



Co-design and co-deployment of nature based solutions for river flooding mitigation in northern Italy river embankments

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Po valley in the Emilia Romagna region, Northern Italy, is threatened by hydro-meteorological hazards, such as river flooding. In the last 50 years this area was interested by an intensive urbanization (with cities that span from the size of a village to metropolitan urban areas such as Bologna) with the realization of infrastructures, e.g. roads and residential settlements near rivers. In addition, the strengthening and expansion of the embankment system led to the development of the areas prone to floods located nearby the rivers. These modifications, in combination with the occurrence of high flood peaks recently experienced in this area have increased the impacts and thus, the attention, on riverine floods. The last event occurred in December 2020, where Panaro river, a tributary of the Po river, broke its banks near Modena causing large flooded area.

Co-design and co-deployment of nature based solutions (NBS) to reduce flooding risk in the Panaro river is one of the objective of the H2020 project OPEn-air laborATORies for Nature baseD solUtions to Manage environmental risks (OPERANDUM). A portion of the Panaro river embankment is one of the Open Air Laboratories (OAL) where special deep rooted plants were implemented to evidence the mitigation of hydro-meteorological risks by NBS.

In this work, a combined approach between Earth Observation (EO) data and multi-scale modelling is shown, to support the co-design process of the NBS. Synthetic Aperture Radar (SAR) and optical EO data were used to identify areas at risk, i.e. the area most likely to be affected by severe flooding events. A thresholding method was applied to the SAR and optical images available during past extreme events to identify size and location of the floods. The remote sensing analysis allowed the definition of specific portions of the Panaro river where NBS can be more effective for flood risk reduction. In a second step, a multi-scale modelling approach, based on the characterisation of deep-rooted plants by laboratory experiments and in-field measurements, is used to determine the response of the identified portions of Panaro river to flooding events and to evaluate the effectiveness of possible NBS.

Remote sensing analysis indicates that the area between Secchia and Panaro rivers, delimited to the north by the town of Bomporto and to the South by the town of Albareto has been most

frequently inundated in the recent extreme events. The integrated analysis leads to the identification of potential sites, along the Panaro river, where NBS could be effective for river flooding risk reduction, contributing to the definition of the priority sites among the ones defined by the stakeholders and engineers.