Where The Streets Are Paved With Green: Counting Urban Trees

Laurie Winkless, CONTRIBUTOR

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Treepedia uses Google Street View data to measure how green the world's cities are.

I am a big fan of trees. Apart from the fact that they are beautiful, they also offer multiple benefits to cities (as I mentioned in a previous article). For a start, they lower the ambient temperature by absorbing shortwave radiation, and using much of it to evaporate water from their leaves. A very useful thing at a time when the "urban heat island" effect is putting unparalleled demand on energy supplies (mainly for air-con). Of

course, trees also absorb CO2 from the atmosphere and produce oxygen, and their roots can help mitigate flooding during storms. In addition, there is widespread scientific consensus that green spaces have a positive impact on the health and well-being of a city's residents. In short, cities need more trees.

This image shows Toronto in all its green goodness (Image credit: MIT Senseable City Lab)

This isn't news to anyone – in fact in in 2015, the World Economic Forum's Council on the Future of Cities included "increasing green canopies" in urban areas as a priority for the coming years. So now they've teamed up with researchers at MIT's Senseable City Lab, to build an online

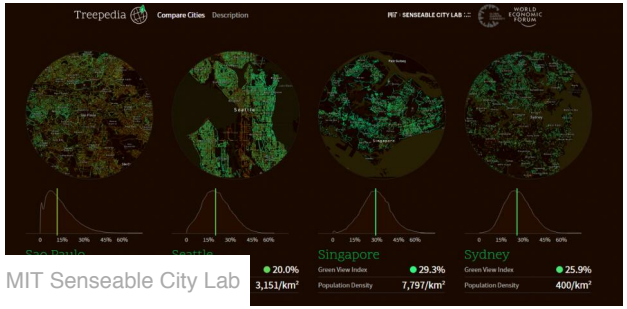
database of urban trees, called Treepedia.

Of course, those who manage forests have been carrying out aerial surveys on tree canopies for decades – and there was a recent (ambitious) attempt to count all of the trees on Earth. But rather than using remote sensing to produce their maps, the MIT team looked to a tool many of us use on a daily basis – Google Street View™. Street View has been around since 2007, and is, in effect, a vast online repository of location-stamped video footage, collected by heavily-instrumented cars, driven down streets all over the world. It gives anyone with internet access an opportunity to virtually explore any city at street-level. For the researchers, it also offered a unique way for them to assess the green canopy of urban areas.

They took this approach because, as the team described in the accompanying research paper, "The profile view of urban vegetation that people see on the ground — precisely the most common view people have of greenery — is different from the overhead view

captured by most remote sensing methods." Things like green walls, or shrubs that sit under a canopy of trees would naturally be missed by aerial/satellite imaging, but from the ground, they are easily seen. So these researchers would argue that, if you're a planner who wants to understand how much greenery your city's residents really interact with, a profile view (i.e. one taken from street level) – paints the most complete picture.
So, how did they do it? Well, they firstly had to stitch together 18 pictures from Street View to produce a panorama for each site. Then they needed to find a way to automatically identify green vegetation in these images. They used the fact that every Street View image is built from three other images – taken at red, green and blue wavelengths (the so-called, RGB color model). As you might expect, green vegetation has high reflectance in the green band, and relatively low reflectance in the red and blue bands, which helped the team to identify green areas. By looking at the images pixel-by-pixel, they could then define a

metric called the Green View Index (GVI), which is the ratio of the green area to the non-green area for that site, expressed as a percentage. Because the data is built on an open platform, and the GVI metric is calculated in a highly-repeatable manner, it offers cities a way to evaluate and directly compare their green canopy to that of other cities.



This image compares some of the twenty cities that have so far been mapped (Image credit: MIT Senseable City Lab)

There are limits though – so far, Treepedia has only included green vegetation, so for Street View images taken during winter are likely to give much lower GVI values than those taken when the city is in full bloom. In addition, Street View imagery is, by its very nature, static – it is an image taken at a precise moment in time. For the purposes of their initial study, the team manually checked all of the images to ensure that their images

were reliable and consistent, but it is something they hope to automate over time. In addition, the images are limited in terms of the viewpoints they offer – for example, the cameras don't point directly upwards, so the tops of tall trees are missing from the analysis. In addition, it can be challenging to differentiate between natural greenery and green street furniture, like billboards and mailboxes. Though the spectral information provided by the cameras provides some information, it lacks any near infrared wavelengths, which are generally used to identify vegetation. They have a plan for that too though – they will begin to incorporate geometric information into the vegetation algorithms, because manmade features tend to be more regularly-shaped than green vegetation.

Despite these limits, Treepedia is already remarkable tool, to-date mapping 20 cities, with Singapore holding the #1 spot (GVI of 29.3%). It also wants to go way beyond helping urban planners to design greener cities – the researchers want to use this data

to actively engage with the public. Their long-term hope is that, “Treepedia will allow city dwellers to view the location and size of trees within their communities, and to submit input to help tag, track, and advocate for more such trees in their cities.”

A snapshot of London Street Trees, showing my old neighborhood (Image credit: Greater London Authority)

And they’re not alone in their efforts to connect urban dwellers to the greenery that surrounds them. Back in 2015, Oliver O Brien (who I’ve featured previously in this column) published a beautiful map of Southwark, a borough in South-East London. It shows the position and genus of every "street tree" (that is, trees along roads, pathways and in public parks) in the borough. Building on that, a few weeks ago, the Greater London Authority recently published a tree map that covers much wider swathes of

the city*. Like Oliver's original map, it sourced its data from the local database maintained by London Boroughs – though not all have made the data available. The (excellent) Mapping London blog says that, "… there are currently 700,000 trees shown, out of a total of around 8 million across London (including those on private land, in forests, and in major parks not managed by the councils)." So yeah, it's incomplete, but it's still fascinating, and is constantly being updated. In late 2016, the New York City Parks Department also published its latest tree census map, which was assembled thanks to the hard work of 2,300 volunteers. According to CityLab, they recorded "…stats on species, bark health, trunk width, latitude and longitude, and — this was new — GPS coordinates for every (tree)."

Other cities have carried out similar surveys of their tree canopies, but for me, it's these public-facing ones that are the most interesting. Most of us who live in cities move through them as quickly as possible, without ever

stopping to think about what we can do to make them better. Projects like these give us access to valuable data, and through that, we can make a real difference to our local environment. For a start, we can advocate for more trees, becoming much-needed custodians of the urban forest.

* The map is data-heavy, so unfortunately, you can't zoom out to see all of London at once. I still recommend exploring it