LANDSCAPE PERFORMANCE SERIES
presented by the Landscape Architecture Foundation

University of Toronto Scarborough Campus Valley Land Trail Methods

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This investigation was conducted as part of the Landscape Architecture Foundation's 2021 *Case Study Investigation* (CSI) program. CSI matches faculty-student research teams with design practitioners to document the benefits of exemplary high-performing landscape projects. Teams develop methods to quantify environmental, social, and economic benefits and produce Case Study Briefs for LAF's *Landscape Performance Series*.

To cite:

Hill, Jenny and Kanwal Aftab. "University of Toronto Scarborough Campus Valley Land Trail Methods." *Landscape Performance Series*, Landscape Architecture Foundation, 2021. https://doi.org/10.31353/cs1701

The full case study can be found at: https://landscapeperformance.org/case-study-briefs/UTSC-trail

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Environmental Benefits

- ***Projected to intercept over 1.8 million gallons of stormwater over the next 20 years through 491 newly-planted trees. This is about 146% the amount of stormwater that would have been intercepted by the 125 mature trees that were removed due to the construction of the trail.***

Method: We reviewed the planting plan and tree removal construction documents, alongside information gathered from the firm about the tree numbers, types, and plantings on the satellite site. From this we were able to identify the type, size, and location of trees removed and trees planted. Using i-Tree Design, we calculated the projected amount of water that the tree canopies will intercept over their projected twenty-year growth. Plantings from the satellite site were included because they were planted as a direct result of this project.

iTree Eco is better designed to process large quantities of data and was considered as an alternative modeling platform, but iTree Design offered the advantage of predicting canopy growth and biomass accumulation over two decades and the commensurate benefits. Modeling future potential was very important on this case study where mature trees were replaced by planting stock from 5 gal. or 2 gal. containers. The limitation of iTree Design is the total number of trees that can be modeled in each run of the program. To account for all of the trees removed the program was run multiple times each with up to 25 individual specimens in each run. As the compensation planting were all a standard size, a single example of each species was modeled, and the results multiplied by the number planted.

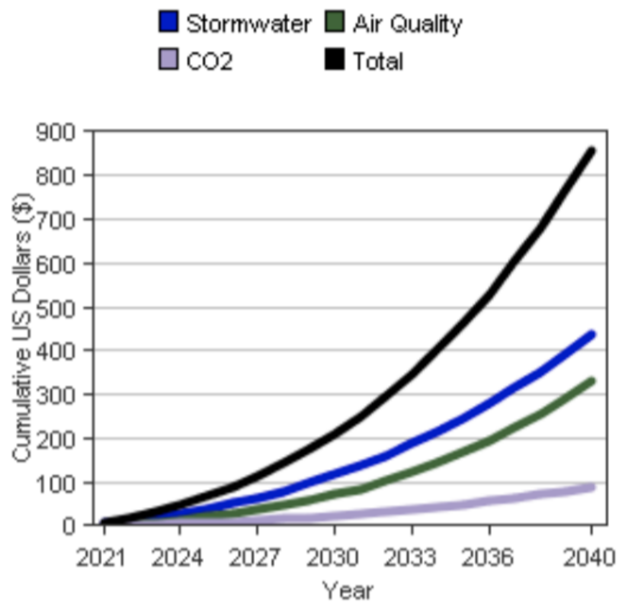


Figure 1. Tree benefit forecast for 20 years

Calculations: Please see Appendix A for the calculation breakdown by tree species of the amount of stormwater retained.

Sources: Planting plans provided Schollen & Company, Inc. and the tree report from the firm ecologist was used to estimate stormwater management potential of removed trees.

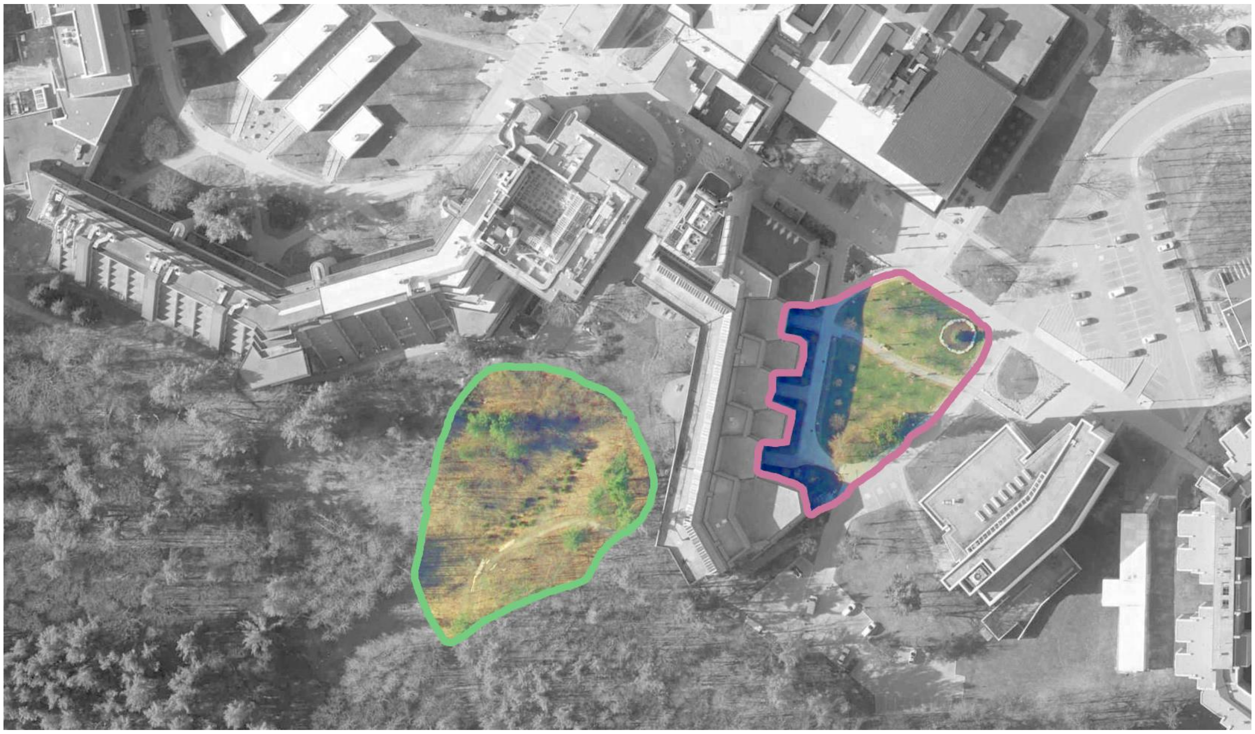
Limitations: This method relies on a long-term projection to understand the benefits of tree planting as all new trees planted were young. In the short term, there are most likely increases to the stormwater runoff while the tree canopies are much smaller.

- ***Improves ecological quality as demonstrated by a high Native Plant Floristic Quality Index (FQI) of 33.9 in comparison to other landscaped sites on campus which had an FQI of 5.9.***

Background: Floristic Quality Assessment (FQA) is a method that derives an estimate of habitat quality based on assessing the plant community present on the site. The Floristic Quality Index (FQI) may be calculated by inventory or abundance, with higher scores representing higher quality habitats. An FQI above 35 is considered to be "natural area" quality.

Method: Through field work we catalogued and identified the species on site against those identified in the planting plan to get an accurate catalogue of plants currently on-site. We then put this information into the University Floral Quality Assessment Calculator Tool, selected the Southern Ontario database to derive the C value for each plan and get an FQI score for our site.

We also conducted fieldwork on other similarly sized areas of the site that experience a fair amount of disturbance and are designed to separate pathways from planting areas. The catalogue collected from this field work was assessed for an FQI score using the same software.



Site area surveyed for floristic quality index (on the left, in green), and comparable area selected from nearby on-campus landscape (on the right, in pink).

The comparable area was chosen because of its proximity to the site, its similar size, and its design along with management regime which is generally representative of the larger campus.

Calculations: The FQI equation uses the Coefficient of Conservatism (C) value which is assigned to each plant species based on the region where it is found. The C value can range from 0-10, with high C values indicating species that occur are sensitive to habitat, and low C values assigned to those that are invasive and commonly occur in areas that experience a fair amount of disturbance.

Conservatism-Based Metrics:		
Total Mean (	2.6	
Native Mean	4.3	
Total FQI:	26.1	
Native FQI:	33.9	
Adjusted FQI	33.7	
% C value 0:	47.5	
% C value 1-:	13.9	
% C value 4-(	25.7	
% C value 7-:	12.9	
Native Tree I	4.7	
Native Shrub	4.6	
Native Herba	3.9	
Species Richness:		
Total Species	101	
Native Speci	62	61.40%
Non-native S	39	38.60%
Species Wetness:		
Mean Wetne	2.2	
Native Mean	1.9	

FQI Results

Sources:

Planting Plans provided by Schollen & Company, Inc.

Oldham, M.J., W.D. Bakowsky, and D.A. Sutherland. 1995. Floristic quality assessment system for southern Ontario. Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Peterborough, Ontario.

Andreas, Barbara K., John J, Mack, and James S. McCormack. 2004. Floristic quality assessment index (FQAI) for vascular plants and mosses for the state of Ohio. OhioEPA, Kent State University.

Francis, Charles M., Madeline J.W. Austen, Jane M. Bowles, and Wiliam B. Draper. 2000. Assessing floristic quality in southern Ontario woodlands. Natural Areas Journal 20: 66-77.

Herman, Kim D., Linda A. Masters, Michael R. Penskar, Anton A. Reznicek, Gerould S. Wilhelm, William W. Broddowicz. 1997. Floristic quality assessment: development and application in the state of Michigan (USA). Natural Areas Journal 17(3): 265-279.

Mathews, Jeffrey. 2003. Assessment of the floristic quality index for use in Illinois, USA, wetlands. Natural Areas Journal 23: 53-60.

Mathews, Jeffrey W., PauL A. Tessene, Scott M. Wisebrook, and Bradley W. Zercher. 2005. Effect of area and isolation on species richness and indices of floristic quality in Illinois, USA wetlands. Wetlands 25(3); 607-615.

Mushet, David M., Ned H. Euliss, Jr., and Terry L. Shaffer. 2002. Floristic quality assessment of one natural and three restored wetland complexes in North Dakota, USA. Wetlands 22(1): 126-138.

Nichols, J.D., J.E. Perry, and D.A. DeBerry. 2006. Using a floristic quality assessment technique to evaluate plant community integrity of forested wetlands in southeastern Virginia. Natural Areas Journal 26(4): 360-369.

Rooney, Thomas P. and David A. Rogers. 2002. The modified floristic quality index. Natural Areas Journal 22(4): 340-344.

Taft, John B., Gerould S. Wilhelm, Douglas M. Ladd, and Linda A. Masters. 1997. Floristic quality assessment for vegetation in Illinois, a method for assessing vegetation integrity. Erigenia 15: 3-95.

Limitations:

- The ideal comparison would have been one that compared the site before construction of the trail and after. It is difficult to assess whether the trail design has increased or decreased the FQI score without an initial assessment.
- The high FQI score is also due to the maintenance regime, which has allowed for native plant species that were not included in the planting plan to propagate on the site.
- Results are not quantitative in a way that supports statistical comparisons. Several important variables can influence the results and make comparisons across sites or of the same site at different times questionable:
  - Skill level of the observer – if identifications are not accurate, or if species (such as grasses, sedges or other hard to identify taxa) are lumped, results will be skewed (Rooney and Rogers 2002).
  - Season in which observations are made – not all species present are identifiable at all times (Francis et al. 2000; Mathews 2003)
  - Size of the tract surveyed – increased size of tract correlates with increased FQI scores because larger tracts have more species. This contradicts the statement of Swink and Wilhelm that the index is independent of the size of the area being surveyed (Mathews et al 2005; Francis et al. 2000).
- The FQA methodology was not meant as a stand-alone method. It should only be used in conjunction with other measures of habitat quality (Taft et al. 1997; Herman et al. 1997)

- ***Projected to sequester over 84 tons or 184,600 lbs of atmospheric carbon over the next twenty years in 491 newly-planted trees. This is about 226% the amount of sequestration of atmospheric carbon that was projected for the 125 mature trees that were removed due to construction of the trail. The number of newly planted trees greatly exceeded the City of Toronto's requirements.***

Background: The City of Toronto requires a 3:1 tree replacement ratio. In this project 100 trees were removed from the site and replaced by 600 trees. Not all the trees were placed on the site as there was insufficient space; many were planted at a satellite site.

Method: We reviewed the planting plan and tree removal construction documents, alongside information gathered from the firm about the tree numbers, types, and plantings on the satellite site. From this we were able to identify the type, size, and location of trees removed and trees planted. Using i-Tree Design, we entered individual specimen data to calculate the projected sequestration amount of the trees over the next twenty years. The 125 trees that were removed had the potential to remove approximately 37,000 kgs/81,570 lbs of atmospheric carbon if they had been left undisturbed. Trees from the satellite site were included as they were planted as a direct result of this project.

iTree Eco is better designed to process large quantities of data and was considered as an alternative modeling platform. But iTree Design offered the advantage of predicting canopy growth and biomass accumulation over two decades and the commensurate benefits. Modeling future potential was very important on this case study where mature trees were replaced by planting stock from 5 gal. or 2 gal. containers. The limitation of iTree Design is the total number of trees that can be modeled in each run of the program. To account for all of the trees removed the program was run multiple times each with up to 25 individual specimens in each run. As the compensation planting were all a standard size, a single example of each species was modeled, and the results multiplied by the number planted.

Of the new trees planted on the satellite site, we calculated approximately 7,500 kg/16,535 lbs of sequestration from coniferous tree types, 34,600 kg/76,280 lbs of sequestration by deciduous trees and an additional 41,700 kg/91,933 lbs of carbon removal from shrubs.

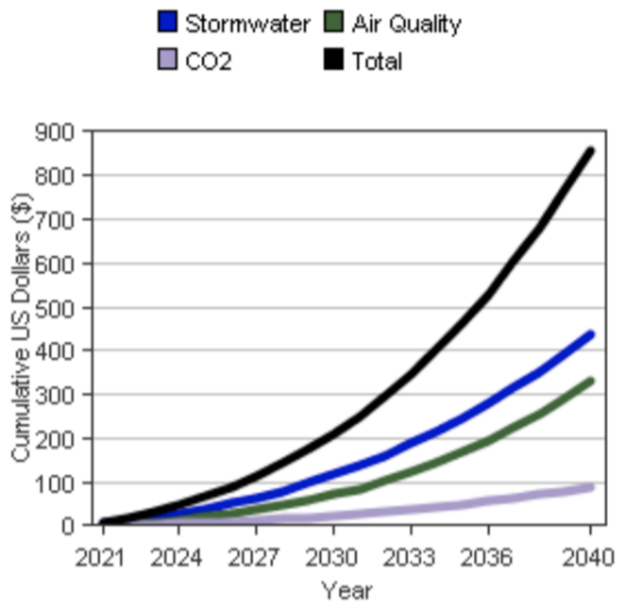


Figure 1. Tree benefit forecast for 20 years

Calculations: Please see Appendix A for calculations including the breakdown by tree species of the amount of atmospheric carbon removal.

Sources: Planting plans of site and remote site provided by firm liaisons to calculate the sequestration of the trees removed. The tree report from the firm ecologist to project sequestration potential of removed trees.

Limitations: Maturity of the trees impacts the sequestration; a visit to the satellite site may be necessary to evaluate the success of trees planted. This method relies on a long-term projection to understand the benefits of tree planting as all new trees planted were young. In the short term, there are most likely losses to the air quality on site since construction emissions will not offset by the new, smaller plants for several years. Carbon costs of tree removal and replanting were not considered in this analysis.

Social Benefits

- ***Attracts at least 30 users on average per hour as observed during late summer afternoons. The majority of users were observed to be pedestrians while about 15% were cyclists.***

Methods:

1. To assess the number and nature of users on the site, we employed a combination of methods to derive results, only one of which was effective. The first method involved using the System for Observing Physical Activity and Recreation in Natural Areas (SOPARNA) to conduct field observations of the number and type of recreational use of the trail. We conducted our observation in the late afternoon over the summer on a weekday, a weekend, and a long weekend. The assumption being that the variation allows for us to study both local and regional users.

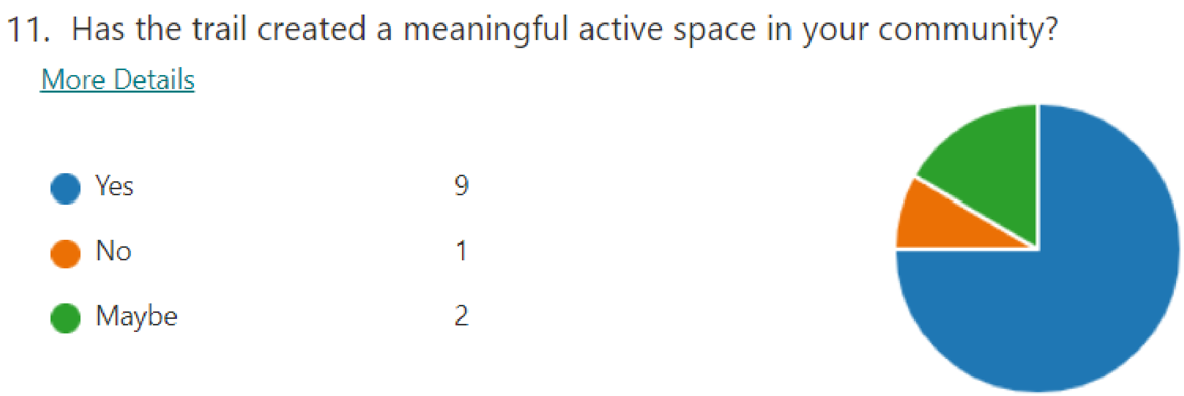
2. We collected data from a municipal bikeshare station near the site to determine the number of users and where they had picked up their bikes (if dropping off), or where they ultimately dropped off bikes they'd picked up at that station. However, this data did not yield meaningful results. The City of Toronto expanded the municipal bikeshare program to include the project area around the same time that the project was being developed. While data on the bike usage was available, rentals were not abundant enough to perform a meaningful analysis.

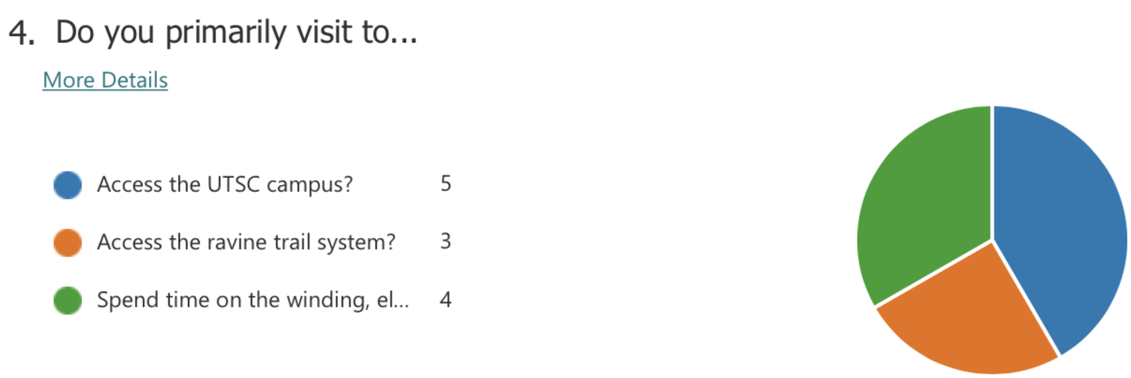
3. The qualitative effect of the trail improvements to recreational activities were evaluated by distributing a public survey using MS Forms. We formulated questions to understand the recreational uses of the trail, using questionnaire 'branching' to direct respondents through the questions. The public survey was promoted through social media including LinkedIn, Instagram, Twitter and iNaturalist. 20 responses were received. Because of the low response rate, results are not reported as a benefit (see results below).

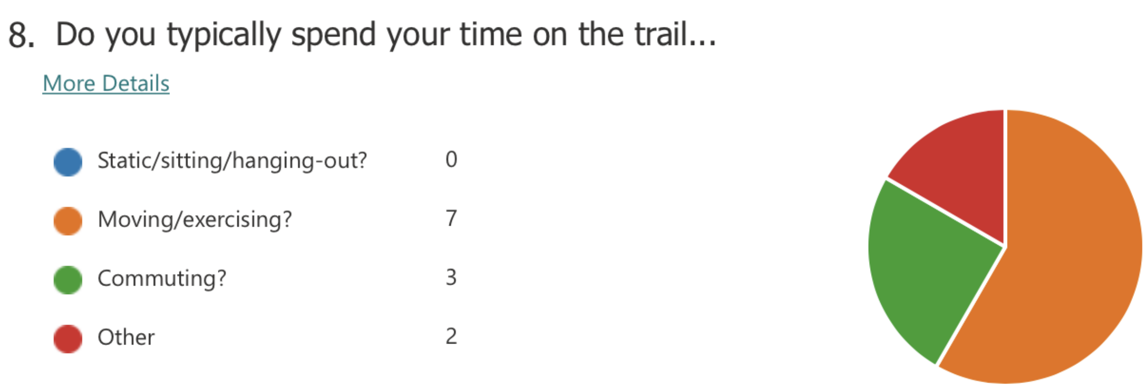
Calculations:

1. SOPARNA results found that about 30 users per hour visited the site during the late afternoon. Of these, approximately 15% were cyclists, many riding uphill. Almost all cyclists identified were males between 20-50 years of age. The pedestrian use of the trail showed more variation in terms of gender and age, mostly adults between 20-60 years of age. Stationary users, resting on the benches and picnicking were identified as adult females during all observation times.

2. The majority of the users surveyed reported using the trail for physical activities such as walking, running and biking both recreationally and as means to access the campus. See below.







Sources:

https://maps.google.ca

https://forms.office.com

https://activelivingresearch.org/soparna-system-observing-physical-activity-and-recreation-natural-areas

See Appendix C for survey questions and results.

Limitations:

- Limited time was available for observation, so these results capture a very limited amount of time and only one season.
- Observational methods are subject to researcher error.

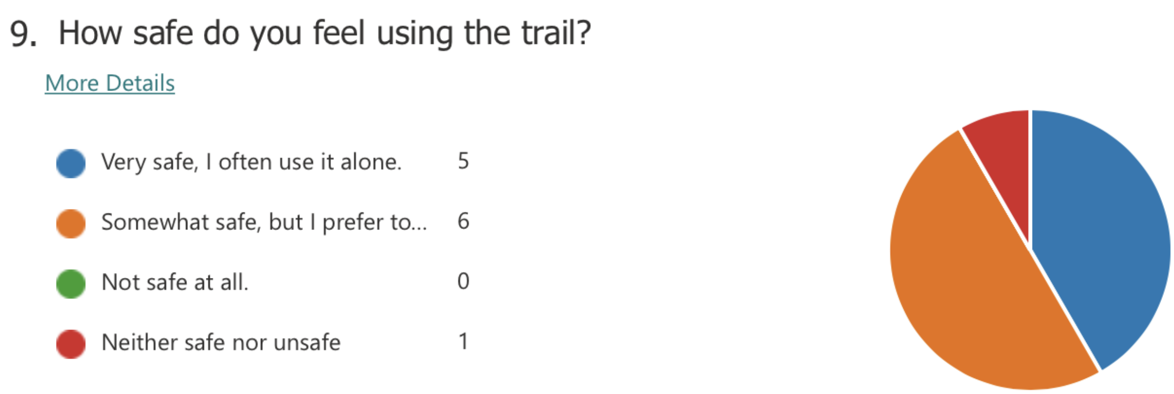
- ***Increased trail safety as evidenced by the number of blue box calls going down by 80% between 2019 and 2021.***

Method: Campus security collects data about the number, nature, and date of calls made from the blue boxes around campus. We reviewed the data collected between 2016 -2021 to understand the nature and number of calls and discovered that while the nature of the calls generally related to vandalism, noise and pollution, the number of security complaints showed a drop down to one call after the opening of the trail.

In addition, we published an online survey (see Appendix C) to collect information about the qualitative community impact of the trail construction on both local and regional visitors of Highland Creek. Over 50% of the users indicated an increased sense of safety on the site due to trail construction. The features that most contributed to the perception of security were the lighting and hand rail align the path although 11 % indicated that features such as visibility of the blue box, seating and charging stations increased a sense of safety as well. Because of the low response rate, survey results are not included in the benefit.

Calculations: This information relies on a qualitative comparison and evaluation of gathered data. Please refer to Appendix A to see survey questions and results.

Sources: Blue box data provided by Campus Security. Results of a blind survey conducted by the research team.



10. What features of the trail contribute to your sense of safety and comfort?

More Details

The lighting along the path.	5
The hand rail and slope.	5
The visibility of the "Blue Box" ...	2
Seating and charging stations ...	2
I was not aware of these featu...	5

Limitations:

- 2021 data was incomplete because this investigation was conducted in mid-2021.
- The frequency of the incidents reported is small in number and the type of incident is too varied to draw firm conclusions about security.
- The blue box data does not date back past 2016, and for the majority of this time it was a construction site. While our results contribute to an understanding of how the features contribute to perception of safety, the deduction about the safety of the site itself is still largely limited in context.

- ***Produces up to 1,600 lbs of edible biomass in fruits and nuts annually.***

Background: As part of the design of the site, and through consultation with an Indigenous Elder, the design incorporated edible and medicinal plants in the planting areas to create opportunities for foraging for the campus and nearby residents.

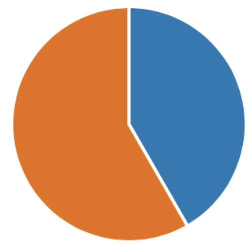
Method: By reviewing the planting plan in conversation with the firm liaison and confirming the edible species on-site visits during field work, edible plant species were catalogued and the potential yield of each plant was tabulated. We calculated the biomass in lbs and gallons that each plant produced in edible fruits, nuts, or sap, based on the number of each plant species on site. This method evaluates the amount of produce the site is capable of producing, and not its actual collection and foraging.

To understand the actual foraging activity, in our survey we included questions to assess awareness and visitor initiative to forage. The survey suggested that while most visitors are aware of the foraging potential, this is still an underutilised feature of the site. Because of the low response rate, resurvey results are not included in the benefit.

12. Are you aware of the edible plants growing along the trail?

More Details

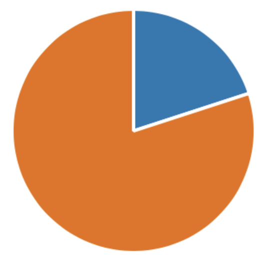
Yes	5
No	7



13. Have you ever foraged from the edible plants on the trail?

More Details

Yes	1
No	4



Calculations:

The following formula was applied across species identified from the planting plan.

$$\boldsymbol{Potential\ Yield\ per\ Plant} = \frac{\boldsymbol{Commercial\ Yield\ per\ Area}}{\boldsymbol{Typical\ or\ Recommended\ Planting\ Density\ (Plants/Area)}}$$

$$Potential\ Yield\ within\ the\ Project = Potential\ Yield\ per\ Plant \times New\ plants\ in\ the\ Project$$

Please see Appendix D to see the breakdown of calculations.

Sources: Additional References can be found in Appendix D.

Limitations:

- There is no way at present to evaluate if this produce is being foraged, beyond an observation method that would rely on high frequency visits.
- Future study could evaluate whether people and species are foraging the site, and to identify foraging patterns, and if certain species were suffering from over foraging overtime.
- The commercial yield amount for all species identified as edible was not available.

Economic Benefits

- ***Saved an estimated $92,200 through the management of cut and fill on the site to reuse stripped soil for fill.***

Background: Initially the cost tendering for cut and fill operations included the cost of purchasing 2020 cubic metres of top soil for roughly $ 32,320 and shipping 3078 cubic metres of stripped topsoil at the cost of $91,260. However the stripped topsoil removed from site was rescued for the fill on the site, as it was a good quality sand, and significantly reduced the estimated cost of both purchase and shipment.

Method: Review of construction documents, tender documents and a cost comparison to identify the cost that was identified against what the identified savings were.

Calculations:
Estimated cost of fill = $ 32,320.00
Amount of soil removed from site = Amount of topsoil stripped - amount of fill reused = 3078.0 - 2020.0 = 1058 (cubic metres)
Estimated cost of removal of stripped soil = $ 91,260.00
Actual cost of removal = (amount of soil removed from site/amount of topsoil stripped) x estimated cost of removal = $ 31368

Total savings = cost of fill + (estimated cost of removal + actual cost of removal) = $ ***92,211***

Sources: Construction documents and initial tender contracts provided by firm liaison.

Appendix A: i-tree Calculations

Table 1 Summary data from iTree Design simulations of planting made in compensation, initial DBH estimated at 1-2 cm for 5 gal. and 2 gal. nursery stock, all said to be in excellent initial condition.

Planted	**Number of plants**	**Total litres rainfall intercepted 2021-2041**	**Total kg of carbon sequestered 2021-2041**
American Beech	12	286,306	1,829
Bigtooth Aspen	19	51,870	4,712
Bitternut Hickory	5	58,646	196
Black Cherry	7	239,289	3,192
Black Walnut	3	95,340	654
Bur Oak	4	91,172	356
Canadian Serviceberry	12	195,906	1,940
Chokecherry	21	417,504	2,968
Common Juniper	15	124,815	3,600
Eastern Hemlock	14	127,231	1,128
Elderberry	31	440,293	4,681
Hazelnut	22	611,820	4,334
Ironwood	8	118,683	188
Northern Bush Honeysuckle	12	358,157	6,181
Paper Birch	14	573,776	5,600
Red Maple	12	145,793	2,224
Red Oak	6	196,464	1,278
Red Osier Dogwood	48	1,519,824	17,568
Sugar Maple	15	174,358	10,955
Tamarack	8	151,694	2,336
White Cedar	16	130,409	2,614
White Oak	6	138,099	3,374
White Pine	7	125,677	1,430
Witch Hazel	20	323,228	405
Smooth Rose	37	No Data	
Purple Flowering Raspberry	28	No Data	
Black Raspberry	24	No Data	
Snowberry	18	No Data	
Buffaloberry	25	No Data	
Nannyberry	22	No Data	
TOTAL	**491 plants**	**6.7×10^6 Litres**	**8.37×10^4 kg**

Table 2 Summary data from iTree Design simulations of matured trees removed during construction of the project, DBH and condition unique to each specimen.

Removed	Number of plants	Total litres rainfall intercepted 2021-2041	Total kg of carbon sequestered 2021-2041
Ash	1	14,751	224
Black Walnut	1	34,910	245
Manitoba Maple	2	38,636	924
Red Oak	5	336,626	2,741
Elm	1	107,855	1,026
Silver Maple	1	21,329	434
Aspen	70	2,673,929	20,918
White Oak	2	26,209	142
White Pine	42	1,321,885	10,393
TOTAL	**125**	**4.58 x 10^6 Litres**	**3.70 x 10^4 kg**

Benefit of replacing the matured trees with new nursery stock in compensation planting:

Stormwater $\frac{6.70 \times 10^6\ Litres}{4.58 \times 10^6\ Litres} = 146$ % volume of rainwater intercepted

Carbon $\frac{8.37 \times 10^4\ kg}{3.70 \times 10^4\ kg} = 226$ % mass of carbon sequestered

Appendix B: FQI Results

Species:

Scientific Na	Family	Acronym	Native?	C	W	Physiognomy
Acer rubrum	n/a	ACERUBR	native	4	0	tree
Acer sacchar	n/a	ACESACCN	native	7	3	tree
Alliaria petio	n/a	ALLPETI	non-native	0	0	forb
Allium schoe	n/a	ALLSCHOS	non-native	0	-1	forb
Allium tricoc	n/a	ALLTRIC	native	7	2	forb
Ambrosia art	n/a	AMBARTE	native	0	3	forb
Amelanchier	n/a	AMEARBO	native	5	3	tree
Amelanchier	n/a	AMELAEV	native	5	5	tree
Arctium min	n/a	ARCMINU	non-native	0	5	forb
Asclepias syr	n/a	ASCSYRI	native	0	5	forb
Avena sativa	n/a	AVESATI	non-native	0	5	grass
Betula papyr	n/a	BETPAPY	native	2	2	tree
Bidens frond	n/a	BIDFRON	native	3	-3	forb
Carduus acar	n/a	CARACAN	non-native	0	5	forb
Carya cordifc	n/a	CARCORD	native	6	0	tree
Catalpa bign	n/a	CATBIGN	non-native	0	3	tree
Cerastium gl	n/a	CERGLOM	non-native	0	5	forb
Chenopodiun	n/a	CHEALBU	non-native	0	1	forb
Cimicifuga ra	n/a	CIMRACE	native	10	3	forb
Circaea lutet	n/a	CIRLUTE	native	3	3	forb
Cirsium arve	n/a	CIRARVE	non-native	0	3	forb
Cirsium vulga	n/a	CIRVULG	non-native	0	4	forb
Conyza cana	n/a	CONCANA	native	0	1	forb
Cornus canac	n/a	CORCANA	native	7	0	shrub
Corylus cornu	n/a	CORCORN	native	5	5	shrub
Deschampsia	n/a	DESCESPC	native	9	-4	grass

Diarrhena an	n/a	DIAAMER	native	10	-3	grass
Diervilla loni	n/a	DIELONI	native	5	5	shrub
Fagus grandi	n/a	FAGGRAN	native	6	3	tree
Festuca rubr	n/a	FESRUBR	non-native	0	1	grass
Fragaria vesc	n/a	FRAVESC	native	4	4	forb
Fragaria virg	n/a	FRAVIRG	native	2	1	forb
Fraxinus ame	n/a	FRAAMER	native	4	3	tree
Galium moll	n/a	GALMOLL	non-native	0	5	forb
Glechoma he	n/a	GLEHEDE	non-native	0	3	forb
Hackelia virg	n/a	HACVIRG	native	5	1	forb
Hamamelis v	n/a	HAMVIRG	native	6	3	shrub
Hordeum jub	n/a	HORJUBA	non-native	0	-1	grass
Hymenoxys h	n/a	HYMHERB	native	10	5	forb
Juglans nigra	n/a	JUGNIGR	native	5	3	tree
Juniperus co	n/a	JUNCOMM	native	4	3	shrub
Krigia biflora	n/a	KRIBIFL	native	10	3	forb
Lapsana com	n/a	LAPCOMM	non-native	0	5	forb
Larix laricina	n/a	LARLARI	native	7	-3	tree
Leonurus car	n/a	LEOCARD	non-native	0	5	forb
Lonicera japo	n/a	LONJAPO	non-native	0	3	vine
Lonicera xylo	n/a	LONXYLO	non-native	0	5	shrub
Lotus cornicu	n/a	LOTCORN	non-native	0	1	forb
Matricaria pe	n/a	MATPERF	non-native	0	5	forb
Matteuccia s	n/a	MATSTRU	native	5	-3	fern
Medicago lu	n/a	MEDLUPU	non-native	0	1	forb
Melilotus alb	n/a	MELALBA	non-native	0	3	forb
Melilotus off	n/a	MELOFFI	non-native	0	3	forb
Monarda fist	n/a	MONFIST	native	6	3	forb
Nepeta catar	n/a	NEPCATA	non-native	0	1	forb
Oenothera bi	n/a	OENBIEN	native	0	3	forb
Ostrya virgin	n/a	OSTVIRG	native	4	4	tree
Oxalis cornic	n/a	OXACORN	non-native	0	3	forb
Oxalis dilleni	n/a	OXADILL	native	0	3	forb
Panicum mili	n/a	PANMILI	non-native	0	5	grass
Parthenociss	n/a	PARQUIN	native	6	1	vine
Phleum prate	n/a	PHLPRAT	non-native	0	3	grass
Pinus strobus	n/a	PINSTRO	native	4	3	tree
Plantago ma	n/a	PLAMAJO	non-native	0	-1	forb
Polygonum p	n/a	POLPERS	non-native	0	-3	forb
Populus gran	n/a	POPGRAN	native	5	3	tree
Populus trem	n/a	POPTREM	native	2	0	tree
Portulaca ole	n/a	POROLER	native	0	1	forb
Prunus seroti	n/a	PRUSERO	native	3	3	tree
Prunus virgin	n/a	PRUVIRG	native	2	1	shrub
Pteridium aq	n/a	PTEAQUI	native	2	3	fern

Quercus alba	n/a	QUEALBA	native	6	3	tree
Quercus mac	n/a	QUEMACR	native	5	1	tree
Quercus rubr	n/a	QUERUBR	native	6	3	tree
Rhamnus cat	n/a	RHACATH	non-native	0	3	tree
Rhus radican	n/a	RHURADIR	native	0	0	vine
Rhus typhina	n/a	RHUTYPH	native	1	5	tree
Rosa blanda	n/a	ROSBLAN	native	3	3	shrub
Rubus occide	n/a	RUBOCCI	native	2	5	shrub
Rubus odorat	n/a	RUBODOR	native	3	5	shrub
Rudbeckia hi	n/a	RUDHIRT	native	0	3	forb
Rumex crispu	n/a	RUMCRIS	non-native	0	-1	forb
Sambucus ca	n/a	SAMCANA	native	5	-2	shrub
Setaria faber	n/a	SETFABE	non-native	0	2	grass
Shepherdia c	n/a	SHECANA	native	7	5	shrub
Silene antirrl	n/a	SILANTI	native	3	5	forb
Sisymbrium (	n/a	SISOFFI	non-native	0	5	forb
Solidago can	n/a	SOLCANA	native	1	3	forb
Sonchus aspe	n/a	SONASPE	non-native	0	0	forb
Sorghastrum	n/a	SORNUTA	native	8	2	grass
Symphoricar	n/a	SYMALBU	native	7	4	shrub
Thuja occide	n/a	THUOCCI	native	4	-3	tree
Trifolium pra	n/a	TRIPRAT	non-native	0	2	forb
Tsuga canad	n/a	TSUCANA	native	7	3	tree
Tussilago far	n/a	TUSFARF	non-native	0	3	forb
Verbena hast	n/a	VERHAST	native	4	-4	forb
Viburnum ler	n/a	VIBLENT	native	4	-1	shrub
Vicia cracca	n/a	VICCRAC	non-native	0	5	forb
Vicia villosa	n/a	VICVILL	non-native	0	5	forb
Vincetoxicum	n/a	VINNIGR	non-native	0	5	forb
Vitis riparia	n/a	VITRIPA	native	0	-2	vine

Appendix C: Survey

Forms(https://www.office.com/launch/forms?auth=2)

Valley Land Trail

20 Responses

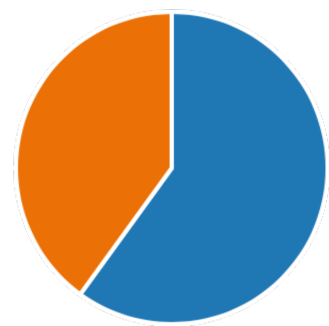
02:26 Average time to complete

Active Status

1. Have you visited the 'Valley Land Trail', which now connects UTSC campus to Highland Creek ravine?

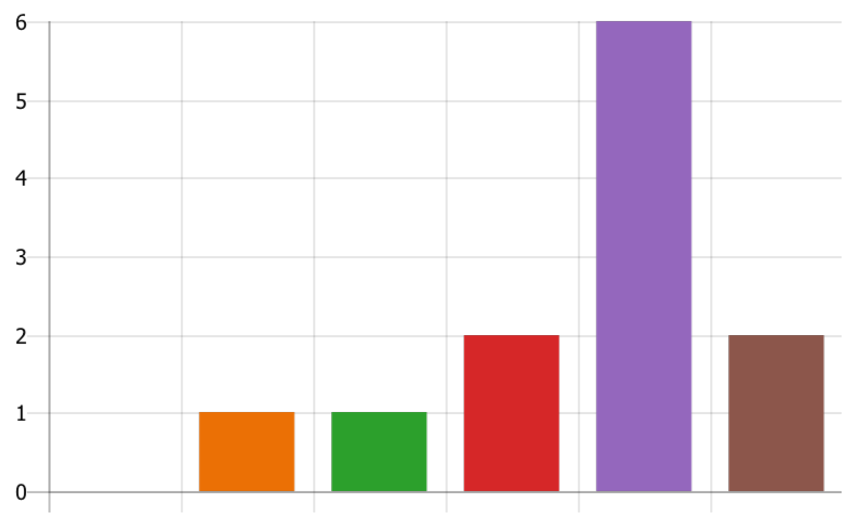
Insights

Yes	12
No	8



2. How frequently do you visit the trail?

Daily	0
More often than once per week	1
Around once per week	1
Around once a month	2
I've been more than once, but...	6
I've visited once	2



3. Is there anything preventing you from visiting more frequently?

Insights

10

Responses

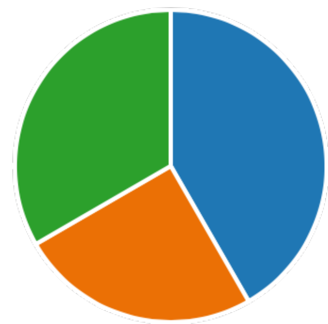
Latest Responses

"No, I use it every time I come to campus, but I have been comi...

"Commute from home"

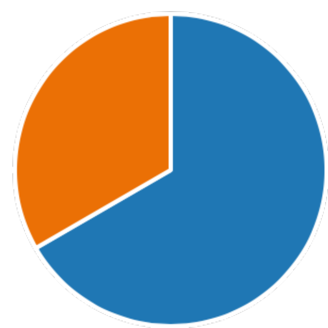
4. Do you primarily visit to...

Access the UTSC campus?	5
Access the ravine trail system?	3
Spend time on the winding, el...	4



5. Did you visit the Highland creek prior to the construction of the trail?

Yes	8
No	4

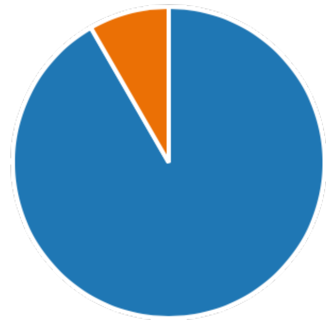


6. How do you access the trail

Bus	0
Bicycle	2
Walk	5
Drive	7
Other	0

7. Do you find the trail easy to access?

Yes	11
No	1
Maybe	0

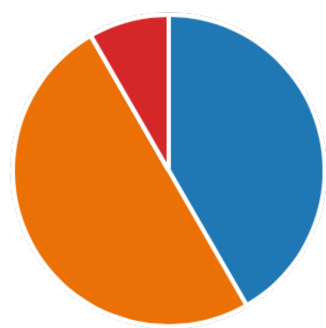


8. Do you typically spend your time on the trail...

Static/sitting/hanging-out?	0
Moving/exercising?	7
Commuting?	3
Other	2

9. How safe do you feel using the trail?

Very safe, I often use it alone.	5
Somewhat safe, but I prefer to...	6
Not safe at all.	0
Neither safe nor unsafe	1

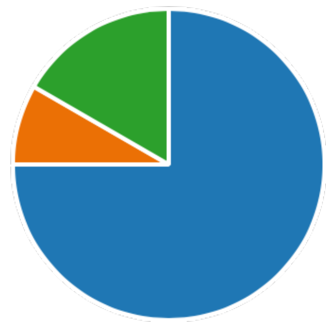


10. What features of the trail contribute to your sense of safety and comfort?

The lighting along the path.	5
The hand rail and slope.	5
The visibility of the "Blue Box" ...	2
Seating and charging stations ...	2
I was not aware of these featu...	5

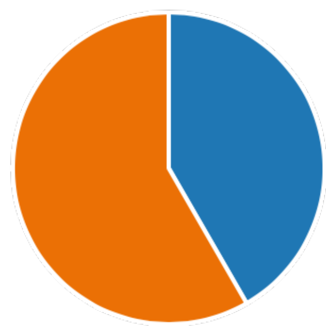
11. Has the trail created a meaningful active space in your community?

Yes	9
No	1
Maybe	2



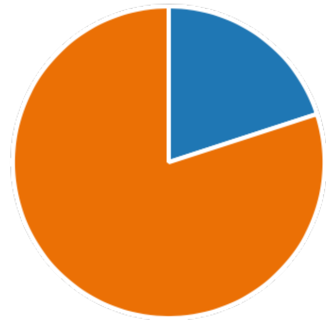
12. Are you aware of the edible plants growing along the trail?

Yes	5
No	7



13. Have you ever foraged from the edible plants on the trail?

Yes	1
No	4



14. Please describe your foraging activity.

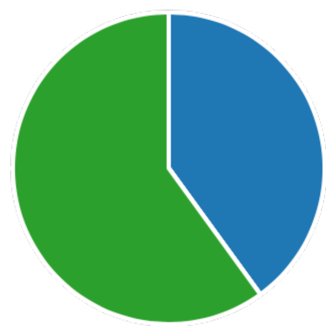
0

Responses

Latest Responses

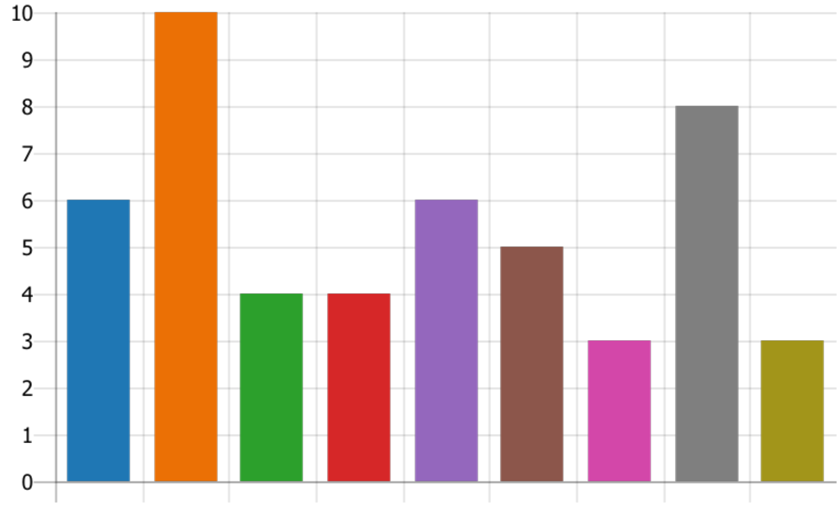
15. Has the trail altered your access to nature?

My access to nature has INCR...	2
My access to nature has DECR...	0
My access to nature has remai...	3



16. Have you seen any of the following whilst visiting the trail?

Deer	6
Squirrels	10
Rabbits	4
Red Fox	4
Cardinal	6
Woodpecker	5
Cormorant	3
Bee	8
Other	3

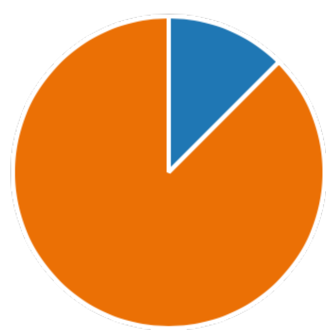


17. In your opinion, what value does the Valley Land Trail offers to the campus and local neighbourhood?

As a community space.	6
As a Nature Trail.	10
As an accessible trail for com...	7
None of the above.	0
Other	0

18. Have you heard of Valley Land Trail?

Yes	1
No	7

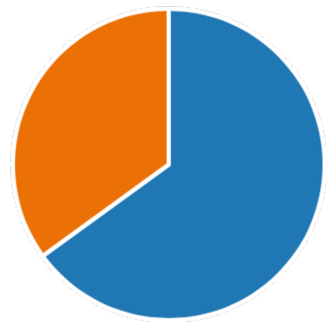


19. Are you:

A member of UTSC faculty?	2
A member of UTSC staff?	2
A student at UTSC?	4
Local (live within 20 minutes w...	3
Someone who lives further aw...	12

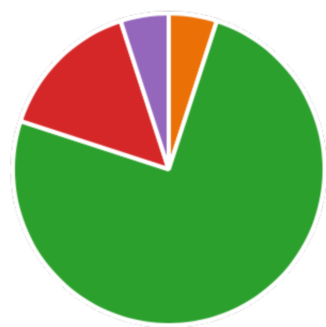
20. Please select your gender

Female	13
Male	7
Non-binary	0



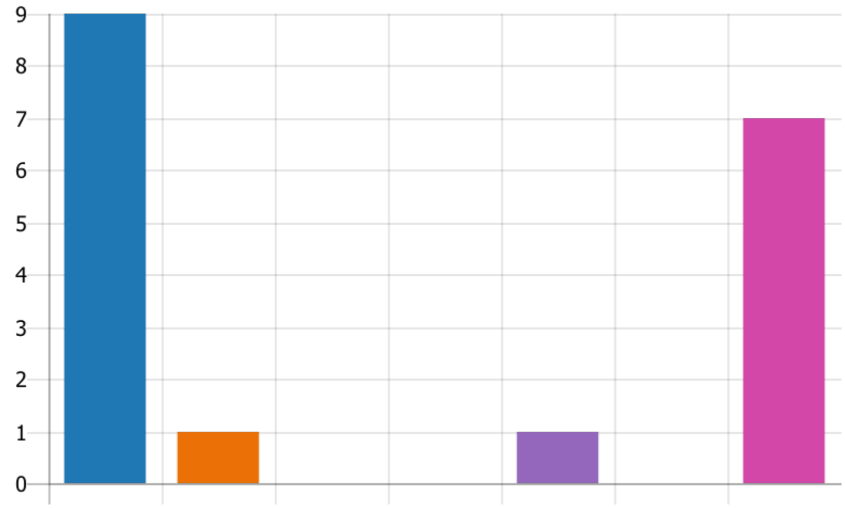
21. Please identify your age bracket

Under 18	0
18-24	1
25-54	15
54-65	3
Over 65	1



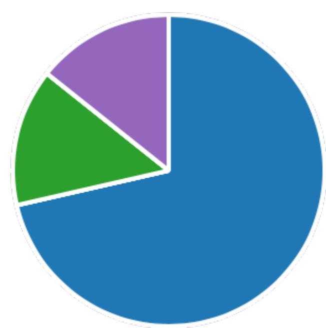
22. Please identify your Ethnic Origin

Canadian	9
English	1
Irish	0
Scottish	0
Filipino	1
East Indian	0
Other	7



23. Do you identify as a Visible Minority?

South Asian	5
Black	0
Filipino	1
Chinese	0
Other	1



24. Do you have any physical or sensory accessibility needs?

14

Responses

Latest Responses

"No"

"No"

Appendix D: Foraging

Number planted	Name	AKA	Consumable (human)	Yield estimate?	Season	Low annual production/per plant	High Annual production per plant	Number planted	Low potential annual yield	High Potential annual yield	Yield Unit	Annual yield description	Other Comments	Ref 1.	Ref 2.	Consumable (non-human)	Ref 1.
3	*Betula papyrifera*	Paper birch	Inner bark and sap	A mature birch tree will give 1 gallon of sap per day durir	Sap may be tapped in early spring	21.0	28.0	14	294	392	Gallons of Birch Sap	294-391 Gal of Birch Sap (3263lbs)					
3	*Juglans nigra*	Black Walnut	Nuts and sap	Trees in the wild commence bearing seeds when about 12 years old[227]. Good seed crops are usually produced every other year, though some plants fruit well annually whilst others produce god crops every third year[269].Whilst potential yields of 7.5 tonnes per hectare have been postulated, it is more feasible to expect annual yields of around 2.5 tonnes per hectare [269].	Sap may be tapped in early spring	3.3	9.8	3	10	29	Pounds of Walnuts	10-29 lbs of walnuts.					
6	*Quercus alba*	White Oak	Nuts and sap	Acorn yields range from 0 to 500,000 acorns per hectare (202,000/acre) (7,22,2		18.0	36.0	6	108	216	Pounds of Acorns	108-216 lbs of acorns.		The traditional method of preparing the seed was to bury it in boggy ground overwinter. The germinating seed was dug up in the spring when it would have lost most of its astringency. The seed can be roasted and then eaten, its taste is something like a cross between sunflower seeds and popcorn[183].			
		Alleghany Serviceberry	Fruits (and sap)			10.3	22.1	4	41	88	Pounds of Berries	41-88 lbs of berries					
8	*Amelanchier canadensis*	Candian Serviceberry	Fruits (and sap)	Trees can yield 7 to 15 tonnes per hectare[160].	Sap may be tapped in early spring	10.3	22.1	8	83	177	Pounds of Berries	83-177 lbs of berries		Trees produce more and better quality fruits better when growing in a sunny position[1].		The main draw-back to this genus is that birds adore the fruit and will often completely strip a tree before it is fully ripe[K].	
22	*Corylus cornuta*	Beaked Hazelnut	Nuts	you can expect a yield of 5-6 Kg per tree.	Mid/late fall	11.0	13.2	22	242	290	Pounds of Hazelnuts	242-290 lbs of hazelnuts		it succeeds in most soils, but is in general more productive of seeds when grown on soils of moderate fertility[11, 200].		The seed ripens in mid to late autumn and will probably need to be protected from squirrels [K].	
22	*Rubus idaeus*	Purple Flowering Raspberry	Fruits (young shoots + leaves for tea)					28						Ontario Specific data about yield here:			
27	*Rubus occidentalis*	Black raspberry	Fruits (and young shoots)	The yields are generally low per acre and this is why the fruits are often expensive.	Fruit: Summer	0.7	1.8	24	16	43	Pounds of Berries	16-43 lbs of berries	The yields are generally low per acre and this is why the fru	Much more detail about yield			
22	*Sambucus canadensis*	Elderberry	Flowers and fruit	Yields of up to 7kg of fruit per tree have been recorded [160].	Flowers: Late June Fruit: Late summer/early fall		15.4	31		477	Pounds of Berries	477 lbs of berries					
189	*Allium schoenoprasum*	Chives	Leaves & scapes	Good average yield – 18,000 lb per acre	Thoughout spring/summer	0.4		189	78		Pounds of scapes	<- note that this one is an average value		https://en.wikipedia.org/wiki/Allium_tricoccum			
126	*Allium tricocum*	Wild leek (aka 'ramps')	Leaves & bulbs	Foraging is destructive, so only up to 5% should be taken by any party.	Late winter/early spring			126	#REF!	#REF!			Increasingly endangered, so education about harvesting leaves only would improve sustainability of this planting.	http://ontariowildflowers.com/main/species.php?id=119	https://wildfoods.ca/blog/wild-leeks-sustainable-harvesting/		
183	*Fragaria virginiana*	Wild Strawberry	Fruits (leaves in tea)		Throughout summer			183	#REF!	#REF!						The nectar and pollen of strawberry flowers, and all parts of the plant, feed a host of bees, flies, butterflies and moths, including some insect specialists like the strawberry leafroller moth (Ancylis comptana fragariae), the strawberry cylindrical gall wasp (Diastrophus fragariae), and the strawberry aphid (Chaestosiphon fragaefolii). Weevils, sap beetles, gall	
	Viburnum Lentago	Nannyberry	Fruits	Yield not quantified				22									
	Shepherdia canadensis	Buffaloberry	Fruits					25									
	Symphoricarpos albus	Snowberry	Fruits					18									
	Sorghastrum nutans	Indian Grass	Seeds	50 to 130 bulk lb/acre		0.0	0.0	12	0.01	0.02	Pounds of Seed						
	Juniperus communis	Common Juniper	Fruit					15								Bascially, animals will eat any of these things. All well documented in FPAP.	
	Prunus virginia	Choke Cherry	Fruit	A scientific study, nice!		8.5	15.0	21	178	314	Pounds of fruit/cherries/berries						
	Pretty much all of these species also have documented traditional medicinal uses too. https://pfaf.org/ was great for those.																