Climate Change Vulnerability in Püspökszilágy

– Municipality of Püspökszilágy, Pest County, Hungary –

This document is an extract of a climate change vulnerability assessment prepared by the municipality of Püspökszilágy in 2018, as part of the LIFE-MICACC – Municipalities as Integrators and Coordinators in Adapting to Climate Change project.

Introducing Püspökszilágy

Location: Central Hungary, about 30km away from the capital city to the north-east. The nearest city is Vác, 20 km away.
Area: 25.3 km^2
Population: 630 inhabitants

Geography and climate:
The settlement lies where the Gödöllő Hills and Cserhát Mountain ranges meet, on the watershed of Hungary's two largest catchments, those of the Danube and Tisza rivers. A mountain stream (Szilágyi-patak) is crossing the settlement. The balance of the average annual precipitation and the calculated evaporation is positive in the region.

Box 1. What is a Vulnerability Assessment?

The aim of a climate change vulnerability assessment (VA) is to identify who and what is vulnerable to changing future climate, including increasing variability and extreme weather events. Vulnerability is usually defined as a function of three factors: **Vulnerability = Exposure x Sensitivity x Adaptive capacity**. This document observes each factor in turn and highlights some of the potential adaptation measures.

Key economic sector:
Retired: 370 persons
Employees: 180 persons
Young people (0-18 years old): 80 persons
65 % of the administrative area is covered by forest, 90% of which is state property; 35% is arable land, mostly used by two large farms for intensive monoculture cultivation of wheat, rapeseed and sunflower. Industry and servicing have negligible water demand. Animal husbandry is also significant, there is a boiler chicken plant with 75,000 pcs capacity, annually raising 450000 pcs. The village has its own well and water tower, these are significant users of water. The only Hungarian Radioactive Waste Treatment and Disposal Facility is also located in Püspökszilágy, which together with the nearby military training area provides significant tax revenues for the local government.

Infrastructure:
The village has well developed infrastructure and public facilities by local standards, which includes a kindergarten, elementary school, a social day-care facility for the elderly, a community building and library, health centre, pharmacy and dentistry. There is also an outdoor football field, and green spaces with playground. 80% of the 310 residential buildings are accessible on paved roads. 25% of the buildings are refurbished, there is virtually no house for sale. The whole town is served by public utilities (gas, water, electricity, sewage), including 30 currently empty building sites.

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Exposure: climate hazard mapping

Number of rainfall days exceeding 30 mm in Hungary in the period 1961 – 1990

Change in the number of rainfall days exceeding 30 mm in Hungary in the period 2021-2050, compared to 1961-2018

Exposure is defined as the degree to which something experiences a climate related hazard, such as an extreme weather event that is capable of causing harm. Key climate hazards in Püspökszilágy were identified based on data from NATÉR[1] and are summarized in the table below.

Data shows that Pest county has seen an average annual temperature increase of 1.5°C since 1901. It is however the climate extremes that pose greater threat. Püspökszilágy is situated in the region that is most hardly hit by flash floods within the country.

Precipitation above 40-50 mm can cause flash floods, bringing in huge amounts of eroded soil from the intensely cultivated upper catchment of the Szilágyi stream.

Climate factor	Current state / change already seen	Future change
Mean annual temperature	1,5°C increase since year 1901	0,5-1,0 °C increase till 2021-2050 compared to 1961-1990 baseline
Temperature extremes, heat waves	Currently 1-7 heat wave days/year	1,5-12 days increase in heat days/year for 2021-2050
Mean annual precipitation	365-972 mm/year based on 1961-2010 baseline (average precipitation 585 mm/year)	25-100 mm decrease till 2021-2050 compared to 1961-2010 baseline
Precipitation extremes (days with > 30 mm precipitation)	0,5-1 day per year between 1961-1990	1-1,5 days per year projected for 2021-2050
Flash flood sensitivity	0,5-1 day/year with > 30 mm precipitation)	1-1,5 day/year with > 30 mm precipitation

There are no water reservoirs on the upper catchment above Püspökszilágy, and no protection is developed against the flash floods coming down from the Szilágyi stream catchment. Flash floods are 40-50 mm precipitation above good probability. Farmlands in the upper catchment are often ploughed in a top-down direction parallelly with the slope gradient, which increases flow velocities and soil erosions. On top of this, distribution of precipitation is changing: while the amount of rainfall stagnates since the beginning of the century, the number of days with precipitation is expected to decrease till 2021-2050, implying that rain events will become more intensive and less

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frequent. Precipitation days with over 30mm may triple till 2050. Models also predict that periods of drought will become longer, and frequency of flash-floods will also increase.

Sensitivity analysis

Sensitivity is defined as the degree of harm a hazard can cause to something.

Public health: In terms of heat waves, Püspökszilágy is highly sensitive, as the **population is ageing**. Heat periods are already causing statistically significant increase in death rate, which is projected to increase by 26-42 % compared to an average non-heat day. Elderly people, newborns and people suffering of cardiovascular diseases are especially susceptible to mortality resulting from high temperatures.

Box 2. Experiences of the local community regarding climate change

Most important local stakeholders – doctor, local agricultural entrepreneur, forester, water management expert,– were involved through face-to-face interviews. They mentioned the following as the most harmful already noticeable impacts of climate change:

Human health: heat waves, allergy to pollens, infections from tick bites

Agriculture: species changes, early sowing, higher maintenance costs etc.

Forestry: Drying, snow, winds and insects and Lymantria

Livelihoods: inundation of basements/cellars, weather extremities, damages by storms.

Water management: Development of water damage prevention systems against flash flood warning

Agriculture is the most important economic sector in Püspökszilágy. The main crops are wheat, rapeseed, sunflower. Agriculture is highly sensitive to damage caused by drought, and highly to damage by erosion because of the monoculture cultivation.

Forestry: Drying, snow, winds and insects and Lymantria became more frequent due to the frequency of climatic extremities.

Housing and infrastructure (roads, bridges, public utilities) is also highly sensitive to flash flood and extreme precipitation. Most of the buildings are modernised and insulated. The share of houses built of loam is high (80%), and these are highly sensitive to flash flood and intensive rain events. Furthermore, many houses are often flooded by flash floods coming down on the Szilágyi stream.

Adaptive capacity

Adaptive capacity is the ability to modify circumstances and improve flexibility to reduce vulnerability.

Households: Significant percentage of the population is elderly or youth with restricted financial resources. An annual local municipality budget is allocated for social causes (eg delivering bottled water during heat waves' days; cutting allergenic plants; cleaning household drainage systems). There is evacuation action plan is in place for the event of flooding, which relies on local citizens.

Health care: The health centre follows the national protocols for heat waves. The municipality supports the resident by providing lifestyle advisement, organizing healthcare days and residential health screening. During heat waves elder residents are given everyday home visit for health-related wellbeing services organizing by the municipality.

Agriculture: 80% of the arable land is occupied by 2 tenants. These large farms have better financial means and capacity to adapt. The continuous and effective soil nutrition replenishment is ensured with the farms' well prepared technical possibilities taking care against the evaporation and drought of the lands' surface, however it also has the possibility to foster the soil degradation. The drainage infrastructures are well maintained, but it is also a source of the rapid water losing situation on the lands.

Water management: observation of weather and water related phenomena is carried out by farmers and public institutions. Water-course paving of Szilágyi stream is under development.

Furthermore, within the framework of this LIFE project, the **municipality** of Püspökszilágy will gain knowledge, expertise and resources in the field of climate adaptation, as well as inform its population, making it more adaptable overall.

Key Vulnerabilities in Püspökszilágy

Box 3: Measures already being taken – Natural Water Retention Measures at Püspökszilágy
In Püspökszilágy, vulnerability to droughts, heat waves and extreme precipitation is already being addressed through a nature based cross-cutting solution. The main goal is to prevent the village from flooding during intense rain events through water retention. To this end, an area situated by the Szilágyi stream will be turned into a green water reservoir with approximately 8-10 thousand m^3 storage capacity, with water inlet and outlet structure. Upstream, sediment retention structures will be built. A geodetic survey and technical plans have already been prepared, these ensure that the natural water retention reservoir not only protects Püspökszilágy against flash-floods, but also retain water for periods of drought; maintains good water quality and therefore serves as habitat for aquatic species. Plans were prepared so that good water circulation and quality is maintained, adjacent woodland patches are preserved and protected amphibians (e.g. *Pelobates fuscus*) gain important habitat.

The below table summarizes the arising vulnerabilities based on the above analysis, and a ranking table that was prepared along with the original VA study.

Climate hazard	Agriculture	Forestry	Public health (Population)	Infrastructure
Flash flood	Soil erosions **Adaptation measure:** NWRM - Renew sediment samplers above the settlement, avoid slope direction cultivation	The flash flood and slope could twist hazardous and healthfull trees **Adaptation measure:** NWRM - Renew sediment samplers above the settlement	Growing frequency of disinfections after floods **Adaptation measure:** NWRM - green water reservoir approx. 8-10 thousand m^3 storage capacity	Houses and public infrastructure – flooding of buildings, cellars, damage of mud, destruction caused by storm and flash flood, drainage system damages **Adaptation measure:** NWRM - green water reservoir approx. 8-10 thousand m^3 storage capacity
Droughts	Crop, rapeseed and sunflower field decrease **Adaptation measure:** NWRM, irrigation and drainage, large farms	Drying, snow, winds and insects and Lymantria **Adaptation measure:** Proper cutting of hazardous trees, NWRM microclimate changes	Increasing number of allergic cases **Adaptation measure:** Proper cutting of hazardous trees, NWRM microclimate changes, cutting allergic plants	Irrigation; education; funding opportunities, rainwater harvesting **Adaptation measure:** NWRM - green water reservoir approx. 8-10 thousand m^3 storage capacity.
Heat waves	Heat stroke of animals retard crop growth **Adaptation measure:** NWRM, providing water and irrigation	Geograpich dislocation of certain tree species **Adaptation measure:** Proper cutting of hazardous trees, NWRM microclimate changes	Population elderly and young people – increased fatality, heart diseases, other health problems, extend the habitat of parasites **Adaptation measure:** Developing heat wave action plans, shading, providing water etc.	Public utilities, drainage system and social institution damages (deformation, dilatation etc.) **Adaptation measure:** air-conditioning , renew public buildings and drainage system

Climate risks were assessed by their probability of occurrence and their potential impact on the settlement. Some with high probability with a relatively high impact are damage in agriculture, public health. Main risk is the occurrence of flash floods.

Recommended adaptation measures

Heat wave plans: public institutions should develop heat-wave action plans on how to respond to prolonged heat-waves. These could include shading, providing water, air-conditioning, changing ordinary routines to reduce exposure to heat. Written information sheet is sent monthly by the Mayor about the expected upcoming heat wave days.

Adapting to heat waves: increasing the proportion of green public spaces to cool the micro-climate, providing free drinking water at key points in the settlement, install shading in bus-stops and other places, and building an alarm system for elderly people who live alone and have a higher risk of suffering form heat-related diseases. The municipality is continually montoring 50 households – or more if needed – habited by old people. There is a local service for transport old and/or ill people to medical assistance and/or carry medicines to the households. There is a village tree planting initative involving the local residents.

Awareness raising: promote rain water harvesting and other nature friendly approaches among people to cope with the foreseen changes. Include nature observation in the programme of the local schools. Inform people about the necessary precautions in time of heat waves. Creating and training local action group for CCA activities.

Health care: Every year there is a public health day with medical screening and lifestyle coaching.

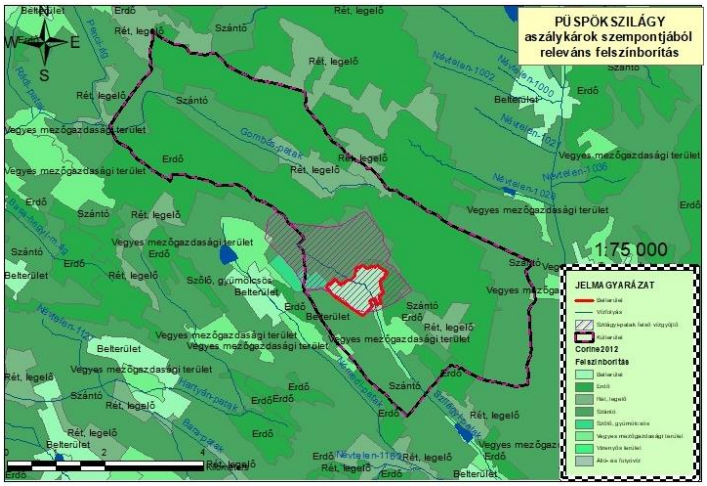
In the **agriculture** sector, increasing **awareness of funding opportunities** among farmers for greening and sustainable water management – either through **nature based water retention or through irrigation** development – would reduce vulnerability.

Flash flood: Maintenance of public roads, drainage infrastructure and fire hydrant, monitor local hydrometeorology situation. the municipality help the administration with the authorities and insurant connected to storm and other vis maior damages, and give help to clean water gutter in old people's estates.

Droughts: Cutting allergic plants on public places and providing help for it on private area if needed.

Forestry: Cutting life-threatening **trees, planting new drought-tolerant trees.**

Natural Water Retention Measures: the concept of NWRM is to retain water during heavy rain and flash flood events for periods of drought in natural, green areas. Püspökszilágy is already implementing an NWRM measure through a LIFE project (see Box 3.)



Site of planned water retention lake where flash flood will be collected, situated just outside the village of Püspökszilágy. The wetland use to be a lake with permanent open water surface, but is currently dry.

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