A photograph of a forest with tall, thin trees and sunlight filtering through the canopy. A large, semi-transparent blue circle is centered over the image, containing the text.

Trees Please

BEACH STRIP

Report for 2016



TREES PLEASE

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About the Project Partners

The Trees Please project is a collaboration between the Hamilton Naturalists' Club (HNC) and Environment Hamilton (EH).

The Hamilton Naturalists' Club (www.hamiltonnature.org) is a volunteer-based, charitable organization with an almost 100 year history of promoting habitat protection, stimulating public interest and action in conservation, undertaking research and education regarding natural areas and acquiring and managing nature sanctuaries. HNC is working to improve Hamilton's urban forest by conducting neighbourhood tree inventory and tree planting projects, as well as by facilitating discussions with the city, conservation groups, and residents, to identify and implement activities to increase forest cover and species diversity.

Environment Hamilton (www.environmenthamilton.org) is a not-for-profit environmental organization that was established in 2001 with a mandate to provide Hamiltonians with the knowledge and skills required to enhance and protect the environment around them. Environment Hamilton is committed to achieving this mandate by showing leadership, educating the community, and pushing for necessary change when required. EH is engaging volunteers in efforts to monitor air particulate pollution while cycling and walking, and using this information to generate public conversations about how to improve urban air quality.

ON POINT

We would like to thank our volunteers and supporters who have helped us to gather data, spread the word and make this important effort a success!

First, a big thanks to the Hamilton Beach Community Council who provide us with keen insights, generously give us time at their regular meetings and for being so willing to help us out whenever we need it.

We would like to specially thank: Jim Howlett, Ed Nolan, Scott Howley, Lisa Witherington for their support and guidance.

We are so grateful to our super star volunteers, who came out in the heat, the rain, the wind to help us collect data: Candice Bergen, Tanya Nan, Chris Murray, Jen Hunt, Berhane Habte Bairu, Utkan Kırğül, Christopher Galano, Laurie Bennie, and our other many volunteers who helped us out on the Beach Strip.

This project is made possible through the generous support of the Ontario Trillium Foundation.



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Why this project is important

Hamilton has a long history of air pollution problems, particularly in the neighbourhoods closest to our industrial core. Fine air particulate pollution is a significant part of this problem as underscored by a recent report identifying Hamilton as the urban centre with the highest levels of respirable particulate pollution in Ontario (ref CCO 2016 report). This reality is cause for concern as respirable particulate - air particulate pollution that is 2.5 microns in diameter and smaller (PM2.5) - contributes to cardiovascular and respiratory illness and is a confirmed cause of lung cancer (ref CCO 2016 report).

Research has shown that trees trap fine particulate pollution on the surface of leaves and needles, effectively reducing human exposure by as much as 50% (ref British study and any other studies confirming this). But you need a healthy urban forest in order to maximize the particle-trapping benefits that trees bring. A healthy urban forest canopy provides at least 30% coverage when trees are in full leaf; the average canopy coverage in Hamilton is 18% or lower. The City of Hamilton set a goal of 35% urban forest cover in its 2009 Strategic Plan. A healthier urban forest would bring significant air quality benefits to our city - especially in neighbourhoods closest to industry where air particulate levels are highest. For more information about air particulate pollution and the benefits of healthy urban forests refer to the appendix.

A healthy urban forest can also provide many other ecosystem benefits including: reductions in stormwater runoff and home heating and cooling costs, and much needed shade and relief from the sun to name a few.

A healthy urban forest canopy provides at least 30% coverage when trees are in full leaf; the average canopy coverage in Hamilton is 18% or lower.

About Trees Please

The *Trees Please - Green Solutions to Air Pollution* project is designed to tackle Hamilton's fine air particulate pollution problem by gathering air particulate pollution and urban forest canopy data in neighbourhoods struggling with poor air quality.

Air and tree data is collected with the help of community volunteers who take on the role of 'citizen scientists' in the project. A basic urban tree inventory protocol enables community members to assess the health of the urban forest by collecting key tree measurements, and an easy-to-use hand-held air particulate monitor used in tandem with a GPS data logger allows community volunteers to collect fine air particulate pollution data as they move through a neighbourhood.

Combined, this tree and air data is used first to assess the health of the urban forest in a neighbourhood and identify air particulate pollution hotspots, and then to guide efforts to strategically plant trees in neighbourhood locations with high fine particulate levels.

The Hamilton Beach Community

During 2016, the Trees Please Project focused on two Hamilton neighbourhoods (1) - including the Hamilton Beach Community. The Hamilton Beach Community is located along a thin spit of sand separating Hamilton Harbour from Lake Ontario. The neighbourhood is immediately downwind of Hamilton's industrial core and the QEW Highway. This means that the community faces greater air quality challenges than any other Hamilton neighbourhood. The neighbourhood is also an active one; the Hamilton Beach Community Council (HBCC) is the City of Hamilton's oldest neighbourhood association. Active members of the Council have been engaged in a host of efforts and initiatives over the years, many of them focusing on environmental concerns including air quality.

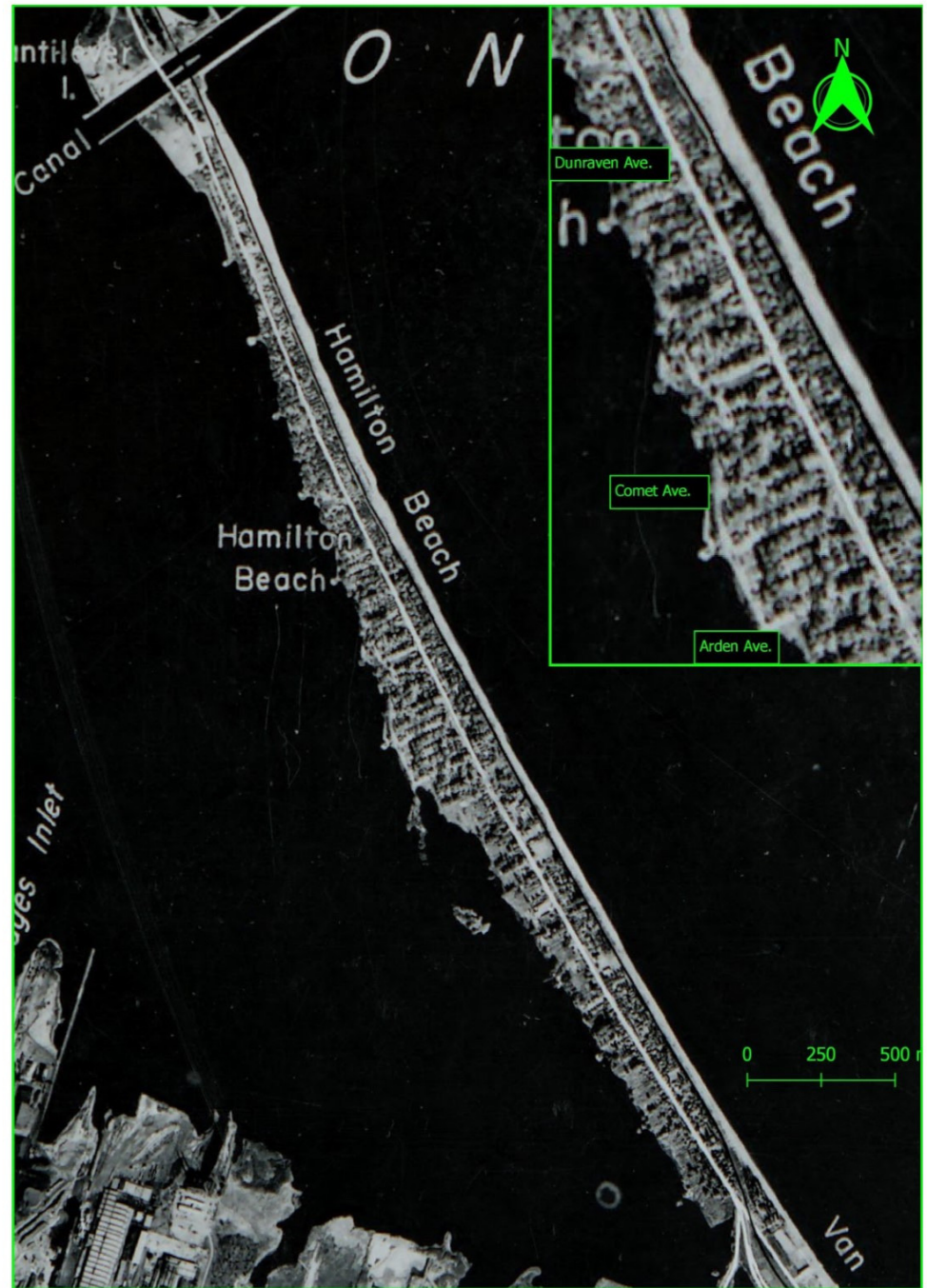
(1) The second community focused on in 2016 was the Beasley Neighbourhood in downtown Hamilton.

More about the Hamilton Beach Community

Over the late spring, summer, and right up until the late fall of 2016, Trees Please project managers worked to recruit and mobilize community volunteers to work as citizen scientists along the Beach Strip, with 7 volunteers helping to collect neighbourhood air particulate data and 10 volunteers helping to audit neighbourhood trees. These dedicated individuals contributed over 200 hours of volunteer time gathering air particulate and tree health information in the Hamilton Beach Community.

This report summarizes the findings of these efforts and sets out recommendations for short, medium and long term actions that could be undertaken in the Hamilton Beach Community to improve the health of the urban forest and, in so doing, to reduce fine air particulate pollution in the neighbourhood.

An aerial shot of the Hamilton Beach Community circa 1954. Much has changed with the expansion of industry along Hamilton Harbour and the construction of the Burlington Skyway bridge and expansion of the QEW highway.



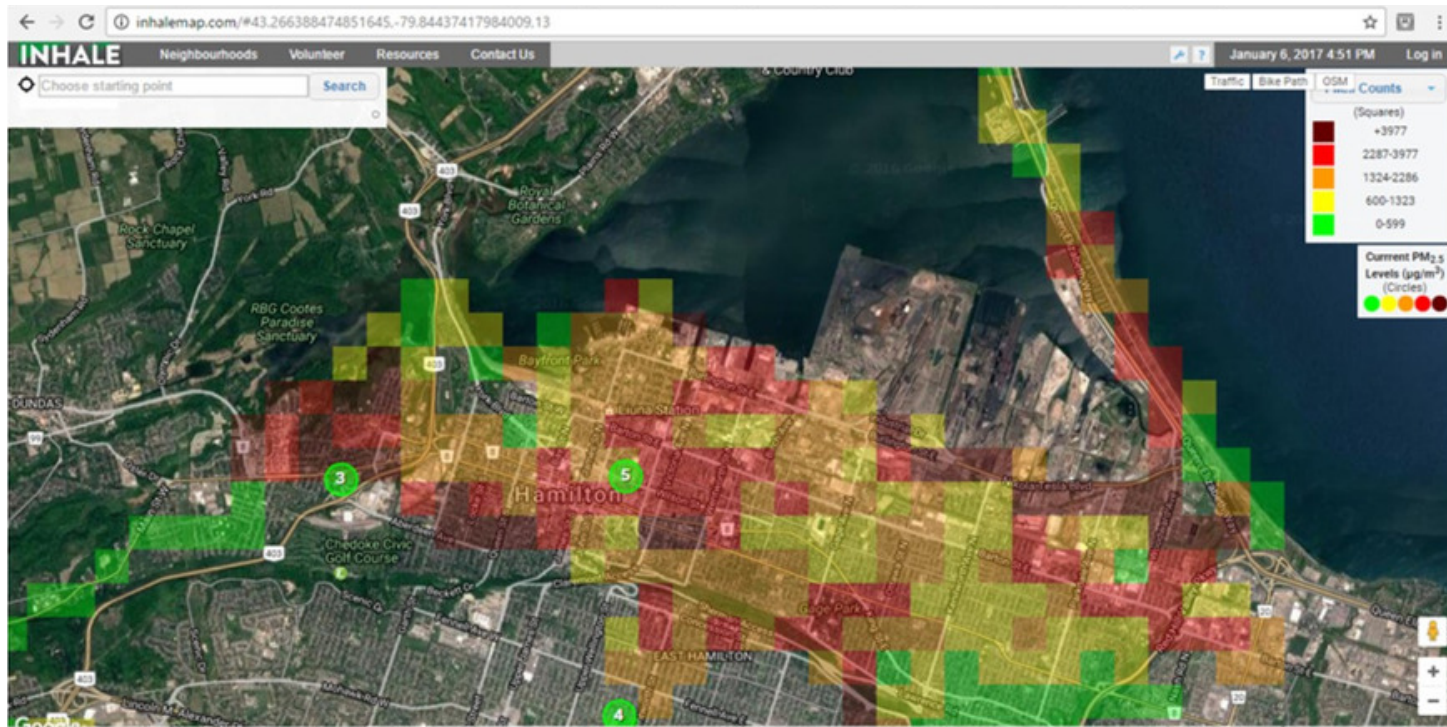
What We Did & How We Did It

The first step in initiating efforts in the Hamilton Beach Community was to undertake outreach and promotions to generate community interest. The project was promoted through social media and notices in the Beach Banner - the neighbourhood's newsletter. A key event was a Trees Please Tree Trek along the Beach Strip which attracted people from the neighbourhood, the ward councillor and the community-at-large, initiating conversations about the state of the forest along the Beach, opportunities for more tree planting and concerns related to air pollution from upwind industries and the highway.

Those interested in volunteering were provided with hands-on training in how to monitor air particulate pollution and/or how to do an urban tree audit. Once trained, most volunteers committed to participate in multiple data collection sessions. In the case of tree audits, these sessions were scheduled at various times of the day on both weekdays and weekends in order to provide anyone with an opportunity to help; all tree audit sessions were led by project staff.

In the case of air particulate monitoring, volunteers were provided with basic training in how to use the air monitoring gear and then borrowed the equipment for a week or more and collected air particulate pollution data when it was convenient for them to do so.

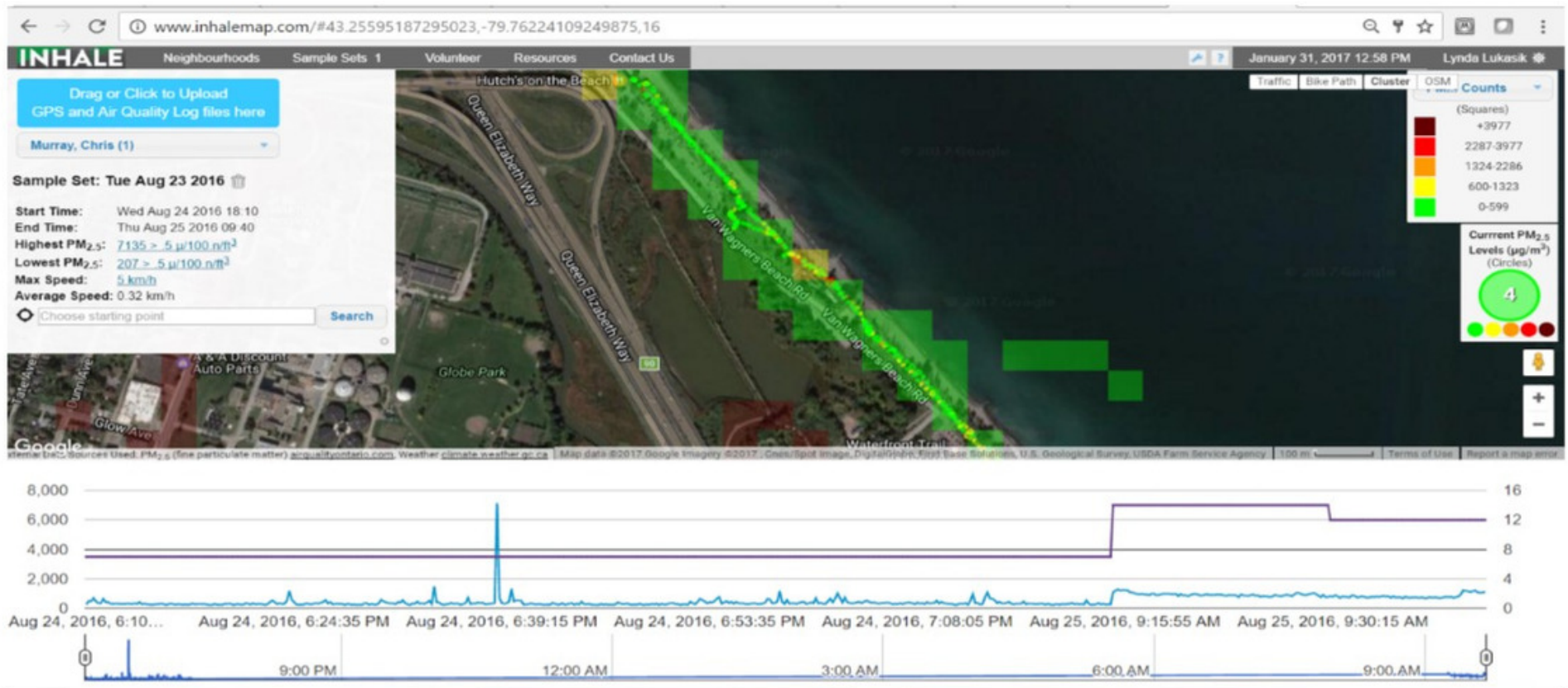
We provide training and tools. We just need you!



A screenshot of the air particulate mapping system - which uses colour coding to highlight high PM2.5 locations.

The map's visual representation of PM2.5 levels helps to highlight areas with chronic particulate pollution problems. Viewers can click on a coloured square to reveal a bar graph display of the monitoring results for that location. There is also a detailed chart that summarizes monitoring dates and PM2.5 levels measured on each date.

The system also provides volunteers with their own accounts which they can access to view the monitoring data they have collected as seen in the following map and chart.



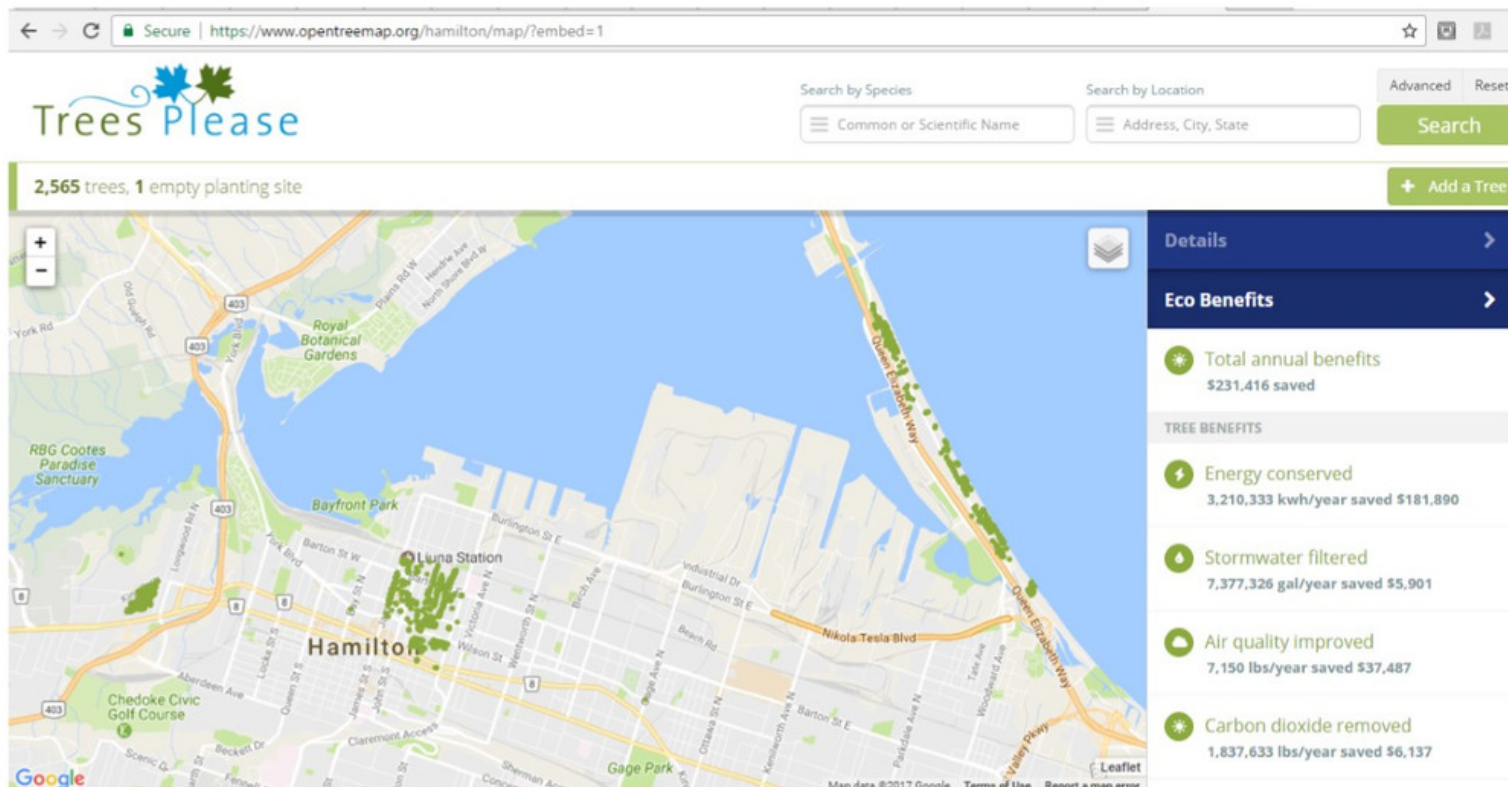


Tree canopy coverage can be seen in this map. The various shades of green and yellow represent the trees and show that the Beach Strip community has about a 30% canopy coverage. The map was produced with a Normalized Difference Vegetation Index at 10m resolution Sentinel-2A satellite.

Inventorying the Urban Forest

In order to inventory urban trees the Trees Please Inventorying Protocol is used. (3) A list of 25 pieces of information is collected for each tree that is inventoried, providing a good understanding of the general health of a tree as well as any potential hazards posed by or threatening that tree. Information collected for each tree includes: tree species identification, height, diameter, as well as parameters that contribute to a categorized assessment of tree health and hazards.(4)

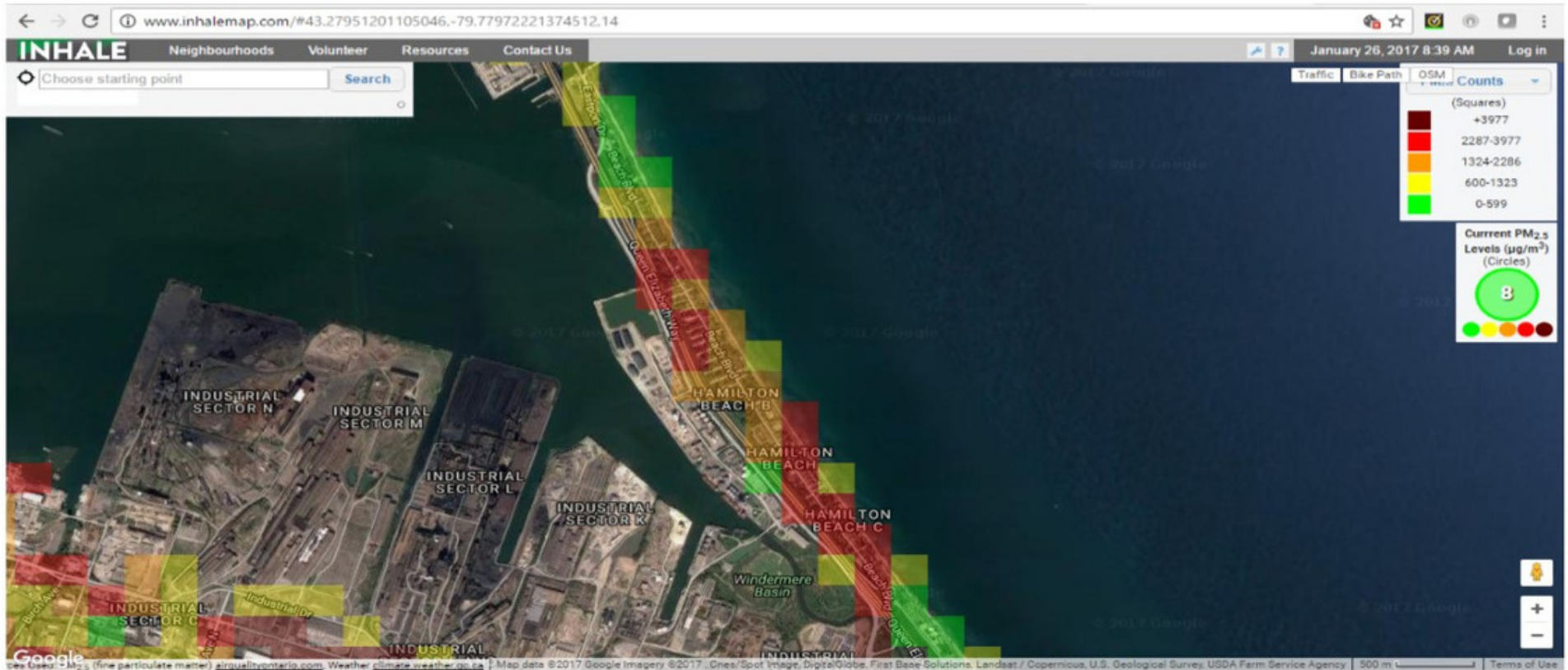
- 1) The protocol being used has been adapted from the Neighbourwoods inventorying protocol developed by Dr. Andy Kenny from the University of Toronto's Faculty of Forestry.
- 2) The full list of parameters assessed for each tree can be found in the Trees Please Inventorying Protocol.



A screenshot of the Open Tree Map system - showing locations of trees that have been inventoried in the Westdale, Beasley and Hamilton Beach Communities.

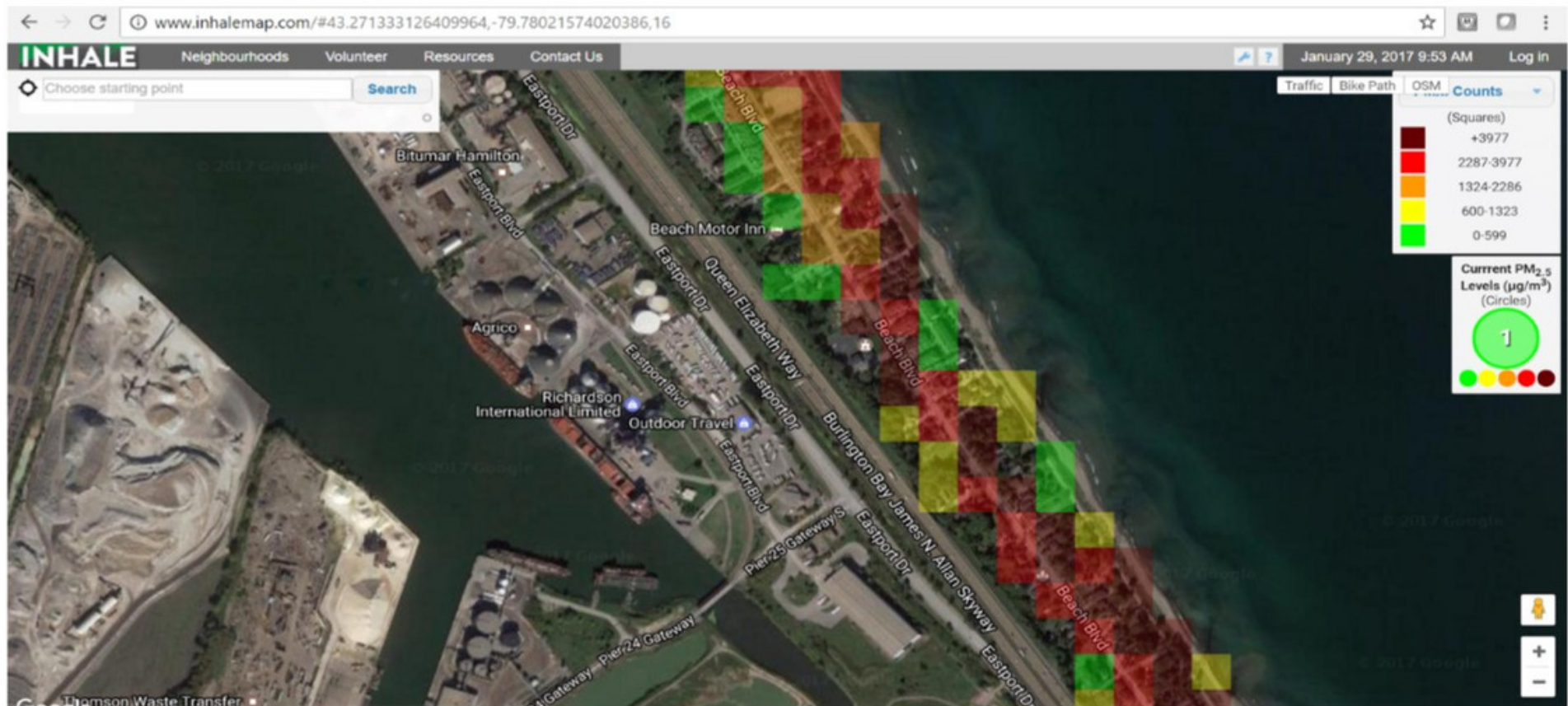
Information collected for each tree is entered into an online application called Open Tree Map. Data entry is done in the field as information is collected, using a tablet. Once tree data has been entered, the tree appears as a green dot on the Open Tree Map. Map viewers can click on a dot and access the tree inventory information for that tree. The system also shares details about the ecosystem services provided by that tree, including the estimated weight of air particulate pollution filtered out of the air by that tree each year. The ecosystem services feature can also be used to calculate the contributions of all of the trees inventoried in a neighbourhood.

What We Found in the Hamilton Beach Community



A screenshot showing air particulate monitoring results for the Hamilton Beach Community

Monitoring results highlight areas of the Hamilton Beach Community with elevated respirable particulate levels. Locations with elevated PM2.5 are areas that are in closest downwind proximity to industrial operations along Eastport Drive and the industrial core south of the Windermere Arm and Windermere Basin. The QEW Highway is another source that contributes particulate pollution in these locations.



Screenshot showing close-up of air particulate mapping in the stretch of the Hamilton Beach Community located closest to Eastport and Hamilton Industrial Core.

Trees Please project staff also used a more sophisticated geographic information systems (GIS) mapping tool called QGIS to map air particulate data collected by community volunteers (see below). This map helps to visually highlight even further the identified particulate pollution problem areas in the Hamilton Beach Community.

These air quality monitoring results show that there are sizeable areas of the Hamilton Beach Community where levels of respirable particulate are cause for concern. Levels of respirable particulate that go beyond counts of ~2,500 are high enough that there is a need to be concerned about the potential for impacts on human health. (5)

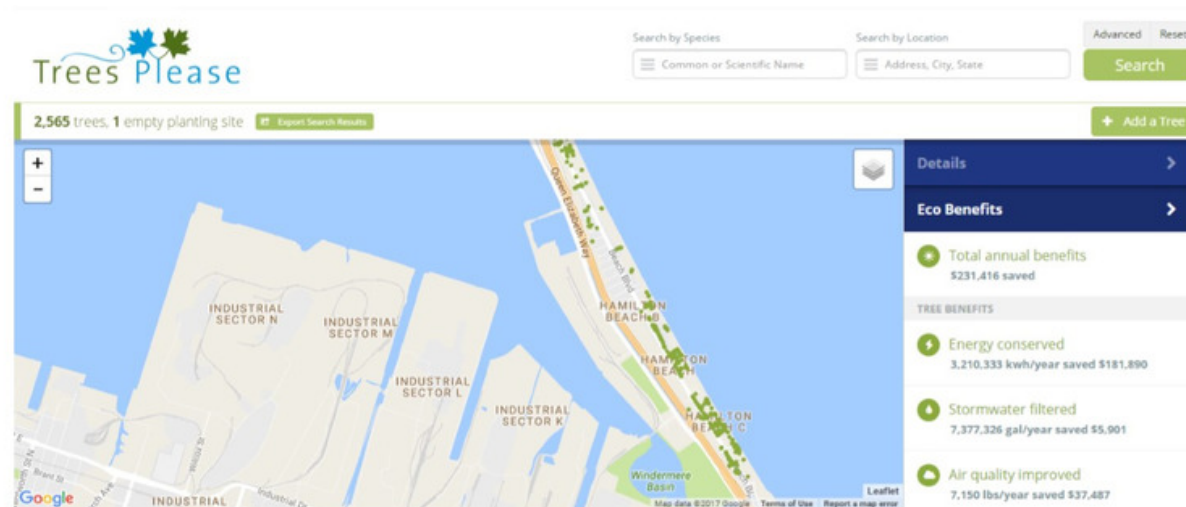
Eliminating or at least reducing particulate pollution levels at the source is the ideal solution but planting more trees can contribute significantly by trapping particulate pollution as explained earlier in this report. Monitoring and mapping PM2.5 serves to 'red flag' areas that require attention on the ground with actions designed to reduce particulate pollution levels. The air particulate findings for Hamilton Beach Community will be considered as part of the process to identify highest priority locations along the Beach for planting more trees in an effort to reduce particulate pollution levels.

(5) This is based on a very conservative estimate of 24-hr PM2.5 levels as compared to World Health Organization recommended guidelines for PM2.5: <http://bit.ly/1qH5Kvy>

Tree inventory findings:

Community volunteers worked with project managers to inventory a total of 535 trees in the Hamilton Beach Community. The Trees Please Open Tree Map includes all of this inventory data and the screenshot below shows the locations of inventoried trees. Inventory data has been used to assess general tree health in the neighbourhood, the eco benefits provided by these trees, as well as challenges and concerns regarding the urban forest in the Hamilton Beach Community.

The inventory results show that the Hamilton Beach Community has an ~30% tree canopy coverage which is higher than average for Hamilton. The urban forest in the Hamilton Beach Community is made up of a mix of native and non-native species.

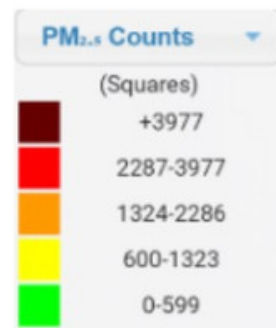


Screenshot of Open Tree Map showing locations of trees inventoried in the Hamilton Beach Community

Monitoring Respirable Air Particulate Pollution

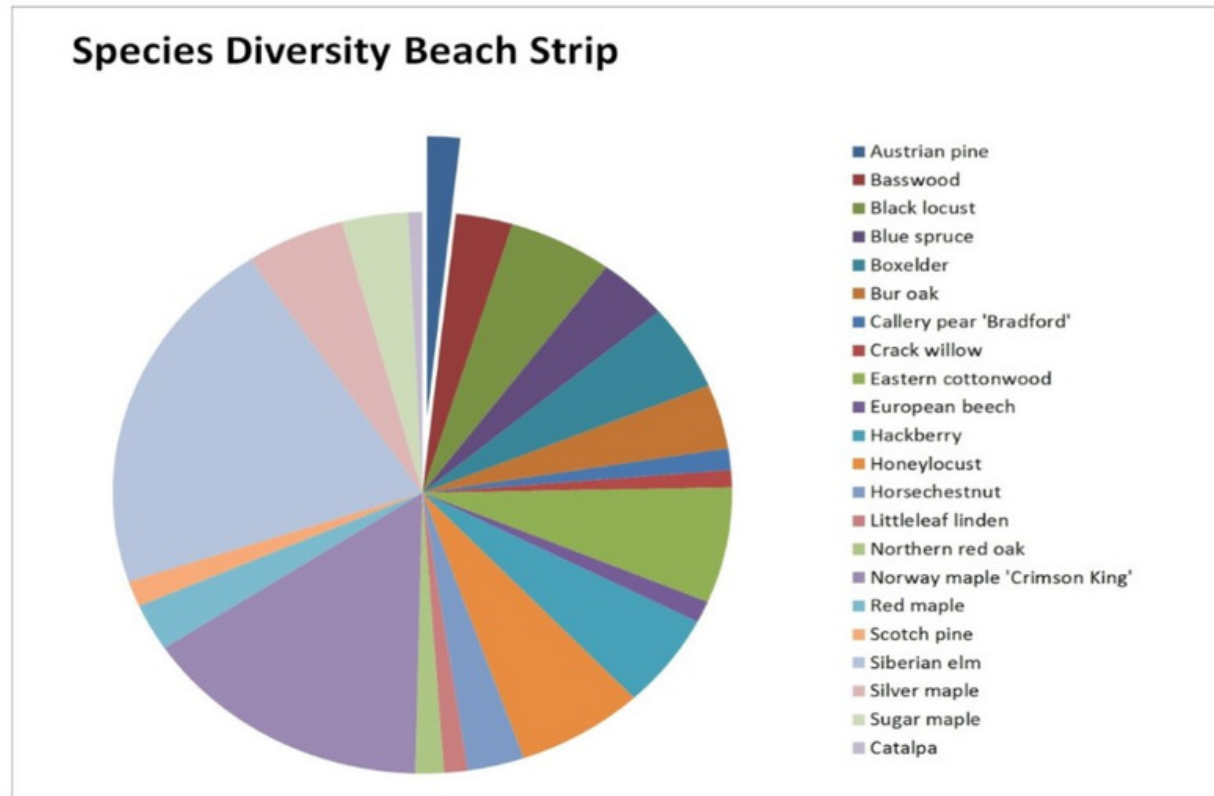
In order to monitor respirable air particulate matter (PM2.5), volunteers use a hand-held Dylos air quality monitor. (2) The monitor measures the actual number of particles in 0.01 cubic feet of air using a laser reader, logging particulate readings every 10 seconds. The air quality monitor is used in combination with a compact GPS data logger, enabling volunteers to 'go mobile' by collecting air particulate measurements as they move through the neighbourhood. Each device generates a data set that is uploaded to an on-line air particulate mapping system, which displays PM2.5 measurements using a colour scheme ranging from green (lowest PM2.5 levels) to deep red (very high PM2.5 levels).

The colour code corresponds to measured levels of PM2.5 as follows:



2) More specifically, a customized Dylos DC1700 air quality monitor was used. For more information on Dylos monitors see www.dylos.com.

Species Diversity in the Beach Strip



This chart shows the top native and non-native tree species found in the Beach Community. The native trees in the above list are Basswood, Bur oak, Eastern cottonwood, Hackberry, Honey locust, Northern red oak, Red Maple, Silver Maple, Sugar Maple.

Using the analytical tools available in Open Tree Map, the eco benefits were calculated for the 535 trees in the Hamilton Beach Community that were inventoried for the Trees Please project. The benefits provided by these trees are significant - they:

- * remove 265,500 pounds of carbon dioxide from the air each year
- * capture 1000 pounds of air particulate each year
- * conserve approx 514,400 kwh of energy each year worth approximately \$26,000 annually

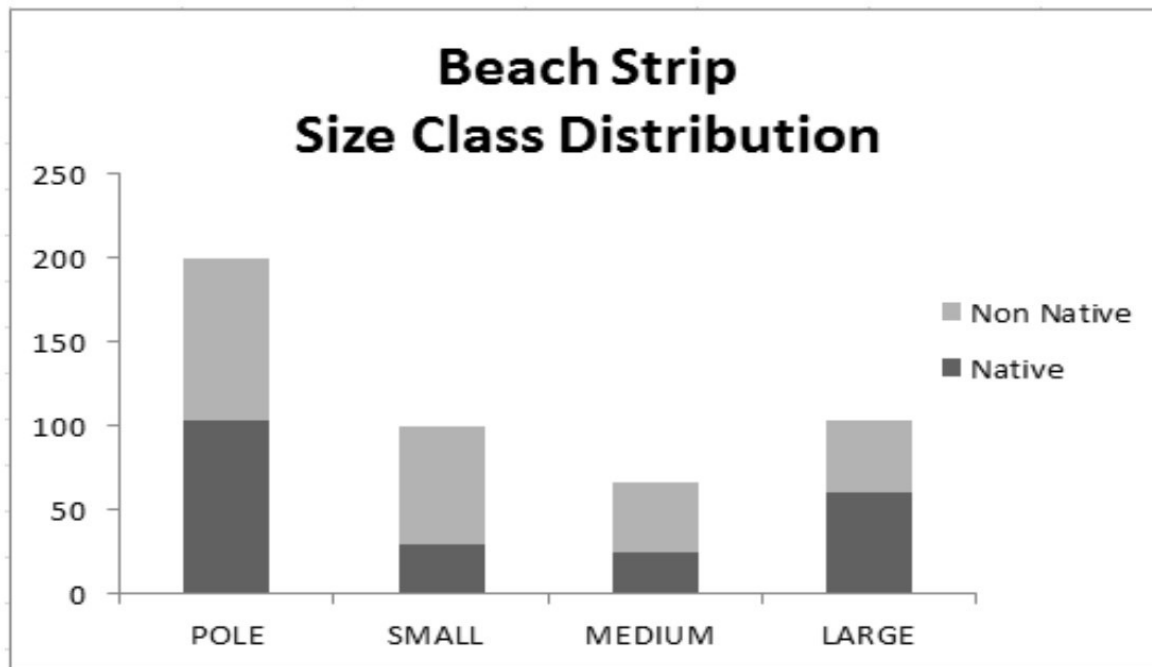
The eco benefits contributed by each individual tree inventoried in the neighbourhood can be seen by clicking on a specific green dot on the map.

As seen in the following chart there are healthy trees of all sizes in the Hamilton Beach Community, making the urban forest here similar to a natural forest stand - something that is unique for an urban neighbourhood. Many of the neighbourhood's mature trees are Eastern Cottonwood poplars approaching the end of their life cycle. As these mature trees eventually decline - potentially all around the same time - there will be significant loss of large mature trees. Both planning for on-going stewardship(6) and the eventual replacement of these trees will be critical to ensuring a healthy tree canopy is maintained and expanded into the future.

(6) This might include consulting with professional arborists regarding these important old trees

The composition of trees found along the Beach Strip has changed significantly over time. Some large native Bur Oaks can still be found in the neighbourhood and provide some insight into the natural history of the area.

The Hamilton Beach Community has one of the best tree canopies in the lower city at approximately 30% coverage. The neighbourhood is well positioned to surpass the City's goal of 35% with proper planning, on-going management, and community involvement in tree planting activities.



Size class distribution of inventoried trees in the Hamilton Beach Community

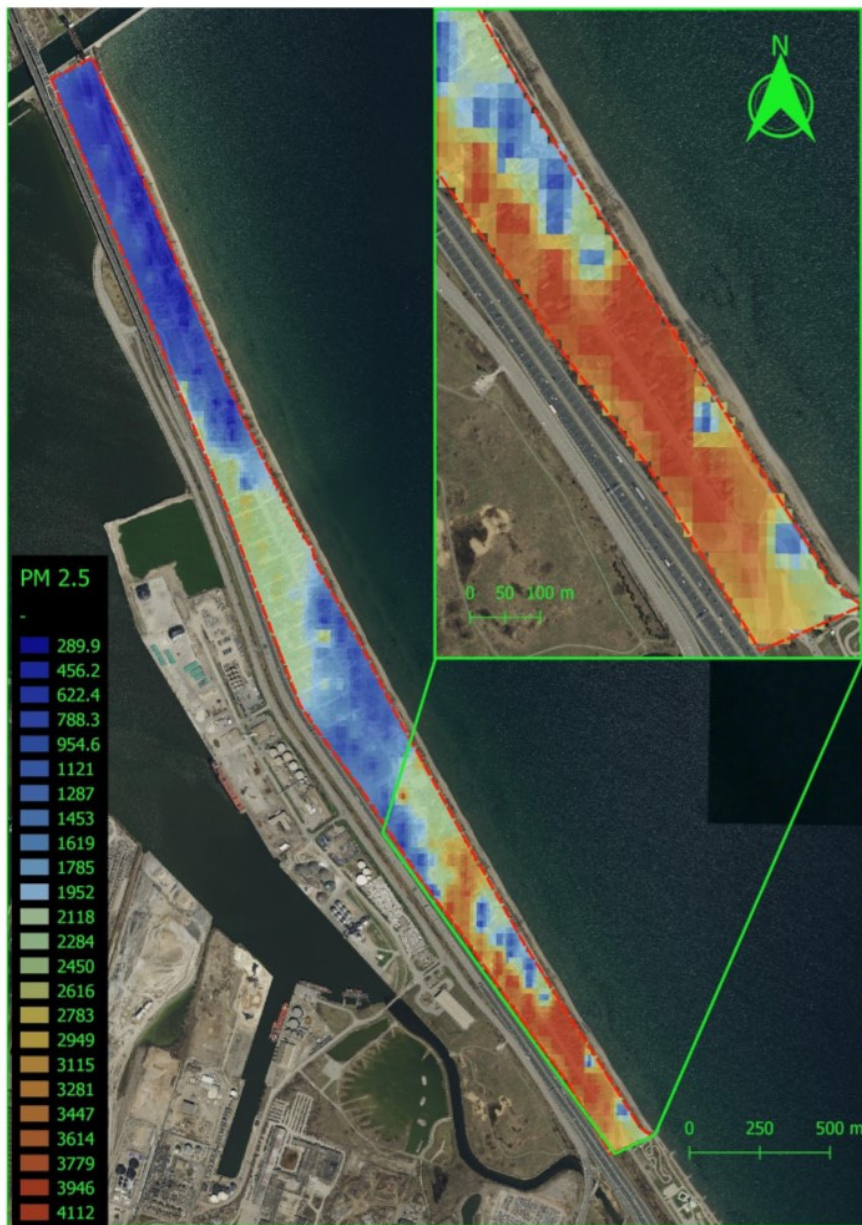
Pole size < 10"
10" < Small ≤ 15"
15" < Medium ≤ 20"
25" < Large

Air and Trees Together

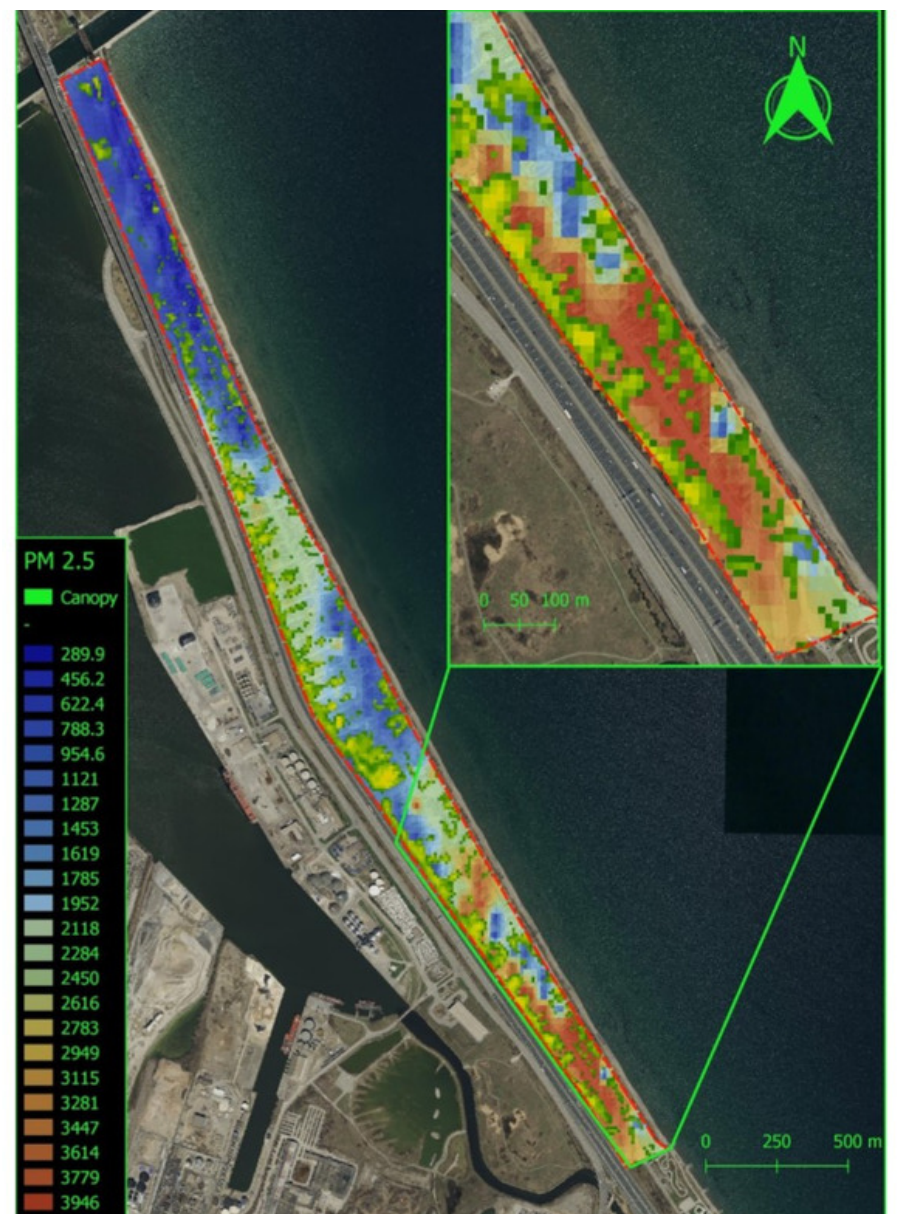
Despite the fact that the Beach Community has the best canopy coverage in the lower city, it still suffers from AQ challenges. The close proximity to particulate sources combined with the prevailing winds present the largest challenges to air quality for the neighbourhood. In our research we were not able to directly relate canopy coverage to air particulate quality within the neighbourhood, and we attribute this result due to proximity to both the QEW and industrial core - both major particulate sources.

Despite this, the air quality benefits of trees are proven, an average sized healthy tree in the neighbourhood removes 1.5lbs of particulate from the air annually. The discovery of AQ hot spots within the neighbourhood only highlight the important role the existing canopy coverage plays for air quality in the neighbourhood. There are opportunities to increase the role of trees to enhance air quality in the face of intense particulate sources, these are centralized on individual landowners, and the buffer between the artificial sound barrier and neighbourhood fence.

**average sized healthy tree in the neighbourhood
removes 1.5lbs of particulate from the air annually.**



This map displays Particulate Matter hot spots within the neighbourhood.



This map uses both the tree canopy and air quality maps and highlights hotspot areas. There is significant tree cover around the areas with poor air quality but long term planning and maintenance is required to maintain the benefits trees provide.



Native and non-native or exotic trees were identified during the tree inventory and the distribution of these species is noted on this map.

Trees Please Project 2016 Recommendations for the Beach Strip Neighbourhood

Recommendation (Short to medium timeline 2017-2018)	Lead	Task
More trees planted along the Beach Strip on City owned property	Trees Please team and City Forestry Department	Provide the City feedback of the Street Tree planting program, including requesting that requests for street trees from the Beach Strip neighbourhood are responded to quickly.
More trees planted along the Beach Strip in general	Trees Please team and City Forestry Department	For example, can we work with the Forestry Department to organize a community tree planting and maintenance plan?

Recommendation (Long Term Timeline 2017-ongoing)	Lead	Task
Increasing the tree canopy along the sound barrier	Trees Please team and the City (including Councillor Collins, Forestry department)	A focus on planting trees and/or distributing seed to increase the number of native trees
Air and Trees Taskforce	Trees Please team, City departments, other organizations	Focused on air and trees and what can be done regarding strategic tree planting to help increase air quality
Engage with entities to reduce particulate matter emissions overall	Environment Hamilton	<ul style="list-style-type: none"> Clean Air Hamilton / HAMN to start monitoring PM 2.5 levels at the Beach Strip location Attend Community Liaison Committee meetings (US Steel / ArcelorMittal Dofasco meet 4 times / year as mandated by Ministry of Environment and Climate Change
Urban Forest Strategy	Hamilton Naturalists' Club	Work with the City to create a policy that will help shape a healthy, urban forest.

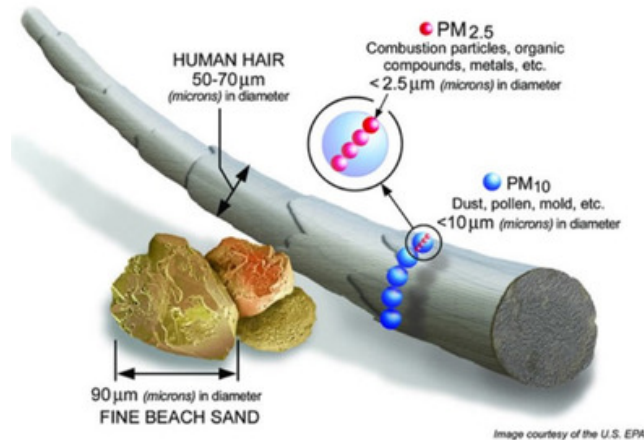
Appendices

WHY FOCUS ON AIR PARTICULATE POLLUTION?

Particulate Matter (PM) is fine dust that is caused by traffic, industry and construction. PM₁₀ is respirable that is linked to a number of respiratory and cardiac related illnesses. PM_{2.5} is even more concerning as the particles are so small they can get deeper into the lungs and at times in the bloodstream. Heavy metals (ex. cadmium, mercury, lead) can attach themselves quite easily to PM_{2.5} which is also what makes this tiny particulate so concerning.

The following image shows the size of PM₁₀ and PM_{2.5} compared to beach sand and human hair.

In this example over five PM₁₀ particles can fit in a strand of hair or a grain of sand and over four PM_{2.5} particles can fit in one PM₁₀ particle.



For more information go to: www.treespleasehamilton.org



www.treespleasehamilton.org