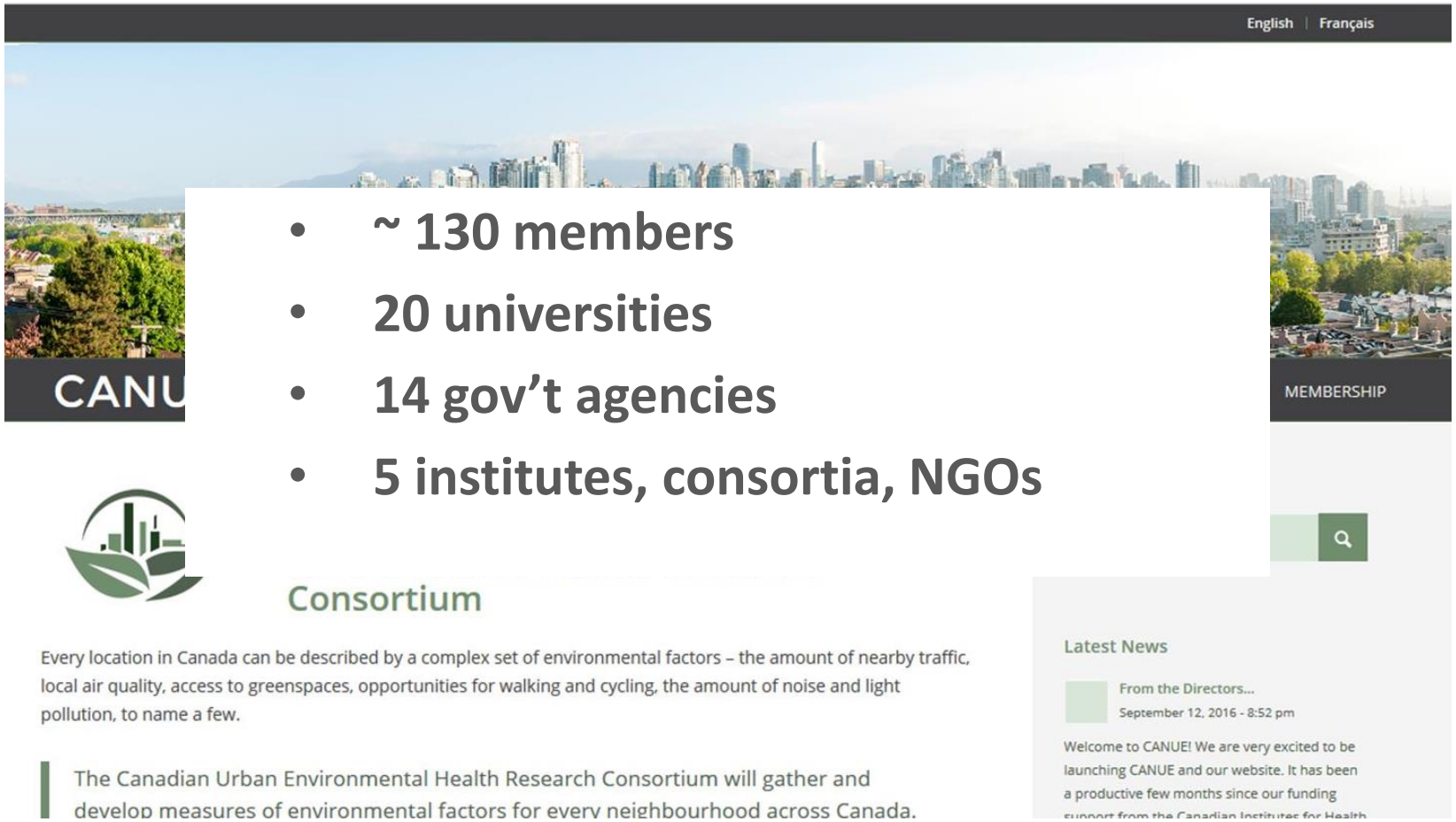
Agenda

- Short round table introductions of participants
- Overview of CANUE current and planned activities on greenness metrics
- Round table of any other ongoing activities being conducted by participants
- Discussion

$4.2 MILLION (2016 – 2021)

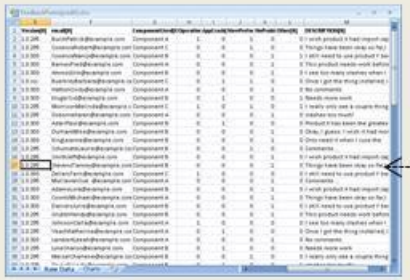


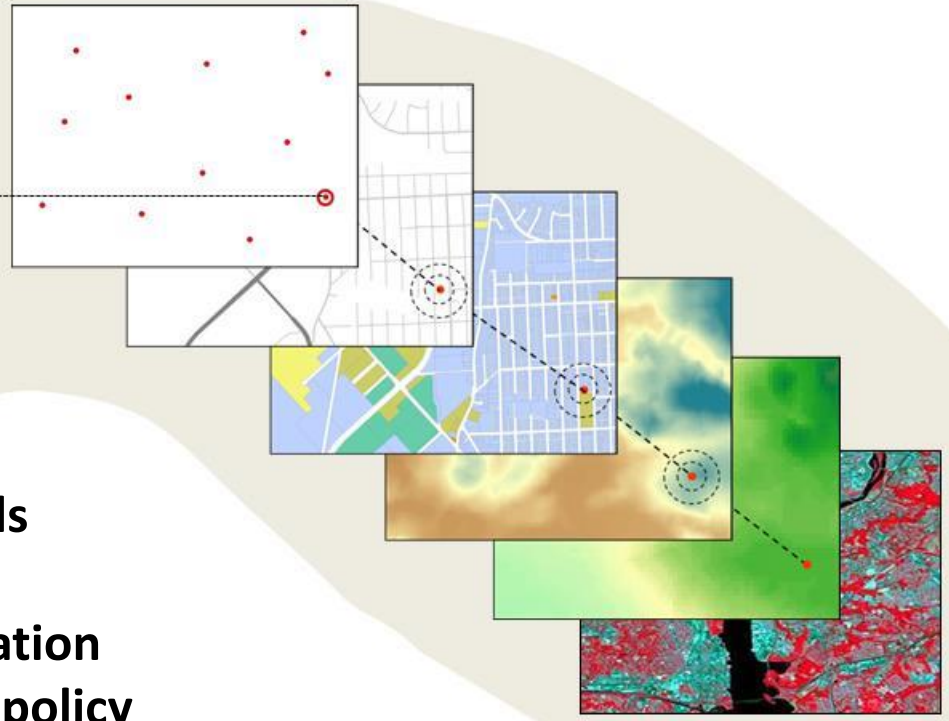
- ~ 130 members
- 20 universities
- 14 gov’t agencies
- 5 institutes, consortia, NGOs

THE BIG PICTURE

- **A wide variety of urban form metrics, well documented and reproducible at the postal code level for all of Canada, from 1980 onward…**
- **Procedures in place for providing these data, free of charge, to any and all Canadian cohorts and administrative health data stewards for use by researchers…**
- **New and improved multi-exposure epidemiological studies that provide policy-relevant evidence**
- **New and improved population exposure characterization, risk assessment and environmental equity studies**
- **Support for extending our efforts beyond Canada's borders, by incorporating global data sets and seeking out international collaborations with the same research interests**

DATA/METHODS/TOOLS PLATFORM





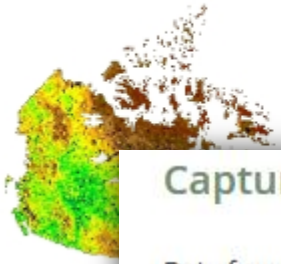
Methods
Tools
Documentation
Distribution policy

1980 **2050**

CANUE DATA

GREENNESS

NDVI: linking to every Canadian neighbourhood



The Normalized Difference Vegetation Index (NDVI) is based on satellite measurements of radiation reflected by the Earth's surface. Different characteristics of the reflected spectra can be combined to identify green vegetation – trees, grass and other plants. The NDVI has been widely used to study greenness and health. We are compiling a

Capturing different greenness qualities

Data from the NDVI only indicate greenness, which prevents us from unraveling the causal pathways between green places and health. We are developing a suite of measures to investigate these pathways, including accessibility of green space, type of vegetation, tree canopy cover, and related estimates of ecosystem services. Building on current work in Vancouver, we will also help to enhance NDVI with measures of green space access and quality by linking municipal data and applying quality appraisal with Google Street.

GREENNESS – CANUE activities

Complete NDVI → postal codes for:

- 30m Landsat 5 – 8 1985 - present
- 250m MODIS 2002 - present
- 1 km AVHRR 1979 – present

Green View Index → postal codes

- MIT code from 2015 (can implement for Canadian postal codes)
- Talking with Google now re: premium account for increased access
- Developing neural network/machine learning to identify vegetation pixels vs other green (signs, cars, buildings, etc)

GREENNESS – CANUE activities

Comprehensive review for methods and data discovery, implement metrics next fiscal (April 2018 →)

- Metrics including access to greenness
- Metrics including type of greenness (playground, sports field, garden...)
- Work on urban tree inventories

- Many other satellite-based measures possible:
  - enhanced vegetation index,
  - leaf area index
  - vegetation continuous fields
  - Soil moisture
  - Normalized difference water index
  - Tassel cap brightness, etc.
  - which to include, if any?

GREENNESS - NDVI

Completing NDVI → postal codes for:

- 30m Landsat 5 – 8 1985 – present ←
  - 250m MODIS 2000 - present
  - 1 km AVHRR 1979 – present

On hand:
Average of annual max within 100m for each postal code, 2004 to 2016)

Approach:

- Use Google Earth Engine to produce cloud free water masked composites and export summary stats per pixel (min, max, mean, others?) – Export times are an issue so want think about what is useful

- Develop python script to calculate values for neighbourhoods (tested 800,000 postal codes → 100 sec for 100m; 176 sec for 1000m

GREENNESS - NDVI

Year/Month	J	F	M	A	M	J	J	A	S	O	N	D
1985	o	o	o	o	o	o	o	o	o	o	o	o
1986	o	o	o	o	o	o	o	o	o	o	o	o
1987	o	o	o	o	o	o	o	o	o	o	o	o
1988	o	o	o	o	o	o	o	o	o	o	o	o
1989	o	o	o	o	o	o	o	o	o	o	o	o
1990	o	o	o	o	o	o	o	o	o	o	o	o
1991	o	o	o	o	o	o	o	o	o	o	o	o
1992	o	o	o	o	o	o	o	o	o	o	o	o
1993	o	o	o	o	o	o	o	o	o	o	o	o
1994	o	o	o	o	o	o	o	o	o	o	o	o
1995	o	o	o	o	o	o	o	o	o	o	o	o
1996	o	o	o	o	o	o	o	o	o	o	o	o
1997	o	o	o	o	o	o	o	o	o	o	o	o
1998	o	o	o	o	o	o	o	o	o	o	o	o
1999	o	o	o	o	o	o	o	o	o	o	o	o
2000	o	o	o	o	o	o	o	o	o	o	o	o
2001	o	o	o	o	o	o	o	o	o	o	o	o
2002	o	o	o	o	o	o	o	o	o	o	o	o
2003	o	o	o	o	o	o	o	o	o	o	o	o
2004	o	o	o	o	o	o	o	o	o	o	o	o
2005	o	o	o	o	o	o	o	o	o	o	o	o
2006	o	o	o	o	o	o	o	o	o	o	o	o
2007	o	o	o	o	o	o	o	o	o	o	o	o
2008	o	o	o	o	o	o	o	o	o	o	o	o
2009	o	o	o	o	o	o	o	o	o	o	o	o
2010	o	o	o	o	o	o	o	o	o	o	o	o
2011	o	o	o	o	o	o	o	o	o	o	o	o
2012	o	o	o	o	o	o	o	o	o	o	o	o
2013	o	o	o	o	o	o	o	o	o	o	o	o
2014	o	o	o	o	o	o	o	o	o	o	o	o
2015	o	o	o	o	o	o	o	o	o	o	o	o
2016	o	o	o	o	o	o	o	o	o	o	o	o
2017	o	o	o	o	o	o	o	o	o	o	o	o

Should we create a ‘base’ data set that can be used to calculate temporal and spatial aggregations as needed?

OR

Will simple annual and growing season (May 1 – Aug 31?) be enough?

Landsat 5 → Landsat 8 ‘bridge’ – method to calibrate?

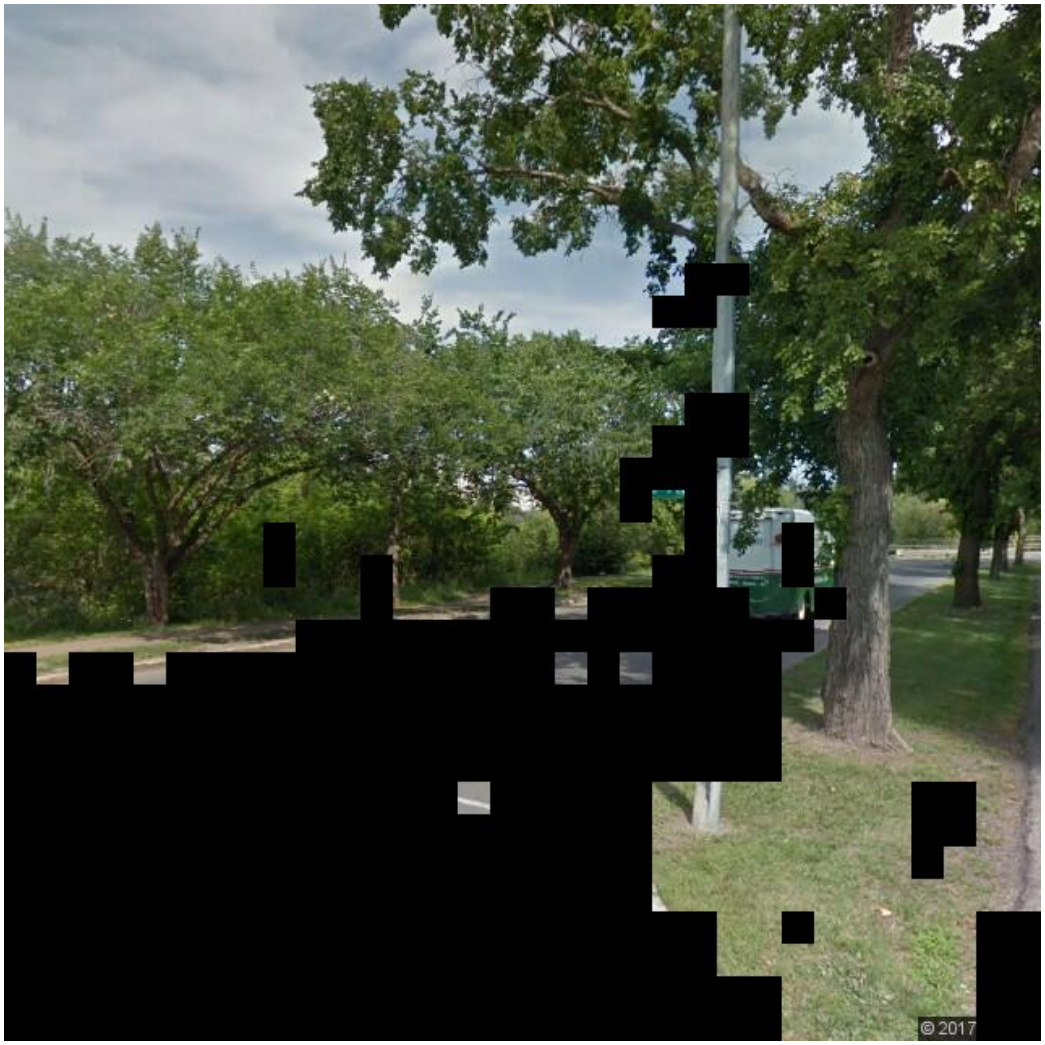
- Missing 2012 – no overlap
- Literature suggests difference is not large, but EVI is more comparable than NDVI

GREENNESS – Neural Network/Machine Learning

- 30 seconds per image
- 6 images per postal code
- 800,000 postal codes

(can parallel process)

GREENNESS – Neural Network/Machine Learning



Not so good:

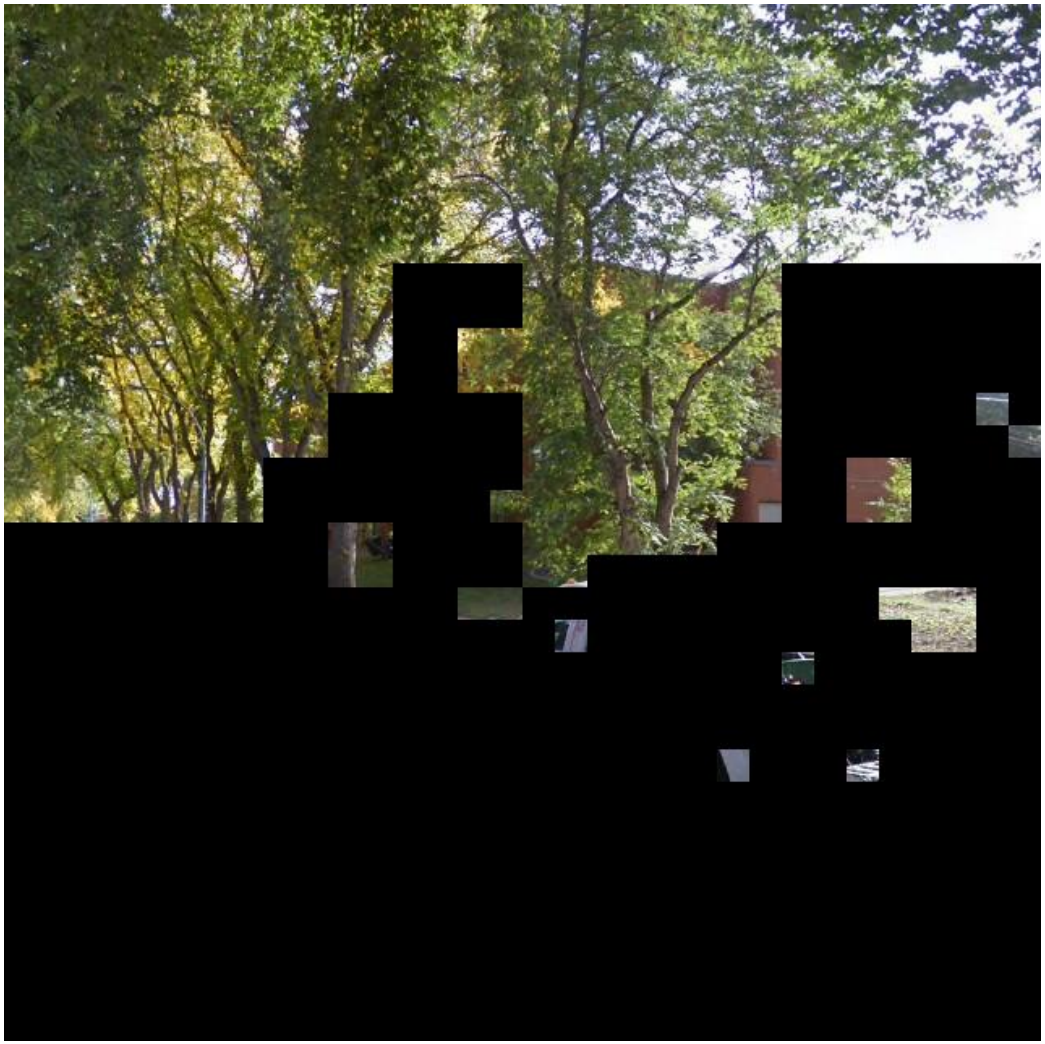
- Sky
- Green vehicle

Good:

- Removed street sign

GREENNESS – Neural Network/Machine Learning

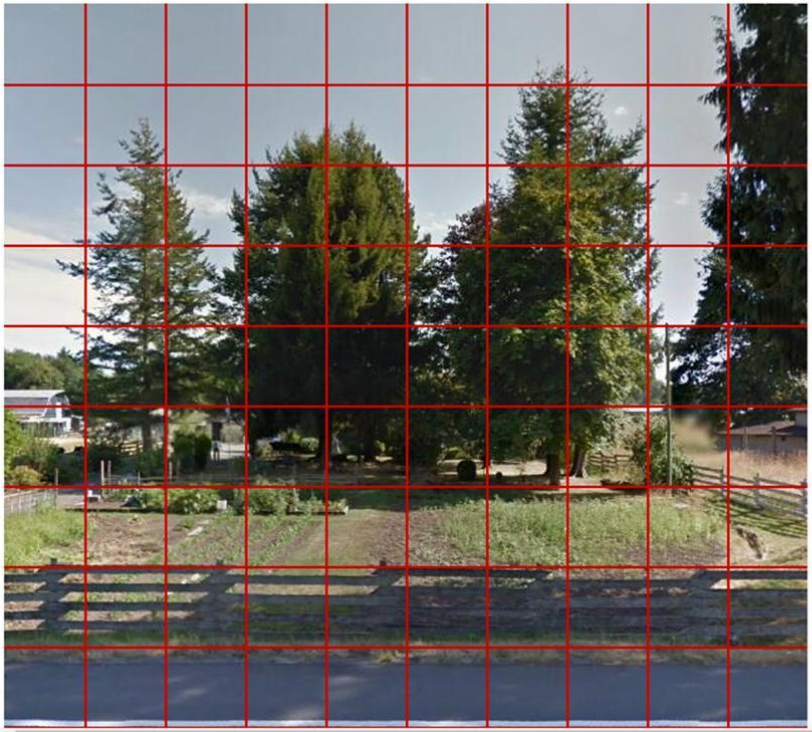
GREENNESS – Neural Network/Machine Learning



Better...

GREENNESS – Neural Network/Machine Learning

First, select the CSV file of ineterested province: Choose File BC_Just_Co...ICode.csv Then, upload it: UploadCSV
If you encounter any kind of error you can change the image: SHOW ME ANOTHER PICTURE
Now, please choose all the cells on the image that have >**50%** vegetation. You can adjust the total vegetation percentage with the green buttons on the right side of the image.
When you are done with the current image, please submit your result: SUBMIT AND SHOW NEXT IMAGE
When you had enough for this session, please export the results, otherwise they are gone: EXPORT ALL RESULTS Now, you are good to go: EXIT
Please come back again! :-)



Greenness Percentage:
0 %

Amazon Turk – could have this done for $.10 per image... $100 for 1000 images...

- **How are others creating good training data?**
- **How sensitive are results to training input?**
- **(Tree trunks vs phone poles...)**
- **Timing/date of pictures?**

Frequency of recalculation?