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The cooling effect of a river as a contribution to climate change adaptation and resilience

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Due to climate change, adaptation strategies are being implemented all over the world, from the scale of the entire country to individual housing estates. The CoAdapt – Communities for Climate Change Action (NOR/IdeaLab/Co-Adapt/0002/2020-00) project documents the best nature-based solutions supporting adaptation to climate change and creates a database of good practices in neighbourhoods. One of the most effective examples is the use of blue infrastructure such as restoring rivers to the surface or thoughtful development of the immediate surroundings of the river. Therefore, to better understand the cooling effect of rivers, research was carried out in the Vistula River valley in Warsaw – the city where CoAdapt project was started. This study aims to investigate the differences in the thermal regime in the river valley and other parts of the city, and determine which elements of the immediate surroundings of the site impact the thermal environment the most.

The basis for the calculations was the air temperature sampled every 10 minutes by HOBO loggers at 2 m above the ground, collected in the years 2017-2022. The air temperature monitoring in the Vistula Valley was carried out on three stations: in the south and the downtown part on the left bank and the north on the right bank of the river. To present the thermal characteristics of the river and its cooling effect, these data were compared with the stations located in other parts of the city and characterized by different types of spatial development (e.g. Floor Area Ratio, Ratio of Biologically Vital Area, Sky View Factor). Moreover, based on 25 satellite thermal images from 2002-2018, the impact of the Vistula River on the incidence of the Cold Spot effect was analysed.

In this study, it was found that with increasing development density and a decrease in the share of biologically vital areas, the average daily air amplitude decreases. The northern and southern parts of the valley in Warsaw are characterized by similar thermal conditions. However, the middle one, located in the downtown area of the city, stands out significantly – it is warmer, and the Cold Spot effect occurs more often. Surrounded by highly heated artificial surfaces, the impact of the Vistula is more visible than in the case of green areas adjacent to the valley, although the range of impact is smaller due to the rapidly growing intensity of development in the city centre.

Getting acquainted with environmental data such as air and surface temperature and the good practices, then selecting diverse, effective methods based on blue and green infrastructure in

neighbourhoods was one of the stages leading to the creation of the serious game – the main result of the CoAdapt project. Moreover, data related to the monitoring of the Vistula Valley were used to select neighbourhoods in Warsaw to conduct the CoAdapt workshops.