RECONECT

Regenerating ECOsystems with Nature-based solutions for hydro-meteorological risk rEduCTion

Hydro-meteorological monitoring activities in Portofino Natural Park (Italy) as a demonstrator of the H2020 RECONECT project: preliminary results.

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Demonstrator A
Portofino Park, Italy

Peculiar morphologic layout:
• Small catchments
• Steep slopes
• Reduced time of concentration
• Peculiar microclimate
• Natural Park - Nature 2000
An outstanding area with high:

- Cultural, Historical value
- Aesthetic, Landscape value
- Socio-economic value

Average number of tourists and hikers per year

San Fruttuoso bay
San Fruttuosso Abbey complex

• The catchment basin was greatly influenced by the Benedictine abbey, founded in the X Century
• The steep slopes behind the Abbey complex were terraced, the stream networks modified and land use variations occurred
Heavy rainfalls on 25th September 1915 caused the partial collapse of San Fruttuoso Abbey, due to debris descending from the slopes.

September 1915 – M. Portofino

Faccini et al., 2009; Parodi et al., 2017; Paliaga et al., 2020

Courtesy by Fondo Ambiente Italiano
A new beach appeared after the 1915 event.

The San Fruttuoso Abbey complex 1905-2020
Main geo-hydrological events (2000-2019)

- 6 Nov 2000
- 24 Nov 2002
- 31 Oct 2003
- 1 Jun 2007
- 4 Nov 2011
- 18 Jan 2014
- 26 July 2014
- 14 Oct 2016
- 29 Oct 2018
‘Valle dei Mulini’ pilot area

Collapsed terraces / landslide
**Project drivers**

- **Geomorphologic Hazards**
  - Flash floods
  - Relict landslides reactivation
  - Shallow landslides, Rockfalls, Mud-debris flows

**Dry stone abandoned terraces as main source of slope instability**

**Opportunity of engaging:**
Administrators and tourism facilities operators.

**Main target:**
Geo-hydrological risk reduction

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**NBS RISK REDUCTION STRATEGY: A CATCHMENT SCALE HOLISTIC ECOSYSTEM-BASED APPROACH**

*Reduce* the linear erosion along the streams

*Reduce* the widespread erosion along the slopes and increase stability

*Improve* hydraulic/geo-hydrological conditions

*Footpath* maintenance and erosion reduction
Terraces and dry-stone walls

From and old best practise to a potential hazard for soil degradation, due to land abandonment

A = debris cover (natural) on the slope
B = deforestation and slope preparation
C = dry stone-wall construction and soil fills
D = terraced slope, with orchards
E = some details

A = cultivated and intege terraces
B, C = dry stone walls collapse along shear surfaces
D = complete collapsed slope with terraces
E = landslide for “domino effect” along slope with terraces
LIDAR survey

N.B.S. Maintenance and prevention measures

Dry-stones walls construction and abandoned terraces restoration

Hydraulic-forestry arrangements on water courses

Riverbed and tributary arrangements

Natural engineering interventions along hiking paths

Wood amelioration and re-forestation

Hydro-geologic and meteoclimatic monitoring

New methodology to estimate soil and debris volume immobilized into terraces

(Paliaga et al., AGU fall meeting 2018)
Monitoring activities

• **Remote Sensing survey**
  - LIDAR survey → terraces detection
  - Orthophoto survey
  - IR orthophoto survey → vegetation status

• **On-site monitoring**
  - 3 weather stations
  - 2 hydrologic stations
The Monitoring activities

Remote Sensing survey

Eurosense a RECONECT partner

The survey has been performed in February 2020, but the lockdown prevented the ground control to be completed. It is actually in progress due to restrictions reduction.
The Monitoring activities

Remote Sensing survey

preliminary results

The high point density and top sensors quality will allow to obtain a 0.5 m and 0.25 m DTM after points classification in: ground, non-ground (includes vegetation, stone walls, buildings...), water and bridges.

Data will allow a precise detection of terraces and a detail geomorphometric analysis.

From the aerial images RGB- and CIR- orthophotomosaic will be obtained.

LiDAR system Riegl VQ 1560-II, with two 2 MHz sensors

Point density= up to 20 m$^2$
Monitoring activities

**On-site monitoring**

- TeleControlNet – InterAct platform

**The Pilot catchments**

**Data management**

**Other stations**

**Portofino NBS preliminary design area**

- Design area
- Terrace
- Hydraulic network
- Culvert
- Monitoring station
- Hydrographic station
- Weather station
Monitoring activities – data management platform InterAct RECONECT partner
NBS measures in San Fruttuoso area

A) **Draining** running water in the compluvium with small stone walls in order to reduce erosion along the slopes; protection of the footpath and the Casa dell’Arco.

B) **Compluvium maintenance; wood amelioration**, by removing allochthonous and degraded species; regeneration of holms (Quercus ilex L.), the climax species in the area that has positive effect on the stabilization of the conglomerate slopes; wood and stone weirs to reduce solid transport into the stream. Consolidation of rock slopes for footpath and building securing.

C) **Stone walls recovery** and environmental engineering to slopes stabilization; proper plating of Mediterranean autochthonous shrub species to reduce erosion and improve slope stabilization.
NBS measures in Paraggi area

D) **Terraces recovery** to slopes stabilization and to avoid strong contribution of solid transport into the stream.

E) **Footpath maintainance and recovery**; vegetation cleaning along the stream and water flow improvement.

F) **Stone weirs** in order to reduce the flow energy and then the erosion along the stream.

G) **Vegetation maintainance** along the stream and water flow improvement.

H) **Selective weir and small sediment trap** to avoid saturating transport capacity of the culvert.
NBS benefits/costs

Expected benefits/co-benefits

- Decrease exposure to **geo-hydrological hazard** - infrastructures and cultural heritages
- Re-building/maintenance of **dry-stone walls** - geo-hydrological risk reduction, landscape (terraces are part of the landscape and cultural heritage), re-incentivize agricultural activities
- Decrease the impacts of **landslides** and **slopes instability** at coastal sediment budget level
- **Decrease the risk** of injuries among park visitors
- Support the **interaction** with private land owners
- **Integrate** the proposed NBS with regional policies for land management/planning
- **Improve** the visibility and the governance model of the Park
- **Improve** the collaboration between the Park Authority and the main local actors
Upscaling

The geomorphological features of the pilot area are paradigmatic of all Liguria and Mediterranean area:

- small catchments
- high slope gradient
- urbanization in the lower part
- stream terminal stretch completely culverted
- short time of concentration
- high geo-hydrologic risk

Similar features in other Mediterranean areas:

- Sicily and Campania regions in Italy
- Balearic islands in Spain
- Cote d’Azur in France
- Greek Islands
- Montenegro coastal areas

The risk reduction strategy:

Spread interventions at catchment scale - NBS
Thank you for your attention!

http://www.reconect.eu

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