URBAN BLOCKS, CLIMATE SHOCKS

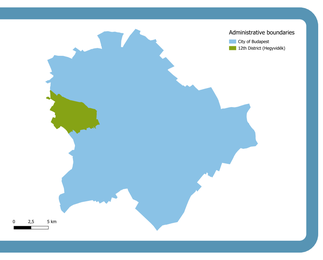
ADAPTING CLIMATE RISK ASSESSMENT ON URBAN BLOCK LEVEL IN CITY ENVIRONMENT

Project MARCAdapt
Hungary, Municipality of 12th District of Budapest
Barcelona, June 10-11, 2025

ABOUT US

The 12th District of Budapest (Hegyvidék Municipality) is located on the western side of the city of Budapest, Hungary. The high vulnerability of Hegyvidék Municipality is mainly determined by its specific microclimate caused by hilly topography (up to 400 m difference in level between the highest and the lowest points) and the local population characteristics (33% of the local population are elderly). The main climate risks affecting Hegyvidék Municipality are flash floods caused by stormwater, heatwaves endangering the elderly, and drought deteriorating urban green spaces. Thus, three risk assessments are carried out in the project: heavy rainfall, heatwaves, and drought. The main challenge is to apply the Climaax methodology on urban block level, specifically in city environment.

Deliverable Phase 1, Chapters 1.1 Background, 2.1. Scoping, 2.2 Risk Exploration



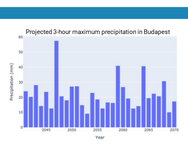
HEAVY RAINFALL

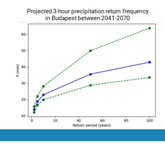
The analysis is focusing on the frequency and intensity of extreme precipitation events, as well as how these are expected to change because of climate change. To this end, climate model data spanning 30-year "climate windows" will be used to examine future return periods and extreme rainfall amounts. A historical database is also being developed to analyze past local events, aiming to extract as much information as possible related to damage incidents. The analysis will also include runoff and land cover characteristics of the project area, traffic data, and the vulnerability of the drainage system.

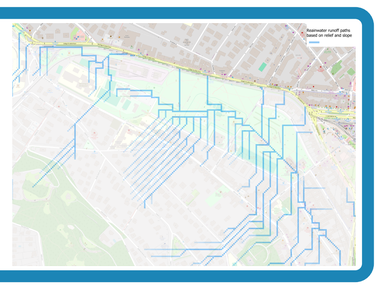
Relevant stakeholders, databases, opportunities for cooperation

Technological University of Budapest, Department of Water Utilities and Environmental Engineering	Cooperation in the past, runoff modelling, sewer vulnerability (LIFE in RUNOFF project)
Budapest Transport Center	Transport, traffic, road safety and accidents data closely linked to weather extremes
Budapest Sewage Company	Data about spills and leaks highlight important points

Deliverable Phase 1, 2.3.2 Workflow #2 – Heavy rainfall, 2.5 Preliminary Monitoring and Evaluation







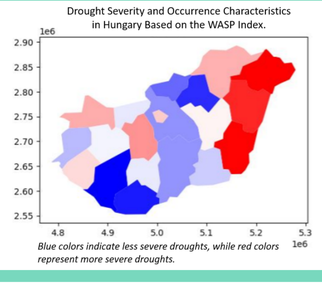
DROUGHT

Hegyvidék Municipality decided to apply an alternative methodology about the risk caused by drought on the urban green areas (city parks, public gardens, tree rows, flower beds, bee pastures, natural protected area and forests). Expected climate hazards such as precipitation deficits are identified using the WASP index. Exposure is described by the identification of plant types, the extent of green areas, rainwater runoff and orientation. To determine the vulnerability of green areas, indicators such as the vegetation's layering, irrigation, mowing and visitation of green areas are used. In addition, the on-site retention of green waste and the built-up density of the surrounding areas are also included in the indicator of the vulnerability.

Relevant stakeholders, databases, opportunities for cooperation

Urban and green infrastructure planners	Methodological support on urban green spaces, satellite data
Forest managers, national parks	Local specificities, identification of problematic places, concrete implementers, data providers
Local green space managers, gardeners	Local specificities, identification of problematic places, concrete implementers, data providers

Deliverable Phase 1, 2.3.3 Workflow #3 Relative Drought, 2.5 Preliminary Monitoring and Evaluation



Blue colors indicate less severe droughts, while red colors represent more severe droughts.

PROJECT TEAM AND STAKEHOLDERS

Project management team

Hegyvidék Municipality: Green Office,
International Projects Office

Budapest-based experts

- Data scientist - Milán Janosov phd.
- Climate change expert - EnviAdapt Kft. (Lilian Fejes)
- Communication and participation expert - Urbavis Kft. (Dorottya Teveli-Horváth phd., Anita Szőllőssy)

Stakeholders

Community stakeholder groups

Representation of the vulnerable population, soft analysis, community engagement

- Educational institutions (nurseries, kindergartens)
- Healthcare institutions (public and private, general and specific)
- Social care institutions (elderly homes, homeless care etc.)
- Religious institutions
- Law enforcement bodies (police, civil police etc.)
- NGOs
- Cultural, sport etc. communities
- Condominiums, informal neighborhood communities

Expert stakeholder groups

City operation, technical aspects, research focus

- Universities, public and private research centers
- Regional actors related to the blue-green infrastructure of Hegyvidék
- Companies of the City of Budapest (e.g. Budapest Sewage Company, Budapest Transport Center)

Relatable projects (e.g. INTERREG, LIFE etc.)

- National public bodies (e.g. ministries)
- Others (insurance companies, telecommunication companies etc.)

Deliverable Phase 1, Chapters 1.3 Project team, 2.1.3 Participation and ownership

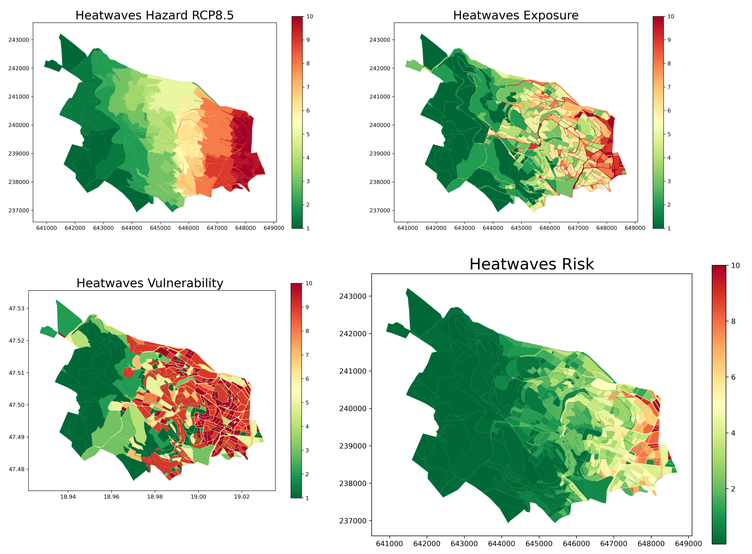
HEATWAVES

To analyze heatwave hazard in the area of Hegyvidék Municipality, we use climate investigations with the SURFEX (Masson et al., 2013) land surface model for the future projection with 1 km grid resolution. Model runs by Hungaromet NZrt. are performed with the RCP4.5 and RCP8.5 climate scenarios for the period 2031-2060 (reference period 1970-2000). Three indicators are incorporated in the risk analysis: first degree heat alarm days (Tavg≥ 25 °C), second degree heat alarm days (Tavg for 3 days ≥25 °C) and tropical nights (Tmin ≥ 20 °C). Landsat surface temperature data are used to explore areas more exposed to the heat island phenomenon. In order to downscale the Climaax methodology to urban block level, high resolution land cover data, traffic data for heatwave days, tree crown size, and exposure to typical building orientation are incorporated. To identify the vulnerable population, urban-block level demographic data from the Hungarian Central Statistical Office are used, including the number of people over 65 and people with disabilities. A key indicator is the walking distance to public transportation stops and the access to important services e.g. medical services. We also consider the masonry, age and air conditioning of the buildings.

Relevant stakeholders, databases, opportunities for cooperation

Expert stakeholder group	Determination of indicators, data providers
Organisations working with vulnerable groups	Representation of the vulnerable population, identification of soft aspects
Citizens	Sharing own experiences, mapping specific problematic locations

Deliverable Phase 1, 2.3.1 Workflow #1 – Heatwaves, 2.5 Preliminary Monitoring and Evaluation



DEMO AREA FOR THE IDENTIFICATION OF THE LOCAL INDICATORS

A downtown, densely built-up area with green spaces.
The figure demonstrates some features and problematic locations suggested by the expert and the community stakeholder groups related to heavy rain, heatwaves and drought. Based on the stakeholders' inputs, we formulated the indicators and the data sources to be incorporated in the risk analyses.

Indicators

1. Rainwater runoff
2. Low points
3. Vulnerability of the sewer system
4. Traffic jams and delays during heavy rain events
5. Households with only +65-year old people
6. Bus stop equipment type
7. Shading by trees and buildings
8. Geographical orientation
9. Share of green spaces
10. Building age and masonry
11. Location of public toilets and drinking water fountains
12. Suitability of public transport vehicles to disabled people, air-conditioned vehicles
13. Walking distance to the closest public transport stop
14. Irrigation system
15. Pedestrian visitation rate
16. Mowing order
17. Size and built-up rate of green spaces
18. Vertical layers of the vegetation

PROGRESS

October 2024 – March 2025

Learning the Climaax methodology
Test of workflows on regional level
Collection of regional data, mapping local data collection options
Development of local stakeholder analysis
Development of community involvement methodology
1 expert stakeholder meeting focusing on heatwaves and heavy rain

March 2025 – June 2025

Starting the local adaptation of the heatwaves workflow
Collection of relevant local data
1 expert stakeholder meeting focusing on drought
1 community stakeholder meeting focusing on vulnerable groups
Climaax Workshop in Barcelona

July 2025 – October 2025

Local adaptation of the 3 workflows
Bilateral meetings with stakeholders
Risk analysis
Validation of results with stakeholders
Publications and dissemination actions
Community involvement activities

More about this project

Funded by the European Union

CLIMAAX climate ready regions