Mainstreaming adaptation in water management for flood protection in Isola Vicentina [1]

Image from Climate Adapt about this case study [2]

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Isola Vicentina (Italy) signed the EUâ€™s Mayors Adapt initiative (current Covenant of Mayors for Climate and Energy) in 2014 and since then started the elaboration process of its Municipal Water Management Plan (MWMP) in order to integrate climate change adaptation into its water management policies. For this purpose, Isola Vicentina Mayor engaged the â€œPlanning Climate Changeâ€• research group at the IUAV University of Venice and Green-Dev studio, a local consultancy firm.

The plan analysed each drainage basin, river and stream flowing through the municipality, evaluating their maximum water flow rate and flood-wave size with different return periods (5, 10, 20, 30, 100, 300-years). The adaptation measures promoted by the plan took into account the statistically evaluated dimension of extreme flooding events according to these different return periods, including climate change effects. Identified critical issues were the starting point to plan prevention and preparedness measures, as well as about 50 punctual protection measures. The plan was approved by the end of 2016 and planned measures will be implemented from 2017 to 2022. A few structural and non-structural measures are being already implemented; specifically: (i) a management and maintenance regulation framework over small private ditches was adopted, (ii) one of the three planned water retention areas is now under construction, and (iii) a ten-hectare pilot area was identified to simulate how the preservation of woodlands can improve the resilience of the municipal territory to flooding and landslides.

Case Study Description

Challenges:

Isola Vicentina is prone to flooding stemming from both the main rivers (i.e. Orolo and Timonchio) and the minor local drainage network (e.g. land reclamation channels, rural and roadside ditches, urban drains). The last main river flood occurred in 2010: fortunately, the municipal area was only partially affected (producing low damage), while the event was much more damaging in the downstream municipalities (e.g. Caldogno, Vicenza). On the contrary, pluvial flooding is a frequent event: almost every year, small and patchyâ€“ both urban and rural â€“ areas get flooded due to rain events, leading to relevant cumulative damage.

In the near future, global warming is expected to alter precipitation quantity and patterns, and to increase the magnitude and frequency of extreme precipitation events. For the Veneto Region, according to latest studies regional models outputs exhibit a general tendency to less frequent and more intense precipitation events (even if the expected changes are weak and their quantitative projections uncertain), thus leading to a likely increase in the occurrence of flood events. Given that â€“ at such local scale â€“ quantitative projections or scenarios of future events are not available, the MWMP took in consideration climate change effects for the flood frequency estimation also considering the more extreme events: the 100 and 300-year return periods were evaluated and precautionary principle considered in the design of flood risk reduction measures, thus extensively exceeding current design standards.

Objectives:

MWMPs are local plans (until now in force only in the Veneto Region) born as coordination tools between municipalities and land reclamation authorities. Their objective is to allow a shared analysis of the local drainage

system, getting an accurate picture over administrative and maintenance responsibilities, to identify the most urgent (and locally relevant) problems of poor drainage and the related flood protection measures.

In the case of Isola Vicentina, the MWMP has been set up with a more ambitious adaptation approach: the idea is to transform the MWMP in a local flood adaptation plan which couples prevention, protection and preparedness strategies. Suggesting how to modify the physical structure of built-up areas, as well as citizensâ€™ behaviour and social organization, the plan tries to reduce the long-term potential damage (up to flood with a return period of 1/300 years) generated by climate change. In other words, the MWMP aims to solve current and future local hydraulic problems acting also on the vulnerability of buildings, infrastructure and people, promoting sustainable land use practices and bridging this new climate adapted knowledge into other sectorial spatial planning tools.

Solutions:
The analyses carried within the MWMP put together different flood hazard data:

- The hazard stemming from the main river network was taken from official maps and plans: the Hydrogeological Plan (*Piano di Assetto Idrogeologico* in Italian); the new Eastern Alpsâ€™ Flood Risk Management Plan, etc.;
- Local authorities (such as *Alto Vicentino* land reclamation authority, civil protection organisations, municipal authority, etc.) have been involved to collect information on historical events generated by the local drainage system;
- Finally, citizensâ€™ local knowledge and direct experience was directly surveyed through consultative public meetings.

Results were then compared and integrated with those coming from the MWMPâ€™s flood frequency estimation and local conveyance capacity analysis. This process led to the identification of more than 20 areas suffering poor drainage or flooding issues. Several measures were identified for each critical area. As suggested by the Flood Directive (2007/60/EC), the proposed measures were divided into three main typologies:

- Prevention measures, aiming to prevent damage occurrence avoiding new developments in flood-prone areas, structurally adapting urban fabrics and reducing soil-sealing and surface runoff generation through Sustainable Urban Drainage Systems (SUDS). A purely theoretical scenario prepared during the MWMP elaboration showed a potential decrease in the flood extent of about 40% (compared to the present land use) if the whole un-built area would be reforested. Thanks to this information, the municipal authority gained a better understanding on the need to preserve woodlands, and is now envisaging to convert some grassland and uncultivated fields into wooded areas. Moreover, a ten-hectare pilot area was identified to simulate in reality how the preservation of woodlands can improve the resilience of the municipal territory to flooding and landslides.
- Protection measures, aiming to reduce the likelihood of floods and/or the impact of floods in a specific location, such as restoring flood plains and wetlands, building flood defences or enhancing the conveyance capacity of the drainage network. About 50 protection measures were identified and planned within the MWMP, including: cleaning up rivers and streams, enlarging existing ditches, opening new roadside ditches, creating new retention areas, widening the existing urban drainage network, etc. In particular, a water retention area is already going through the design and implementation phases, thanks to a regional funding. The retention measure (with a water capacity of about 1 million cubic meters) is located in a South area of the Isola Vicentina Municipality, on the Orolo River. It mainly aims to protect downstream municipalities (in particular Vicenza) from the main river floods, reducing and temporarily storing a portion of the flood-wave.
- Preparedness measures, aiming to provide instructions to citizens on how to react/respond in case of flooding events. Starting from the existing documents and guidelines produced by the Italian civil protection service, Isola Vicentina citizens have been equipped with a booklet on what to do before/during/after a flood in their territory. Moreover, citizens were trained through a cycle of 4 public

workshops.

Importance and relevance of the adaptation:
PARTFUND_AS_CCA;

Additional Details
Stakeholder engagement:
During the MWMP elaboration process â€“ through four public workshops â€“ citizens and local stakeholders were consulted and involved in order to envisage locally suited flood risk reduction measures, and gather feedback on the proposed actions. Final MWMP measures were selected comparing the results obtained from the hydrologic/hydraulic analysis with peopleâ€™s priorities and feedback. Beyond the general public, targeted key stakeholder groups (such as farmers, business people and the landowners of flood-prone areas) were explicitly invited. Around 200 people participated to these meetings. In general, all participants were highly motivated since the 2010 flood affected adjacent municipalities, generating fear and increasing the relevance of the issue in the public opinion. Consequently, these workshops were also used to spread flood risk awareness and train people on how to cope with extreme weather conditions. Finally, given the existence of non-structural measures directly involving all the inhabitants in the local water management, the public participation and consultation process was also aimed to spread good practices and behavioral daily guidelines (e.g. on management and maintenance of small water courses).

Success and limiting factors:
The elaboration of the MWMP, according to an adaptive approach has been possible thanks to the determination of the municipal government of Isola Vicentina, the scientific support of the IUAV University and the field work carried out by municipal and technical consultants. A relevant role was also played by the whole citizenship, who was directly involved in site surveys and in the identification of the most critical areas (thanks to their past experience of flooding).

The development of the plan has been hampered by two main elements:

- A single municipality was in charge of the MWMP, without an official coordination with surrounding municipalities: as a consequence, downstream municipalities will benefit from the implementation of some risk reduction measures, whereas some critical issues generated outside (upstream) Isola Vicentina could not be solved by the plan.
- The definition of the exact responsibilities of each stakeholder group (including farmers for agricultural practices and rural drainage; home-owners for cleaning of private urban ditches and reduction of soil-sealing; water companies for urban storm-water management) over the various drainage system components was not easy to be agreed.

Budget, funding and additional benefits:
The cost for the elaboration of the MWMP was â‚¬25.000. According to the plan, the cost for structural protection measures range from about â‚¬2 million (up to flood with a return period of 1/50 years) to about â‚¬4 million (up to flood with a return period of 1/100 years). Minor interventions will be paid (or directly realized) by the municipal authority and private citizen. Major works, involving wider areas and catchments going beyond the municipal boundary, will require the economic contribution of the â€œ*Alta Pianura Venetaâ€•*land reclamation authority (a public-private consortium made up of all landowners in the area of competence) and of the Veneto Region government, the availability of which will depend upon the political choices of the next years. Considering that the total damage of the 2010 flood exceeded â‚¬400 million, and that damages for â‚¬80 million affected just the Caldogno municipality, which is just downstream Isola Vicentina, the convenience of the planned risk reduction measures clearly emerges.

Legal aspects:
The whole MWMP elaboration was inspired by the flood risk management approach suggested by the Flood Directive (2007/60/EC), focused on prevention, protection and preparedness strategies. A specific chapter of the

MWMP explicitly lists all the regional and national laws related to the plan, among which the major ones are:

- Lgs. 152/2006 (Italian environment act);
- Lgs. 49/2010 (Italian Flood Directive implementation act);
- G.R. 3637/2002 - D.G.R. 1322/2006 - D.G.R. 1841/2007 - D.G.R. 2948/2009 (Veneto Region: standards for stormwater and flood management in urban areas);
- R. 11/2004 (Veneto Region: spatial planning act);
- R. 12/2009 (Veneto Region: land reclamation act);
- D.G.R. 427/2013 (Veneto Region Spatial Plan, which includes the MWMP directive.

Implementation time:
The MWMP elaboration process started in October 2015 and was concluded in June 2016. Planned measures will be implemented from 2017 to 2022, considering two 3-years steps. The implementation of the first measures already started with: (i) the adoption of management and maintenance regulation framework over private ditches, (ii) the design and construction of a water retention area in a southeast area of the municipality, (iii) the designation of a ten-hectares pilot area where to simulate how the preservation of woodlands can improve the resilience of the whole municipality to flooding and landslides.

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Sources:
Isola Vicentina Municipality and its Municipal Water Management Plan (MWMP)

Links
[1] https://www.adaptecca.es/en/mainstreaming-adaptation-water-management-flood-protection-isola-vicentina
[2] https://www.adaptecca.es/sites/default/files/isola_figure1.jpg
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