MScSM

Master of Science in Sustainability Management UofT

Institute for Management & Innovation
UNIVERSITY OF TORONTO
MISSISSAUGA

Urban foraging and Sustainability:

Analysis of current capacity of forgeable non-timber products in Toronto.

Introduction

Current financial, employment, and environmental crisis's have caused strains in mainstream food production systems resulting in increased food prices decreased availability of food and increased difficulties in production at both global and local levels. Food insecurity is expected to rise in 2023 according to CEO of Toronto's largest food bank (Lavoie et al., 2022). The rise of food cost has placed serious pressure on the almost 1 in 5 people who live in Toronto that are in a food-insecure household in 2021 (Statistics Canada, Income Statistics Division, Canadian Income Survey).

Urban green spaces are a valuable resource and have untapped potential to provide provisioning ecosystem services. Nearly half of the world's population reside in cities and the rate of urbanization is growing (Sardeshpandeid & Shackleton, 2020). Canada's most populous and diverse city, Toronto Ontario is home to a diverse group of foragers, and multiple foraging communities (Clark & Nicholas, 2013; Shortly & Kepe, 2021).

Accessible free food can be a supplemental supply of food that reduces economic and nutritional strains of food insecurity. The gathering of both edible and medicinal products can be a means of cultural expression of food identity (Nyman, 2019) strengthening the sovereignty of equity deserving groups(Heynen et al., 2006).

Recognizing and analyzing the potential of the practice can be a method of legitimizing it (Shortly & Kepe, 2021). Foraging can be a significant tool in improving food sovereignty and resilience and therefore quantifying its potential can be a step-in foraging being included in city planning.

What is Urban Foraging ?

Urban foraging has broadly been defined in literature as the gathering or harvesting of uncultivated biological resources within urban settings without any economic transaction (Poe et al., 2013a).
The collection and harvesting of fruits, herbs, nuts, and other products from local communities has been connected to improved food security, cultural expression, and ecological connection (Hare & Peña del Valle Isla, 2021; Poe et al., 2014; Taylor, 2011).

Research Question

What is the current capacity and potential for urban foraging of non-timber tree product in Toronto's urban green spaces.?

Research objectives

- To map the distribution and abundance of forgeable non-timber resources that currently exist in Toronto's urban green spaces.
- To assess an estimated capacity of foraging to provide better insight to policy makers and land planners for further development.

Methods

Study Area: Toronto

- Area of 630km^2, a
- Population of 2,956,024 people
- 600,000 street trees (Geospatial Competency Centre, Parks, Forestry & Recreation, Natural Resources Canada.).
- Toronto has a large green space with 1500 parks covering Green space is 13% of the total land cover (City of Toronto 2018).

Mapping methods

Accessible criteria—Within 50 meters of from the pedestrian network

Forgeability criteria—database from Plants for the future database PFTF (pfaf.org) All the tree species that have an edibility and medicinal used rating greater or equal to 3 were included.

Spatial analysis— using Neighborhood and Ecosystem class to find A count of both EFAT and MFAT was conducted using ArcGIS software.

Total forgeable biomass

Biomass regression equation and the known DBH of each tree in the inventory. The equation used was developed by Martinez-Yrizar et al. (1992).
Y = exp{-1.996+2.32*ln(DBH)}

From the total aboveground biomass portion of biomass is the forgeable product. An estimate of current forgeable biomass was calculated at 5%, 3%, 2% and 1% of calculated total aboveground biomass.

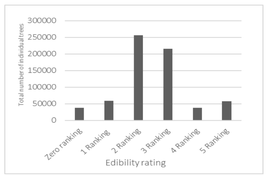
Potential Capacity.

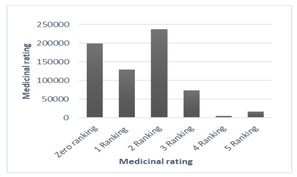
The total potential forgeable area of land was calculated for areas that are classified, tree, grass bare and shrub that fit publicly owned, and accessibility criteria. Using the total potential forgeable area and productivity results (yield per hectare) of urban food forest from Clark & Nicholas, 2013, (Grafius et al., 2020) and Nytofte & Henriksen, 2019. The total forgeable product was calculated if 75% 50% and 25% of that land was used as a food forest.

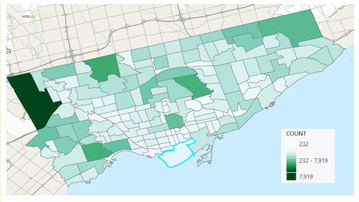
Results

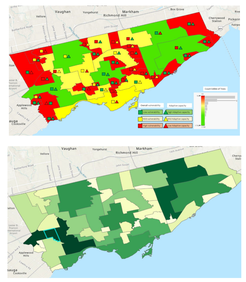
Forgeable Trees

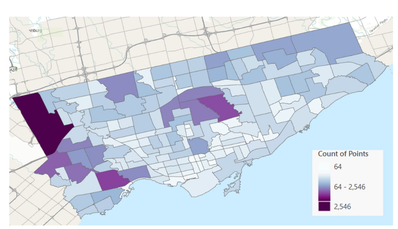
	All Trees	Edibility rating ≥ 3 edibility rating	Edibility rating ≥ 3 Medicinal rating
# of Species	282	117	64
Total number of individual trees	662,128	310,268	95,483
% of trees		47%	14%









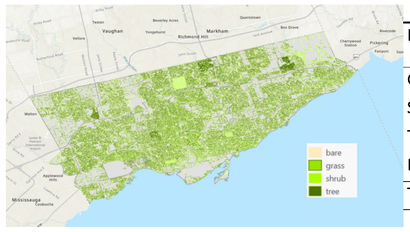


	Correlation coefficient	Level of correlation	p-Value
Income and Number of Edible trees	0.559006958	Moderately correlated	7.07E-13
Population density and Number EFAT	0.415912015	Low correlation	3.21E-07
Area and Number EFAT	0.813777042	High Correlation	2.48E-34

Total forgeable biomass

	Count of trees in Toronto	Average DBH	Sum of biomass (metric tons)	Sum of 5% of biomass (Metric tons)	Sum of 3% of biomass (Metric tons)	Sum of 2% of biomass (Metric tons)	Sum of 1% of biomass (Metric tons)
Edibility rating equal to 3	206005	22.85	333799.12	16689.96	10013.97	6675.98	3337.99
Edibility rating equal to 4	36494	16.81	9228.29	461.41	276.85	184.57	92.28
Edibility rating equal to 5	56245	27.27	33699.23	1684.96	1010.98	673.98	336.99
Total EFAT	298744	22.31	376726.64	18836.33	11301.80	7534.53	3767.27
Medicinal rating equal to 3	71595	29.74	47079.57	2353.98	1412.39	941.59	470.80
Medicinal rating equal to 4	4916	21.98	2450.96	122.55	73.53	49.02	24.51
Medicinal rating equal to 5	16497	9.89	2004.44	100.22	60.13	40.09	20.04
Total MFAT	93008	20.54	51534.97	2576.75	1546.05	1030.70	515.35

Potential Capacity.



Land cover	Total area (hectares)
Grass	508.6
Shrub	223.9
Tree	2369.8
Bare	1600.4
Total	4702.6

Clark & Nicholas, 2013	% of available area	0.05			0.25			0.5			Location
	Open space planted (ha)	235.13			1175.65			2351.3			Burlington, Vermont
	Percent of mature yield achieved (%)	0.25	0.5	0.75	0.25	0.5	0.75	0.25	0.5	0.7	
	Total fruit yield (metric tons/year/ha	13.45	26.9	40.35	13.45	26.9	40.35	13.45	26.9	37.66	
	Total fruit yield (metric tons/year)	3162.49	6324.99	9487.49	15812.49	31624.99	47437.48	31624.99	63249.97	88549.96	
	Edible fruit yield (metric tons/year)	2846.24	5692.49	8538.74	14231.24	28462.49	42693.73	28462.49	56924.97	79694.96	
Nytofte, 2019	% of available area	0.05			0.25			0.5			Location
	Open space planted (ha)	235.13			1175.65			2351.3			Coldstream, Scotland
	Total food yield (kg/year/ha	891			891			891			
	Total food yield (metric tons/year)	209.5008			1047.504			2095.008			
Grafus 2020	% of available area	0.05			0.25			0.5			Location
	Open space planted (ha)	235.13			1175.65			2351.3			Bedford, Luton and Milton Keynes
	Scenario	1	2	3	1	2	3	1	2	3	
	Total food yield (Kg/year/ha	435	1787	2575	435	1787	2575	435	1787	2575	
	Total food yield (metric tons/year)	102.2816	420.173	605.4598	511.4078	2100.887	3027.299	1022.816	4201.773	6054.598	

Discussion

Where and who has access to edible landscapes

There is a modernly strong correlation between income and abundance of forgeable trees. This is a gap in equity that can be addressed in city planning by focusing future foraging efforts in neighbourhood that have more equity deserving communities.

Areas that have a high abundance of EFAT and lower exposer and lower sensitivity can be areas where the city can target to promote urban foraging.

How much forgeable product is being produced and what that means for Toronto.

Forgeable edible biomass material between 20,160 metric tons and 4032 metric tons. This information can be an over estimation of the available forgeable product due to the percent of total biomass.

The finding showed that the EFAT with an edibility rating equal to 3 made up the majority of the forgeable biomass calculated.

The potential future of urban foraging within Toronto

The results of the analysis show that there is a large presence of forgeable trees and If tree planting focused on planting a variety of trees species with higher forgeability rating, it would they be increasing the amount of forgeable product and increasing the tree species diversity of the city.

Urban foraging can be done within a city without compromising the environmental health of urban green spaces. As other cities have proven urban foraging can be promoted without damaging the cities environmental health. Urban foraging can be a tool to increase food security, but it is not a solution in its self.

Recommendations

1. Change legalisation: *By-law 608–6B in the Toronto Municipal Code, Chapter 608,* should be removed and should replaced with site specific guidance on foraging rules.
2. Create a Foraging pilot project - that plants forgeable species, educate on gathering and partner with local community groups
3. Engage with the public and private groups about plant forgeable species on private land.

Limitations

Limitations to this study is the quality and accuracy of data obtained from the city open source and Statistic's Canada. The data obtained is the most recent publish data but the lasted updated are dated.

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SSM1100