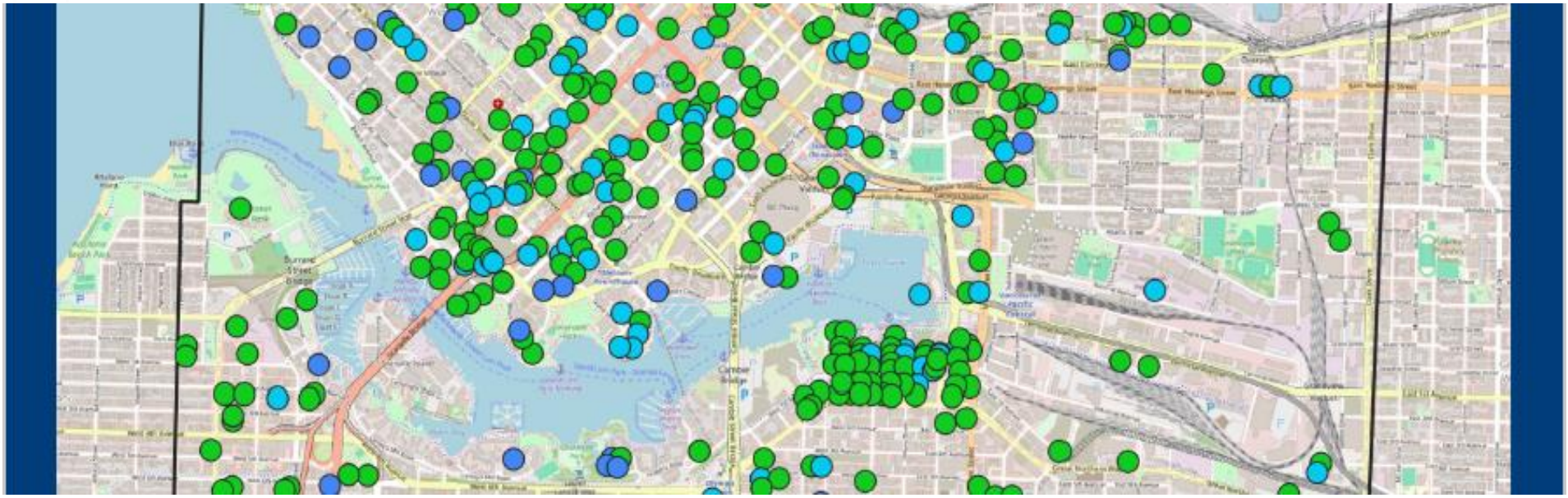
GRIN British Columbia

Green Roof Infrastructure Network of BC

Liability and Potential: Mapping Vancouver's Roofs, Trees, and Green Spaces



Dr. Kathy Dunster, President, GRIN BC

With support from directors: Dr. Karen Liu, Josh Stewart, Fai Hui, Ryan Vasseur, Goya Ngan, Randy Sharp, Genevieve Noel, Olya Trush, and Dr. Christine Thuring

Intro: Who is GRIN?

The Green Roof Infrastructure Network of BC (GRIN) is a registered nonprofit that emerged in 2023 from GRiTT (Green Roof Info Think-Tank) and intersectional overlaps with the BCIT Centre for Architectural Ecology.

We're an interdisciplinary network united to advance the widespread implementation of green roofs and stormwater solutions in BC.

What does GRIN do?

We are Green Roof Champions: cultivate and support

- Advance policies, remove barriers
- Fill knowledge and information gaps

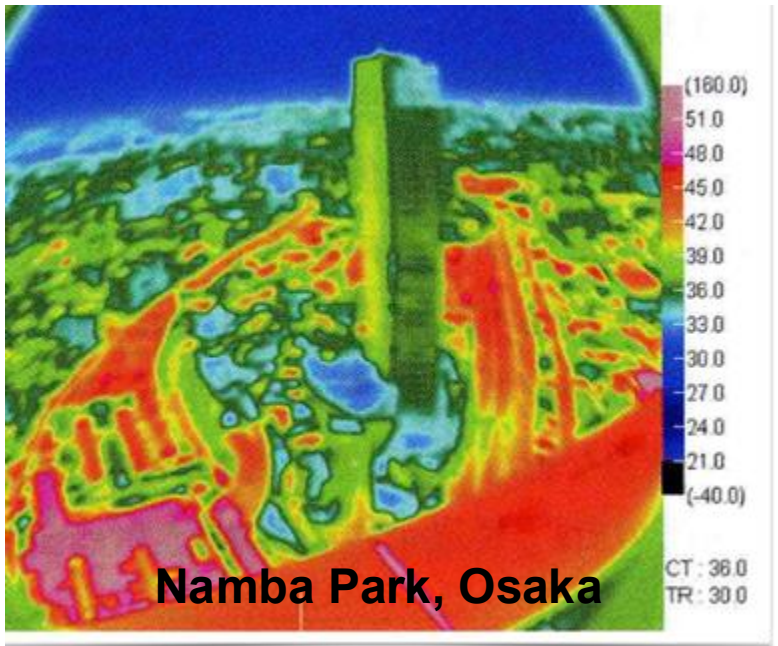
We Provide Outreach and Education:

- Green Roof Tours
- Presentations
- Webinars
- Courses/ training

Mapping Vancouver: Pilot Project

In 2024, GRIN began collaborating with Gentian Ltd. and Small Change Fund to generate baseline maps assessing the green infrastructure of BC towns and cities, with emphasis on green roofs (existing and potential), private gardens, and urban trees.

Goal: Identify achievable opportunities to improve resilience to flooding, drought, and heat (see image), and create opportunities for biodiversity.



Namba Park, Osaka

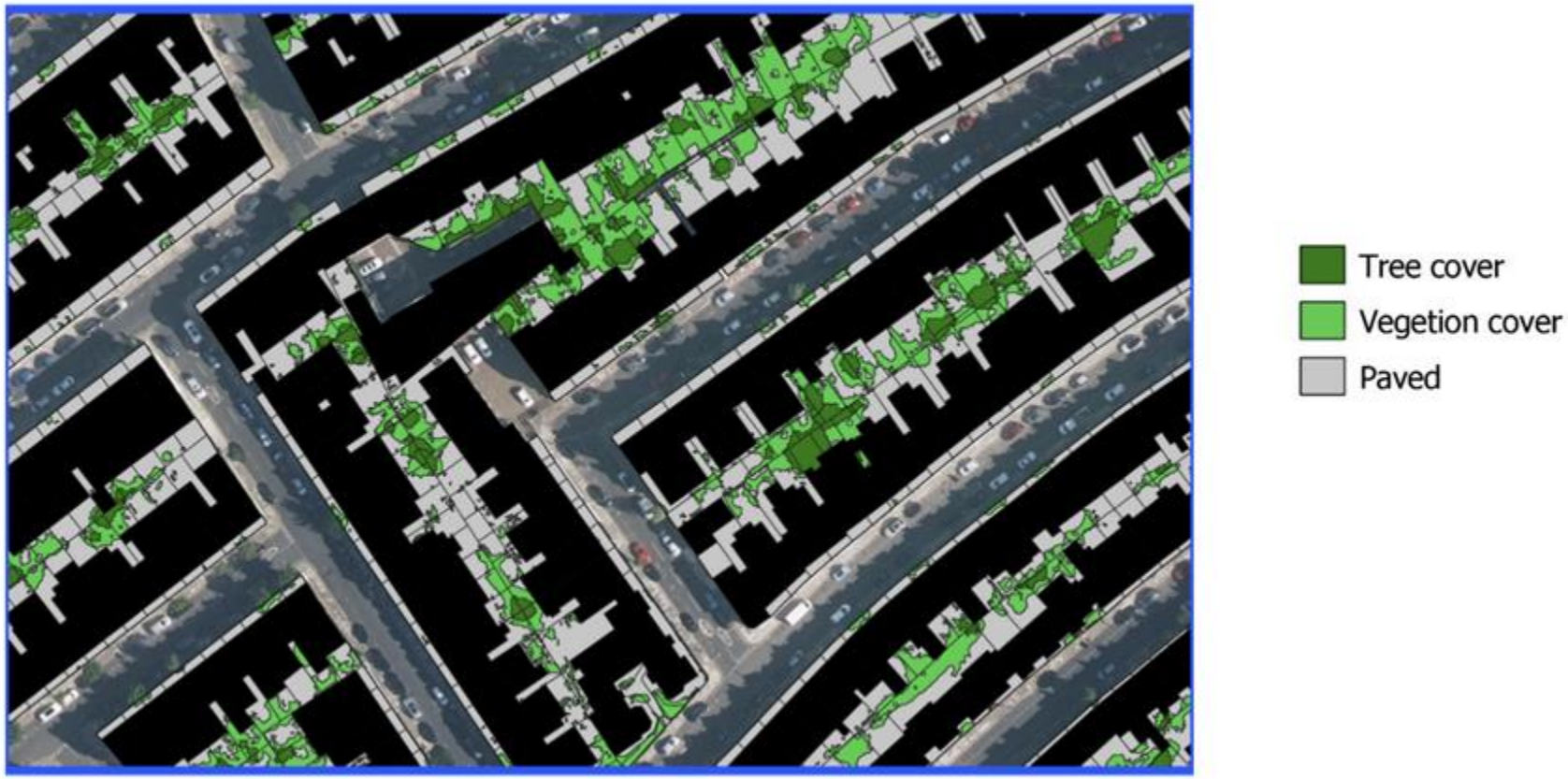
What is Gentian Technology?

Established in 2020 with funding from the European Space Agency, Gentian's primary goal is to reverse biodiversity loss. It applies artificial intelligence (AI), computer vision, and high-resolution remote sensing data to conduct rapid, precise ecological surveys.

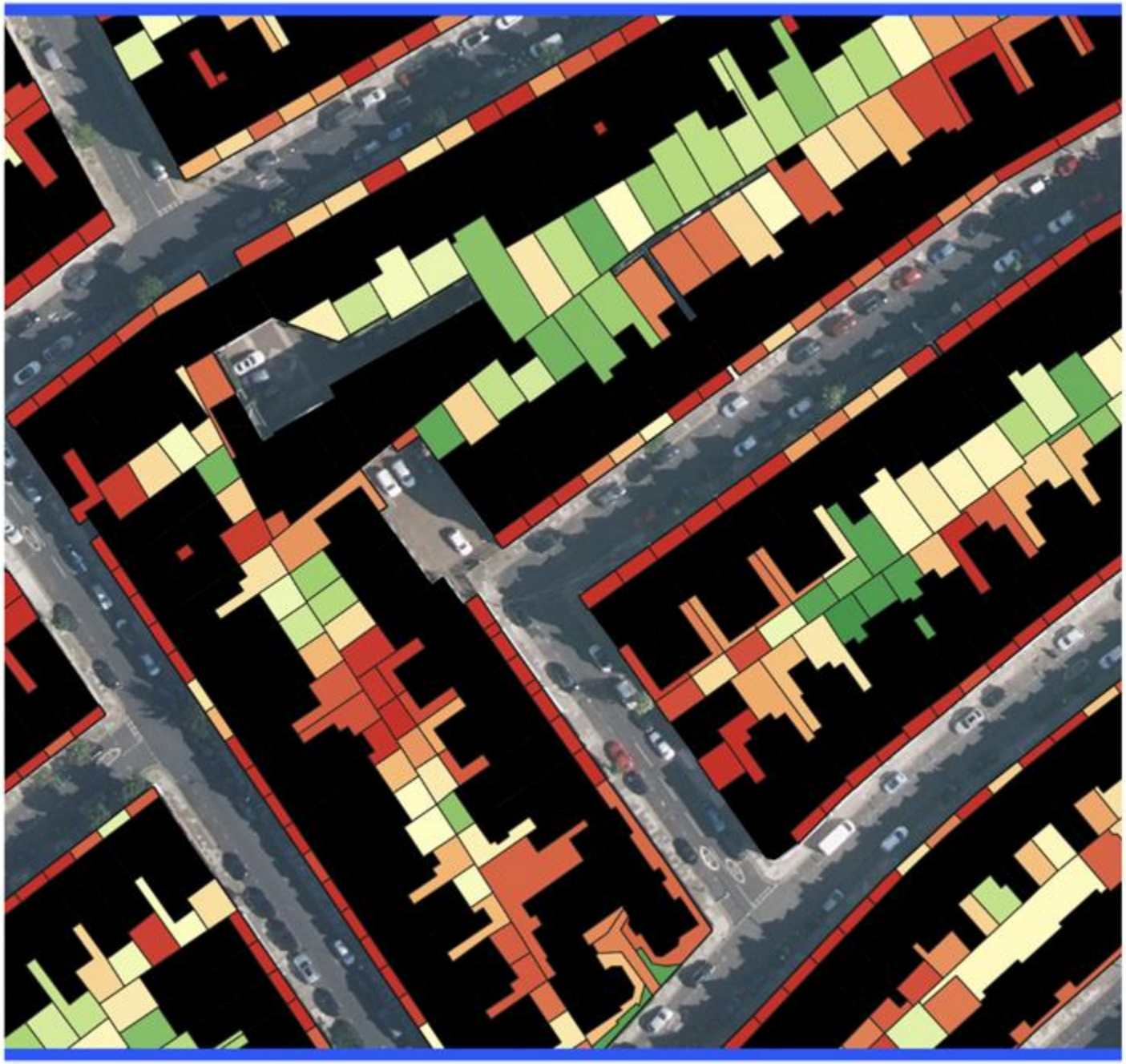
In the UK introducing the AI technology was well-timed to assist developers and planning authorities required to meet *Biodiversity Net Gain* on every project site because:

- Time is of the essence to meet global climate targets
- Clarifies type & quality of habitat available within urban limits
- Assesses potential green roof (GR) retrofits for biodiversity
- Identifies strategic opportunities for GI and NbS (especially areas prone to flooding, fire, urban heat, drought, etc.)
- Illustrates the benefits of GRs & GI at appropriate scales

Advanced satellite imagery and AI serve to **automate mapping, measuring, and monitoring habitats**. No matter the location or habitat type, on this planet, Gentian's innovative technology delivers precise data at a fraction of the time required by field mapping, leaving time and space for humans to ground truth, calibrate, and verify the AI results.




Vegetation cover
0%
100%


Vegetation cover
0%
100%

Vancouver is the first North American city mapped by Gentian.

GRIN members are helping train the AI models by:

- Reviewing the analyses, human eyes interpreting the data
- Ground-truthing, calibrating the AI algorithms, and verifying results if/when roof access is possible, including roofs we have worked on.
- Correcting false assumptions: The AI was initially trained and calibrated on European urban environments (e.g. organic growth vs. planned grids; old buildings vs. skyscrapers)

The data is high-resolution, remarkably precise, and swiftly delivered, with human expertise at the helm.

- Monitor/measure impervious cover changes over time.
- Model impact on flood control and stormwater.
- Monitor/measure changes to the built landscape (new buildings and shadows) and their effects on plant health on roofs and at grade.
- Assess quality and performance of GR & GI to meet other goals (e.g., improving biodiversity, reducing the urban heat island, and improving health and well-being for all).
- Tracking GRs through time: type and function; gap analysis; equitable distribution for health + well-being.

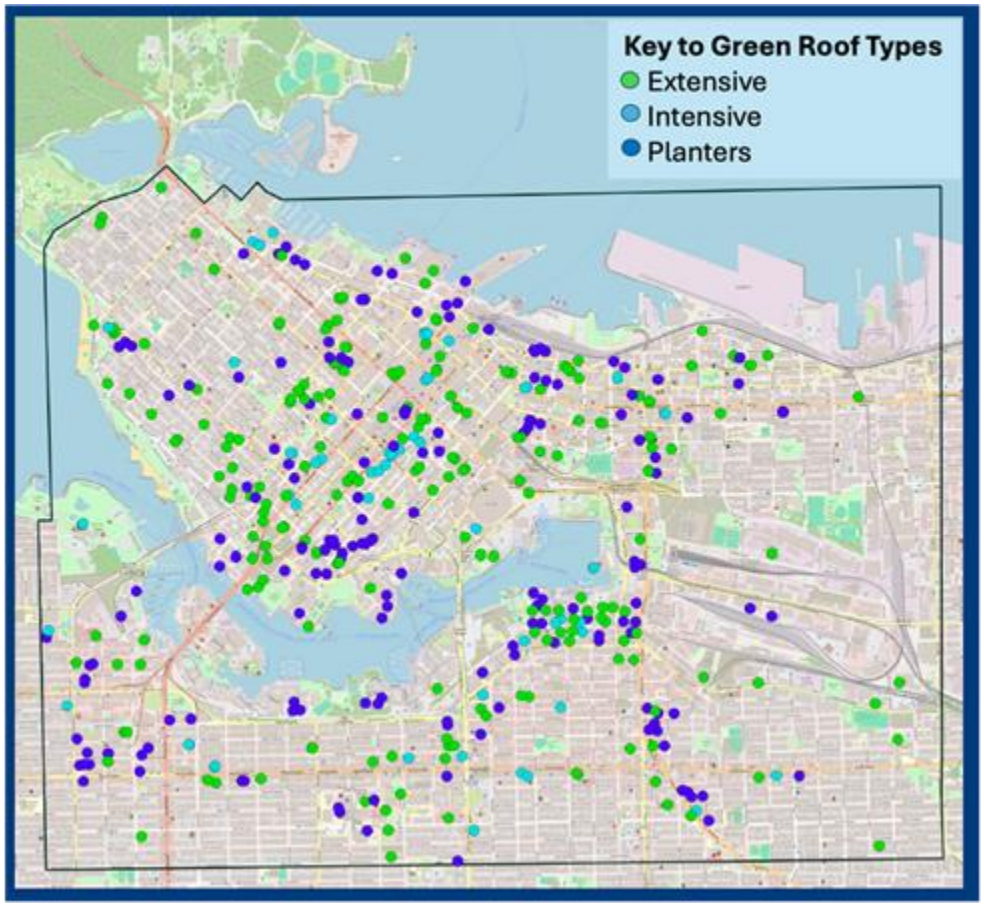
High resolution satellite photography = details

AI is trained to delineate building polygons (black)

AI is trained to recognize different types of greenness

Results

The pilot used very high resolution 2023 satellite imagery (30-50 cm) to locate and analyse GRs and other forms of vegetation within a 20 km^2 Area of Interest (AOI).



Results: AOI Roof Data Summary

99,279m²

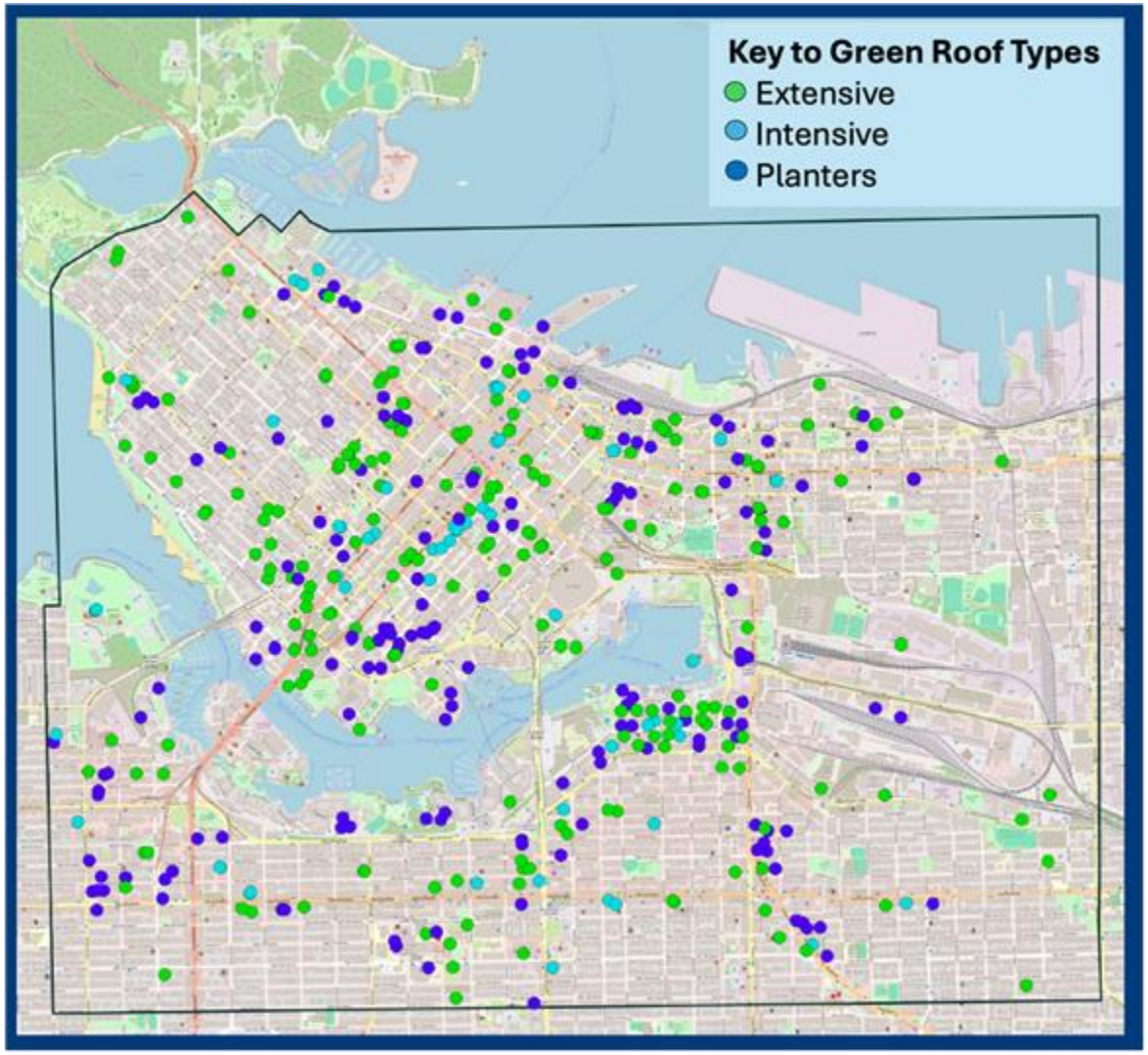
	Area (m²)	% GR Area	% All Roof Area	Buildings
Extensive	83,183	83.78%	1.65%	221
Intensive	16,096	16.21%	0.32%	62
TOTAL	99,279		1.98%	283

Roof Summary

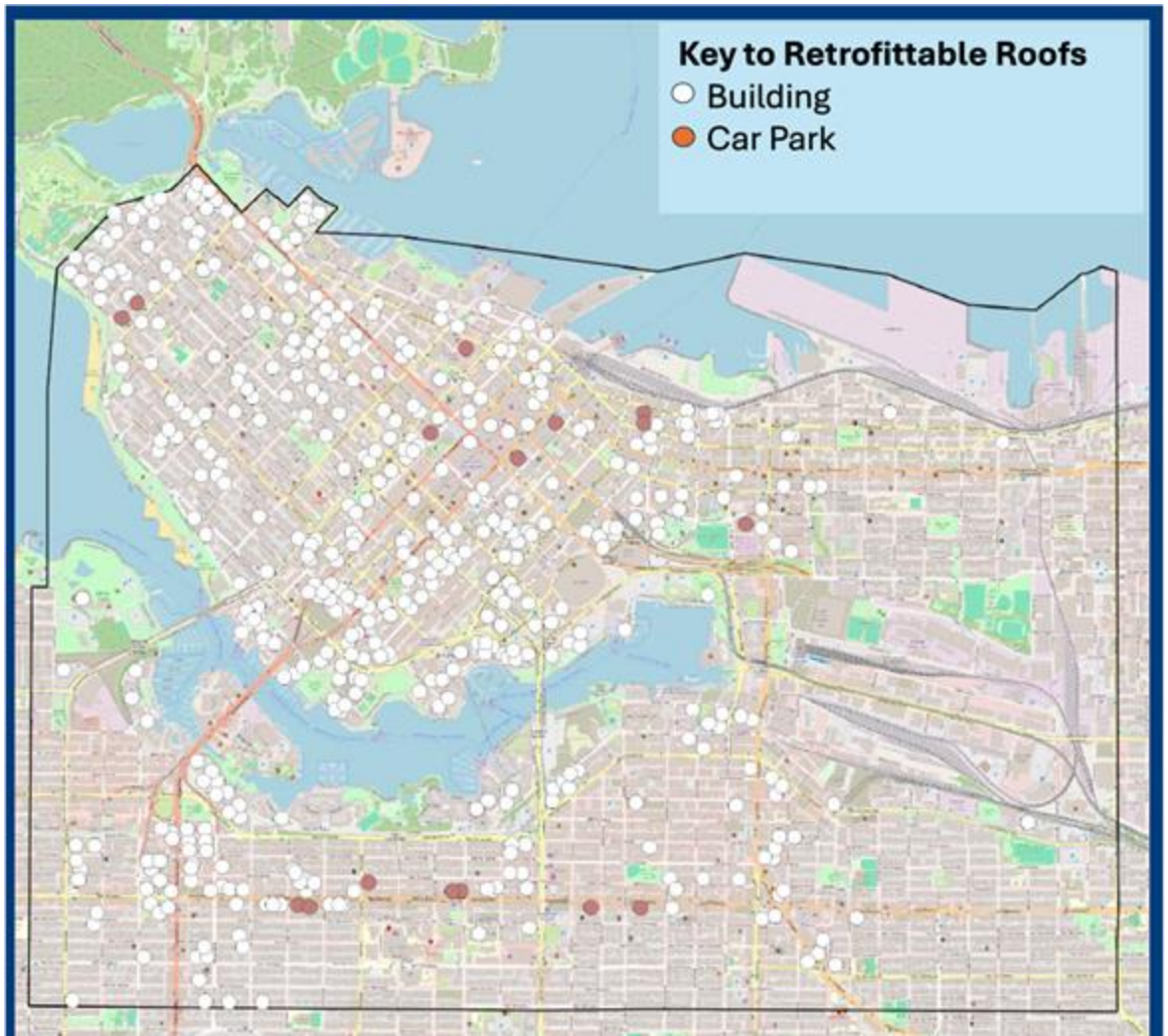
99,279m²

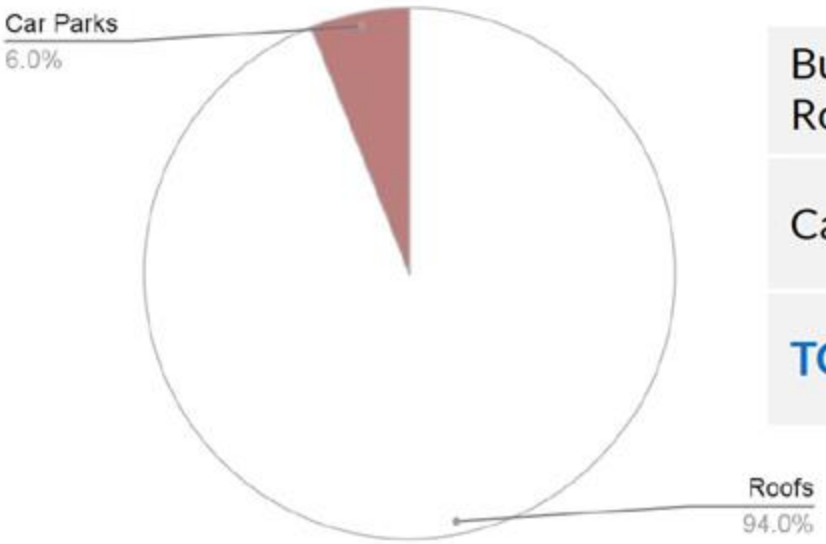
- About 10 ha. or 24.7 acres, the size of Strathcona Park.
  - Total CoV land base area = 11,497 ha.
  - 1164 ha (10%) of CoV land base = parks/ open space
- 283 of 9526 buildings = only 3% of the roofs in the AOI are presently vegetated GR.
- Potential through retrofits = 97%, but realistically less

The 283 GRs identified cover < 2% of the roofscape.
Of those, 83.8% were extensive and 16.2% were intensive (not including roofs with temporary planters).



10-15% of impervious roof area offer GR retrofit opportunities. Retrofits were identified as inverted roofs and multi-storey car parks with load- bearing capacity of at least 120 kg/m².

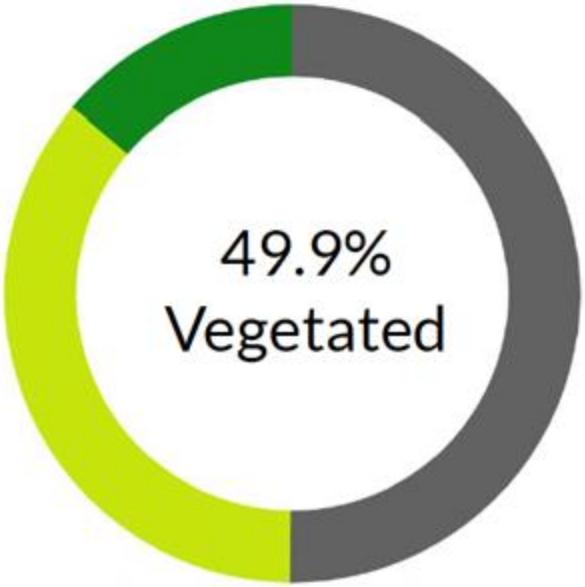




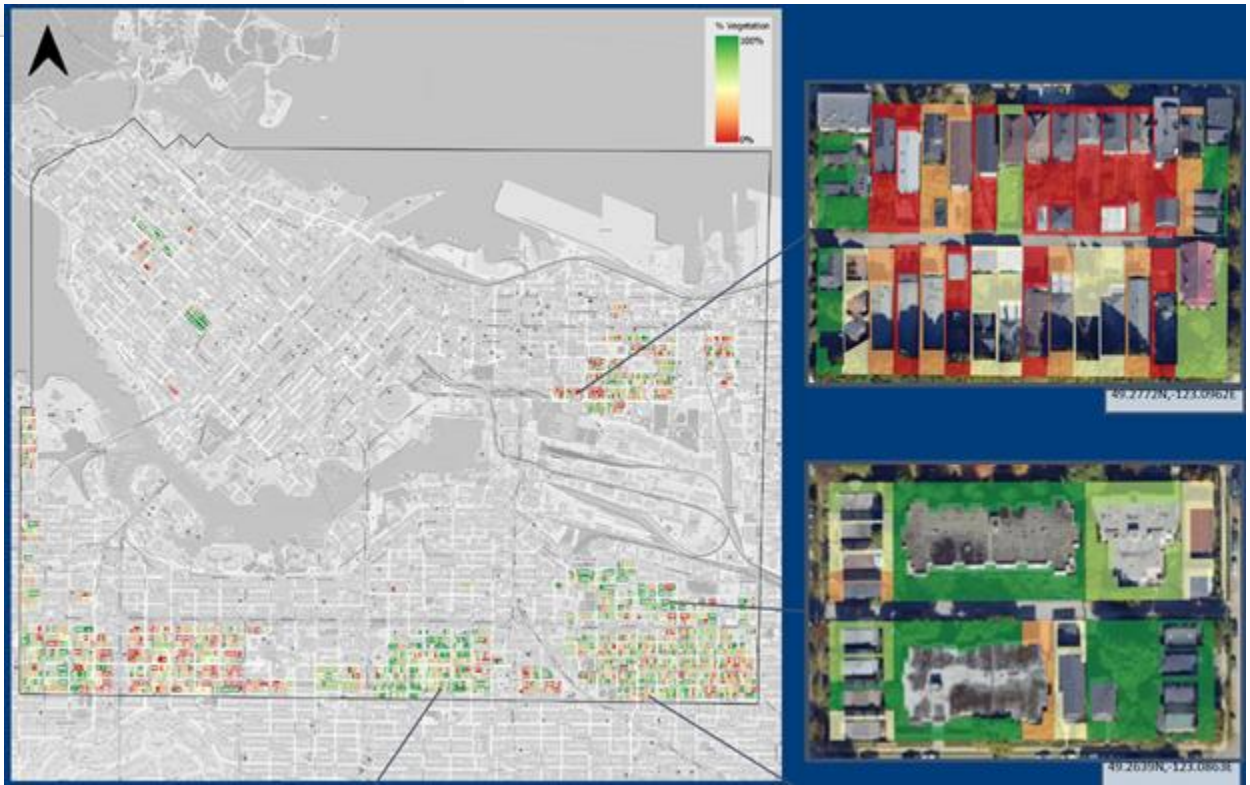
	Area (m²)	%All Roof Area	Number
Building Roofs	707,712†	14.08%	482
Car parks	45,363†	0.90%	16
TOTAL	**753,075†**	**14.98%**	**498**

†Total roof area of retrofittable buildings; not all of the surface of each building is retrofittable.

Results: Private Gardens, Trees, and Green Cover



Land cover	Area (ha)
Unvegetated garden	439.03
Vegetated garden	315.86
Trees	121.15
TOTAL	876.04



Key Takeaways

Vancouver has far fewer green roofs than we thought.

- Yet lots of retrofit potential

Fewer trees and green spaces, too.

- Green roofs and living walls could help, especially where densification limits space for trees and shrubs

AI and machine learning have a role.

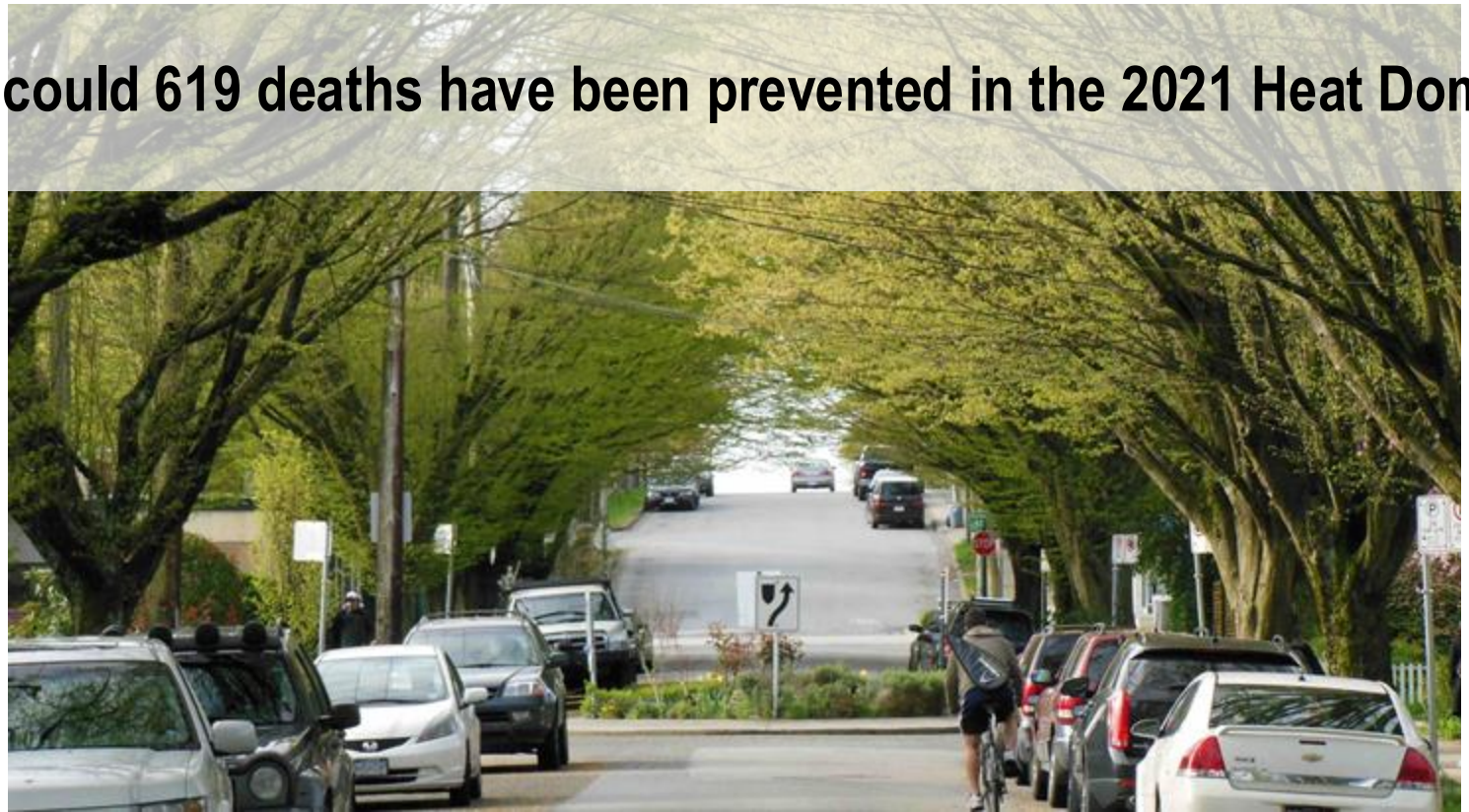
- Time: Climate emergency and biodiversity crisis
- Precision: Human directed, machines do the grunt work

Everything is connected and partnerships are essential.

Less Vegetation = Significant Public Health **Liability**

A study of 830 urban areas in 53 countries (published April 2025 in the Lancet) found that **increasing vegetation cover by 30% lowers temperatures and substantially decreases urban heat-related deaths**

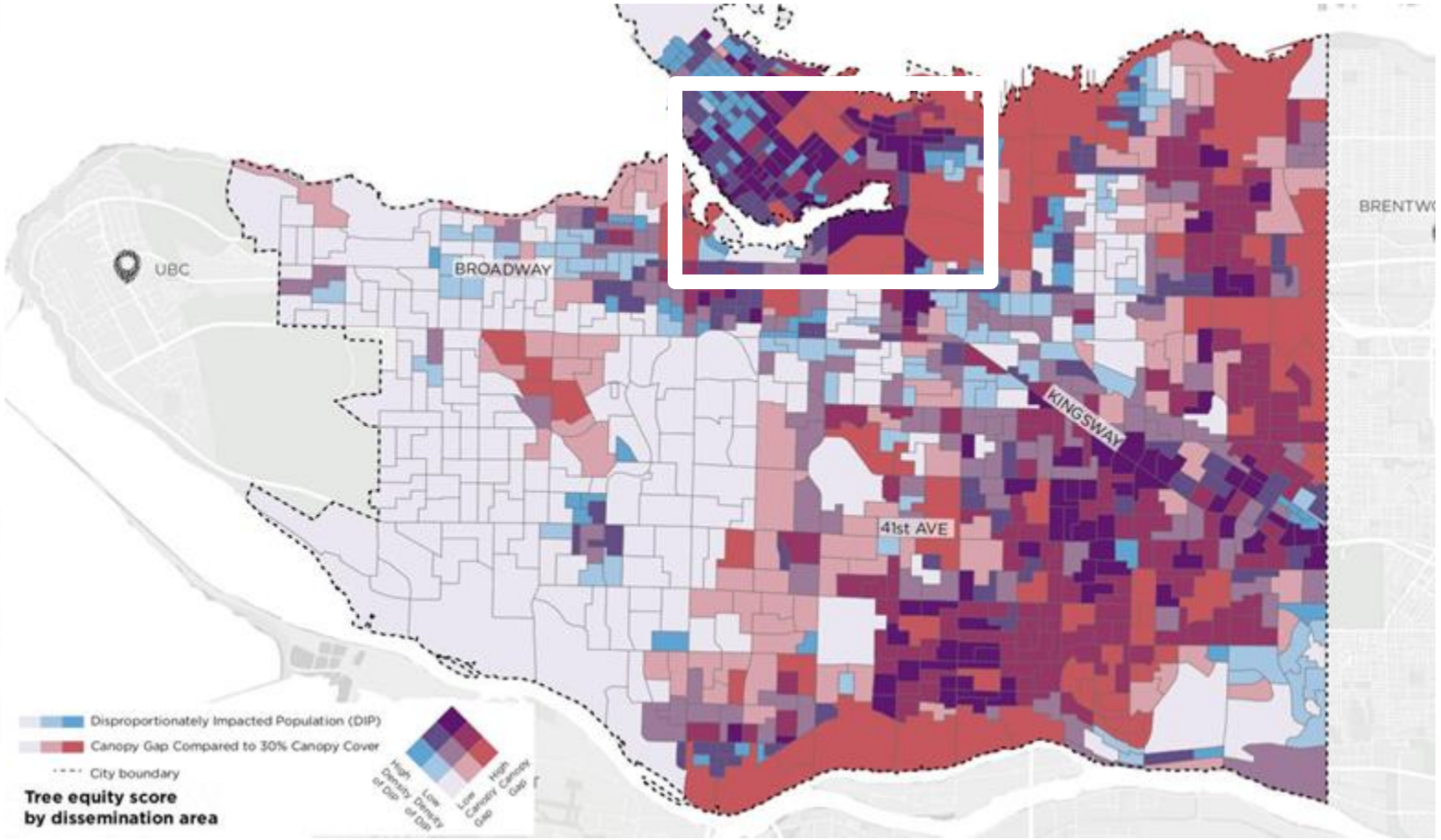
- **could 619 deaths have been prevented in the 2021 Heat Dome?**



Speaking of Trees

Vancouver's **Urban Forest Strategy** aims for **30% city-wide tree canopy** cover by 2050 (5% more than estimated 25% cover, 2022).

Let's expand the target to include roofs and walls = "Green Cover"



Green Cover = Local Bio-cultural Potential

Think about the city as a whole functioning ecosystem with a **diverse mosaic of habitats that occurred before settler colonisation.** No separation of public/private; no jurisdictional squabbles.

Imagine:

The urban forest on the ground. Dense canopy reduces heat stress by providing more shade and creating a more stable microclimate. Air quality is improved by increasing leaf surface area to capture fine particulate matter. Both are crucial elements in urban areas where heat waves and airborne pollutants are more frequent, adding more stress to human health (asthma, etc.).

Canopy gaps on roofs with biodiverse patches of open meadows, wetlands, and urban agriculture. Safe refugia from the street. Co-benefits for all. With deeper shade on the ground, roofs are where we can grow food.

Connectivity provided by rain gardens (vertical + horizontal) threading and stitching **green cover** into a healthy functioning urban ecosystem that joins with life on and below water.

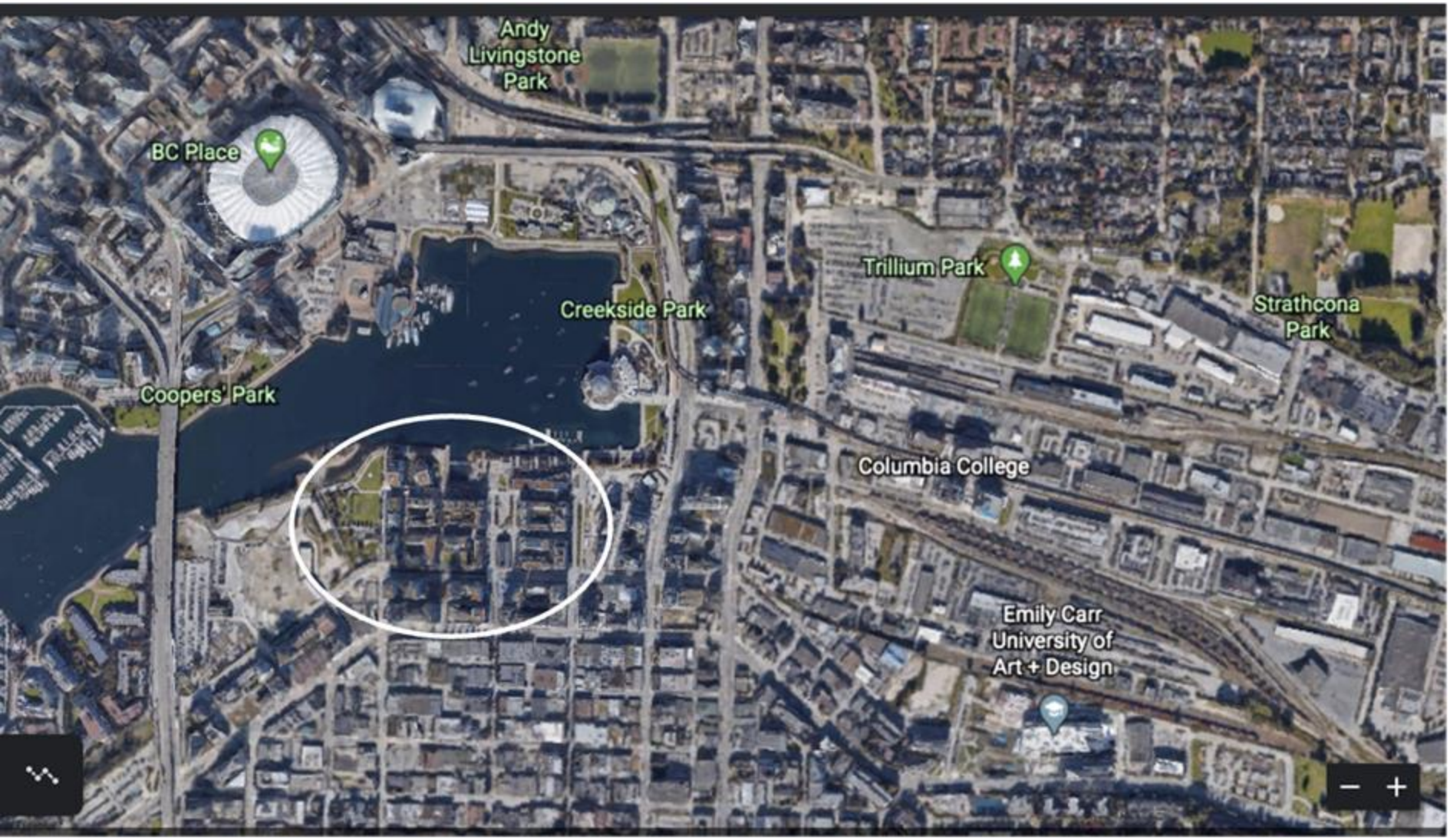
Green roof performance is essential…

..and GR performance is tied to maintenance!

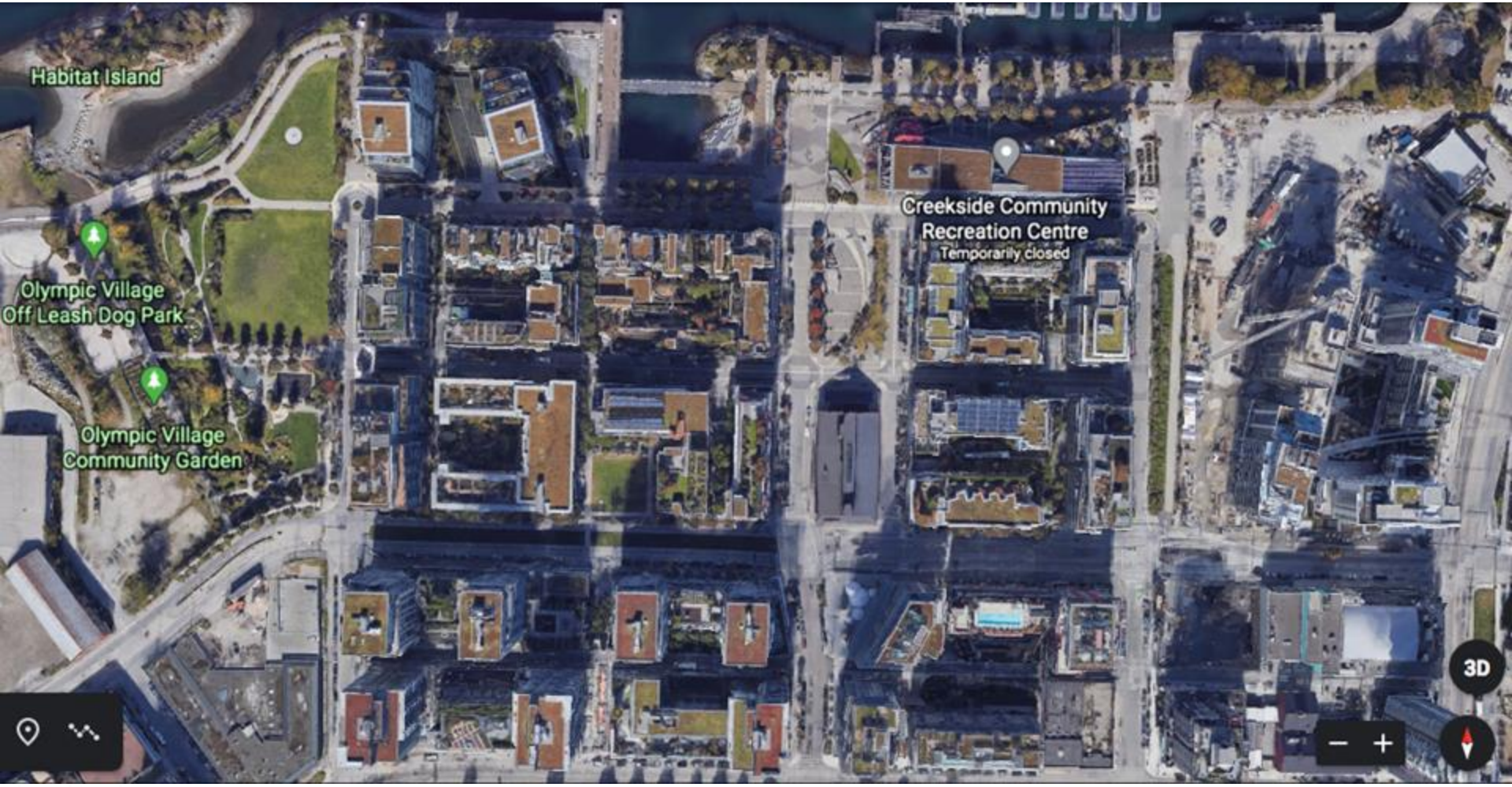
Green roofs need to be regularly maintained by trained professionals to ensure the suite of co-benefits.

- **Once the baseline is ready:** regular and remote assessments can identify maintenance needs, retrofit potential, and/ or target areas for improving social and ecological equity.
- **Independently Audit GRs:** to ensure best practices on maintenance.
- **Provide trainings** for property managers / strata councils, as needed or requested.
- **We encourage GRIMP accreditation** across all disciplines.

There is clearly work to be done on scaling up!



Scaling up required for full suite of GR co-benefits.



Next steps

Ground-truth the maps to train the model:

- Assess status/ performance of natural and GR assets
- Tie in maintenance and education/ training

Translate data into action via collaboration & best practices:

- Publications
- Policy-makers
- Industry stakeholders, including property owners

Once the model has been trained:

- Map more of (Metro) Vancouver
- Map other interested BC municipalities

Fundraising: Many thanks to **Goya Ngan** and Wild Island Foundation for kickstarting this project, with Small Change Fund https://smallchangefund.ca/campaign/mapping-green-roofs-and-their-retrofit-potential/.

- Tax-deductible donations will allow us to expand this project

Read more about it here:

https://livingarchitecturemonitor.com/articles/mapping-vancouvers-green-infrastructure-and-roofscape-wi24

Thank you!

Get in touch

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