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A Nature-Based Solution to mitigate the risk of river flooding: a case study in the Open-Air Laboratory Italy

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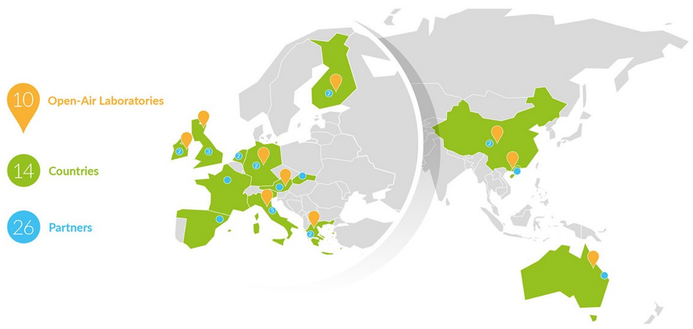
OPERANDUM

OPERANDUM (OPEn-air laboRA-tories for Nature baseD solUtions to Manage hydro-meteorological risks) is a 4.5 year-long project funded by the EU H2020 programme that aims to demonstrate the efficacy of nature-based solutions (NBS) to mitigate the impact of extreme weather.



At the core of the project, there is the set-up of laboratories (Open-Air Laboratories) in several countries selected according to the specific hazard to be investigated.

In the OAL, NBS are co-designed and implemented according to the local needs and tested through continuous monitoring and assessment. Within OPERANDUM several hazards are studied such as river flooding, coastal erosion, shallow landslides, salt intrusion, droughts.

The Open-Air Laboratory Italy

One of the OALs deployed by OPERANDUM
In numbers:
3 operational sites in real life environment, **6** international partners
4 Nature-Based Solutions implemented, modeled and tested
10 monitoring, modelling and experimental initiatives
more than **40** scientists and stakeholders involved

The Panaro Site

Target Hazards: River Flooding
NBS: Plantation of deep-rooted plants on the riverbank

The Po di Goro Site

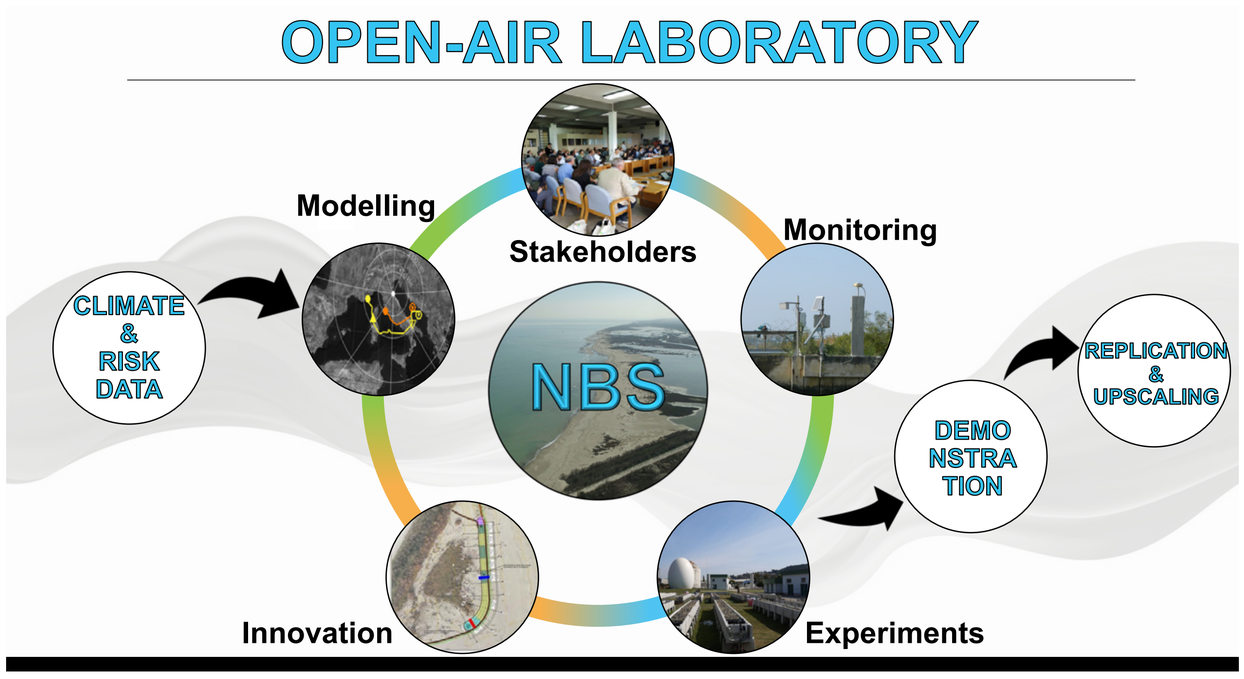
Target Hazards: Salt wedge intrusion, drought
NBS: Plantation of halophytes plants

The Bellocchio/Volano Site

Target Hazards: Storm Surge, Costal Erosion
NBS: Artificial dune with natural material & seagrass

Open-Air Laboratories

An innovative multi-disciplinary framework for the **co-design, co-development and co-deployment of Nature-Based Solutions.**



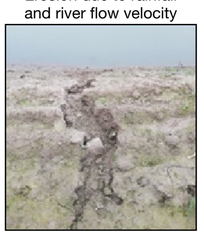
The Open-Air Laboratory (OAL) is a novel concept developed by OPERANDUM to design and implement NBS. It generalises the Living Lab approach to the application of NBS to mitigate hydro-meteorological risks in a rural environment. An OAL is a trans-disciplinary framework where scientists work together with companies, agencies, citizens, practitioners and decision-makers. The NBSs are implemented via a co-creation approach that harmonizes impact modelling, monitoring protocols and laboratory experiments. The OAL operationalises an ongoing transition of climate science into a bottom-up approach that, when addressing climate change adaptation, starts from local stakeholders and aims at providing climate-related information that is relevant at the local scale

The site at the river Panaro and the NBS

One of the sites of the Open-Air Laboratory is in the river Panaro, a tributary of the Po river in the province of Modena. The Panaro basin is a populated area that holds many industrial and agricultural activities. The area is threatened by a high risk of flooding associated with soil erosion on the internal margin of the riverbank and by collapse mechanisms when there are extreme events

NBS implementation site on the Panaro riverbank

Erosion due to rainfall and river flow velocity

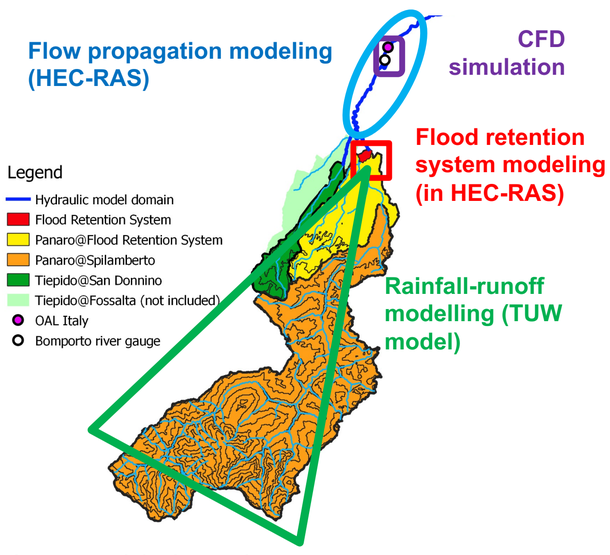


The NBS is the plantation of a dense vegetation cover with a mixture of twelve deep rooting perennial herbaceous species on the embankment. The NBS was co-designed with stakeholders to prevent riverbank failure induced by erosive processes and therefore mitigate flood risk. Experiments in hydraulic flume proved the efficacy of the NBS to hamper the erosion.

The NBS was then implemented in the site where soil conditions are continuously monitored by a series of sensors of soil water content, matric suction and pore water pressure. Simulations with a model chain quantified the efficacy of the NBS to mitigate flood risk in present and future climate.

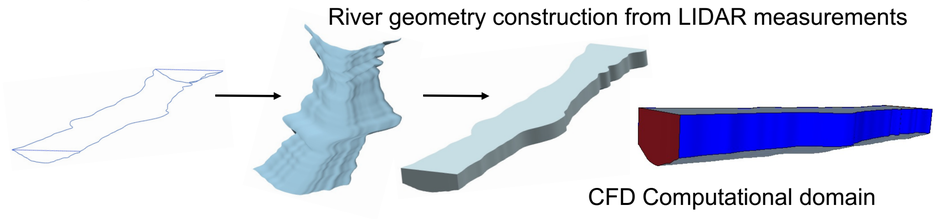
Model simulations to evaluate the impact of the NBS

The modelling chain

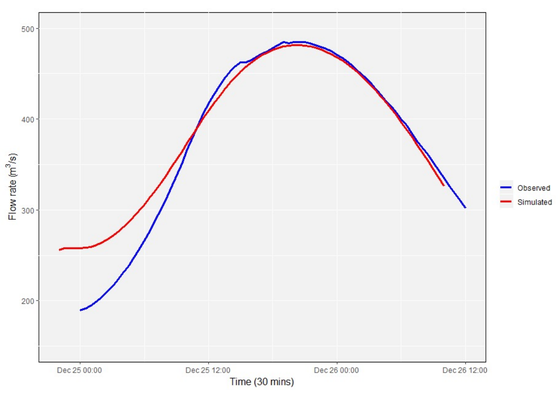


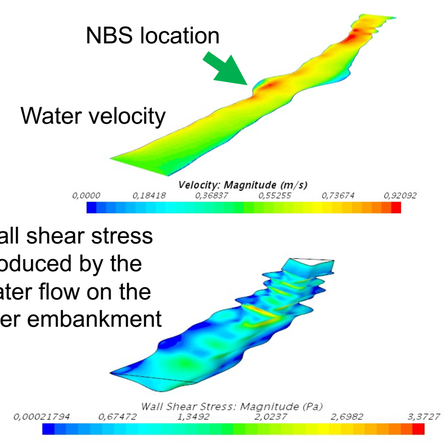
Input: precipitation and temperature:
- Gauge observations (historical control period)
- GCM-RCM modelling chains (control period and future climate)

Preliminary results



Flow Hydrograph at Bomporto





Take home

-Open-Air Laboratories (OALs) as innovative framework for Climate Change adaptation

-Presentation of the OAL-Italy

-Methodology to demonstrate the effectiveness of a NBS to mitigate hydraulic risk

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