

## Towards a climate change adaptation framework for heatwaves through open space transformation at the neighbourhood scale in Alberta

© Zahra Azarm, 2023

Climate change stressors at the local scale impact health and quality of life in urban areas. Heatwaves are a significant risk during the summer, and extreme heat threatens the viability of urban areas and the welfare of residents. In Alberta, the major cities of Calgary and Edmonton have experienced summer heatwaves in recent years. Open spaces are one of the places in the summer where people can seek social connections and respite from hot indoor conditions. However, poor adaptation of neighbourhood open spaces to heatwaves can exacerbate negative health effects and contribute to spatial inequalities across the city. Considering these factors, the main contribution of this research is to find out how open spaces and surrounding walkable areas can be designed for climate resilience. Specifically, it focuses on policies and interventions that can be applied to Downtown Calgary and Edmonton. This paper includes a review and interpretation of global and local precedents, urban design guidelines and action plans to identify practical and beneficial strategies for adapting neighbourhood open spaces to heatwaves, and an assessment of current public open space qualities in central Edmonton and Calgary. After reviewing the literature and relevant studies from different contexts, the most significant factors for adapting to heatwaves are the built environment, infrastructure and design, the density of the neighbourhoods, building pocket, materials, vegetation, and street design. Though environmental attributes such as green space is a significant impact to create cool spaces, this research finds more variables that climate adaptation should address by introducing a three-dimensional framework; Environmental, Physical, and social attributes.

Climate change adaptation should take the first step by focusing more on the Environmental aspect of the city and spaces. The lack of greenery and small open spaces or green spaces in the Downtowns requires more considerations such as enhancing the tree density and having small green spaces or green buffers around the parking lots. Also, blue infrastructure such as watery spaces, ponds, or waterplay installations in open spaces can be some strategies to reduce the effects of the heatwave.

Secondly, Physical attributes like urban patterns, high-rise building placement, materials, land use patterns, and urban design components are the elements that can play a role in thermal comfort and the climate change adaptation process. For example, land use and compact urban pattern can reduce the use of private cars and gas emissions that intensify the heat waves. Additionally, the large parking lots paved with asphalt downtown should be integrated with green spaces and trees to minimize the effects of the heat wave. Furthermore, providing the shadow in the downtown can be achieved through creative design strategies, more greenery, and dense nodes and corridors.

Finally, this research highlights the social aspect of the adaptation to allow discovering the mobility patterns and social gatherings in the Downtown neighbourhoods. Cities should know the places people mostly use and the new patterns of gathering to plan for better open spaces. Also, urban planners and city staff should be trained through conducting workshops to know the effects of the heatwave, different strategies that can be applied to the individual buildings, and future impacts on the city's growth.