Flood protection in the Upper Vistula river basin: grey and green measures implemented in the Sandomierz area [1]

Image from Climate Adapt about this case study [2]

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The Vistula River is a 1,046 km long river which springs in southern Poland and ends in the Baltic Sea. The Upper Vistula extends over the three Polish provinces of Ma?opolskie, Podkarpackie and Swietokrzyskie. The Upper Vistula region covers an area of 43,000 km2, including the cities of Krakow, Tarnow, Kielce, Nowy Sacz, Rzeszow, Przemysl and Krosno. The area is also known for its extraordinary natural values. The region is prone to flood risk both in winter and in summer. This includes different types of flooding like freshets, flash floods, pluvial floods, snow-melt floods and floods caused by ice dams on rivers.

This case study focuses on a specific part of the Upper Vistula areas, namely the area near the town of Sandomierz, in the province of Swietokrzyskie. The area is characterized by several significant tributaries, including San Rive, the largest Carpathian tributary of the Vistula River. In this area, the 2010 devastating floods resulted in 3,000 evacuated people and 4 casualties. Consequently, new initiatives were launched to increase flood protection and the retention capacity of the river basin. These initiatives include a hybrid approach of green and grey infrastructure measures like renaturalisation of reservoirs and wetland restauration; expansion reconstruction and modernization of river embankments; restoration of dike functionalities; and reconstruction of water pump stations and water discharge channels.

Case Study Description

Challenges:

The main challenge in the Upper Vistula region is the high occurrence of floods. Precipitation and run-off in the area are respectively 15% and 50% greater than Poland’s average. Other elements determining high flood vulnerability are: a dense hydrographic network, steep slopes, the oval shape of the catchment area, high road intensity and high population density in the catchment area. Floods are of diverse origin: flash floods caused by intense and short-lived downpours, freshets caused by melting snow, and flood caused by ice dams.

Several areas of the Upper Vistula region are vulnerable to floods. The highest flood risk is located on the right bank of the Vistula, upstream the town of Sandomierz which is home to about 24,700 people. The floods of May and June 2010 were caused by heavy rainfall and have resulted in collapsed levees in the neighboring area of Sandomierz, affecting this town and the neighboring towns of Tarnobrzeg and Gorzyce. In Sandomierz, an area of 1,154 ha was flooded, corresponding to 40% of its total extension. The area was flooded for about two weeks and the region had a standstill of several months. The flood losses were estimated at approximately EUR 100 million, while 3,000 people were evacuated and 4 died. Then, in July 2011, heavy rainfall caused another flood event, damaging the old town in Sandomierz, road infrastructure, the sewerage network and recreational areas. Total losses amounted to almost EUR 2 million.

Although current flood risk is already high, climate change models indicated that this risk will increase tremendously. In the region of Upper Vistula, the additional area prone to flooding can extend up to 1,751 km2 in case of a 1 in 100 year return period flood by 2050, including an additional urban area of 89 km2.

Objectives:

The main objective of the adaptation measures implemented in the Sandomierz area is to increase the retention capacity and to reduce flood risk in and around this town, also in light of future climate change. Other objectives

that were considered in the design of the solutions are: protection of public health and safety, biodiversity conservation, environmental objectives with regard to water quality, protection of soil, landscape and cultural heritage protection, and economic prosperity.

Solutions:
The adopted solution to reduce flood risk and to improve flood protection in the area of Sandomierz is a hybrid and integrated approach of green and grey infrastructure measures, including some institutional measures as well. These solutions were designed within the scope of the Vistula River Management Basin Plans, which are part of the implementation of the European Water Framework Directive and the European Flood Directive.

Renaturalization of reservoirs and wetland restauration are considered green measures to reduce exposure of people to flooding. These adaptation measures are implemented in 15 locations along the Upper Vistula River and aim to increase the controlled water retention capacity of the area. Indeed, naturalized reservoirs and restored wetlands are used to capture the surplus of river water and therefore to reduce the risk of flooding. These green measures are combined with grey ones: expansion, reconstruction and modernization of river embankments, specifically aimed to further protect urbanized areas from flooding reducing the risk of water overflow. The existing embanked area is enlarged to include the entire area that can be flooded during high water levels. Moreover embankments are raised up to a maximum elevation of 1.4 m, ensuring that embankment crowns along both river banks are adapted to the same safety level. Modernization intervention includes also the (re)construction of water pump stations and water discharge channels, that help to discharge the water in excess.

Importance and relevance of the adaptation:
OTHER_POL_OBJ;

Additional Details
Stakeholder engagement:
The design of the adaptation measures is under the competence of the core organisations acting within the river basin of the Upper Vistula: the Regional Water Management authorities of Krakow, Kielce and Rzeszow. These authorities worked closely together with local ones. The green and grey adaptation measures were designed within the scope of the River Basin Management Plans (RBMP) elaborated according to the WFD and the Flood Directive and therefore have been part of the related stakeholder consultation process. Stakeholders have been involved via the informal Public Participation Committee of the Water Management Council. The 20 members of this Committee are elected representatives of various interest groups, like local government authorities, agriculture, fisheries, other economic sectors and ecological organizations as well as water users and water managers. This informal Committee disseminated information about the RBMP to the participating organisations and other interested parties, which had the opportunity to express opinions on draft plans. Stakeholders and citizens could provide input via a first questionnaire to identify the main issues related to flooding characterizing the area. A second questionnaire was aimed to gather input on potential solutions. In addition, seminars and public meetings were organised in the period 2008 – 2009.

Success and limiting factors:
One of the major drivers for the implementation of the flood protection measures was the direct experience of local communities being affected by recent floods (2010 and 2011). This has contributed to increase the sense of urgency for the implementation of measures contributing to cope with the flooding challenges. The EU Water Framework and the Flood Directives also played an important role in initiating the integrated process aiming to reduce the flood risk. As alternative to traditional measures, these Directives have been also relevant in promoting green measures aiming to increase the retention capacity of the area while respecting their natural values.

During construction the natural value of the area had to be maintained. Therefore, the impact on natural habitats and habitats of species for community interest, according to Natura 2000 policies, had to be monitored. Another factor affecting the measure implementation is changes in land entitlement that had to be organised in order to expand the embankments.

Budget, funding and additional benefits:
The total cost of the adaptation measures implemented in the Sandomierz area is about EUR 217 million. This includes costs incurred to implement the expansion, reconstruction and modernisation of the river embankments (grey measures) as well as the renaturalisation of reservoirs and wetland restauration (green measures), including the needed land purchases. Funds for implementing these measures were requested and received from the World Bank.

The avoided flood damage to buildings (5,632 buildings in total) was estimated to be about EUR 445 million in constant values. Taking into account only this estimate, and therefore not considering impacts on people, the benefit-cost ratio is 2.05, implying that expected benefits are at least approximately twice larger than costs (DHI Polska, 2013, Raport z opracowania programu dzia?a? dla Regionu Wodnego Górnej Wis?y, Report KZGW/DpiZE-op/POPT/1/2013, DHI Polska, Warsaw, Poland; EEA, 2017 [3]).

Legal aspects:
The adaptation measures have been implemented within the scope of the EU Water Framework and Flood Directives that are both transposed into the national Water Law. The implementation of the adaptation measures required the application of the due procedures of environmental impact assessment. The formulation of mitigating measures to prevent environmental and social impacts is in particular important within the scope of the received World Bank funding for construction.

Implementation time:
The design of the plan originates from 2011, during the process of elaboration of the 1st River Basin Management Plan. The plan, including the measures was finalized in 2015. Implementation of the described measures is currently taking place and is expected to be completed by 2019.

Reference Information
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Websites:
https://www.eea.europa.eu/publications/green-infrastructure-and-flood-ma... [3]

http://www.sandomierz.pl/assets/sandomierz/media/files/6ccb317b-838d-4b0... [6]

Sources:
EEA 2017 Green Infrastructure and Flood Management. Promoting cost-efficient flood risk reduction via green infrastructure solutions Report No. 14, 2017. ISSN 1977-8449

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Links

[1] https://adaptecca.es/en/flood-protection-upper-vistula-river-basin-grey-and-green-measures-implemented-sandomierz-area
[2] https://adaptecca.es/sites/default/files/vistula_figure-1.jpg
[3] https://www.eea.europa.eu/publications/green-infrastructure-and-flood-management
[4] mailto:um@um.sandomierz.pl

[5] mailto:kancelaria@sejmik.kielce.pl
[6] http://www.sandomierz.pl/assets/sandomierz/media/files/6ccb317b-838d-4b0b-b37a-4f89366470ce/emp-3b-1-text.pdf