

 **CIB TG97**  
**Nature-Based Solutions for Climate Resilient Buildings and Communities**

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National Research Council Canada*

**Thursday, 6 February, 2025**

*New Task Group*  
**Nature-based solutions for climate resilient buildings and communities**



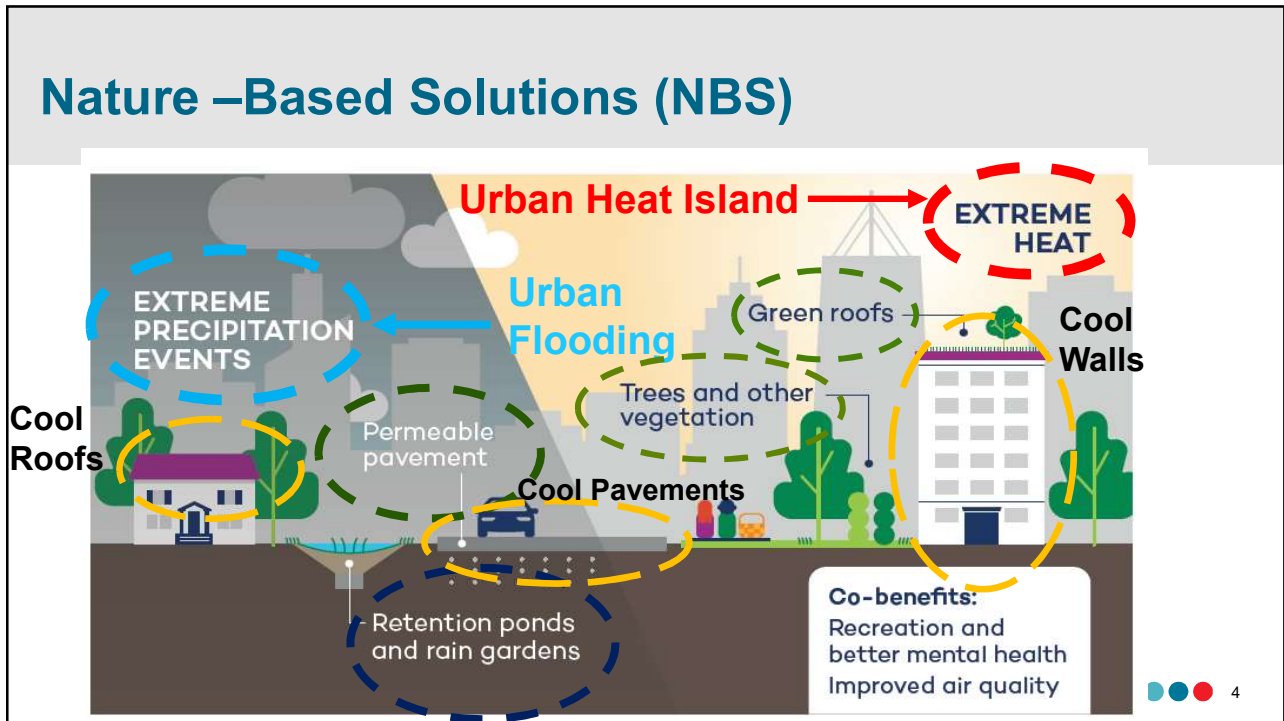
[https://cibworld.org/Welcome Members to CIB New Task Group TG97 Nature-based solutions for climate resilient buildings and communities](https://cibworld.org/Welcome%20Members%20to%20CIB%20New%20Task%20Group%20TG97%20Nature-based%20solutions%20for%20climate%20resilient%20buildings%20and%20communities)

 **Agenda**

- Overview of TG97
- Nature-Based Solutions (NBS) to Mitigate Urban Heat Islands Effects
- TG97 Activities to Date
- Passive Cooling Strategies and NBS Techniques
- Future Collaboration & Next Step



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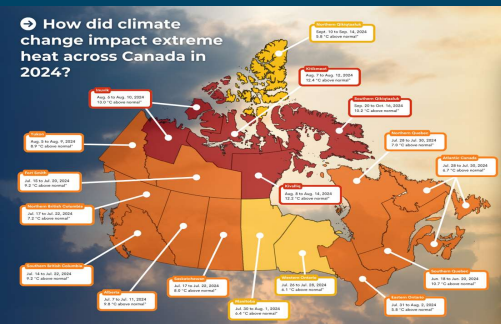
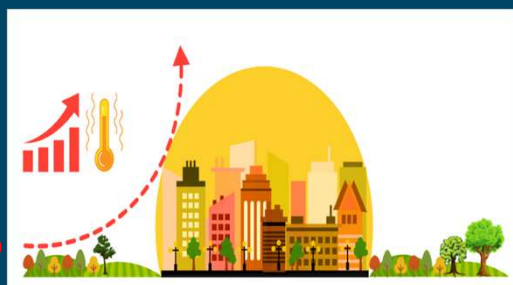
## TG97 Objectives

### Share research on nature-based solutions (NBS) to:

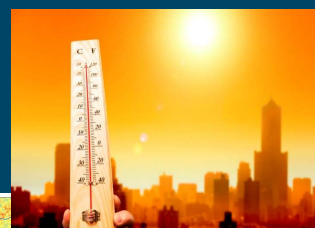
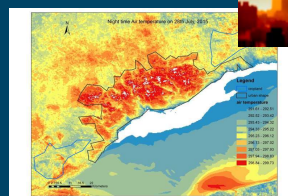
- ❑ Quantify the role of NBS in mitigating urban heat island and urban flooding effects and reducing building GHG emissions.
- ❑ Demonstrate strategies to develop NBS for climate-resilient, carbon-neutral communities using simulations under current and future climate scenarios.
- ❑ Develop best practices and guidelines for implementing NBS, enabling professionals and policymakers to confidently apply these solutions globally.



## Urban Heat Islands



Rapid Extreme Weather Event Attribution system: top heat events of 2024 — [ClimateData.ca](https://climatedata.ca)



## Nature – based Solutions (NBS) Increasing Greenery & Vegetation



Green Wall in Toronto



Green Roof in Toronto



Green Roof in Vancouver



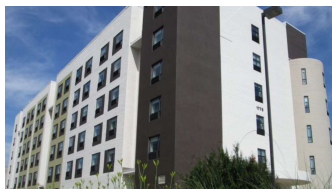
Vertical Garden in Vancouver

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## Nature – based Solutions (NBS) Increasing Surface Solar Reflectivity



Cool Roof in Toronto



Cool Building in Toronto

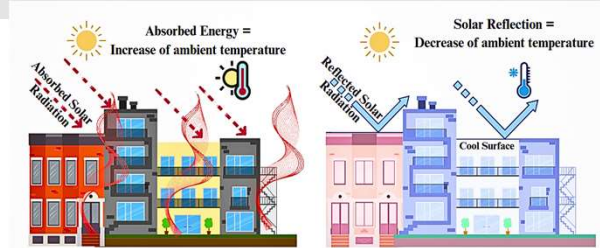


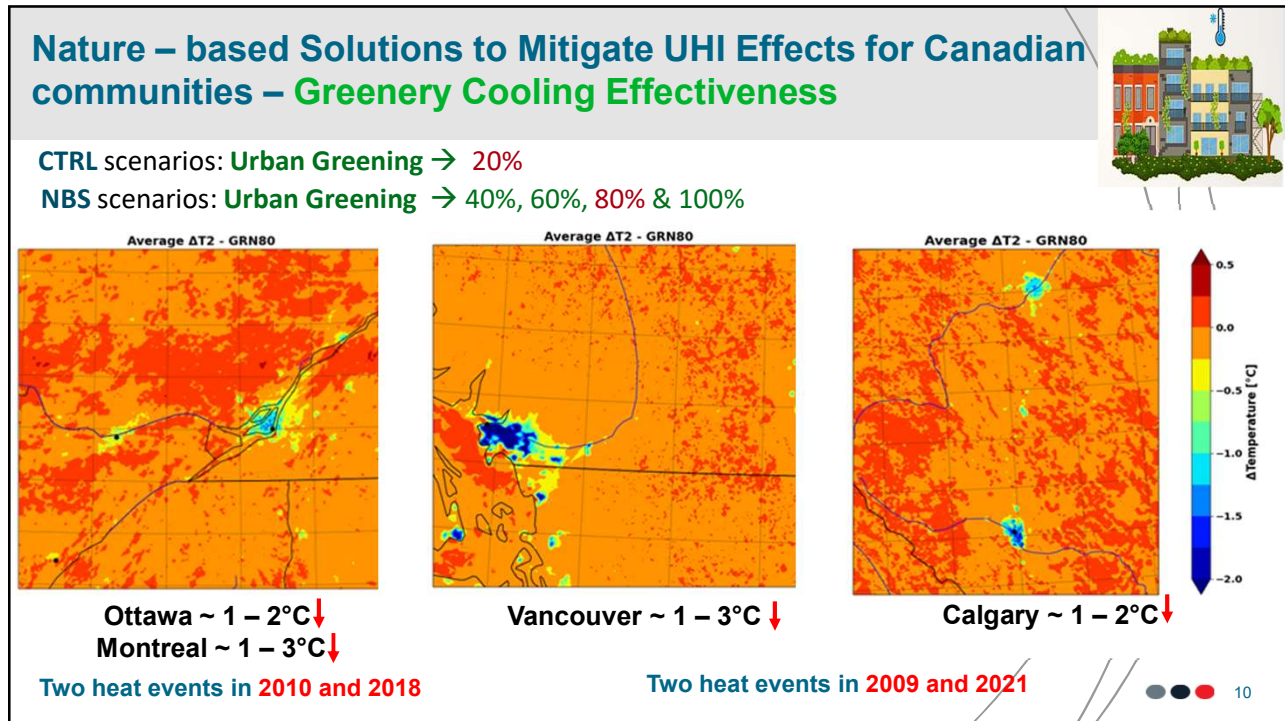
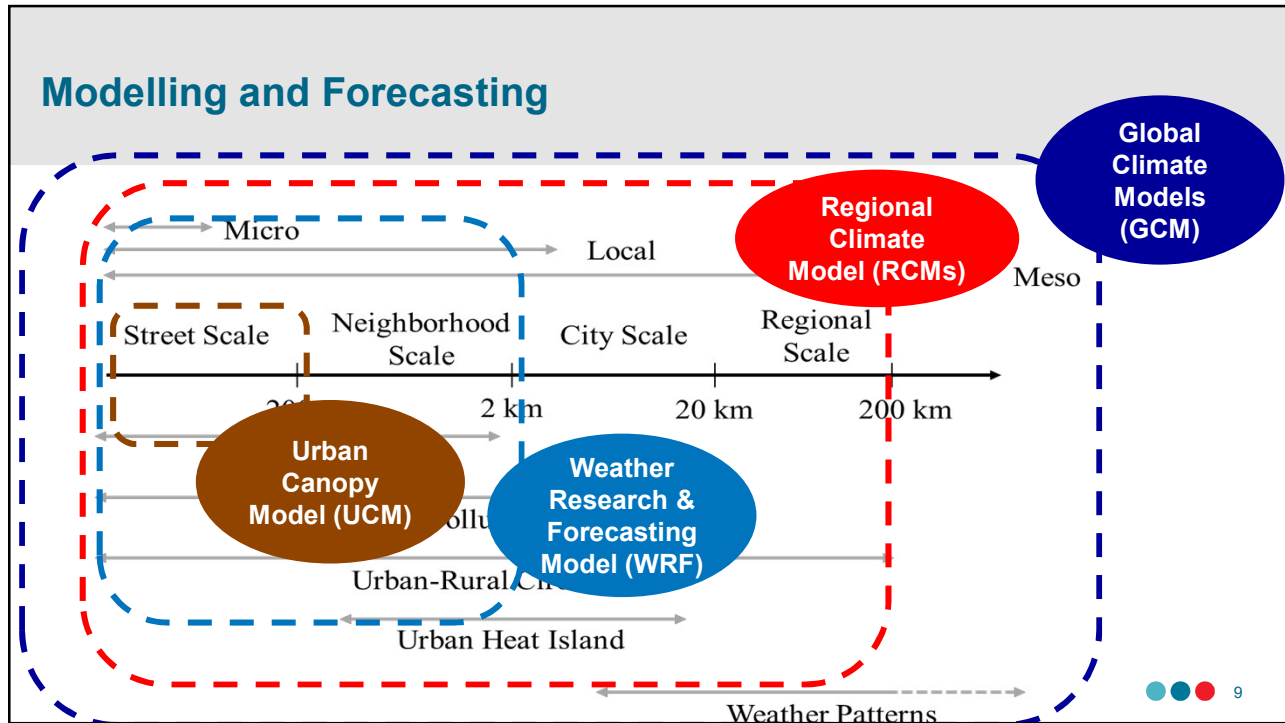
Cool Building in BC



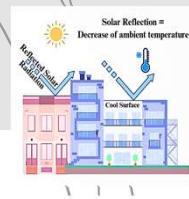
Cool Roof in Ottawa

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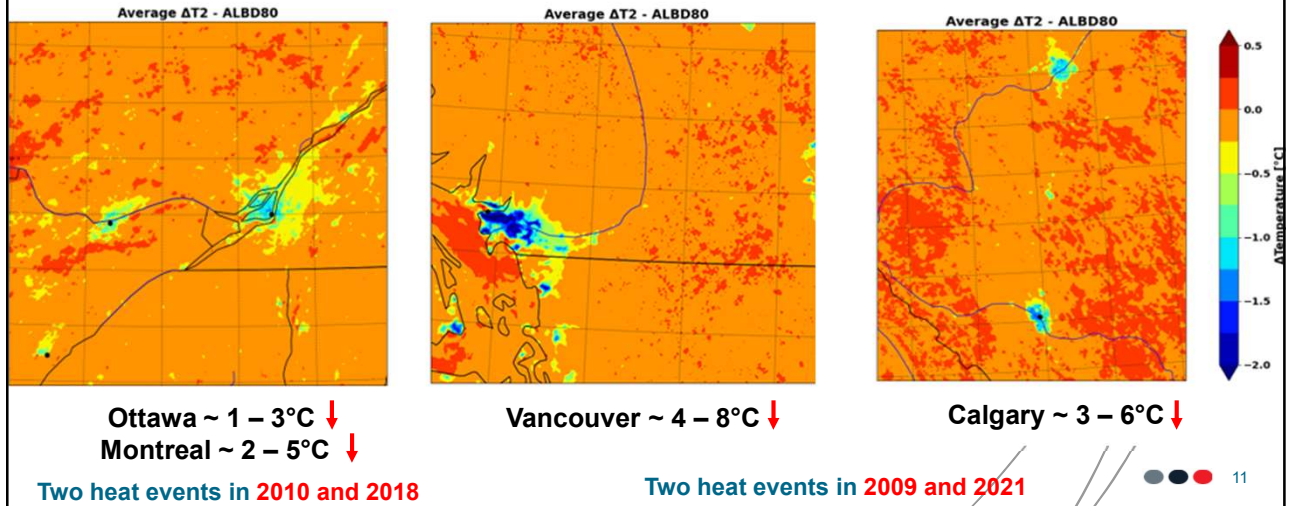




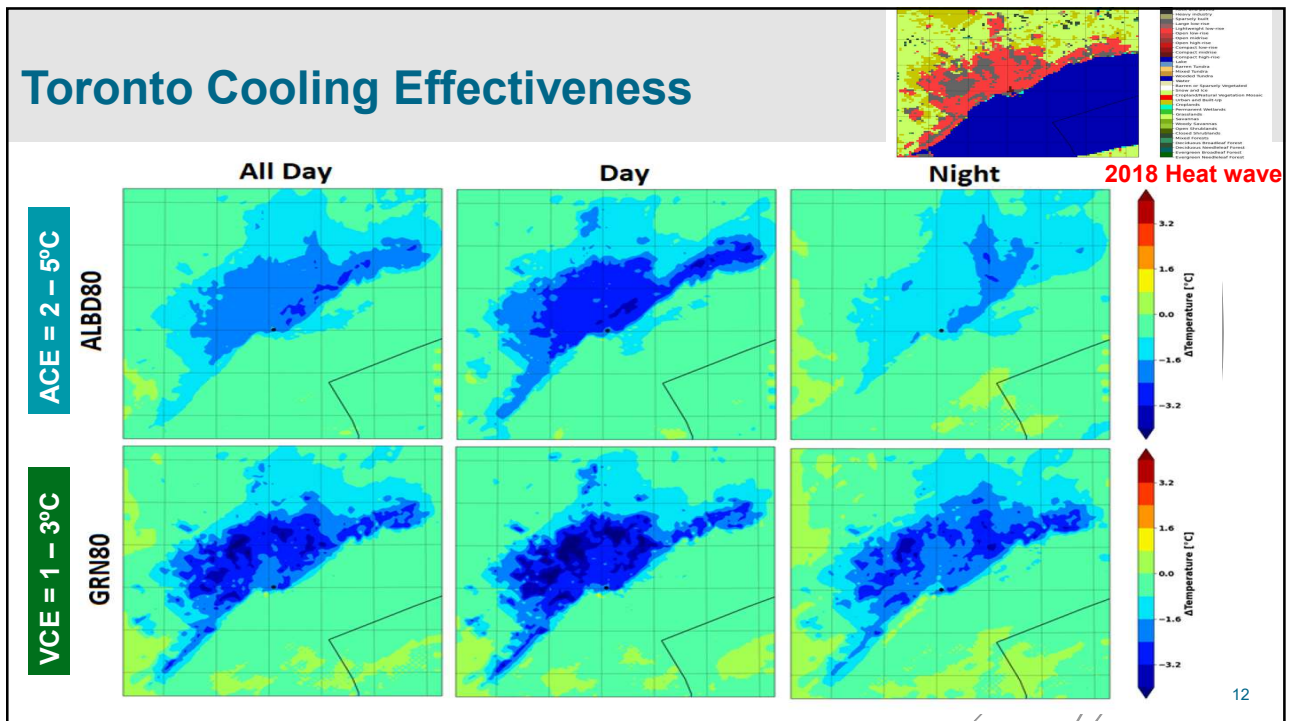
## Nature – based Solutions to Mitigate UHI Effects for Canadian communities – Albedo Cooling Effectiveness



CTRL scenarios: Building Albedo → 0.2  
 NBS scenarios: Building Albedo → 0.4, 0.6, 0.8 & 1.0

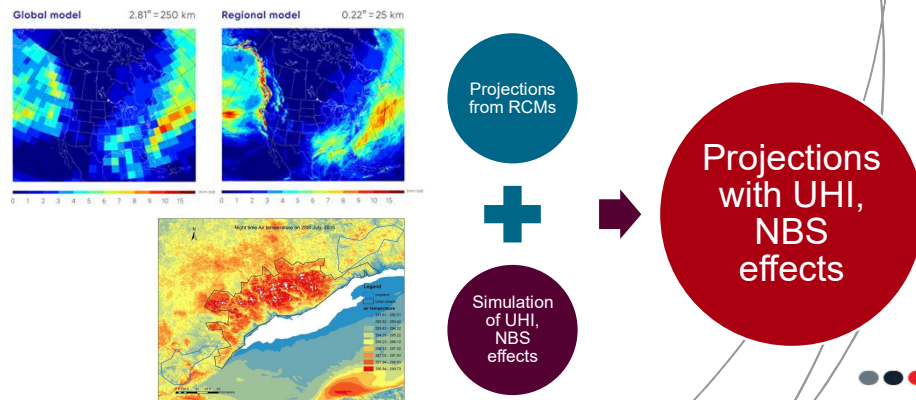


## Toronto Cooling Effectiveness



## Future Steps

- **Objective:** To prepare building simulation climate files incorporating the effects of climate change, UHI and select NBS for the cities of Ottawa, Montreal, Calgary, Vancouver, and Toronto.
- **Approach**



## Cool Building Envelope (CBE) Materials to Mitigate UHI Effects

## Cool Building Envelope Consortium (CBEC)

**buildings** | MDPI

Review  
**Increasing Solar Reflectivity of Building Envelope Materials to Mitigate Urban Heat Islands: State-of-the-Art Review**  
 Bahador Ziaemehr<sup>1</sup>, Zahra Jandaghian<sup>2,\*</sup>, Hua Ge<sup>3</sup>, Michael Lacasse<sup>2</sup> and Travis Moore<sup>2</sup>

Energy and Buildings  
 Volume 207, 15 January 2020, 109627

ELSEVIER

Analysis of the cooling effects of higher albedo surfaces during heat waves coupling the Weather Research and Forecasting model with building energy models

Zahra Jandaghian, Umberto Berardi

- Evaluate temperature reduction, UHI mitigation and energy and carbon savings

**Saving Cooling energy demand in Toronto by 7% to 10%.**

## NBS to Mitigate Overheating Risks in Buildings

Convective exchange with environment

Solar load

Room AC

Movable window blind

Window

Thermal radiation

Marble path

Grass

Senior Social Housing

Long term care

Senior social housing

Primary school

LONG-TERM CARE CENTRE

Primary School

Temperature

Humidity

Sunlight

Radiant heat

Airflow

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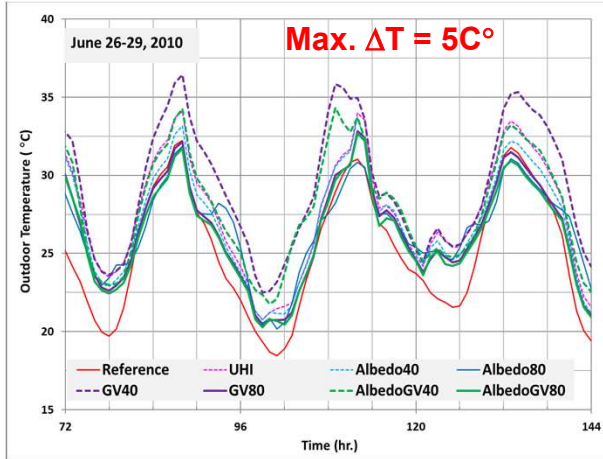
## NBS – Building Level: 7 Scenarios

Scenario	Details	Picture
0. Reference (RegE)	Default settings (regular envelopes)	
1. Albedo 40 (RW40RR40)	Reflective walls/roofs (reflectivity=40%)	
2. Albedo 80 (RW40RR80)	Reflective walls (40%) and roofs (80%)	
3. Green roofs (GR)	Regular walls with green roofs	
4. Green roofs/walls (GCWGR)	Green roof and green walls (with climbing plants)	
5. Green roofs/walls (GLWGR)	Green roof and light green walls (with a growing medium)	

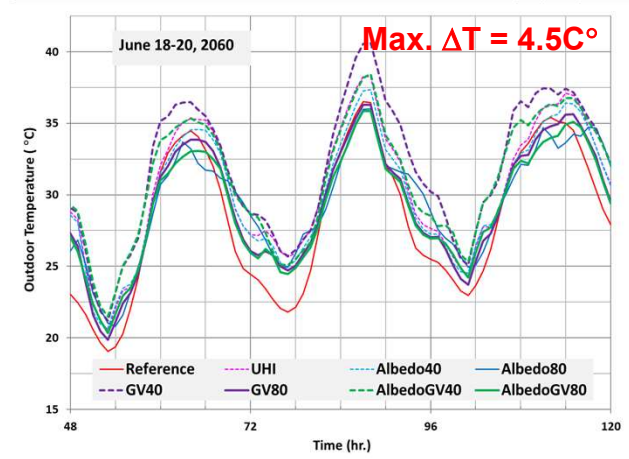


## NBS Effects on Outdoor Temperature (Ottawa)

Historical

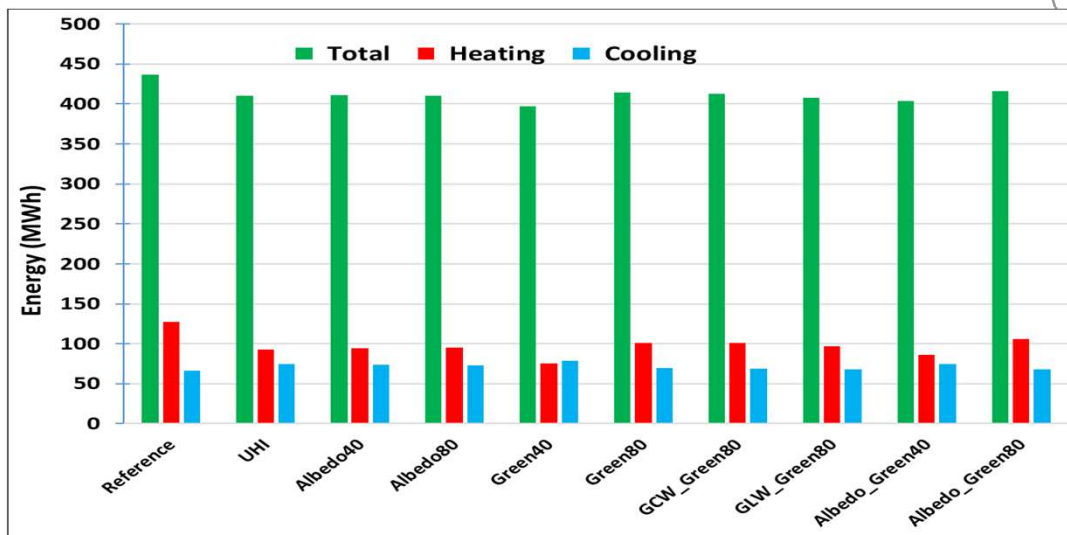


Future projection GW2.0



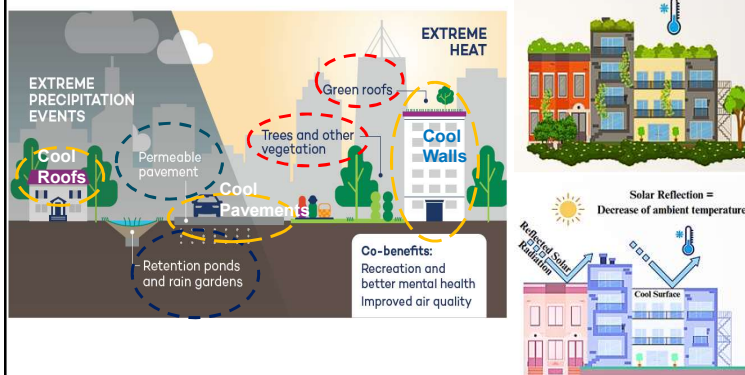
## Long – Term Care Homes (New Construction – Ottawa)

### Energy Use



## Nature-based Solutions to Mitigate the Effects of Climatic Changes

### City-level and Building-level NBS



### Key Research Innovations:

- Develop research data and analyses methods on the NBS Design, Construct, and Implementation
- Develop best management practices to implement and maintain the NBS in various climatic conditions
- Develop a web-based and evidence-based decision making tools to employ the NBS techniques in cities with confidence.



## TG97 Activities to Date

11 Countries: Canada, Germany, Norway, USA, UK, South Africa, Australia, Finland, Sweden, Switzerland, Hong Kong

### 29 Members

- 1st Meeting in October, 2021
- 2<sup>nd</sup> Meeting in October, 2024

- MDPI **Buildings** — Special issue on "*Nature-Based Solutions for Carbon Neutral Climate Resilient Buildings and Communities*" and "*Nature-Based Solutions to Mitigate the Effects of Urban Heat Islands and Urban Flooding*"

Nature-based solutions for climate resilient buildings and communities



Join TG97

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## TG97 2<sup>nd</sup> Meeting in Oct 2024

- Dr. Dominique Derome, University of Sherbrooke – Canada
- Dr. Nasrin Aghamohammadi, Curtin University Sustainability Policy Institute – Australia
- Dr. Jan Carmeliet, ETH Zurich – Switzerland
- Dr. Afshin Afshari, Fraunhofer Institute for Building Physics IBP – Germany



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## TG97 Milestones and Deliverables

- **State-of-the-Art Reports on NBS for Climate-Resilient Buildings and Communities:**
  - ❑ Inclusion of unique terminology specific to NBS.
  - ❑ Analysis of the key challenges and benefits associated with implementing NBS in both buildings and communities.
  - ❑ Case studies: A report featuring three to five real-world examples of NBS implementation across various climatic zones.
- **Publications in NBS:**
  - ❑ A series of publications focusing on how NBS can enhance climate resiliency of built environment and contribute to carbon sequestration, reduce carbon emissions from buildings, and moderate urban micro-climates.
  - ❑ These publications will be featured in a special issue of *MDPI Buildings*, dedicated to Nature-Based Solutions:

[Buildings | Special Issue : Nature-Based Solutions to Mitigate the Effects of Urban Heat Islands and Urban Flooding \(mdpi.com\)](#)



## Passive Cooling Strategies

- Window glazing types** (High vs. low solar heat gains)
- Solar shading devices** (fixed, dynamic, internal, external)
- Space ventilation**
  - Natural ventilation by opening windows
  - Mechanical nighttime ventilation (10:00 pm to 9:00 am; or 12:00 am to 6:00 am)
  - Mechanical (continuous) ventilation of common spaces (Halls, corridors, etc.)
  - Mixed mode ventilation (nighttime + natural)
- Mechanical cooling**
  - Room cooling with a relaxed setpoint temperature
  - Cooling of common spaces

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## Proposed Future Work: Integrate NBS & Passive Cooling Strategies

- **Urban Microclimate Modeling for NBS – Passive Cooling Integration**
- **Smart and Adaptive Nature – Based Cooling Systems**
- **Hybrid Materials Combining Biogenic and Radiative Cooling Properties**
- **Policy and Economic Feasibility for Large-Scale Deployment**
- **Long –Term Performance Monitoring and Lifecycle Assessment (LCA)**

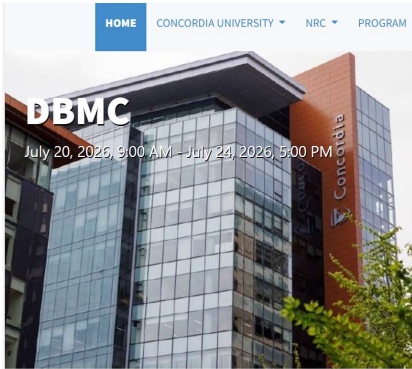
# TG97 Future Step

- ❑ **WBC2025** (19 – 23 May, Purdue University, USA) [CIB World Building Congress 2025](#)  
**1/2 day workshop on NBS and Passive Cooling for interested WG participants**



World Building Congress WBC2025  
19-23 May 2025  
Purdue University, USA

The theme of this conference is *Sustainable Built Environment: the role of the construction industry in meeting the UN Sustainable Development Goals (SDGs)*.



- ❑ **DBMC 2026** in July at Concordia, Montreal; [Home | DBMC](#); **17th International Conference on the Durability of Building Materials and Components (XVII DBMC)**



**Nature-based solutions for climate resilient buildings and communities**





**One Plant @ a Time**



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