

## WHAT ARE SOME OF THE HUMAN HEALTH CO-BENEFITS EMERGING FROM LOW-CARBON AND NATURAL INFRASTRUCTURE?



### What are human health co-benefits?

- ▶ **Positive health effects that result from policies, projects (which could range from retrofitting buildings to building new greenspaces), or programs aimed at reducing greenhouse gas emissions, supporting greater environmental conservation or supporting cleaner economic growth.**
- ▶ **Human health co-benefits can result from:**
  - reductions in risk factors like air or water pollution, or mitigation of adverse impacts from environmental exposures.
  - a project's impacts on determinants of health such as the physical and built environment, community and social factors, or livelihood and lifestyle factors.

They can vary geographically depending on the proximity to a project, and will vary depending on the time horizon used to assess impacts.

### How will climate change impact human health?

Health Canada has identified six categories of negative health effects on health and well-being related to climate change:<sup>1</sup>

- ▶ **Temperature-related morbidity and mortality** that increase rates of heat and cold-related illnesses, occupational risks and rates of respiratory and cardiovascular disease;
- ▶ **Weather-related natural hazards** resulting in increased rates of social and mental stress, population displacement, and damaging public infrastructure;
- ▶ **Reduced air quality**, and increased exposure to air pollutants and allergens, can increase rates of respiratory disease and cardiovascular disease;
- ▶ **Water-and-food-borne contamination** can lead to intestinal illnesses and disorders;
- ▶ **Higher exposure to ultraviolet rays** can increase rates of skin damage, skin cancer and disturb immune function; and,
- ▶ **Increased rates of vector-borne and zoonotic diseases** as activity patterns of disease vectors such as mosquitoes, ticks and other animals change.

### What are some of the human health cobenefits that could result from deploying lowcarbon infrastructure projects in the buildings, energy and transport sectors?

- ▶ If 25% of the US light-duty vehicle fleet were electrified, the reductions in particulate matter emissions and ozone formation, two air pollutants, could result in 437 and 98 avoided premature deaths annually, respectively<sup>3</sup>.
- ▶ Energy efficiency retrofits to a building in New Zealand resulted in residents self-reporting improvements in their hypertension and sinusitis symptoms by 14% and 5% respectively<sup>4</sup>.
- ▶ A Canadian report identified that electrifying all light-duty vehicles in the Greater Toronto-Hamilton Area could avoid 313 premature deaths annually, while electrifying all public transit buses in the GTHA could avoid 143 premature deaths annually<sup>5</sup>. Avoided mortality was attributable to reductions in particulate matter, ozone, nitrogen dioxide and black carbon (a part of particulate matter).
- ▶ Replacing 17% of electricity generation with solar power in the continental US could avoid 1424 premature deaths through reduced exposure to particulate matter in the summer<sup>6</sup>. The potential to avoid premature mortality could be even higher if there were more pollutants under consideration.

### Those living in directly proximity to a project may experience *reduced health risks*

- ▶ **Life-cycle impacts:** The full life-cycle impacts of a project need to be taken into account, from manufacturing to disposal
- ▶ **Frequency and type of use patterns:** How a project could be used by stakeholders and community members, and how these differences in use-patterns influence how health impacts will be experienced
- ▶ **Equity:** Who within a community might experience the beneficial and adverse health impacts emerging from the construction and adoption of a project
- ▶ **Proximity:** Health impacts will differ by how close individuals reside to a project. Those living in direct proximity to a project may experience larger overall health benefits.

### What are low-carbon infrastructure projects?

- ▶ **Low-carbon infrastructure** projects are projects that reduce fossil fuel energy consumption and greenhouse gas emissions within the buildings, transportation and electricity subsectors<sup>2</sup>. Project include:
- ▶ **Renewable energy**, including solar and wind generation assets.
- ▶ **Retrofits to improve energy efficiency** of buildings and homes.
- ▶ **Zero-emissions transportation** vehicles, solutions and supporting infrastructure.

1 Health Canada, 2019. *Climate change and health: Health effects*. <https://www.canada.ca/en/health-canada/services/climate-change-health.html>

2 Definition adapted from the World Bank (World Bank, 2017) [https://ppi.worldbank.org/content/dam/PPPI/documents/2017\\_Low\\_Carbon\\_Infrastructure\\_PPI.pdf](https://ppi.worldbank.org/content/dam/PPPI/documents/2017_Low_Carbon_Infrastructure_PPI.pdf)

3 Peters, D. R., Schnell, J. L., Kinney, P. L., Naik, V., & Horton, D. E. (2020). Public Health and Climate Benefits and Trade-Offs of U.S. Vehicle Electrification. *GeoHealth*, 4(10). Scopus. <https://doi.org/10.1029/2020GH00027>

4 Wilson, J., Dixon, S. L., Jacobs, D. E., Breyse, J., Akoto, J., Tohn, E., Isaacson, M., Evens, A., & Hernandez, Y. (2014). Watts-to-Wellbeing: Does residential energy conservation improve health? *Energy Efficiency*, 7(1), 151–160. <https://doi.org/10.1007/s12053-013-9216-8>.

5 Environmental Defence & Ontario Public Health Association. (2020). *Clearing the air: How electric vehicles and cleaner trucks can reduce pollution, improve health and save lives in the Greater Toronto Hamilton Area*. Clearing the Air. <https://clearingtheair.ca>

6 Abel, D., Holloway, T., Harkey, M., Rrushaj, A., Brinkman, G., Duran, P., Janssen, M., & Denholm, P. (2018). Potential air quality benefits from increased solar photovoltaic electricity. *Atmospheric Environment*, 175, 65–74. <https://doi.org/10.1016/j.atmosenv.2017.11.049>

## What are nature-based solutions?

Nature-based solutions (NBS) are actions inspired and supported by nature to protect, sustainably manage and restore ecosystems to enhance community resilience, address societal challenges, conserve biodiversity and improve human well-being<sup>7</sup>. NBS are typically placed in five main categories:

- **Restoration:** Ecological restoration/engineering e.g., afforestation
- **Issue-specific:** Climate change adaptation/mitigation, disaster risk reduction e.g., vegetation buffers to limit coastal flooding
- **Infrastructure:** Natural and green infrastructure e.g., rain gardens, green roofs, stormwater ponds
- **Ecosystem-based management:** integrated management of nature and people e.g. Great Lakes watershed management
- **Ecosystem protection:** protected and conserved areas, national parks

## What are some of the human health co-benefits of using nature-based solutions?

- ▶ **Reduce risk of disease.** A Canadian study identified more greenspaces within 500m of a home could result in a reduced risk of mortality from cardiometabolic diseases by 8-12%. The results were strongest among adults aged 35 to 74 and demonstrate the protective effect that more urban nature can have on physical health outcomes<sup>8</sup>.
- ▶ **Improved Air Quality.** A study in 86 Canadian municipalities estimates that urban forests provide \$227M in human health co-benefits by removing up to 16,500t of air pollution annually. Pollutants removed include nitrogen dioxide, ozone and fine particulate matter (2.5) and are linked to 30 fewer deaths, 22,000 fewer acute respiratory illnesses, 16,500 fewer cases of severe asthma symptoms and 4,500 fewer missed school days due to illness<sup>9</sup>.
- ▶ **Social Benefits.** Community cohesion centered around urban nature is an important factor that frames lifestyle choices, healthy behaviors and active living. Studies in Saskatoon identify self-reported feelings of accessibility, safety and belonging in urban greenspaces as primary factors that encourage healthy behaviors in children aged 9-14.<sup>10,11</sup>

These studies show that inclusive greenspaces can result in more than twenty additional minutes of outdoor recreation and socialization.

- ▶ **Support Mental Health.** Urban parks, woodlands and densely vegetated greenspaces can provide a variety of mental health benefits, which can include reduced stress and anxiety, less impulsive decision-making, and a lower risk of suffering from depression and other mental illnesses. Greenspace features that are shown to be crucial for relaxation and mental restoration can include tree canopy/vegetation density, biodiversity, and the auditory and visual experience of nature contact.<sup>12</sup>

- ▶ **Considering socioeconomic and socio-demographic factors is essential for ensuring the equitable distribution of health co-benefits among community members.** For example, health co-benefits from nature-based solutions can have the greatest impact for low-income households<sup>13,14</sup>, yet a study of 30 Canadian cities identifies that parks, urban greenspaces, and their corresponding health co-benefits are concentrated in high-income areas<sup>15</sup>.

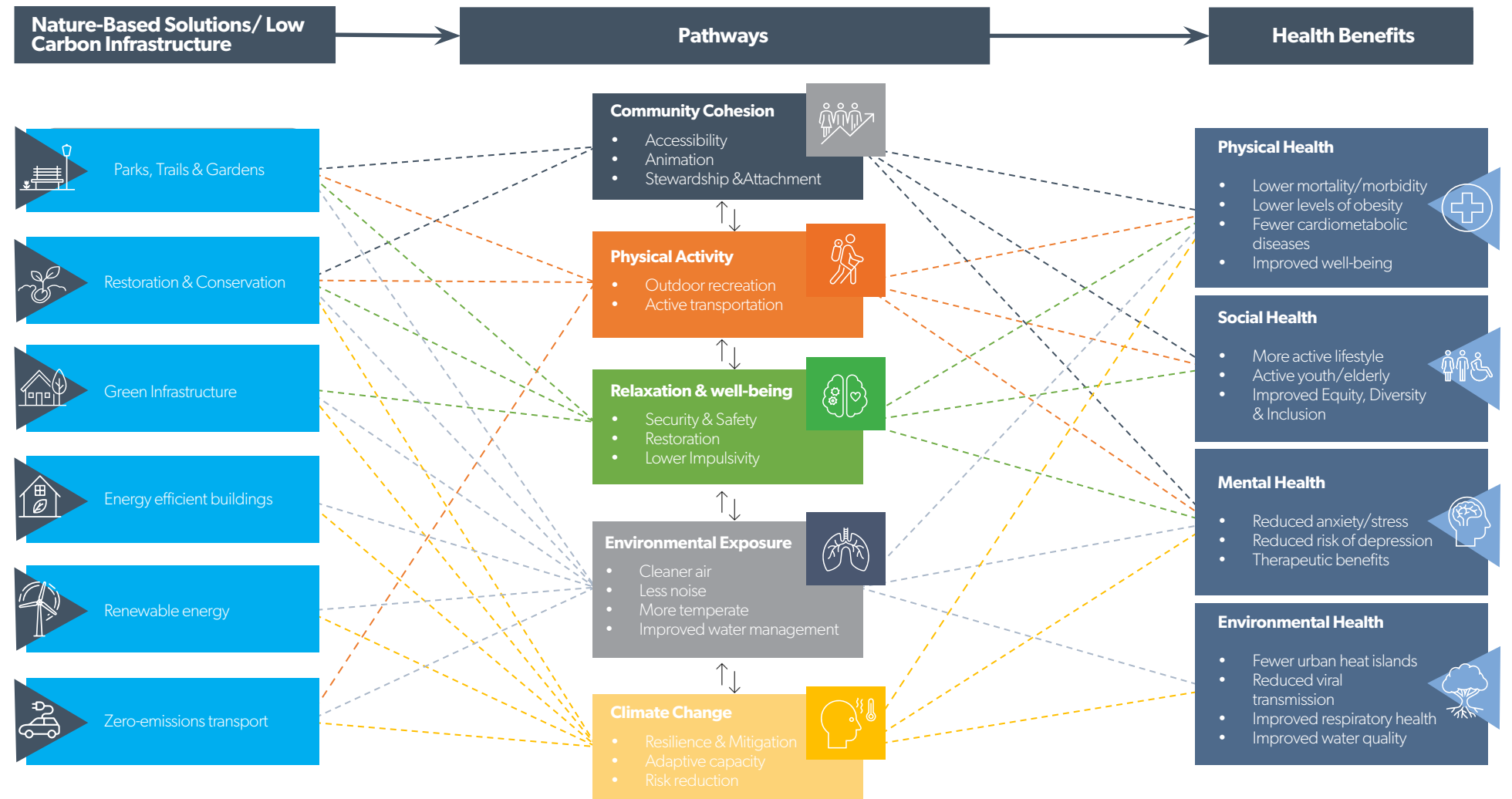
- ▶ Specific features can be linked to feelings of ownership and attachment that influence how urban greenspaces are being used, and by whom:

- A study in Germany identifies playgrounds and open grass areas as key greenspace features for young children and families<sup>16</sup>
- Greenspace maintenance is an important factor that can determine usage among women, children, and seniors<sup>17</sup>
- Greenspaces with recreation facilities are important sources of socialization and physical activity for youths and teenagers<sup>18</sup>
- Greenspaces with social amenities (e.g., park benches) are important sources of socialization and physical activity for seniors<sup>19</sup>

## Why is it important to consider equity and accessibility when evaluating health impacts of low carbon and natural infrastructure projects?

- ▶ **Increasing investment does not mean the benefits will be evenly distributed.** Accessibility, feelings of belonging and inclusion, and safety and security are important when determining who benefits from investments in infrastructure projects.

7 Definition Adapted from IUCN Commission on Ecosystem Management (IUCN 2021) [www.iucn.org](http://www.iucn.org)  
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To read more about the health co-benefits of low-carbon infrastructure projects, please read Smart Prosperity's reports "The human health co-benefits of low-carbon infrastructure in the buildings, energy and transportation sectors" and "The benefits of cleaner air".

To learn more about the health co-benefits of nature-based solutions and natural infrastructure, please read Smart Prosperity's "The Nature of Health".