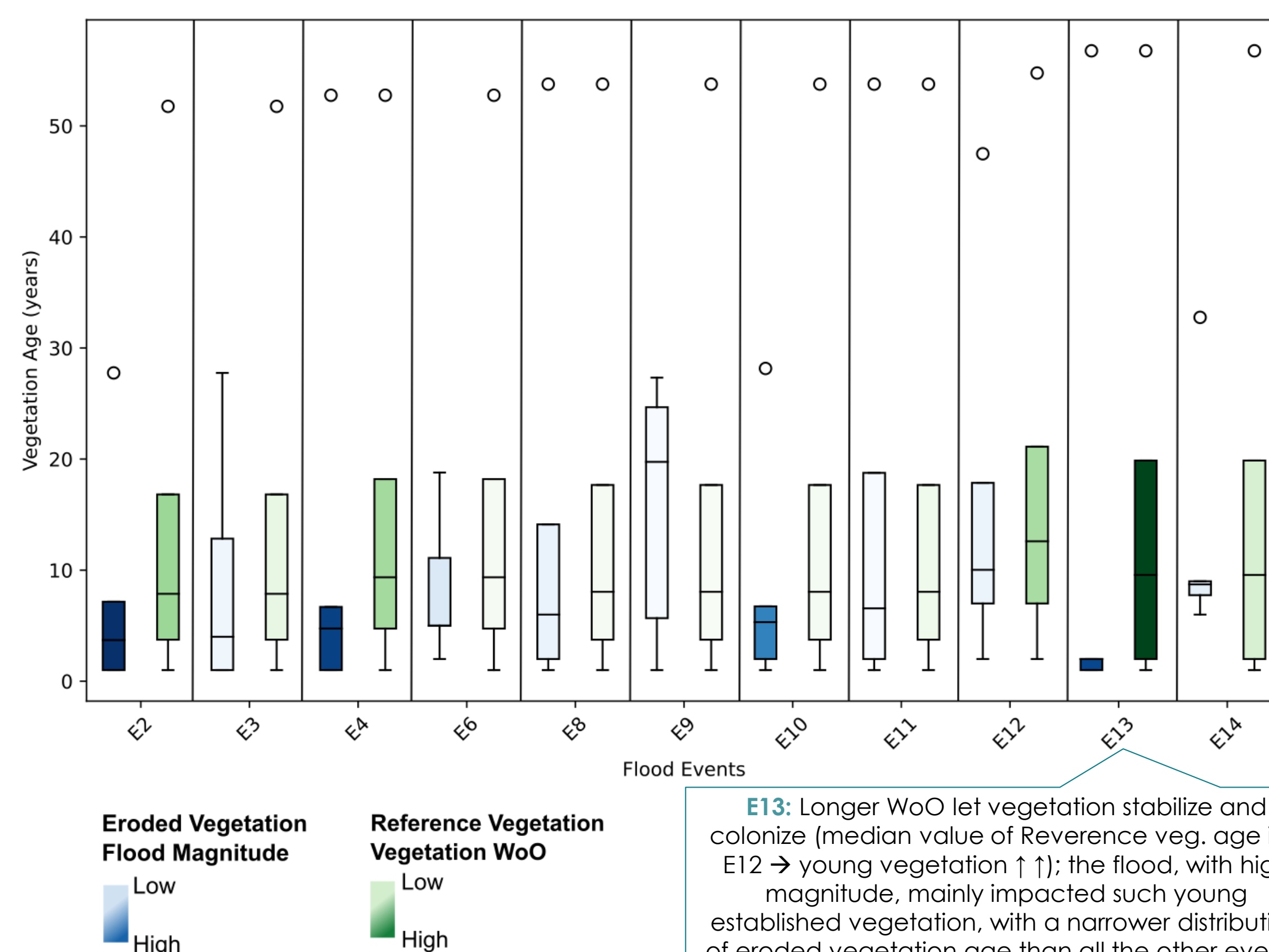
E13: Longer WoO let vegetation stabilize and colonize (median value of Reverence veg. age is < E12 → young vegetation ↑ ↑); the flood, with high magnitude, mainly impacted such young established vegetation, with a narrower distribution of eroded vegetation age than all the other events.

Magnitude

R² = 0.67
R² = 0.86

Duration

R² = 0.49
R² = 0.75

- **Magnitude** ↑ →% of Eroded vegetation ↑ (R² = 0.67 , R² = 0.85 for woody veg.);

- **Duration** plays a role (R²=0.75) in **the erosion of woody vegetation** more than the young phase;

- **2022-2023 drought** → vegetation stabilised and got old, with **less erosion-colonisation dynamics**; after that, in 2024, the relative distribution of eroded vegetation age changed;

→ Role of intermediate events (RI ≥ 6m) to renovate vegetation composition in braided morphology.

SCAN ME for abstract and references