

## Social vulnerability to heatwaves – from assessment to implementation of adaptation measures in Košice and Trnava, Slovakia <sup>[1]</sup>

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High temperatures and heatwaves in the summer pose increasing risks to people living in Slovakian cities. In particular older people and children, those living on top floors in poorly insulated buildings, and those relying on facilities such as nurseries, schools or care homes are prone to heat stress. The Carpathian Development Institute, in collaboration with local authorities in Trnava and Košice, carried out an assessment of vulnerability to high temperatures and heatwaves in residential environment, taking into account the social aspects. Factors such as presence of older people, children and location of facilities serving these vulnerable groups were considered.

Based on the results of the assessment, adaptation strategies are being implemented in both Trnava and Košice, including measures such as thickening of tree stands in parks, building and restoration of water elements (blue infrastructure) and fountains in most vulnerable places, actions aiming at changing citizen behavior during heatwaves, etc., Moreover, a neglected public open space in a vulnerable area in Trnava was redesigned to provide shading through planting of trees and other vegetation.

### Case Study Description

#### **Challenges:**

Both Trnava and Košice face increasing temperatures. In Košice, ten hottest years in the last 150 years have occurred since 1990, and the annual mean temperature between 1881 and 2100 has increased by 1.6°C. Number of tropical days (mean temperature above 30 °C) has increased in the last 20 years from 12 to 20 days (in the year 2012 it was 37 days) and the maximum temperature frequently exceeds 34°C. Similarly, in Trnava, summers are getting hotter and winters are getting warmer (although the winter temperatures are increasing at a slower rate than summer temperatures). The annual number of summer days (mean temperature above 25 °C) is projected to rise from 58 (1961–1990) to 100 (2051–2100). The annual number of tropical days will rise from 12 to 36 in the same periods. Both cities are likely to be affected by longer and more severe droughts in the future. Whilst in Trnava the precipitation is slightly decreasing (more substantially in winter), in Košice the total amount of precipitation remains steady, whilst there are more torrential rains possibly causing flooding interspersed with dry periods.

#### **Objectives:**

Trnava (population of about 68,000 inhabitants) is extremely vulnerable to the urban heat island effect, due to its historical character associated with high proportion of paved surfaces, which exacerbate heat stress during periods of high temperature. In Košice (population of about 240,000 inhabitants), large proportion of residents are living in prefabricated blocks of flats, prone to overheating in high temperatures.

The Carpathian Development Institute, in collaboration with local authorities, carried out an assessment of vulnerability to high temperatures of the entire city of Trnava and the densely populated and materially deprived Zapad district (40,000 inhabitants) in Košice. The assessment was a basis for the development of a range of actions aiming to improve the adaptation capacity of Trnava and Košice to climate change and heatwaves in particular.

### **Solutions:**

In Košice, the Mayor of the self-governed city borough of Zapad decided to prepare a climate change adaptation plan. Zapad is a relatively homogenous residential area, consisting of mainly blocks of flats constructed from prefabricated elements and poorly insulated. Despite the high density of population, there is a considerable amount of green space between the apartment blocks, making it the greenest part of Košice city.

First, a vulnerability assessment was carried out by the Carpathian Development Institute. The following vulnerability, exposure and adaptive capacity indicators were collected and analysed for 200m x 200m grid cells to identify hotspots of vulnerability and risk in relation to heatwaves:

- Percentage of people over the age of 75 and below 4 years;
- Percentage of people living in top-floor flats;
- Location of vulnerable facilities (e.g. nurseries, kindergartens, care homes for the elderly);
- Level of thermal insulation of prefabricated apartment blocks;
- Extent of paved areas with no shade;
- Coverage of green areas, and in particular availability of green areas with a tree crowns coverage over 60% and with surface over 2 ha (considered as the most effective in cooling);
- Surface roughness (height and orientation of buildings);
- Temperature distribution pattern (based on measurements during heatwaves);
- Circulation of cooling air and katabatic wind (i.e. downslope, cool wind);
- Presence of air conditioning on the city transport;
- Availability of medical assistance during heatwaves.

In addition, a survey was carried out with the local citizens on the awareness of heatwaves, knowledge of behaviours reducing heat stress risk, perceived need for adaptation planning in their area as well as on the preferred adaptation measures.

All factors were weighted considering their influence on the risk of high temperatures to human health, based on scientific literature, and presented on maps. The combination of all factors produced the overall vulnerability map of the Zapad borough. The analysis allowed the identification of areas that are particularly vulnerable from the social perspective and exposed to high temperatures. The results, combined with the outcome of the survey, informed a local government-led strategy including the implementation of the following types of actions:

- Improved shading through vegetation and artificial structures.
- Cooling of existing public spaces, including: increase of green areas, revitalization of existing parks and green areas, use of climate-resilient tree species, reduction of sealed surfaces, building and restoration of elements of blue infrastructure and water fountains. Among the various interventions, thickness of green stands in parks has been improved, aiming at 60% coverage of tree canopy.
- Cooling of indoor public spaces, including: improved thermal insulation, vertical greenery, shading of transparent openings, windows and displays, green/reflecting roofs, some use of air conditioning in most vulnerable facilities.
- Early warning system on heatwaves, developed in cooperation with the State Health Authority of Slovakia.
- Information and educational activities for citizens related to safe behavior during heatwaves.

Another action included in the local strategy was the establishment of a 'climate-correct decision-making' programme, i.e. building capacity of public administration; introduction of mechanisms ensuring that climate concerns are taken into account in planning and issuing of construction permits.

In Trnava, a similar approach to vulnerability assessment was taken, and similar range of adaptation measures was developed in the climate adaptation plan. Moreover, a former neglected open space neighboring a block of flats, kindergarten and care home for the elderly (thus identified as a location highly vulnerable to heatwaves) was transformed through removal of tarmac, planting of trees (to achieve 60% crown coverage once the trees mature), construction of a fountain, and provision of new benches. This resulted in an inviting green space offering respite during heatwaves, which is also being used for socialising by the local community. In addition, sustainable urban drainage systems were introduced to improve water infiltration and retention. The evaluation of the effectiveness of the measures is planned 5 years after completion of the project in 2019.

At the city scale, Trnava also encourages citizen engagement in adaptation through setting up of a municipal budget (minimum 10,000 euro a year) for adaptation grant applications. The adaptation measures can be proposed by either individuals or organisations and a detailed set of criteria ensures that they are in line with the city adaptation plan. To date, mainly awareness-raising activities at local schools are being supported.

The City of Trnava is one of the first cities in Slovakia with systematic approach to climate change impacts. The adaptation plan will serve not only as a tool to tackle heatwaves and urban heat island effect; it is also considered a prerequisite for drawing external resources from EU in the funding period 2014–2020.

#### **Importance and relevance of the adaptation:**

Case developed and implemented as a CCA (Climate Change Adaptation) Measure.

#### **Additional Details**

##### **Stakeholder engagement:**

The vulnerability assessment supporting the identification and implementation of adaptation measures was carried out by the Carpathian Development Institute, which developed the methodology and provided the expert leadership for the project. In Košice, the Mayor of the Zapad borough provided political support for the project and the civil servants provided the necessary data. Additional expertise was provided by the Slovak Hydro-meteorological Institute and the Regional Office of Public Health.

Local authorities were closely involved in the vulnerability assessment in both cities. The development of the adaptation strategies (for 10-15 years) and the adaptation action plans (for 3 years, with concrete adaptation measures and allocated responsibilities and finance) was a collaborative effort between the Carpathian Development Institute and local authorities.

During the project in Košice, local citizens were consulted (through a survey) on their perceived need for the adaptation planning in their area, as well as on the preferred type of adaptation measures. The planning and implementation of the pilot greening project in Trnava was carried out by the local authority, but the idea was consulted with the district committee including local residents. Moreover, in Trnava, the citizens and local organisations can propose adaptation measures to be funded by the city through a participatory budget mechanism.

##### **Success and limiting factors:**

Slovakia is currently revising its National Adaptation Strategy, but has not developed a national adaptation action plan yet; the initiative in Košice and Trnava was carried out in the absence of national regulations. Therefore, there is little support on adaptation for local authorities from the national level. Alongside Trnava and the Zapad borough of Košice, only Bratislava and Kezmarok have developed adaptation plans to date. Therefore, overall, there is a limited willingness of the local authorities to invest their resources into the systematic adaptation process.

At the city level, other limitations are associated with the local authority officials, being overwhelmed by their day-

today activities. Also the novelty of the climate adaptation topic and its multispectral character make it a difficult subject to tackle by representatives of local authorities.

A major success factors was strong commitment from the city leadership. In Košice, a strong enabling factor was the support from the local Mayor interested in the adaptation agenda. In Trnava, the interest of the local government officials in climate change and the willingness to learn drove their participation in the international conference *Climate Change and Local Development – Challenge for Local Governments* (March 2012, Bratislava). Following the event, the representatives of Trnava City actively looked for support in development of their adaptation action plan. The solution was found in the joint project led by Carpathian Development Institute dealing with the assessment of vulnerability to high temperatures and heatwaves. The collaborative nature of the project was one of the success factors. The availability of external funding was also crucial in completion of the vulnerability assessment and development of the climate change adaptation plans.

#### **Budget, funding and additional benefits:**

In Košice, funding for the development of the Zapad Adaptation Strategy was provided through the project “Climcross Development: Partnership for addressing climate change impacts on development” run within the Hungary-Slovakia Cross-border Co-operation Programme 2007–2013.

In Trnava, funding was provided by the project “Cities resilient to Climate Change Impacts” inspired by city of Trnava, which was funded via Swiss Financial Mechanism (SFM). The SFM financed mainly the development of the Adaptation Strategy, but 20,000 euros were provided for tree seedlings, which were planted and are being maintained by the Trnava city. The grant/participatory budget scheme aiming to support small-scale adaptation measures (minimum 10,000 euro a year) is financed from the city budget.

#### **Legal aspects:**

There is no legal framework in Slovakia specifically supporting urban adaptation to climate change. The main strategic document of reference is the Slovak National Adaptation Strategy, adopted by the Government in 2014. Trnava is a signatory of the Covenant of Mayors for Climate and Energy since 2016, with an adaptation target.

#### **Implementation time:**

In Trnava, the vulnerability assessment and the development of the adaptation action plan were carried out in 2013-2015. The vulnerability assessment and the elaboration of adaptation strategy in Košice took 13 months, from early 2013 to mid-2014. The various adaptation measures are progressively implemented.

#### **Reference Information**

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[http://www.kri.sk/web\\_object/638.pdf](http://www.kri.sk/web_object/638.pdf) [5]

##### **Sources:**

“Carpathian Development Institute” and “Energia Klub Climate Policy Institute and Applied Communications (2017) Adaptation Best practices from the Visegrad countries

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