URBAN GREENING EXPLORER

An Interactive Dashboard for Exploring Vancouver's Public Trees

Progress Report 5

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Work Logs

Date	Hours	Description of Work Done
Nov 09, 2025	2.0	Began designing the new Green Comfort Zones feature, including the definition, analytical requirements, and user interface planning.
Nov 11, 2025	2.5	Implemented the density-based algorithm for detecting comfort zones using quantile thresholds.
Nov 13, 2025	2.0	Built the Green Comfort Zones Folium map with green-highlighted neighbourhood polygons and contextual tooltips.
Nov 15, 2025	2.0	Added the Green Comfort Zones ranking table and ensured consistency with existing neighbourhood-level metrics.
Nov 17, 2025	3.0	Integrated OpenAI's API and added functionality for generating automated summaries.
Nov 19, 2025	2.5	Debugged OpenAI integration issues and improved reliability of model outputs.
Nov 21, 2025	2.0	Finalized the Green Comfort Zones tab, cleaned UI elements, prepared documentation, and validated the entire workflow.

Description of Work Done

The work completed between November 9 and November 21 focused on expanding the analytical depth of the Urban Greening Explorer by implementing the Green Comfort Zones feature and integrating AI-generated summaries. This phase strengthens the project's interpretive capabilities and transforms the application from a purely visual dashboard into a tool that can communicate meaningful insights.

Development began with defining the concept of a Green Comfort Zone. The approach identifies neighbourhoods within the top twenty percent of tree density by calculating trees per square kilometre for each area. Once the underlying logic was constructed, a set of functions was created to compute thresholds, filter qualifying neighbourhoods, and prepare them for downstream visualization.

A substantial portion of the work involved creating a dedicated Green Comfort Zones map. This new map highlights only the top-performing neighbourhoods using green styling, overlaying tooltips that summarize key attributes such as overall tree count, unique species count, area, and density. Parallel to the map, a ranking table was built to provide a structured, sortable view of neighbourhood performance. Its metrics align with the logic used in the Neighbourhood Overview tab, ensuring consistency across the application.

An important milestone during this period was the successful integration of the OpenAI API. A new AI Summary section was added to the Green Comfort Zones tab, designed to interpret the quantitative results and present them in narrative form. The system compiles neighbourhood statistics into a structured prompt, sends it to an OpenAI model, and displays the returned summary. The process required handling several model-specific challenges, such as unsupported parameters, reasoning requirements, token limitations, and response parsing. Ultimately, the AI workflow was stabilized and enhanced through the addition of a "Generate AI Summary" button that allows the user to trigger the analysis as needed.

Additional refinements were made to the user interface to ensure visual and structural consistency across all three tabs. Captions, titles, and formatting were added to guide users clearly through the new analytical view. The complete workflow, including dataset filtering, mapping, and AI generation, was tested with the full Vancouver dataset to validate performance and stability.

Current state of the web application is as follows:

The current application consists of three main tabs:

1. Explore Trees – Provides an interactive Folium map with local area boundaries, optional neighbourhood highlighting, sampled tree points with tooltips, and a responsive sidebar filter. Below the map, the Key Stats panel and live charts summarize filtered results in real time.
2. Neighbourhood Overview – Presents a city-wide choropleth highlighting tree density by local area, along with a sortable ranking table that compares all neighbourhoods based on trees per km² and other attributes. The tab serves as a high-level analytical view of Vancouver's green distribution.
3. Green Comfort Zones - Identifies the top 20% highest-density neighbourhoods using a quantile-based threshold. A dedicated map highlights only these high-performing areas, and a corresponding table lists their key metrics. This tab also includes an AI-generated summary feature, allowing users to generate an interpretive narrative of the comfort zones using the OpenAI API.

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Urban Greening Explorer – Vancouver

Explore Trees | Neighbourhood Overview | Green Comfort Zones

Green Comfort Zones (High-Density Neighbourhoods)

Green Comfort Zones are defined here as neighbourhoods in the top 20% of tree density (trees per km²). This is a simple, rule-based approximation of areas with especially rich tree cover.

Comfort zones found	Density threshold (80th percentile)	Median density (context)
5 / 22	1764 trees/km²	1551 trees/km²

Map of Green Comfort Zones

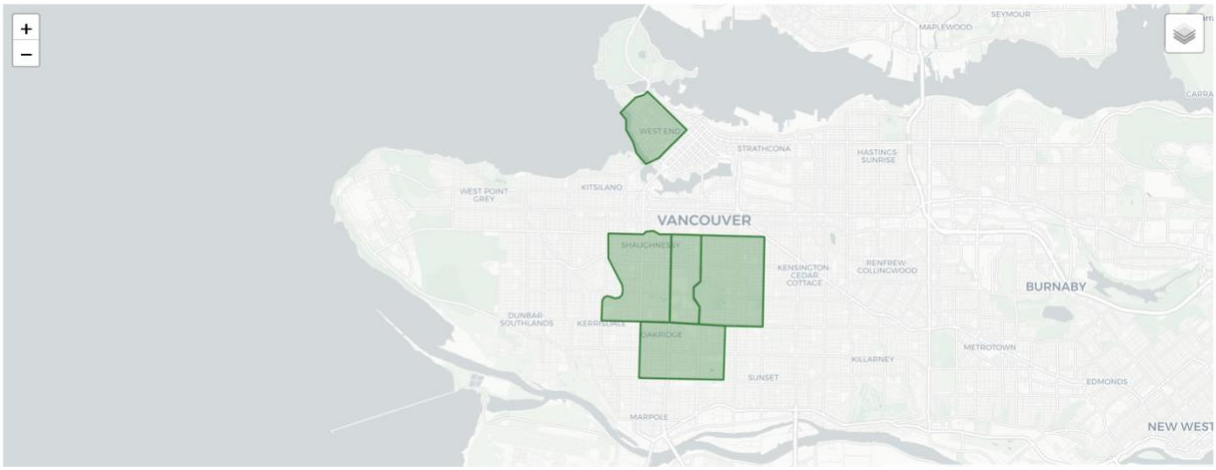

Figure 1: Green Comfort Zones map

High-Density Neighbourhoods (Green Comfort Zones)

Local Area	Trees	Unique Species	Area (km²)	Trees/km²
Shaughnessy	9365	407	4.4803	2090.2684
Riley Park	9997	272	4.9317	2027.0997
West End	4031	155	2.2562	1786.6103
Oakridge	7165	160	4.0236	1780.7422
South Cambie	3848	149	2.1764	1768.0951

AI Summary of Green Comfort Zones

Generate AI Summary

Shaughnessy and Riley Park stand out as the densest and most tree-rich areas: both sustain very high canopy concentration while also supporting the largest counts of unique species. Their combination of intense tree cover and greater species variety suggests mature, well-established urban forests with diverse compositions — a sign of both ecological resilience and long-term investment in greenspace. West End, Oakridge and South Cambie also qualify as "Green Comfort Zones" but show noticeably lower species richness relative to their tree densities, indicating many trees may be of fewer common species or younger plantings.

Across these neighbourhoods there's a loose pattern where the very highest densities tend to coincide with higher species richness, but not perfectly: some areas achieve high density with more limited species mixes. That distinction matters because dense monocultures can be vulnerable to pests and disease, while diverse stands offer greater ecological stability and benefits (pollination, habitat, air purification). For planners and communicators, these insights can guide priorities: protect and maintain the mixed, high-density pockets; target lower-richness dense areas for diversification (e.g., infill plantings of underrepresented native species); and use the high-density/high-diversity neighbourhoods as showcase examples in public outreach to demonstrate benefits of street and park tree programs.

Data: City of Vancouver Open Data (Public Trees & Local Area Boundaries).

Figure 2: High density neighbourhoods table with AI summary

Repo Check-in of Implementation Completed

The GitHub repository has been updated to include the following files under **Implementation** folder:

1. **app.py -** The main application has been expanded to include the newly developed Green Comfort Zones tab, featuring density-based classification, an interactive Folium visualization, a structured high-density neighbourhood table, and an OpenAI-powered summary generator.
2. **requirements.txt -** The dependency list has been updated to support the new AI summary feature:
    a. The "openai" package has been added to enable integration with the OpenAI Responses API used for generating automated summaries in the Green Comfort Zones tab.
3. **.gitignore -** A new entry has been added for:
    a. ".streamlit/secrets.toml" - This prevents sensitive credentials-such as the OpenAI API key-from being committed to the repository. The change ensures secure handling of secrets, especially when deploying the application to Streamlit Cloud.