

Natural Water Retention Measures Harnessed for Climate Change Adaptation in Rural Hungary

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The LIFE Climate Action project titled '*Municipalities as integrators and coordinators in adaptation to climate change*' (LIFE16 CCA/HU/000115, LIFE-MICACC) is implemented in Hungary through a wide-range partnership. The coordinating beneficiary is the Ministry of Interior of Hungary. Associated beneficiaries: Municipality of Bática, Municipality of Püspökszilág, Municipality of Rákócziújfal, Municipality of Ruzsa, Municipality of Tiszatárján, Association of Climate-Friendly Municipalities, General Directorate of Water Management, PANNON Pro Innovation Services Ltd. and the WWF World Wide Fund for Nature Hungary Foundation. The project started in September 2017 and will end in 2021.

Hungary is expected to be impacted by climate change more severely than the global average. According to regional climate models' forecasts (ALADIN, RegCM) for the period of 2071-2100 the increase in average temperature will be over 3-5 °C (Sütő, 2016). This is expected to be accompanied by a seasonal decrease in precipitation with a more hectic distribution and increase of extremities, leading to change in the runoff up to 60% (Nováky, 2005). With climate change more frequent extreme hydrological events are expected, i.e. more severe water scarcity and droughts, more intensive and unpredictable precipitation, increasing floods and excess inland water inundations. The traditional water management approach and the intensive agricultural land use have drained waters from the landscape, eliminated wetlands and contributed to the drying out of soils and vegetation.

The project addresses a key cross-sectoral issue: the role of natural water retention measures in climate change adaptation and sustainable water management. It seeks ecosystem-based solutions for the mitigation of the water challenge and the improvement of the resilience of small rural settlements. The objectives of the LIFE-MICACC project are the following:

- To improve climate resilience of the most vulnerable Hungarian local governments
- To build local capacity for adaptation to climate change
- To increase knowledge of decision makers regarding climate change and Natural Water Retention Measures as a tool to improve climate resilience
- To test and demonstrate the practical applicability and viability of NWRM prototypes on five pilot sites
- To support Hungarian municipalities in accessing to European networks

Effective adaptation requires coordinated and integrated territorial solutions, as opposed to the traditional fragmented sectorial approaches. As the responsibility of municipalities is territorial and they are embedded in the local society, they are the most appropriate bodies to coordinate local adaptation processes. The focus of our approach is mainstreaming adaptation into natural resources management strategies and land use planning practice of Hungarian local governments, linking the urban areas with the surrounding outer land that also belongs to the municipality. The project will demonstrate on 5 pilot sites how and which local natural 'assets' can be used for climate adaptation.

Pilot sites

Bática – Historical clay-pits as water reservoirs

Vulnerability factors: Damaging water abundance in the village in case of extreme rainfall events, accompanied by serious water scarce periods during summer.

Solution concept: Use local clay-pits in climate change adaptation to collect and retain rainwater during extreme rainfall events, and to ensure infiltration of the retained rainwater to recharge groundwater in periods of drought. The restored and expanded clay-pit system will serve as freshwater habitat for birds, fish and amphibians, and also as a buffer zone around the settlement, improving local climate through evaporation.

In Bática a clay-pit previously used for illegal waste-disposal will be restored and transformed to a wetland system. It will be designed as a criss-crossed, multi-basin lake system with several sub-basins with different depths. This will ensure permanent coexistence of deeper open water surface and shallow wetland habitats. Rainwater recharge will be supplied from the residential area through the existing channel network.

Püspökszilágy – NWRM against upland erosion and flash floods

Vulnerability factors: Record level flash floods every 2-3 years lead to significant soil erosion and causes damages to buildings, while the upland village is also exposed to droughts during summer.

Solution concept: Combination of natural water and sediment retention measures both in the upper and the lower basins of the local stream to create buffering capacity for hydrological extremities. The system will be created under local ownership and as a result of collective actions of different interested stakeholders.

In the upper watershed, four wooden check dams will be built in the erosional gullies and in the Szilágyi stream to retain water and the sediment load during flash floods, before they reach the built environment. In the lower watershed, a small wetland and lake system will be restored on the floodplain to increase water retention capacity and reduce drought risk. Besides, a wooden check dam will be built right above the wetland to retain sediment that would otherwise block bottlenecks, such as small bridges.

Ruzsa – Wastewater effluent as a valuable natural resource

Vulnerability factors: The average precipitation decreases, the groundwater table is sinking, and the soils are sensitive to hydrological effects. Water shortage has a stress-like effect on the vegetation, on agriculture, forestry, urban areas and the drinking water supply.

Solution concept: The goal is to improve groundwater recharge as much as possible by retaining and infiltrating locally available water resources (effluent decanted water treated sewage). In the outer areas, collective implementation of the Greening element of the EU CAP will be tested by “greening” those land tracts where temporal inundations may occur.

The effluent grey water from two local water treatment plants, which till now has been drained in the main canal, will be retained in two newly created ponds within the settlement. Outside the settlement, three sections of the channel network, originally designed to drain excess water, will be re-designed to retain it. Local farmers will be engaged in a pilot cooperation for collective use of created wetlands as ecological focus areas.

Rákócziújfalu – Preserving inland water for conservation and water management

Vulnerability factors: Situated on the former floodplains of river Tisza, the area is especially affected by inland water inundations from melting snow in early spring, followed by severe summer droughts. These phenomena cause severe losses to agriculture, a key economic sector in the area.

Solution concept: A currently unused channel, which was originally designed to drain former marshlands, will be redesigned into a multi-purpose channel to both collect and retain excess water. It will feed collected water into a natural depression on the historical floodplain, transforming it into a wetland habitat, as a nature-based adaptation measure to excess water, heavy rainfalls and droughts.

Using green engineering solutions, a 0.6 hectare wetland will be created through deepening the lowland and dam construction, to serve the dual purpose of water retention for droughts and nature conservation. On the channel, 2 water retention engineering structures will retain water and control its flow to the wetland.

Tiszatarján – Multi-purpose use of abandoned floodplain croplands

Vulnerability factors: An economically disadvantaged settlement that has the majority of its territory in the floodplain of the Tisza river. It is exposed to floods, droughts and inland excess water. As a symptom, the expansion of invasive plants reduces water retention capacity, increases flood risk, and harms biodiversity.

Solution concept: Removing invasive bushes, then partly replacing them with native willow plantations for biomass energy supply; partly maintaining the cleaned grassland through grazing with grey cattle and water buffalo. This is combined with the restoration of the clay-pit system on the floodplain for water retention, and as a suitable habitat for the buffalos.

Land management interventions are already on-going, and in this project the clay-pits will be transformed into an interconnected system of open surface water bodies. These will retain and store water from floods, provide natural water supply through infiltration to the groundwater, and serve as spawning, hiding and feeding ground for grazing and wild animals. A visitor trail will be built in the restored floodplain, to reduce dependence on climate-sensitive agriculture through enhancing ecotourism.

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