
Urban Soils
photo: Sandra Brown


Outline:
• Anthropogenic soils
• Main properties of urban soils
• Virtual field trip of urban soils in Vancouver
• Vancouver soil map
• Soil and micro-climate assessments for urban gardens
photo: Sandra Brown

Definition of an urban soil?

Traditional pedologic definition:

Soil is a dynamic natural body, composed of mineral and organic solids, gases, liquids and living organisms, which can serve as a medium for plant growth

Definition of an urban soil:

"Soil material having a non-agricultural, man-made surface layer > 50 cm thick, that has been produced by mixing, filling or contamination of land surfaces in urban and suburban areas"

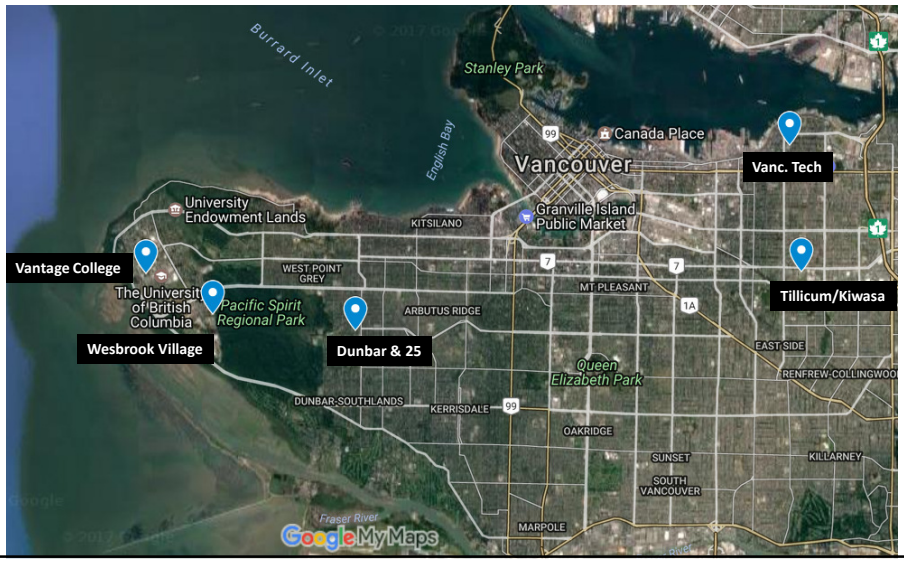
Bockheim, 1974

Anthroposolic soil:

"…one or more of their natural horizons removed, removed and replaced, added to, or significantly modified by human activities….. ≥ 10 cm"

Naith et al., 2012

Virtual field trip → main properties of urban soils:



Forest soil, Pacific Spirit Park

Vancouver Technical School Market Garden

2012, prior to establishment of Fresh Root school market garden

Main properties
1. **Compaction**
2. Poor drainage
3. Anoxic conditions

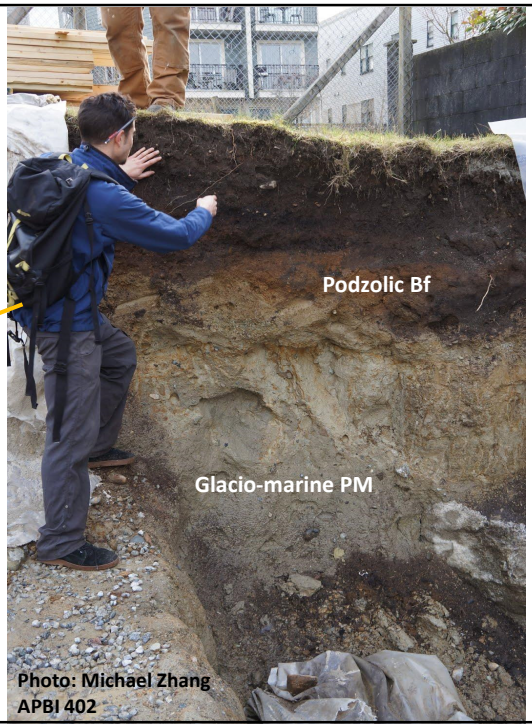
Glacio-marine PM →

Photo Teresa Porter: APBI 402

Tillicum Kiwassa

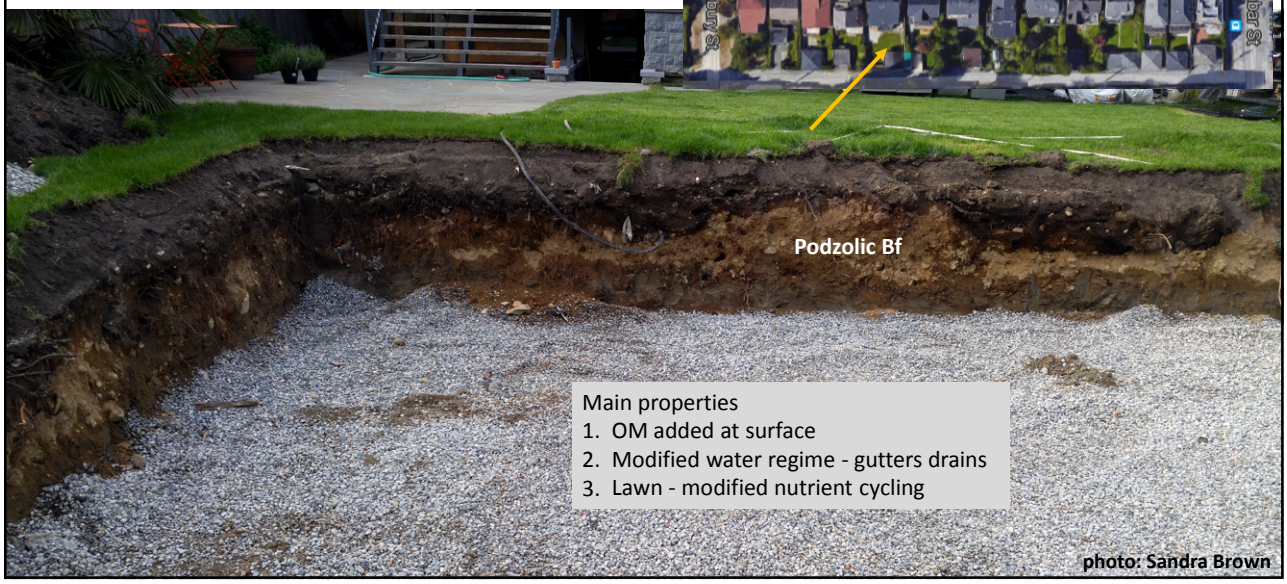
2013, gravel sports field prior to establishment of native plants (pollinators)

Main properties
1. Poor drainage at depth
2. OM added
3. Buried under gravel soccer field
   (Natural nutrient cycling disrupted)



25th and Dunbar

backyard renovations, June 2017



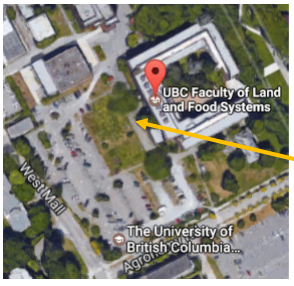
UBC Wesbrook Village

south campus, June 2017

Characteristics
1. Impervious layer near surface
2. Limited rooting volume
3. Low plant available water storage

Vantage College

Excavation, November 2014



Main properties
1. Surface **compacted** layer
2. Limited water movement
3. Limited gas exchange

Main properties of urban soils:

- Compaction and modified soil structure
- Restricted water movement and aeration
- Disrupted nutrient cycling
- Limited rooting volume / AWSC
- Modified temperature regimes
- Presence of contaminants (e.g. metals)

The dilemma:

CBC news

B.C. boasts the highest proportion of female farmers in Canada, according to 2016 agriculture census

The overall number of B.C. farmers is down since 2011 but the number of women who farm is up

By Belle Puri, CBC News Posted: May 12, 2017 7:03 PM PT | Last Updated: May 12, 2017 7:03 PM PT

Elana Evans (left) and Maddy Clerk (right) operate City Beet Farm in Vancouver. (City Beet Farm)

VANCOUVER SUN

Metal contamination found in Vancouver community garden, brownfield sites

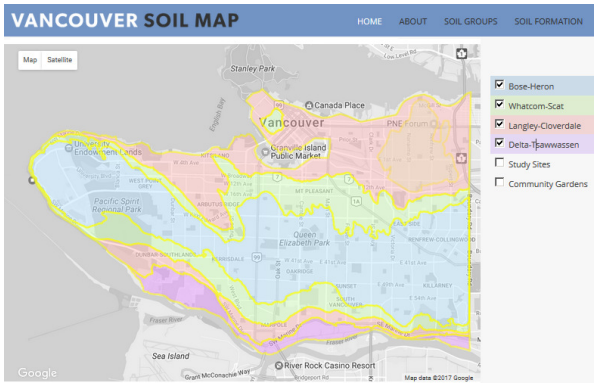
RANDY SHORE, VANCOUVER SUN 12.02.2014 |

Oka et al., 2014. Soil Assessment for urban agriculture. J. Soil Sci and Plant Nutrition 14(3) 16 pp.

How can we assess soil for urban gardens?

1. Soil map

- Soil order
- Soil parent material
- Inherent characteristics



Iverson et al. http://vancouversoils.ca/

Soil and micro-climate assessment for an urban garden

2. Preliminary site visit

- Soil assessment worksheet
  e.g. stained soil, dead plants, debris, burnt patches etc.

3. Site history - Interview land owner

→ Past land use

Level of concern [1]	Example criteria
High	Has been gas station, dry cleaner
Medium	Within 30 m of major road
Low	Always been a park or residential

[1] health risk

Soil and micro-climate assessment for an urban garden

4. **Soil physical** & environmental characteristics
   - Site assessment
     e.g. texture, topographic position, stoniness
   - Identify potential issues
     e.g. compacted layer at depth (perched water table)
     limited rooting depth

Soil and micro-climate assessment for an urban garden

5. **Soil analyses**

Level of concern	Sampling	Parameters	Interpretation
High	Contaminants of concern	e.g. PAHs	CCME soil quality guidelines; B.C. soil quality standards
Medium	"	e.g. metals	"
Low	Soil fertility	e.g. nutrients[1], pH	SPEC 2017

[1] spring sampling, composite samples → PSAI lab

Soil and micro-climate assessment for an urban garden

6. Micro-climate

- Precipitation
- Soil moisture

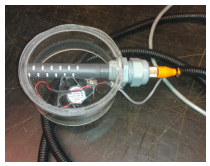
} Crop water requirements

- Air temperature
- Soil temperature

} Urban heat island effect

- CO_2 flux

} Impact of gardens on emissions



Soil and micro-climate assessment for an urban garden

7. Site specific management options

e.g.

Indicator(s)	Issue	Option
Soil depth (m)	Lack rooting depth	Import soil; raised beds
% sand CEC	Low nutrient retention	Add organic matter
% sand Soil moisture content	Low plant available water	Add organic matter Import soil
Aspect Shade	Low sunlight	Plant selection (shade tolerant vegetables)

Key management challenges in urban soils

- Compaction
- Limited plant available water storage
- Limited rooting depth
- Poor drainage
- Concerns about trafficability

Readings if you want to know more!

- Naeth et al. 2012. Proposed classification for human modified soils in Canada: Anthroposolic order. Canadian Journal of Soil Science, 92: 7-18. *(pages 7 and 8)*
- Dudal, R. 2004. The Sixth factor of soil formation. International Conference on Soil Classification. http://www.css.cornell.edu/faculty/dgr2/research/suitma/Dudal_6thFactor.pdf
- Craul P.J. 1985. Urban Soils. Pennsylvania State University, 45-61. https://www.ces.ncsu.edu/fletcher/programs/nursery/metria/metria05/m57.pdf