



REGGIO CALABRIA 2025
INTERNATIONAL CONFERENCE

**BIOSYSTEMS ENGINEERING
FOR THE GREEN TRANSITION**

BOOK OF ABSTRACT

REGGIO CALABRIA, ITALY
SEPTEMBER 21-24, 2025



ASSOCIAZIONE ITALIANA DI
INGEGNERIA AGRARIA



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Groundwater Recharge in the Padana Plain: Irrigation as a Driving Force

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Abstract. Historically, the Padan Plain has been characterised by extensive agricultural expansion and intensification of production, relying heavily on intensive irrigation supported by widespread traditional surface irrigation systems. These systems draw water mainly from rivers and distribute it through an extensive network of canals. In addition to increasing and securing crop yields, they contribute to groundwater recharge, which mitigates river droughts and seasonal fluctuations in surface water availability. Accurate estimation of irrigation-related groundwater recharge is therefore crucial but remains under-studied due to the complex hydrology of the region and lack of data.

Within the framework of the MidAS-Po project, a methodological approach was developed and applied for estimating the groundwater recharge. On the one hand, the agro-hydrological model IdrAgra-Po was implemented to simulate daily soil water balance, obtaining the recharge from agricultural fields and open surfaces; the model incorporates inputs like agro-meteorological data, soil hydro-pedological properties, land use and water table depth. On the other hand, groundwater recharge due to seepage from the extensive networks of irrigation canals was estimated using a simplified methodology based on data on irrigation networks and seasonal water volumes from the national agricultural information system SIGRIAN.

Preliminary estimate of groundwater recharge associated with irrigation practices highlights the important role of irrigation on aquifer replenishment in the Padana Plain. However, further efforts are needed, involving stakeholders, to enhance the quality of input data, particularly regarding local irrigation methods and practices, land use, and the volumes of water diverted from rivers or extracted from aquifers.

Keywords: Irrigation systems, Groundwater recharge, Agricultural water balance, Agro-hydrological model, Padan Plain