

Adopting Nature-based solutions to cope with flooding phenomena: the participatory approach of the LIFE Beware project

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Abstract

The LIFE Beware Project addresses the problem of the increase in flooding phenomena that has been registered in Italy and many other Countries due to climate change. Started in 2018, it proposes an integrated multiple approach aimed at adopting Nature-based solutions (NBS) to mitigate the risk of flood and increase territorial resilience to climate change with: *i*) information and raising awareness activities involving multiple stakeholders at the local, national and international level; *ii*) participatory processes for the involvement of the local communities in the development of effective public policies to mitigate the risk of flood in the Altovicentino area (North-east Italy); *iii*) support to citizens interested in adopting sustainable water retention, infiltration and storage measures; *iv*) training and educational processes targeting professionals, technicians and students; *iv*) networking and replicability activities to multiply the impact of the generated good practices and increase the sustainability of the project actions. The core element of the project is its participatory approach, made by different actions that aim at the involvement of citizens, farmers, professionals and stakeholders, together with information, diffusion, educational activities (i.e. conferences cycle and events) from primary schools to University masters, training initiatives at local, national and international level (webinars, publications). Several raising awareness and knowledge dissemination activities have been organized to boost citizens' active involvement as it is the case of the conferences' cycle, with national and international experts in climate change and resilience, the School of Common Goods to increase citizens' knowledge about the concept of "common goods" and reflect about the challenges faced by the territory of the Altovicentino, the set of educational activities for students and teachers to have an impact on the youngest generation and improve their knowledge and awareness about climate change, with a specific focus on the cycle of water and sustainable hydraulic management. Furthermore, through the hydraulic restoration tour, the visitors, students, schools and citizens have the opportunity to discover and visit the different measures that can be implemented to mitigate the flood risk in urban and rural areas. The project proposes a direct support to those citizens who are interested in investing in small water retention and storage measures through the creation of a help desk and the activation of a purchasing group for NBS.

Keywords: resilience, dissemination activities, citizens.

INTRODUCTION

The increase in heavy rainfalls induced by climate change and observed in many parts of the world (Fischer et al., 2016), and the expansion of population toward hazard-prone areas, are contributing to an increase in economic damages and loss of lives due to floods (Paprotny et al., 2018). This process is currently taking place in the Veneto region (northeastern Italy) where the positive trend of the number of flooded locations is related to an intensification in the precipitation patterns and to the broadening of the sealed urban areas (Sofia et al., 2017). Veneto

is one of the areas that show the greatest flood hazard in Italy (Pagliacci and Russo, 2019), presenting the 41.2 % of the regional territory under risk (Triglia A. et al., 2018). This critical situation is worsened by the unpreparedness of local communities, still incapable to implement actions that can mitigate the floods effects. As a matter of facts, the Altovicentino, a piedmont area located in the middle of the region (northern Vicenza Province), was affected in recent years by different flood events, including both localized floods in urban areas due to high intensity rainfalls, and river overflows. Among the latter, the most catastrophic episodes occurred in 1966, 1982 and more recently in 2010, between the 30th of October and the 2nd of November. During the 2010 flood, an average of 173 mm of rainfall with peaks of 540 mm was registered, resulting in 140 square kilometers of flooded area, 130 municipalities involved, and the displacement of about 500,000 citizens. Moreover, 3 persons and more than 150,000 animals died, and damages were estimated at 429 M€.

In this context, the project LIFE BEWARE (Better Water Management for Advancing Resilient-communities in Europe), co-funded by the Life Program of the European Union, promotes the diffusion of Nature-based solutions (NBS) to increase the resilience of the territory to flooding. The project is built on the fact that the widespread use of NBS have been shown *i)* to reduce local flooding, economical loss and discomfort at storm events, in particular for medium or frequent return periods, *ii)* to maintain and promote ecosystem services and deliver multiple benefits for humans. The paper describes the multiple approach fielded by the project to raise the stakeholders' awareness and knowledge and to improve the local governance of the Altovicentino area in order to create a favorable environment for NBS widespread implementation.

MATERIAL AND METHODS

The Altovicentino area

The dissemination activities carried out within the BEWARE project are mainly located in the Altovicentino area (northern Vicenza Province, Veneto Region, Italy), a territory that groups the pre-Alps of the Vicenza province and the relative piedmont area (Figure 1).

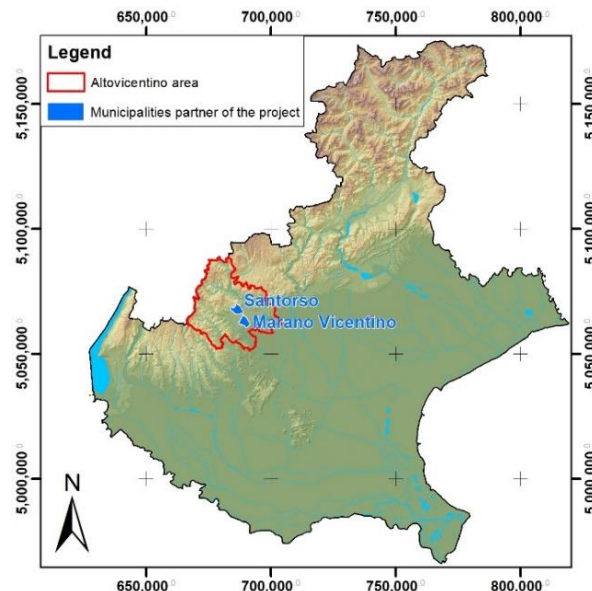


Figure 1. Localization of the Altovicentino area within the Veneto Region (northeastern Italy), and of the two Municipalities involved as partner in the BEWARE project: Santorso (lead partner) and Marano Vicentino.

The area is characterized by a more severe rainfall regime than the rest of the Region, with annual precipitations that ranges from 1300 (in the lower plain section) to 2100 mm/year (in the mountain section), against 1114 mm mean annual precipitation of the entire Veneto Region (time series 1993-2019; ARPAV, 2019). The area shows a great flood hazard. Pagliacci et al. (2020) estimated that the pluvial floods occurred in the decade 2010-2019 in the Municipalities of Santorso and Marano Vicentino (localization in Figure 1) entailed €0.44 million in protective and restoration costs to private properties, €0.35 million in protective and restoration costs to public properties and €0.52 million in mitigation measures in public properties. In addition, they found that despite the amount of damage and the observed increase in flood occurrence over time, people living in the area lack proper preparedness for future floods, and seem to adopt limited mitigation actions. In addition, citizens present lack of knowledge about NBS that contribute in limiting the adoption of this kind of structure in the area.

The information and dissemination activities

The information activities have been planned through the four years of duration of the LIFE BEWARE project (from June 2018 to June 2022) in order to enhance the project main aims: to improve awareness and knowledge of citizens in order to foster their commitment to reduce the flooding risk in the Altovicentino area, and to promote a regulatory framework and specific technical skills facilitating the widespread use of NBS in urban and rural areas.

At the beginning of the LIFE BEWARE project, a series of cultural events were realized in order to raise awareness on climate change, climate adaptation and resilience, with a particular focus on the characteristics of the local territory. The events ranged from lectures by experts and professors (conferences' cycle), workshops and visits to local woods, waterways and the most critical areas in terms of flooding. We also had evening talks where we invited people who actually lived through extreme events to share their experience, what they learned and their opinion about the actions have to be carried out to prevent flooding.

The events were linked together to create a meaningful path to all the people who participated. We started from general topics (like climate change) and then we went more and more into the details and the complexity of the situation. The awareness raising activities has been promoted also at the educational level, with the organization of activities for students of different ages and the realization of a Comic telling a story about the principles of the BEWARE project. At the academic level, a class in "Resilient Communities to Hydro-Geological Hazards" has been activated within the Short Specialization degree in "Manager of sustainable local development" at the University of Padova.

The core element of the project is actually the participatory approach, actualized by the participatory process carried out in order to define, in agreement with the different stakeholders, an Adaptation Action Plan for the climate change adaptation of the Altovicentino area, with a particular focus on the hydraulic risk mitigation. The participatory processes were realized by adopting different actions to involve the highest number of people and stakeholders, and to collect good quality information from the different actors. The adopted actions comprise: *i)* preliminarily live meetings, involving both administrators and technicians of Santorso and Marano Vicentino, and experts in order to identify the stakeholder to be involved in the participatory process, and to lay the foundation in the identification of a shared and effective solutions to widespread NBS; *ii)* live encounters between administrators and technicians of municipalities of the Altovicentino area and experts in order to create a better communication and network among the project and the stakeholders, to bring in other municipalities the BEWARE message, to verify the current state of the building regulations, to identify the needs of the administrators and managed territories, and to identify a shared solution to the problem of urban and rural flooding; *iii)* an on-line participatory process (activated on a later stage) involving citizens, technicians, practitioners, administrators, representatives of associations, and

experts, coming mainly from the Altovicentino area but also from other localities of the Veneto Region, in order to share actions for the climate adaptations measure that shall be adopted in the Altovicentino area, and laying the foundations to the Adaptation Action Plan.

One of the most important actions identified in the Adaptation Action Plan concern the modification of the local building codes through the identification of new rules that aim to reduce the soil sealing impact and to promote a widespread adoption of NBS. This action was foresaw by the project, but it has been concretely developed during the preliminary encounters with technicians and administrators. In addition, it was presented during the participatory process where it was supported and improved by the contribution of the involved people, mainly by public administrators. Other important actions act at the social level, where the lack of awareness, the difficulty in involving people and organizations, and the absence of collaboration could be important limiting factors in the Plan implementation. These actions were developed based on the concept of strategic management of niches, a procedure focused on the management of innovations to achieve a change in socio-technical systems, revealed crucial for learning about social challenges and stimulating transitions (Caniels and Romijn, 2008; Raven et al., 2010).



Figure 2. Pictures of some of the dissemination activities organized by the BEWARE project.

RESULTS

During the fulfillment of the first sequence of information activities (cultural events realized in order to raise awareness on climate change, climate adaptation and resilience), seven pilot NBS (Table 1) were realized to create a local/national focal point for the promotion and awareness of the benefits of this kind of solutions to mitigate the risk of floods and other climate-related risks, and to solve hydraulic problems really present in the territory. In fact, each intervention has been designed and dimensioned mainly in order to mitigate the flooding risk of the served area. In designing phase, to foster the didactical purpose of the interventions, particular attention has been posed on the choice of a wide range of NBS typologies as showed in Table 1. Indeed, all the succeeding planned teaching and dissemination activities, including the participatory process, benefitted from the important demonstrative function of these interventions. More information, can be found at the project website (www.lifebeware.eu), such

as intervention projects, results from the activities of water flow monitoring, and economic impact of interventions.

The participatory process, that followed the first sequence of information activities, resulted the core element of the project. Due to the COVID19 pandemic, the participatory process was held on-line with the support of a video teleconferencing software program and a cloud-based collaboration tool. Eight meetings have been realized at the initial phase of this process. Each of them dealt with a specific topic and was structured as follows: a presentation of the discussed theme held by an expert, and following round tables between the participants divided in breakout rooms of 4/5 persons. Each table was moderated by personnel involved by the project and the aims of the discussion were to give a critical analysis of the instruments currently adopted to tackle the discussed issue, and to identify new solutions and strategies. At the end of the eight meetings, the emerged ideas have been selected and summed up into 16 concrete actions that make up the Adaptation Action Plan. The approach of the Local Transformation Toolkit (Macedo P., 2021), a model developed to promote collaboration between public administrations and civil society, was applied in this phase of the process to support the coproduction of the actions.

Table 1. Pilot NBS realized by the BEWARE project.

Intervention ID	Location	Intervention type	Extent (m²)	Upslope drainage area (m²)	Storage volume (m³)
1	Piazza della Libertà (Santorso municipality)	Rain garden plus underdrained bioretention	67	784	42
2	Grumo hill (Santorso municipality)	Grass swale and bioretention area	44	4200	67.5
3	Via Volti (Santorso municipality)	Detention basin with an internal bioretention pond	2000	12520	430
4	Corte Acquasaliente (Santorso municipality)	Rainwater harvesting plus drywells	17	-	27
5	Via dei Prati (Santorso municipality)	Rain garden, infiltration trench, permeable pavement	172	1145	103
6	Primary school (Marano Vicentino municipality)	SUDS treatment train (strip of tree-lined swale in sequence with porous paving, rain garden and bioretention area)	694	3750	146
7	Locality of Giavenale (Schio municipality)	Water retention basin (double objective: flood mitigation and water source for irrigation in drought periods)	2948	1100000	2288

Other dissemination activities developed during the whole project duration include:

- The activation of a Help Desk that provide information to citizens and practitioners about the impacts of climate change in the Altovicentino area, the potential risks and solutions, the different water infiltration and storage technologies, and how to self-built water retentions devices. Up to now, more than 100 people took advantage of this service.

- The constitution of the Community of Interest involving about 100 members from the public sector, the civil society and the private sector, in order to create a wide network in the field of hydraulic safety and resilience with the aim of fostering the involvement of the stakeholders in the project activities and to ensure the replicability of its results.
- Innovative proposals for the primary and secondary schools of the Altovicentino area in order to raise awareness and generate further knowledge and sensitivity on climate change, its effects on the hydrological cycle and the main adaptation and mitigation measures. The teaching proposal included a series of environmental education initiatives, such as: interactive lessons (either online or in presence) and workshops using innovative digital tools; bike rides in the territory and among the BEWARE interventions to get to know an area made up of rivers, streams, roads, villages and industrial areas, and to contextualize the challenges of territorial resilience and climate change; walking tours in the territory and among the BEWARE interventions to live a direct experience by visiting the project sites through a guided tour; training sessions for teachers. Up to now, more than 800 students attended the proposed teaching activities.
- Three editions of the class in “Resilient Communities to Hydro-Geological Hazards” has been activated within the Short Specialization degree in “Manager of sustainable local development” at the University of Padova, involving 43 postgraduate students.
- A Festival about the themes of the BEWARE project: a week of workshops, meetings, presentations and guided tours to promote knowledge and sensitivity to the issues of climate change, its effects and possible measures for the good management of water resources. It involved about 1000 people.

CONCLUSIONS

More than two thousand people has been involved in the information and teaching activities, and 130 persons contributed to the drafting of the Adaptation Action Plan within the participatory process. A new version of the building code has been achieved, addressing the issue of the soil sealing and promoting a widespread adoption of NBS. This regulation is going to be adopted by the partner Municipalities up to the end of the project. Thanks to networking and a strategy to create synergies with existing networks, up to the end of 2021, most of the Municipalities of the Altovicentino area, signatories of the Covenant of Mayors for Climate and Energy, are going to adopt Sustainable Energy and Climate Action Plans (SECAPs) which include the new building regulation and the adaptation actions defined thanks to the participatory process.

These successful results confirm the effectiveness of the multiple approach fielded by the LIFE BEWARE project, that mixed the realization of concrete interventions with a series of teaching and information activities and a diffused participation process that involved different target groups (stakeholders, citizens, technicians, etc.) and resulted in an extensive and active involvement of civil society, that has proven responsive and proactive in addressing the issues posed by climate change and related phenomena.

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