

Mapping potential high nitrogen leaching zones using TETIS hydrological model

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1. INTRODUCTION

Motivation: Improve the sustainability of citrus production by localizing and quantifying **nitrogen leaching hotspots**

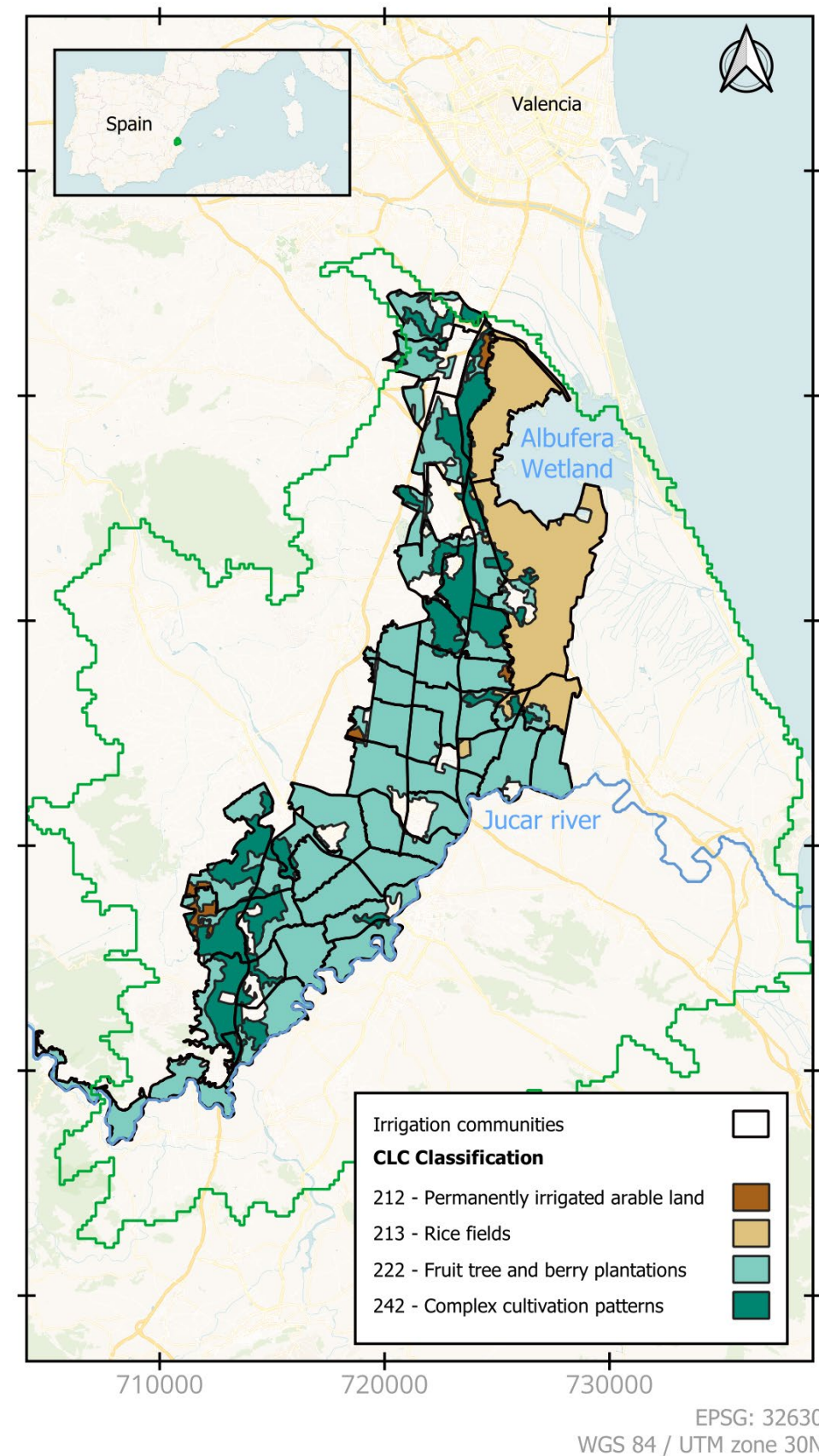
❖ This study uses a simplified representative case, assuming that all crops in the **irrigation communities** are **citrus orchards** [1]

❖ The entire irrigated area is represented by two irrigation types: **drip and flood** [1]

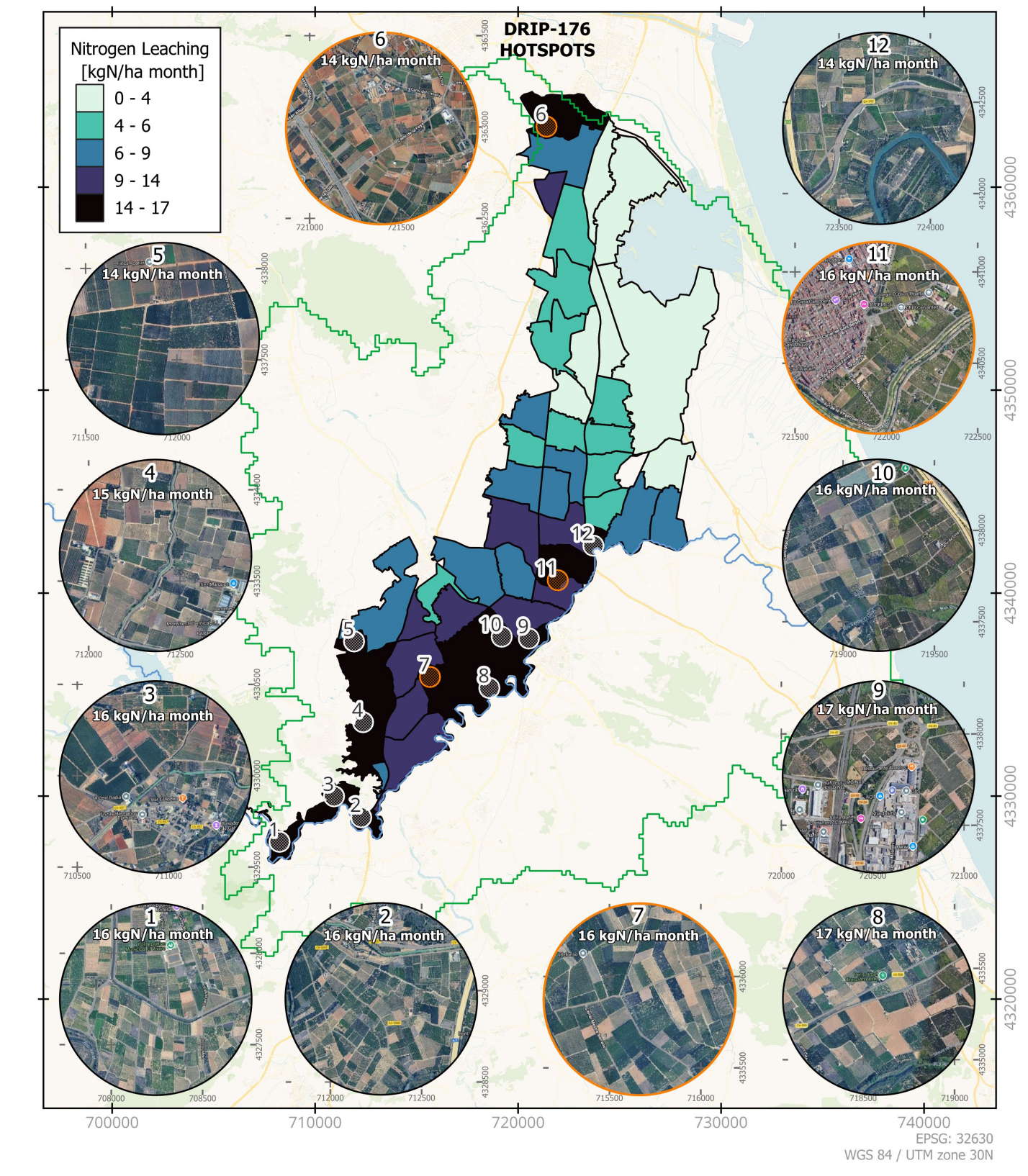
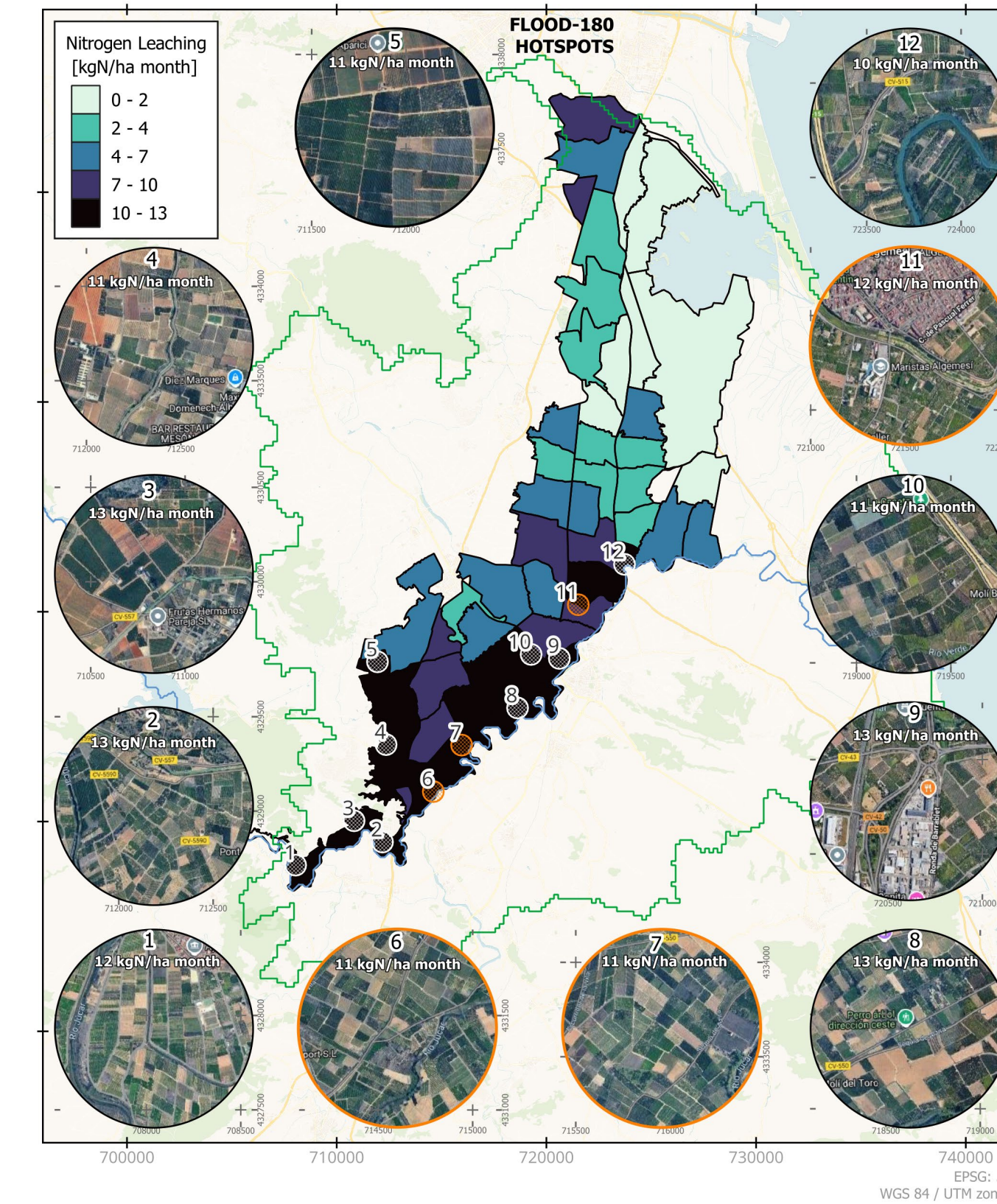
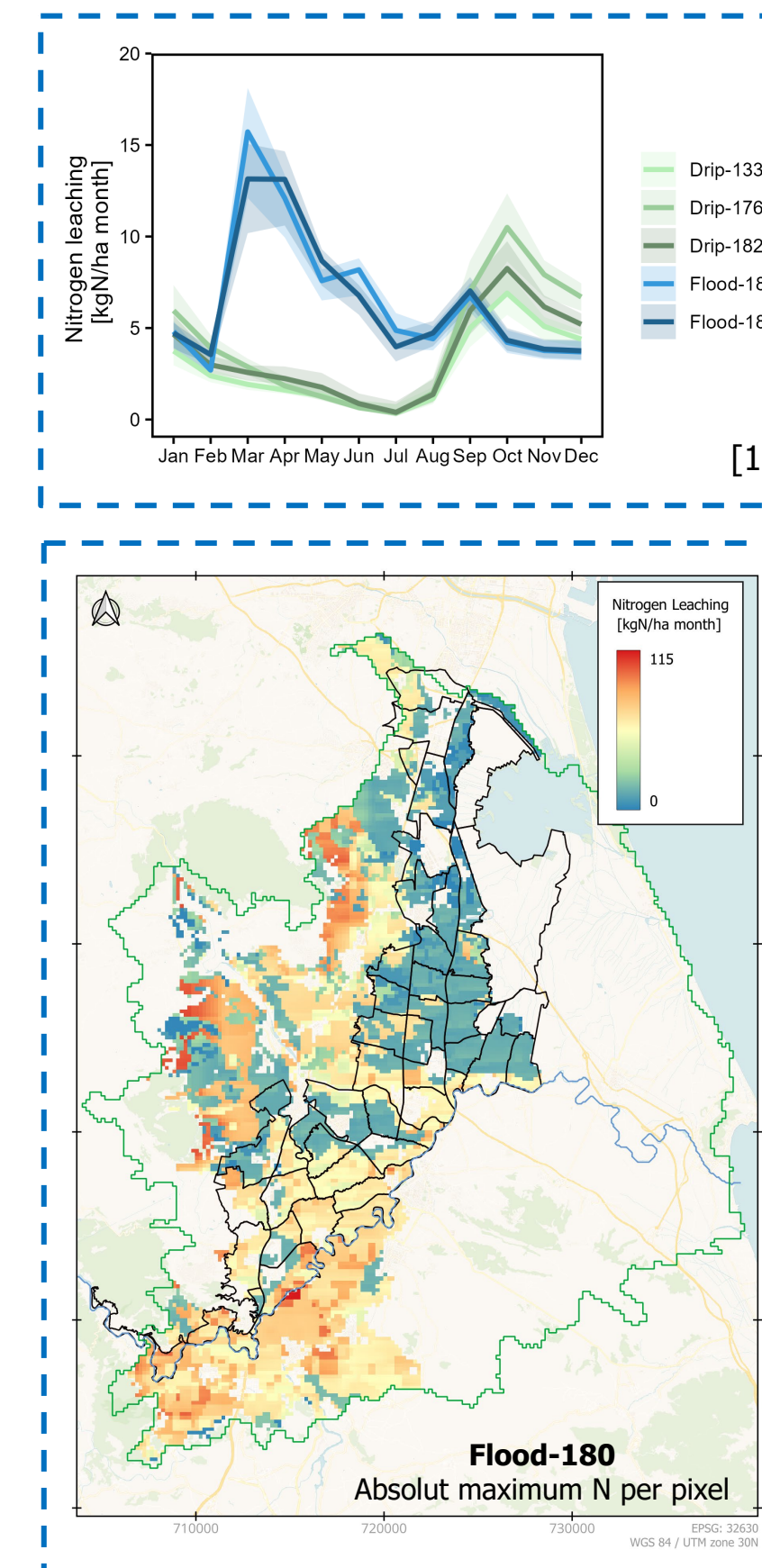
❖ Five **scenarios** were defined by combining irrigation type and nitrogen application rates [1]

❖ The identified nitrogen leaching hotspots will serve as potential locations for **sensor-based monitoring**

2. STUDY AREA



4. RESULTS



3. METHODOLOGY

TETIS ECOHYDROLOGICAL MODEL

Hydrological sub-model [2]

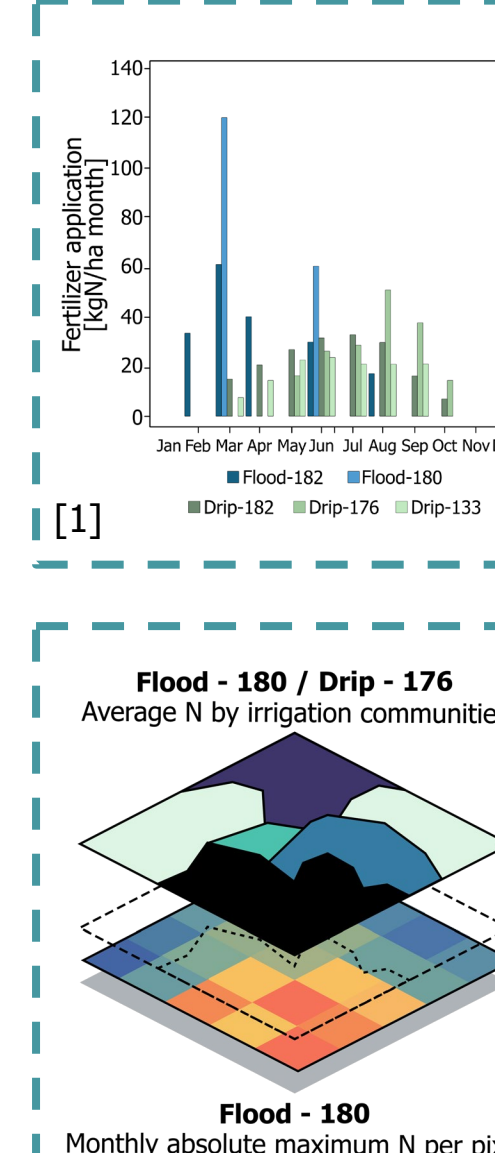
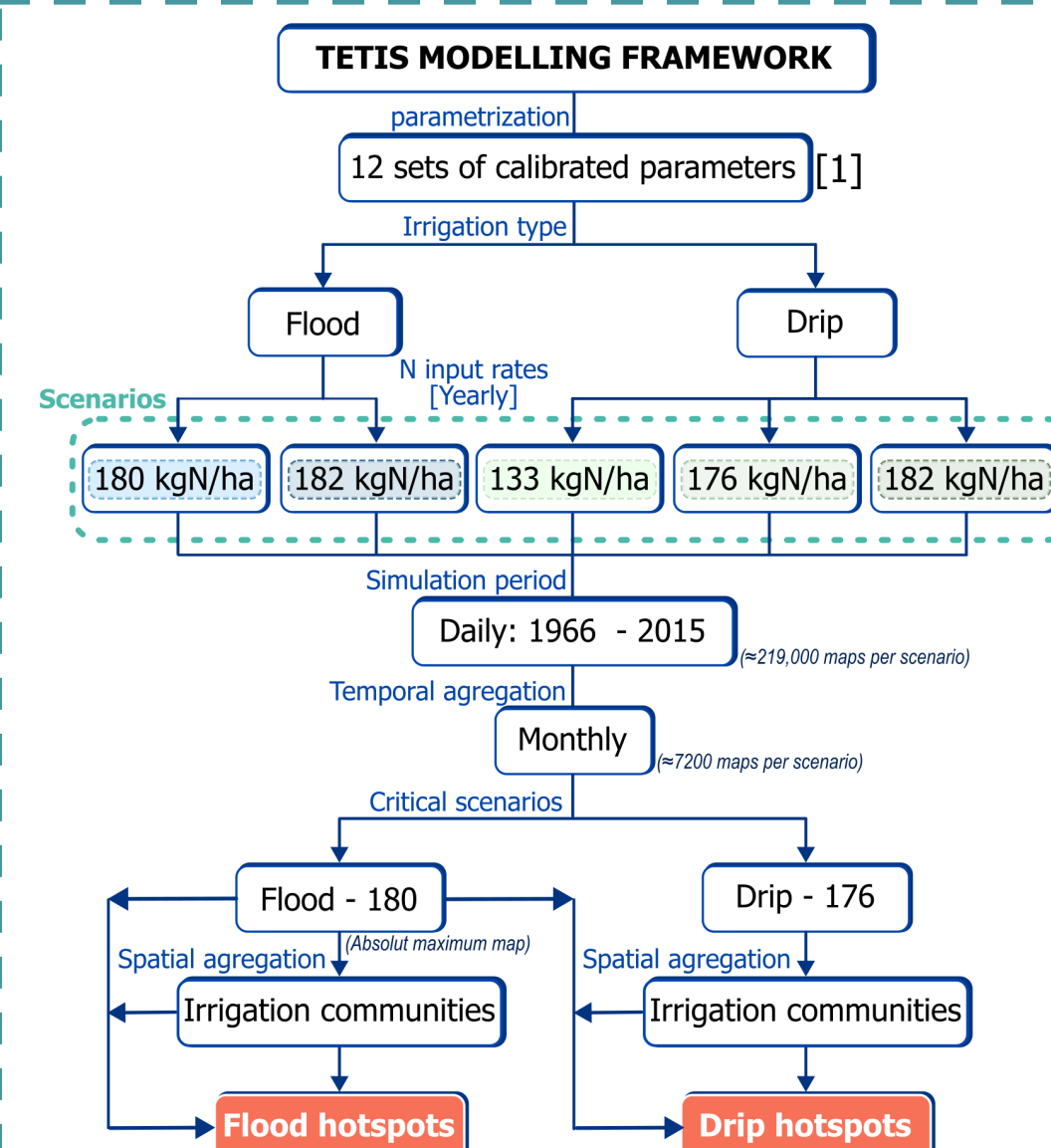
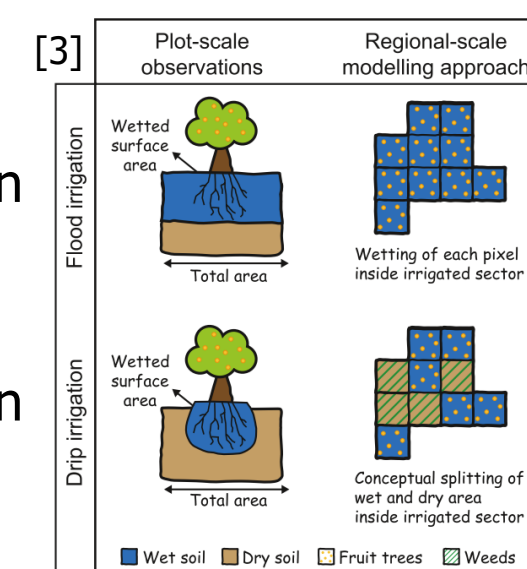
- ❖ Conceptual (tank structure)
- ❖ Physically based parameters
- ❖ Fully distributed in space
- ❖ Spatial scale of 200m
- ❖ Daily temporal resolution

Nitrogen sub-model [3]

- ❖ N inputs and biogeochemical processes to estimate leaching
- ❖ Water flow, crop uptake, and soil memory drive the outcome

Irrigation sub-model

- ❖ Flood as uniform application
- ❖ Drip as localized application



5. CONCLUSIONS

- ❖ **Flood-180 and Drip-176 are the critical scenarios.** Leaching increases with fertilizer rate under flood irrigation, while drip leaching peaks are in fall during intense precipitation events.
- ❖ **Peak values are comparable.** The absolute monthly maximum leaching reaches **17 kg N ha⁻¹ month⁻¹** under drip and **13 kg N ha⁻¹ month⁻¹** under flood, across the irrigation communities.
- ❖ **Differences are limited.** Hotspots show only minor contrasts between irrigation types.
- ❖ **The maps support sensor placement.** They help define priority zones for monitoring, groundwater protection, and sensor deployment.

6. REFERENCES

[1] Pool et al. 2022. Impact of a transformation from flood to drip irrigation on groundwater recharge and nitrogen leaching under variable climatic conditions. Science of The Total Environment, 825. doi: 10.1016/j.scitotenv.2022.153805. [2] Francés, F., Vélez, J. I., Vélez, J. J. 2007. Split-parameter structure for the automatic calibration of distributed hydrological models. Journal of Hydrology, 332(1-2), 226-240. doi:10.1016/j.jhydrol.2006.06.032. [3] Pool et al. 2021. Hydrological modeling of the effect of the transition from flood to drip irrigation on groundwater recharge using multi-objective calibration. Water Resources Research, 57, https://doi.org/10.1029/2021WR029677 [4] Güiza-Villa et al. 2026. Impact of satellite derived irrigation on hydrological modelling: TETIS model water balance and performance analysis for the Po River basin. Ingeniería del agua, 30(1), 31-47. https://doi.org/10.4995/ia.24708.

7. ACKNOWLEDGEMENTS

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