

GLOBE Regional Learning Expedition

**Land cover measurements and biodiversity in Vabaduse
puiestik, Tartu, Estonia**

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Tilen Burja (Slovenia)

Vid Felicijan (Slovenia)

Luka Komatar (Slovenia)

Laura Javoršek (Slovenia)

Erik Lindgren (Estonia)

Kättrin Kaunimäe (Estonia)

Marit Lõbu (Estonia)

Anti Tohva (Estonia)

Roomet Tapfer (Estonia)

Marianna Lili Aly (Estonia)

Milena Saan (Estonia)

Kateryna Ternova (Ukraine)

Oleksiy Ternovoy (Ukraine)

Supervisors: Marie Johanna Univer

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Abstract

Our study focused on land cover in Vabaduse puistik, a city park in the downtown of Tartu in southern Estonia. The goal was to analyze and characterize our study area, which included determining its MUC classification, measuring the extent of the canopy cover, measuring the height of trees, and listing the different plant, fungus and animal species inhabiting the area. The results would then be submitted via the GLOBE observer app. Our findings could also be compared with other similar environments in the city of Tartu.

On the course of our expedition on 8th of August, our team of 11 people analyzed a 30 by 30 meter area in Vabaduse puistik. Our group worked on the site for a total of 5 hours, each person being assigned a different task. Analyzing the area was rather easy, since the city landscape was easy to cover.

In conclusion, Vabaduse puistik could be described as diverse compared to other city parks. 35 different plant species were found, in addition to 4 fungus and 8 animal species. In comparison, 11 out of 15 observed city parks in Portland, Oregon have a smaller amount of plant species (Talal and Santelmann, 2019).

Introduction

Our expedition took place in Vabaduse puistik, a city park in the centre of Tartu, Estonia. The research area was a 30 by 30 meter square centered at the coordinates 58°22'59.5"N 26°43'27.1"E. “Puistik” in Estonian describes a man-made forested area, more like a forest than a park.

Our aim was to research the biodiversity of the plants growing in our study area so the results could be compared with other similar environments in the city. The biodiversity in the area might be affected by the age of the park, as it is significantly older than other parks in Tartu, being present on a historical map drawn 1895–1918 (see Figure 3, below). Our research questions were:

- **Q1: What kind of species can be found in the Vabaduse city park?**
- **Q2: What is the ratio of native species to non-native ones?**

Our hypotheses were:

- **Hypotheses 1:** There are more native species than non-native species in the research area.
- **Hypotheses 2:** The study area is classified as a closed forest according to the MUC code.

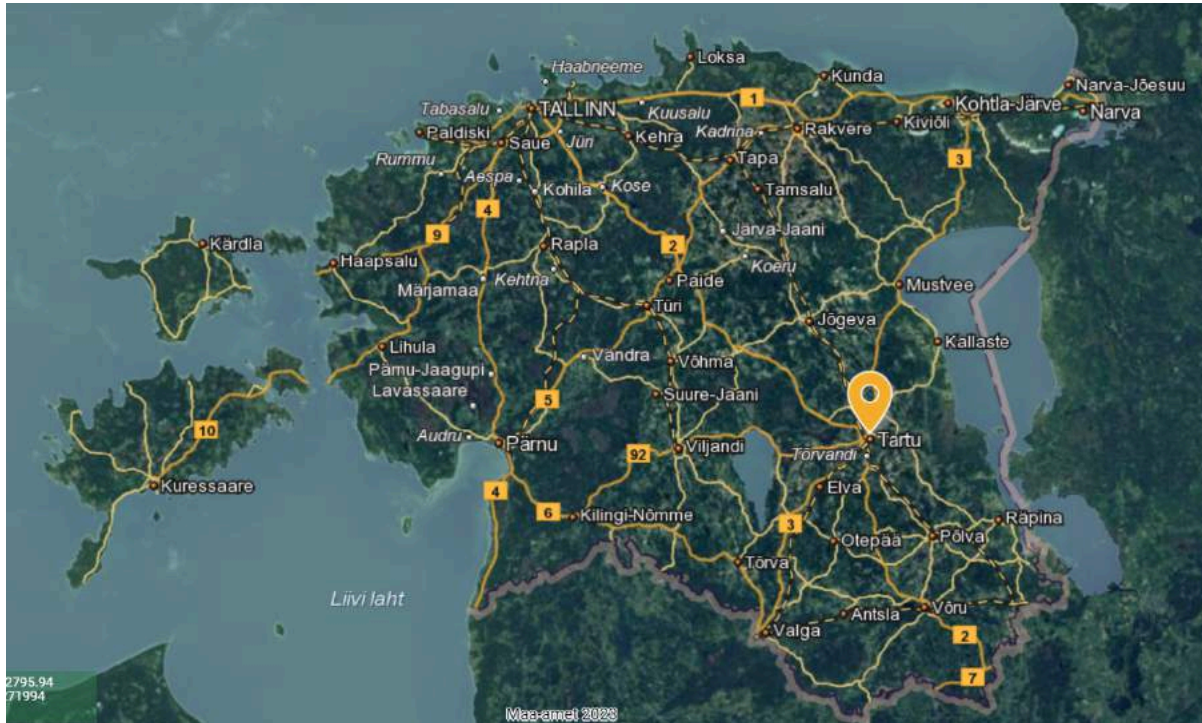


Figure 1. Location of Vabaduse puistik in Estonia. (Source: Estonian Land Board)



Figure 2. Boundaries of the study area in Vabaduse puistik in Tartu, Estonia. (Source: Estonian Land Board)



Figure 3. Vabaduse puistik present on an 1895–1918 map (highlighted here in red). (Source: Estonian Land Board)

Research Methods and Materials

Our site was selected to include a variety of plant species. The area was measured and marked using measuring tape and marker flags (see Figure 5, below) and the MUC field guide was consulted in order to determine the MUC code of our research area (see Figure 4, below).

Canopy coverage was calculated using a densiometer on the 42,4 meter long diagonal transects. In addition, an inclinometer was used to estimate the height of trees, which were chosen to include multiple tree species (*Tilia × Europaea* and *Aesculus hippocastanum*). Work was distributed among the team members.

The tools we used were:

- rope
- flags
- measuring tape
- clinometer
- densiometer
- GLOBE data entry app
- interactive identifier keys

The method we used to classify the type of ground cover were the GLOBE land cover protocols. It is important to note that non-native plants within our research are those species which do not have a national elimination agenda, but are not necessarily considered to be invasive species.



Figure 4. Determining area MUC code using the handbook



Figure 5. Measuring the boundaries of the research area using measuring tape

Results

Vegetation covers

- Tree cover 100% (which consisted of only deciduous trees)
- Shrub cover 0%
- Ground 78% green
 - 22% brown
- MUC codes 821 and 0232

The dominant ground cover was the ground-ivy (*Glechoma hederacea*) (see table 2 below), which is also the dominant ground on most of the Estonian mainland. (See figure 6, below)

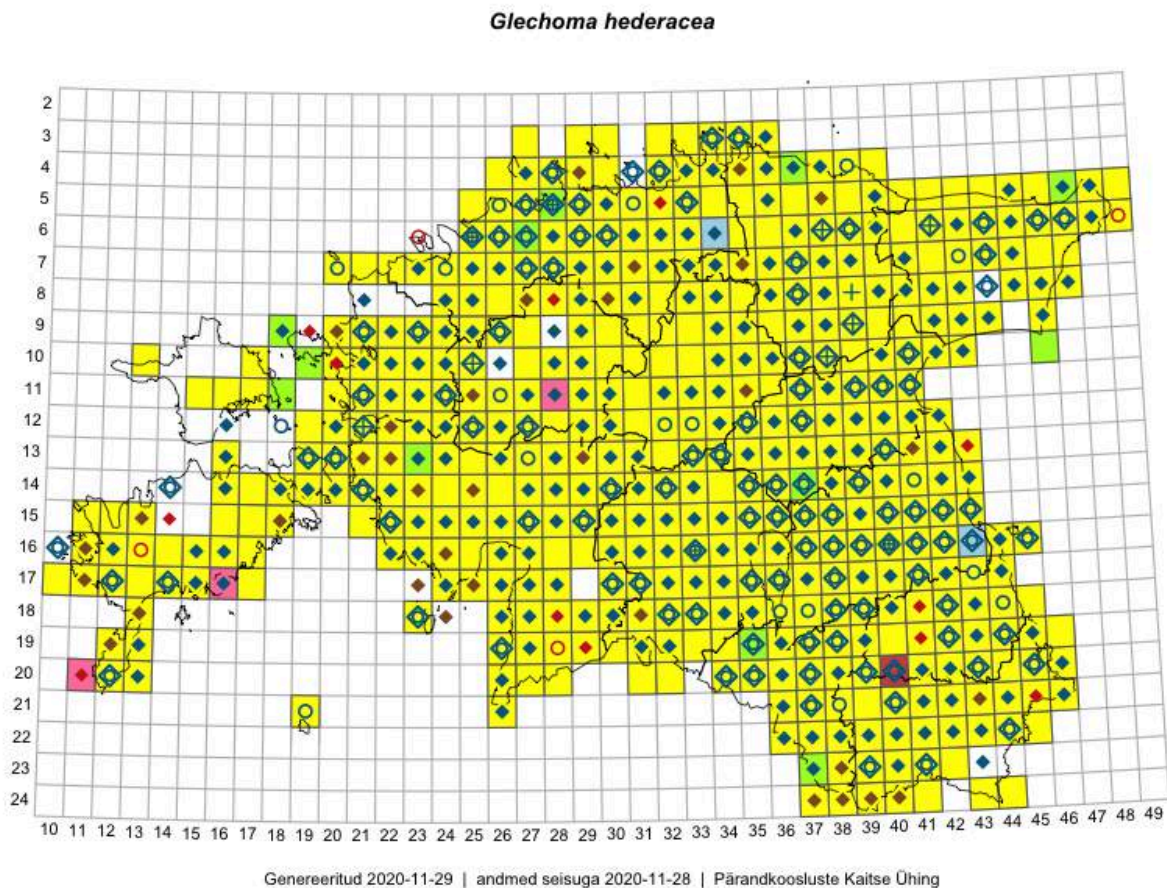


Figure 6. Range of *Glechoma hederacea* in Estonia. Squares highlighted in yellow signify the plant being dominant in that particular area, per the most recent observations. (Source: Kukk, et al., 2020)

Tree heights

Table 1. Summary of tree heights

	Average height (m)	Average circumference (m)	Number of trees
European lime (<i>Tilia × europaea</i>)	25,9	239	6
European horse chestnut (<i>Aesculus hippocastanum</i>)	21,3	207	2
Both species combined	24,8	231	8

Species diversity

Table 2. List of species found in our study area

#	Latin name	Nativeness	English name	Slovenian name	Estonian name	Ukrainian name	Arabic name	Notes
Woody plants								
1.	<i>Sorbus aucuparia</i>		rowan, mountain-ash	jerebika	pihlakas	Горобина Європейська	رشفة أكوبرا	
2.	<i>Berberis thunbergii</i>	non-native	Japanese barberry	Thunbergov češmin	Jaapani lodjapuu	Японський барбарис	بربريس فانبريجي	
3.	<i>Crataegus</i> sp.	non-native/native in Slovenia and Ukraine	Hawthorns	glog	viirpuu	кропива	نبات القراص	

4.	Prunis sp. 'Red'		cherry/plum	češnja/sliva	kirss/ploom	червона слива	برقوق أحمر	red leaves, planted
5.	Prunis sp.			češnja	kirss	зелена слива	برقوق اخدر	green leaves
6.	Tilia chordata		Linden tree	lipovec, malolistna lipa	harilik pärn	липа	الزيفون الأمريكي	
7.	Lonicera sp.	non-native/native in Slovenia and Ukraine	Honeysuckle	kosteničevje	kuslapuu	жимолість	لونيسيرا	
8.	Aesculus hippocastanum	non-native	European horse-chestnut	navadni divji kostanj	hobukastan	кінський каштан звичайний	الاسيقواني بکيتاتو	
9.	Acer platanoide s		Norway maple	ostrolistni javor	harilik vaher	клен гостролистий	بلاتانويت أيسر	
10.	Fraxinus excelsior		common or European ash	navadni jesen	harilik saar	Черемха звичайна	ارتفاع الرماد	
11.	Salix repens		creeping willow	plazeča vrba	roomav paju	Чортополох	الصفصاف الزاحف	
12.	Populus tremula		European aspen	trepeljika	Euroopa haab	осика	ارتعد الشعب	
13.	Parthenocissus quinquefolia	non-native	virginia creeper	peterolistna vinika	harilik metsviinapuu	дикий виноград п'ятилистий	فيرجينيا الزاحف	

Graminoid								
1.	<i>Impatiens parviflora</i>	inv for Slovenija//native for Estonia	Small Balsam	malocvetna nedotika	Väikeseõeline lemmalts	Стрімкий дрібноквітковий	بلسم صغير	dominant species in the ground cover
2.	<i>Urtica dioica</i>		Common Nettle	velika kopriva	nõges	кропива звичайна	نبات القراص المشترك	
3.	<i>Cirsium vulgare</i>		Spear Thistle	navadni osat	tuliohakas	будяк звичайний	شوك الرمح	
4.	<i>Solidago canadensis</i>	non-native	Canada goldenrod	kanadska zlata rozga	Kanada kuldvits	золотарник Канадський	كندا الذهب	
5.	<i>Oxalis sp.</i>		Wood sorrel	zajčja deteljica	oblikas	кислиця	خشب الحميض	
6.	<i>Campanula sp.</i>		Bellflower	zvončica	kellukas	дзвіночок	الجرس	
7.	<i>Epilobium sp.</i>		Willowherbs	vrbovec	Karvane pajulill	знїт вузьколистий	أعشاب الصفصاف	
8.	<i>Artemisia vulgaris</i>		Mugwort	navadni pelin	Harilik puju	полин звичайний	عشبة النار	
9.	<i>Trifolium pratense</i>		Red Clover	črna detelja	ristik	конюшина лугова	معطف أحمر	
10.	<i>Glechoma hederacea</i>		Ground-ivy	bršljanasta	Harilik maajalg	розхідник	الأرض اللباب	dominant species in the ground cover

11	Taraxacum sp.		Dandelinos	regrat	võilill	кульбабка	داندیلینوس	dominant species in the ground cover
12	Achillea millefolium		Common yarrow	navadni rman	raudrohi	деревій звичайний	اليارو العادي	
13	Geum urbanum		Herb bennet, wood avens	navadna sretena	maamõõl	гребінник звичайний	عشب بينيت ، خشب أفينز	
14	Hepatica nobilis		Liwertwort	navadni jetrnik	harilik sinilill	печіночники	ليويرورت	
15	Dactylis glomerata		Cat grass	navadna pasja trava	harilik kerahein	грястиця збірна	عشب القط	
16	Festuca sp.		Festuca	bilnica	aruhein	костриця	فيستوكا	
17	Aegopodium podagraria		Ground Elder	navadna regačica	harilik naat	яглиця звичайна	شيخ الأرض	
18	Fragaria vesca		Wild strawberry	jagodnjak	metsmaasikas	дика полуниця	فراولة برية	
19	Brassica campestris	non-native	Field mustard	ogrščica	tõlkjas	pipa	خردل الحقل	
20	Plantago major		Broadleaf plantain	veliki (širokolistni) trpotec	suur teeleht	подорожник великий	برودليف لسان الحمل	

21	Polygonatum sp.		Polygonatum	salomonov pečat	harilik kuutõverohti	купина	مضلع	
Mosses								
1.	Bryophyta		Bryophytes	mah	lehtsamaltaimed	мохоподібні	بريوفيت	
Fungi								
1.	Agaricus bitorquis		mushroom	mestni kukmak	linnašampinjon	печериці	فطر	
2.	Fungus		tree mushroom	drevesna goba	puuseen	гриб	فطر الشجرة	
3.	Fungus		tree mushroom	drevesna goba	puuseen	гриб	فطر الشجرة	
Lichen								
1.	Lichen		lichen	(skorjasti) lišaj	tuvatsamata samblik	лишайники	حزاز	At least 2 types of crusted lichen (gray and yellow).
Animals								
1.	Cameraria ohridella	non-native	Horse-chestnut leaf miner	listni zavrtač divjega kostanja	hobukastani keerukoi	Мінуюча міль каштанова	عامل منجم أوراق الكستناء الحصان	Butterfly; the larva feeds in the leaf pith

2.	Aphidoidea sp.		aphid	listna uš	lehetäi	тлі	أربيد	
3.	Aphidoidea sp.		aphid	listna uš	lehetäi	тлі	أربيد	
3.	Aves		bird	ptica	lind	птиця	طائر	bird feather
4.	Eriophyidae		eriphyidae	listna pršica šiškarica	eriphyidae	лісовий кліщ	القراد	bangs on linden leaves
5.	Vespula vulgaris		wasp	osa	herilane	оса	ديور	
6.	Culicidae		mosquito	komar	sääsk	москіти	البعوض	
7.	Musca		fly	muha	kärbes	муха	يطير	
8.	Aranea		spider		ämblik	павук	العنكبوت	several types

Table 3. Summary of different species – total, non-native and invasive

	Plants		Total plants	Mosses	Fungi	Lichen	Animals	Total species	Percentage	Percentage of total plants
	Woody plants	Graminoid								
Number of species	13	21	34	1	3	1	8	47	100,00 %	100,00 %
Number of non-native species	5	2	7	0	0	0	1	8	17,02 %	18,92 %
Number of invasive species	0	0	0	0	0	0	0	0	0,00 %	0,00 %



Figure 7. Collage of observed plant species

Conclusion

In conclusion, we found answers to both of our research questions, and discovered that our results agree with our initial hypotheses.

Hypotheses

Out of the 47 total species we found, 8 were non-native, which is about 17% of the total species. In addition, no species were found that were invasive in Estonia. Thus, our first hypothesis (*There are more native species than non-native species in the research area*) holds true.

Out of the two suitable MUC codes for our study area, one is a type of forest, which is in accordance with our second hypothesis (*The study area is classified as a forest according to the MUC code*).

Research questions

- *What kind of species can be found in the Vabaduse city park?*

A variety of species can be found, including plants, fungi and animals (refer to tables 2 and 3, above). Vabaduse puistik could be described as diverse compared to other city parks. 35 different plant species were found, in addition to 4 fungus and 8 animal species. In comparison, 11 out of 15 observed city parks in Portland, Oregon have a smaller amount of plant species (Talal and Santelmann, 2019). There were fallen trees, tall grass, shrubs and different trees.

- *What is the ratio of native species to non-native ones?*

About 17% of the total species were non-native, meaning there were 4.875 native species for each non-native one.

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