Spatial Knowledge and Information CANADA:

Developing a Volunteered Geographic Information System to Support Local Food Systems Mapping in the Region of Durham

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Background and Relevance

The fifth assessment report by the Intergovernmental Panel on Climate Change (IPCC) used the strongest language yet, indicating it is "extremely likely" that the dangers posed by global climate change are caused by human influence. The observed changes in the climate–most notably the increased frequency and severity of extreme weather events–are affecting natural ecosystems and built environments, threatening their resistance and resilience capabilities (IPCC, 2013). Of particular vulnerability are food systems, as agricultural production is especially prone to the effects of drought, extreme heat, extreme cold, and severe storms (EPCCA, 2009). In addition to the inherent vulnerability, the global and industrial nature of our current food system is a major contributor of green house gases (Region of Durham, 2012). Agricultural vulnerability, coupled with unsustainable practices, is highlighting the need for adaptive strategies to build more resilient local food systems.

In this study, we focus on supporting resilient local food systems in the Region of Durham, Ontario, Canada, which is within the Greater Toronto Area and consists of eight municipalities (see Map). Supporting a sustainable local food system is a central theme in the Region of Durham Community Climate Change Local Action Plan (Region of Durham, 2012), with a particular emphasis on urban agriculture. As identified in the Local Action Plan,

Source: Regional Municipality of Durham, Planning Department, 2012

urban agriculture strategies aim to promote community gardens, backyard gardens, and local food producers; educate and engage the local community; and increase "the carbon sequestration capacity of Durham's built environment, reduce food miles and implement key provisions of the Food Charter" (Region of Durham, 2012, 25). As part of their progressive programs and policies on local food and sustainability, the Region is working toward assessing urban agriculture within their jurisdiction in order to coordinate, connect, promote, and develop a sustainable local food system.

Urban agriculture in Durham is associated with an active group of local food system stakeholders, which includes departments, divisions, and councils within government (e.g., *Durham Food Policy Council*), nongovernmental organizations (e.g., *Durham Integrated Growers*), community groups (e.g., *Durham Environmental Advisory Committee, Oshawa Gardening Club*), businesses, and individuals. Collectively, these stakeholders are contributing to local food security through often isolated and hyper-local initiatives by way of public engagement (e.g., *webinars and workshops*) and action (e.g., *community gardens, backyard share programs, farmers markets*). The diverse stakeholders involved in local food systems should not be undervalued, and given the immediate threat of climate change and heightened need for adaptive measures, we need to better understand the stakeholders and their individual and collective initiatives while gathering additional data to support decision making.

The objective of this study is to create an environment that supports the development of a virtual urban agriculture community where stakeholders can visualize, discuss, and share information on the local food system. We hypothesize that we can engage local stakeholders to collaboratively map urban agriculture in the Region of Durham. The study, if successful, will provide a collaborative map-based resource that engages all levels of urban agriculture stakeholders, from community members to decision makers. Ultimately, we would like to foster an environment for collaborative asset mapping that can be used to strengthen the adaptive capacity of the local food system in the Region of Durham, supporting the strategic direction of the Durham Round Table on Climate Change and the Food Policy Council. This paper outlines the methodological framework currently under development to achieve this goal.

Methods and Data

Recent developments in geographic information systems (GIS) and Web 2.0 (the interactive web) led to the development of the Geoweb: a collection of tools, infrastructure, and services that support online maps and mapping (Johnston and Sieber, 2012). Due to the interactive nature of the Geoweb, a new type of information is emerging from citizen contributions on the Geoweb: volunteered geographic information (VGI). Typically qualitative, crowdsourced, and non-authoritative, VGI is similar to user generated content with an explicitly spatial component (Goodchild, 2007). In order to collect user generated *geographic* content (UGGC) from urban agriculture stakeholders, the methodology for this project is built on the volunteered geographic information system (VGI-S) framework, which establishes the parameters of the components and functions of the system. The components: people, application, hardware, software, and data—which support input, management, analysis, and presentation functions—are summarized in **Table 1**.

The **application** of this project is a six-month pilot designed to map the local food assets in the Region of Durham, Ontario, Canada, from May to November 2014. The **people** involved in this application range from project initiators, to contributors and end users, with overlapping roles between each group. The initiators are those involved in the development stage where important methodological and deployment decisions are made. The contributor group is comprised of the wide range of urban agriculture stakeholders, which can include members of the government, nongovernment organizations, community, and the public at large. The end users are those who will utilize the Geoweb and/or the datasets created from the project. The **software** is built on the Neptis Geoweb tool: a collaborative, online web map environment for visualizing, exploring, and discussing planning issues for the municipalities within and around the Greater Golden Horseshoe in Southern Ontario. The tool was designed to provide a regional cross-municipality perspective to inform discussions on growth and change, and support informed decision-making. The **hardware** necessary to run the tool includes servers housed by Ryerson University's information technology services. The **data** can be categorized into base data, seed content, and user generated geographic content (UGGC). The base data is generated by

OpenStreetMap and supplemented with land use data, which includes settlement areas, proposed development, and designated green belt land. The seed content will be comprised of existing urban agriculture spatial data made available by the Region. The UGGC, contributed by the stakeholders and public, will be structured using forum categories, and organized into six themes: farmers markets, community gardens, driveway produce stands, backyard gardens, backyard garden share programs, and workshops/community events.

The functions serve to classify the sequence of tasks necessary for inputting, managing, analyzing, and presenting the UGGC within the VGI-S. The **input** of the data is manual, where contributors use a desktop computer to digitize points and polygons on the map, and add relevant attributes (text) to those points. The **management** of the system includes security and storage considerations. The Geoweb does not require a user login to access the content, but does require a simple name and password to create and edit content. In addition to daily monitoring of the site by system initiators, a "report post" helps identify incorrect content. The content generated will be stored on Ryerson servers. The content generated will be downloaded and **analyzed** at the end of the pilot project in order to determine what it adds to the existing information on urban agriculture. The textual contributions will be examined using content analysis and the spatial data will be analyzed to determine patterns in the contributions; i.e., does the data highlight food deserts, or, areas with a thriving local food system? In addition, website usage statistics will be collected, such as the number of viewers, how long they stayed on the website, how many people contributed, how often, and who they are based on login information. This analysis will provide insight into the urban agriculture stakeholders within the Region. The UGGC will be **presented** three ways. First, the Geoweb will exist for the duration of the project and serve as a method to present the urban agriculture information to the public. Second, a static map will be created from the UGGC for future use in urban agriculture decision-making. Finally, a standalone spatial dataset of the contributions will be created and packaged for use in mapping and decision-making. This dataset will not be available for public download from the Geoweb, but will be made available to interested parties.

Table 1: Components and Functions of an urban agriculture VGI-S
COMPONENTS
APPLICATION
Duration of Project: 6 month pilot (May 2014 to November 2014) **Location:** Region of Durham (8 municipalities, population approximately 608 000) **Theme:** urban agriculture
PEOPLE
Initiators: Ryerson University research team (funded, in part, by GeoThink SSHRC partnership grant), in partnership with the municipal government (Region of Durham) and Toronto-based NGO (Clean Air Partnership) **Contributors:** urban agriculture stakeholders **End Users:** broader public, regional government, and university researchers
SOFTWARE
Platform: Neptis Geoweb infrastructure
HARDWARE
Server: Ryerson University
DATA
Base Data: Open Street Map, settlement areas, green space **Seed Content:** current spatial data on urban agriculture (i.e., location of community gardens, farmers markets, and other urban agriculture data available) **User Generated Geographic Content (UGGC):** community gardens, backyard garden share, backyard gardens, farmers markets, food stands, gardening workshops
FUNCTIONS
INPUT
Mechanism: desktop computer **Data type:** points and polygons; plus text (discussion forum attached to points/polygons)
MANAGE
Security: unprotected access, login to contribute plus daily monitoring of posts by initiators and "report post" function **Storage:** on Ryerson server
ANALYZE
Dataset created from UGGC: content analysis of all contributions **Usage:** analyze usage stats on web
PRESENT
Map (dynamic): keep web map open and operational throughout duration of project **Map (static):** create static map of urban agriculture in the Region to incorporate into reports **Dataset:** give dataset to Region of Durham to incorporate into their SDI

Results

Currently, the project is in its development stage, with project initiators continuing to devise the best methodology for system deployment. In addition to these system specifications under development, an outreach or media strategy is also necessary to generate participation. The initiators of RinkWatch—an interactive map that serves to track the condition of outdoor ice rinks—attributes their success, in part, to the media strategy they employed (Lawrence, Robertson, and McLeman, 2013). In addition to various other outreach strategies, RinkWatch generated attention from

traditional media (including the Montreal Gazette and CBC Radio's Metro Morning) and social media (including popular blog The Dish by Andrew Sullivan), which directed high volumes of traffic on their site, and in turn, created a sizable dataset of volunteered contributions and usage statistics.

The challenge, moving forward with an urban agriculture VGI-S, is generating interest from stakeholders before and during project deployment. Preliminary outreach to stakeholders, which includes meetings with members of the GTA Clean Air Council, is generating significant interest in the project. To further the outreach, project initiators are working with identified stakeholder groups, including environmental committees, gardening groups, and NGOs. We anticipate, through a series of webinars, presentations, and social media strategies, that the project will garner necessary attention from the groups targeted as the primary contributors.

Conclusions

This project applies a volunteered geographic information system to enable existing urban agriculture stakeholders to map the local food system in the Region of Durham. Although many urban agriculture initiatives are hyper-local, isolated, and often invisible from Regional local food scans, these actions collectively support more sustainable, resilient, and livable communities. Engaging the diverse stakeholders and mapping local urban agriculture initiatives is a necessary next step in building more resilient local food systems.

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