Lower Danube

CASE STUDY 6

Cross-sectoral multi-hazard risk

CrossEU

Lower Danube

Context

The Lower Danube region in Romania is defined by an extensive floodplain that spans approximately 6,000 km², housing crucial ecosystems, agriculture, energy infrastructure, and human settlements. Historic discharge data and future projections (RCP4.5 and RCP8.5 scenarios) jointly indicate a trend toward greater hydrological volatility: more frequent & intense floods on one hand, and longer & harsher droughts on the other.

The highest risks concentrate in the Danube floodplain corridor, where both flood hazard and social vulnerability peak. Poor, rural communities behind aging dikes face the burden of floods, and the same communities suffer most in droughts due to their reliance on rain-fed agriculture. Without intervention, climate change could widen this vulnerability gap, hitting hardest those least able to cope.

Case study area - Lower Danube (land cover)

Climate Change Hotspots (CCH)

Hotspot 1: Lower Danube

The storyline events – catastrophic floods like that of 2006 and unprecedented droughts like 2022 – are signals of a new normal where extremes are more frequent.

- 2006 Extreme Flood: A prolonged spring flood (March–May 2006) with peak discharge >15,000 m³/s at the upstream Bazias gauge. Water levels at Brăila exceeded safety thresholds for 69 days, straining dikes. The flood affected an estimated 116,000 ha in Romania, including poldered farmland and several villages. Damages were catastrophic (over €340 million) and thousands were displaced.

- 2022 Extreme Drought: An exceptional drought from late spring through summer 2022 resulting in record low Danube levels. By August 2022, the water level at Tulcea (Danube Delta) dropped to only 51 cm, about 6 cm below the minimum level for navigation. This event had profound socio-economic effects, crop failures, water rationing, energy production drops, navigation restrictions. Danube floodplain wetlands disconnected from the main channel, threatening aquatic ecosystems.
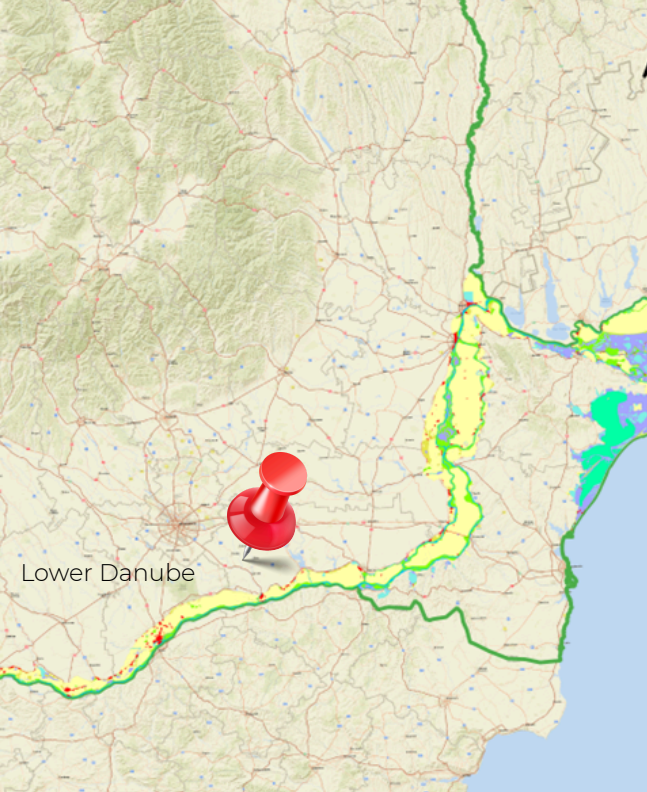
Objectives

The overall objective of this study is to assess the risks posed by shifting climate seasonality and water availability in the Lower Danube region. This includes investigating the socio-ecological impacts of climate extremes, such as droughts and floods, on agriculture, navigation, energy infrastructure, human settlements, and ecosystems.

The specific objectives are to:

- Analyse the trend and the seasonal shifts of high and low-flow hydrological data extremes for historical and mid-century (2030, 2050) and late-century (2100) scenarios;
- Assess sector-specific risk as a function of hazard intensity and the exposure of assets or populations;
- Perform an integrated socio-economic vulnerability analysis.
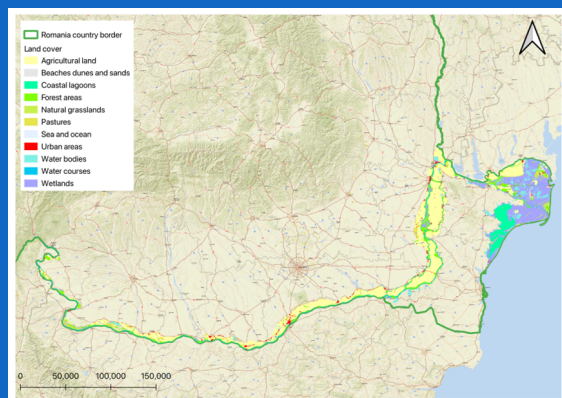
Methods

- **Hydrological data** - Trend & Seasonality statistical analysis

- **Socio-economic analyses** - focusing on exposure and vulnerability - use of derived indicators based on spatial data aggregated at the NUTS3 level, e.g. **Population in flood-prone areas** – Number of residents living within the modelled 100-year floodplain (e.g. 2020, persons). **Area at risk of flooding** – Land area exposed to a 100-year return period flood, as % of total county area (e.g. 2018, %). **Agricultural land in floodplain** – Arable and pasture land located in flood-risk zones (2018, hectares or % of farmland). **Urban areas in floodplain** – Built-up area (towns/ cities) within flood hazard zones (2018, km²). **Infrastructure near rivers** – Length of roads and number of bridges within 100 m of major rivers (2020, km and count). **Critical facilities in flood zone** – Count of key facilities (e.g. hospitals, power plants including 1 nuclear plant at Cernavodă) located in the floodplain (2020, count).

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