GLOBE Estonia Learning Expedition 2024

Land Cover Investigation in Taevaskoda Using GLOBE Methods

Authors: Kristofer Osman (Tallinna Reaalkool),
Art Raju (Kääpa põhikool)
Luisa Kurss (Antsla Gümnaasium)
Rasmus Roosileht (Antsla Gümnaasium)
Greete-Liis Võro(Tartu Kivilinna Kool)
Elis Loreen Nälk (Viljandi Jakobsoni kool)

Instructors: Imbi Henno, Laura Altin

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Abstract

Land cover plays a crucial role in understanding ecosystems, biodiversity, and environmental changes. The GLOBE Program (Global Learning and Observations to Benefit the Environment) offers a standardized methodology for land cover measurement and analysis, allowing students and researchers worldwide to contribute to environmental monitoring. This study utilized the GLOBE methodology to assess vegetation structure and composition in the Taevaskoja area, located in southeastern Estonia. The research aimed to compare two distinct vegetation sites and test hypotheses related to shrub density, ground vegetation abundance, forest density, and tree canopy cover. The data collection involved tools such as a measuring tape, string, MUC code guide, phone compass, densiometer, clinometer, and flags to ensure accurate measurements. Our findings revealed significant differences between the two research areas, with varying levels of shrub density, canopy cover, and forest openness. The hypotheses regarding ground vegetation and shrub density were largely supported, though tree canopy density was not consistently observed across both sites. These results highlight the influence of local environmental factors on land cover characteristics and emphasize the need for further investigation to better understand vegetation distribution in the region. This study contributes to the broader environmental education and citizen science efforts fostered by the GLOBE Program.

1. Introduction

Land cover plays a crucial role in understanding ecosystems, biodiversity, and environmental changes. The GLOBE Program (Global Learning and Observations to Benefit the Environment) provides a standardized methodology for measuring and analyzing land cover, enabling students and researchers worldwide to contribute to global environmental monitoring. By using the MUC (Modified UNESCO Classification) system, GLOBE land cover measurements help classify vegetation, assess forest density, and analyze changes over time.

In this study, we conducted land cover observations in the Taevaskoja area using the GLOBE methodology to assess vegetation structure and composition. Our goal was to compare two different research areas and test hypotheses related to shrub density, ground vegetation coverage, forest openness, and tree canopy density. Data collection tools included a measuring tape, string, MUC code guide, phone compass, densiometer, clinometer, and field markers to ensure accurate measurements.

By applying GLOBE protocols, this research contributes to a broader understanding of local land cover characteristics while also providing data that can be compared with global observations. The findings help illustrate how vegetation distribution varies across different locations and contribute to ongoing environmental education and citizen science efforts.

The data was collected in Taevaskoja on August 13th 2024. Taevaskoja is located in the South-East of Estonia (Figure 1).

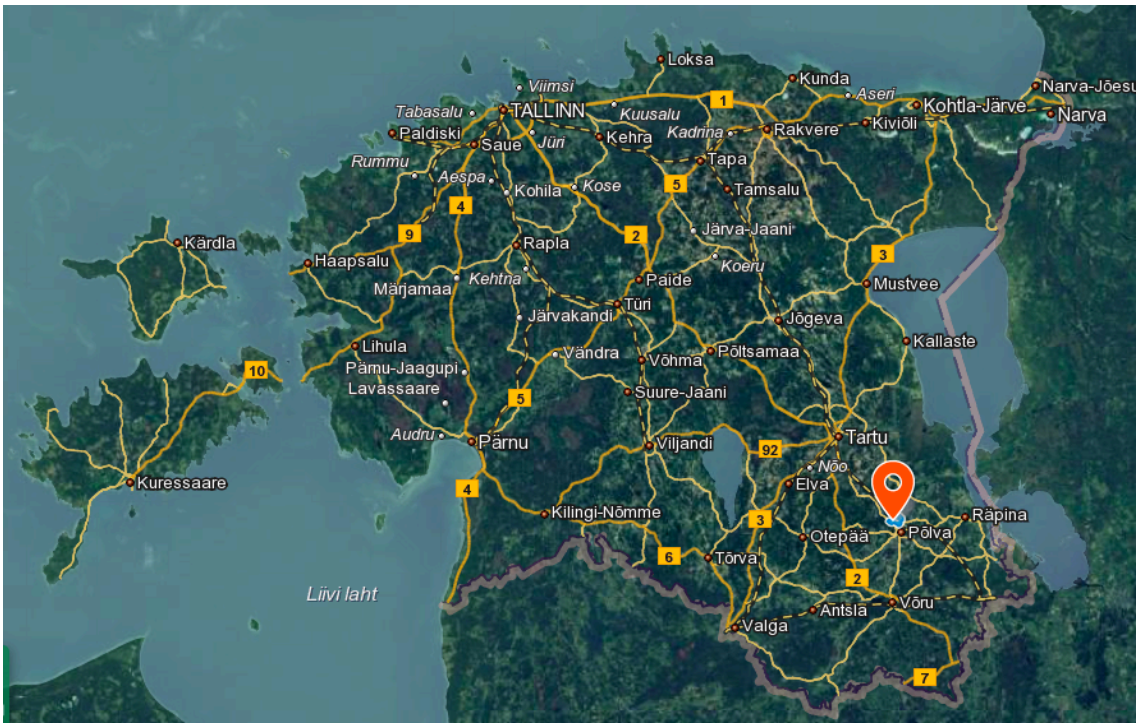

Figure 1. Research Area (Taevaskojas)

Research Questions and Hypotheses

Our study focused on key vegetation parameters, including shrub density, ground vegetation abundance, forest density, and tree canopy coverage. Based on initial observations, we formulated the following hypotheses:

- There are many shrubs in the research area.
- The ground vegetation at the measurement site is less abundant than at the learning session forest site.
- The forest at the measurement site is sparser than at the learning session site.
- The shrub layer at the measurement site is less dense.

- The tree canopies at the measurement site are denser.

2. Data and Methods

We used a measuring tape, string, an MUC Field Guide, a phone compass (iPhone), a densiometer, a pencil, paper, a clinometer, and flags to collect our data (Figure 2). These tools allowed us to accurately measure vegetation height, canopy cover, and forest density while ensuring consistency with the **GLOBE Program's** land cover classification methodology.

We studied two sites, each with distinct vegetation characteristics, to compare differences in shrub density, ground vegetation, and canopy coverage. Our goal was to select two clearly different vegetation sites that were located close to each other, allowing us to examine how local environmental factors influence land cover patterns while minimizing the impact of broader regional differences.

Figure 2. Equipment and tools

3. Results and Discussion

3.1 Research area 1

MUC code for the research area is 0192. Major species is the pine tree (Pinus sylvestris) (Figure 3). We measured the height and circumference of trees: 3 pines, each measured 3 times. The tree height at the first measurement site ranged from 27.5 to 35.5 meters. Circumference was between 1 - meters (Table 1).

The canopy cover at the first site was between 54% and 64%, while at the second site, it ranged from 72.5% to 97%.

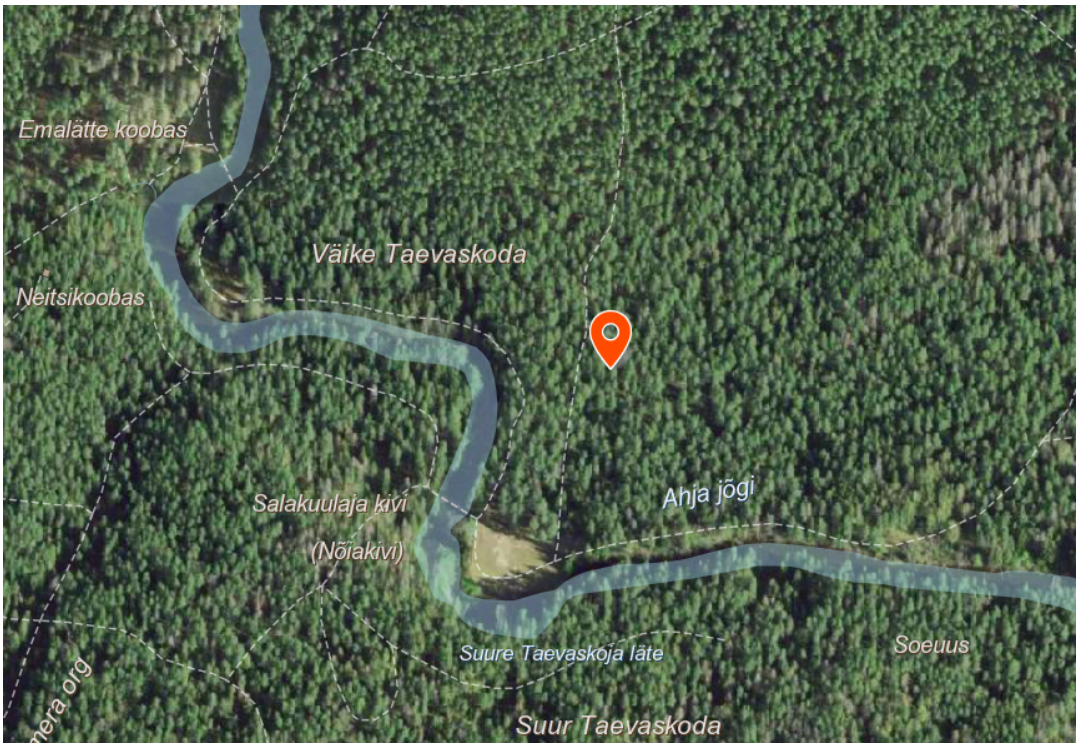

Figure 3. Location of research area 1

Table 1. Trees in research area 1

Tree	Height (m)	Circumference
I pine tree	35.3	1.83 m
	34.3	
	34	
II pine tree	27.5	1.25 m
	28.3	
	28.1	
III pine tree	35.5	1.63 m
	35.2	
	35.2	

3.2 Research area 2

The second research area was located on the other bank of the river (Figure 4). The MUC code for research area 2 is 0193. The tree height in the second measurement site ranged from 33.5 to 37.3 meters. We measured the height and circumference of trees: 3 pines, each measured 3 times (Table 2).

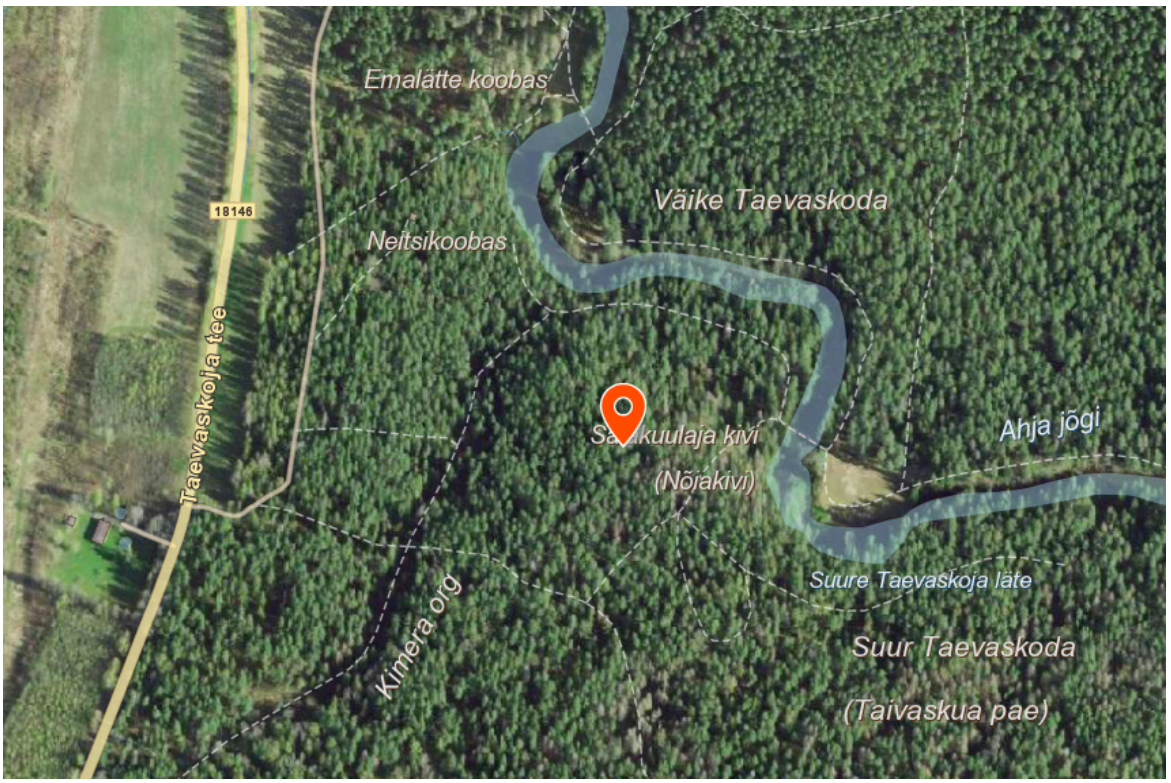

Figure 4. Research area 2

Table 2. Trees in research area 2

Tree	Height (m)	Circumference
I pine tree	33.6	1.55 m
	33.5	
	34.5	
II pine tree	37.2	1.95 m
	37.3	
	36.6	
III pine tree	35.2	1.68 m
	36.3	
	35.1	

3.3 Comparison of two research areas

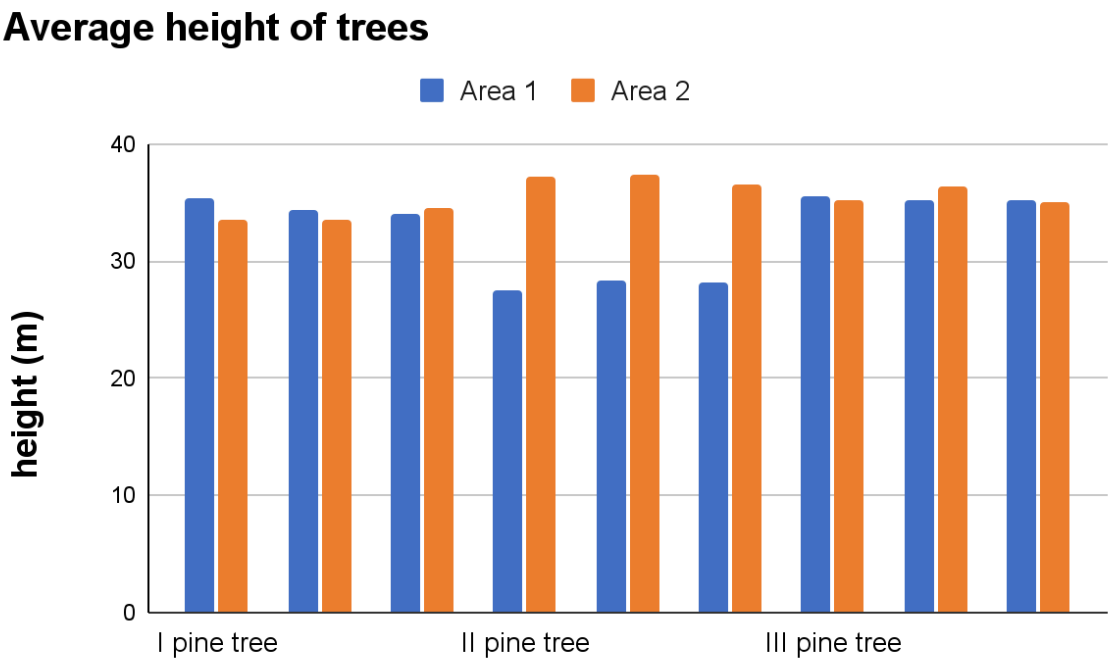

Figure 4. The height of the canopy layer

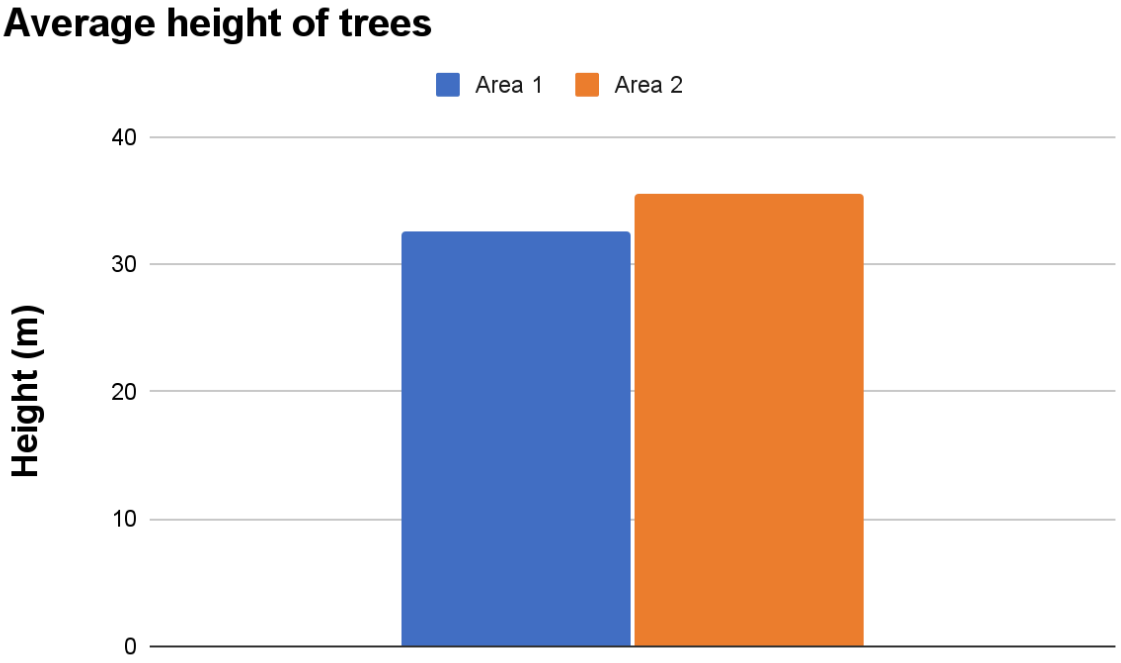

Figure 5. The height of the canopy layer

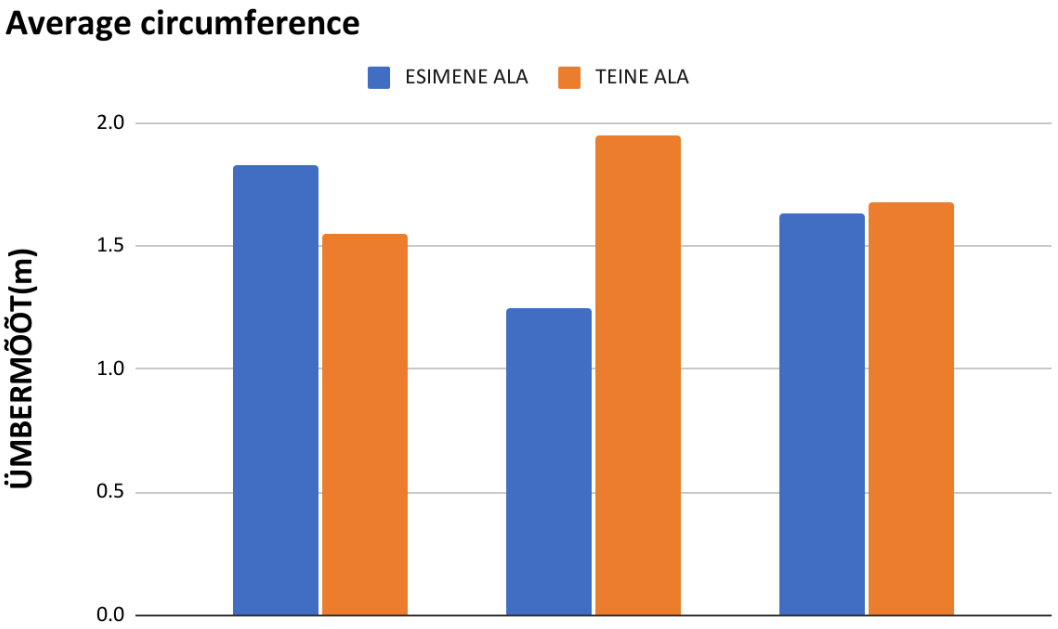

Figure 6. Circumference of trees in meters. First area in blue, second area in orange.

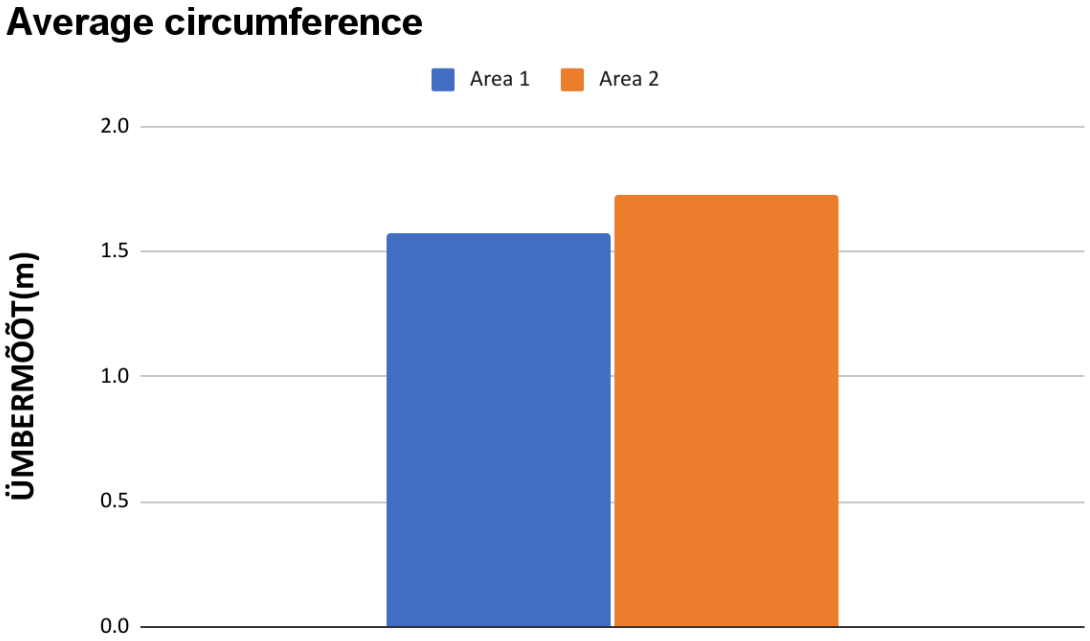

Figure 7. Average circumference of trees in meters. First area in blue, second area in orange.

Figure 8. Research area 2

Table 3. Canopy cover in area 1 and 2.

	Research area 1	Research area 2
1. group	64%	82%
2. group	63%	97%
3. group	54%	72.5%

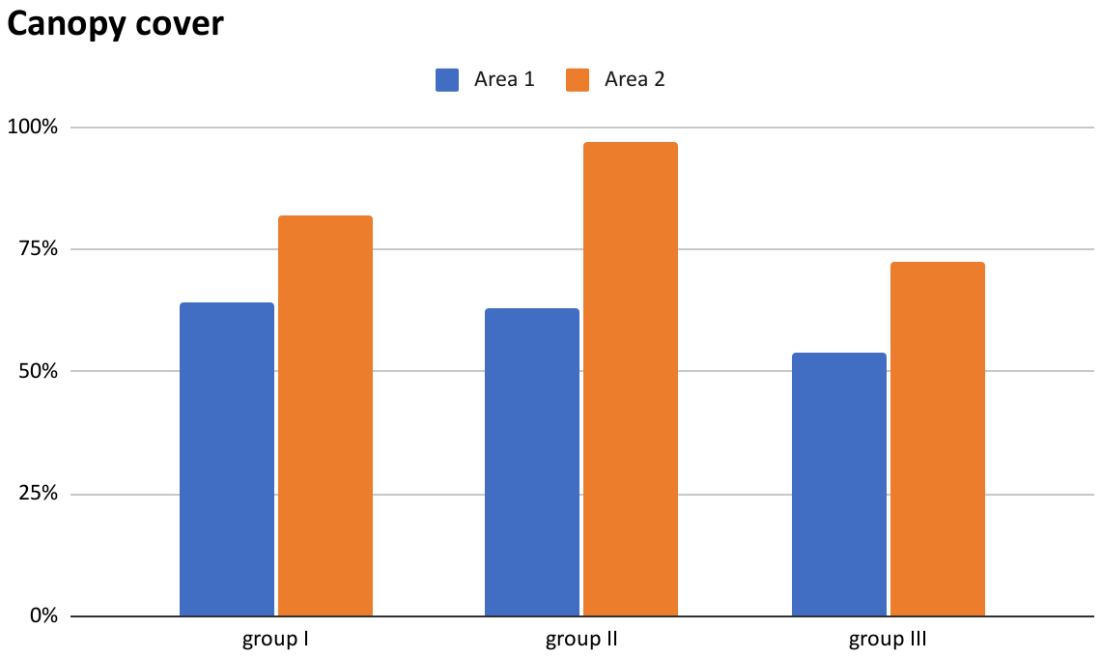

Figure 9. Canopy cover between trees at the two measurement sites.

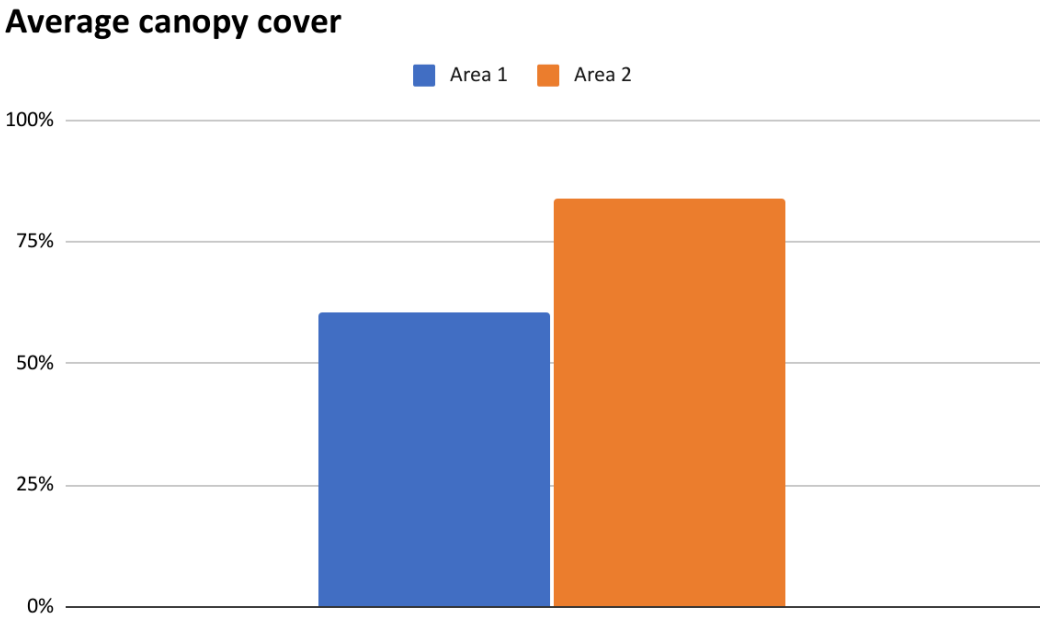

Figure 10. Average canopy cover between the two measurement sites.

Figure 11. Canopy cover in Area 2.

Table 4. Ground cover in Area 1 was 197.2% and 207% in Area 2.

	Research area 1	Research area 2
Low tree layer/ bushes (1.5-4m)	0%	15%
Shrub layer (below 1.5m)	96.40%	48%
Graminaceous plants	0.80%	19%
Flowering and broad-leaved plants	0%	25%
Ground cover layer (moss)	100%	100%
Sum	197.20%	207%

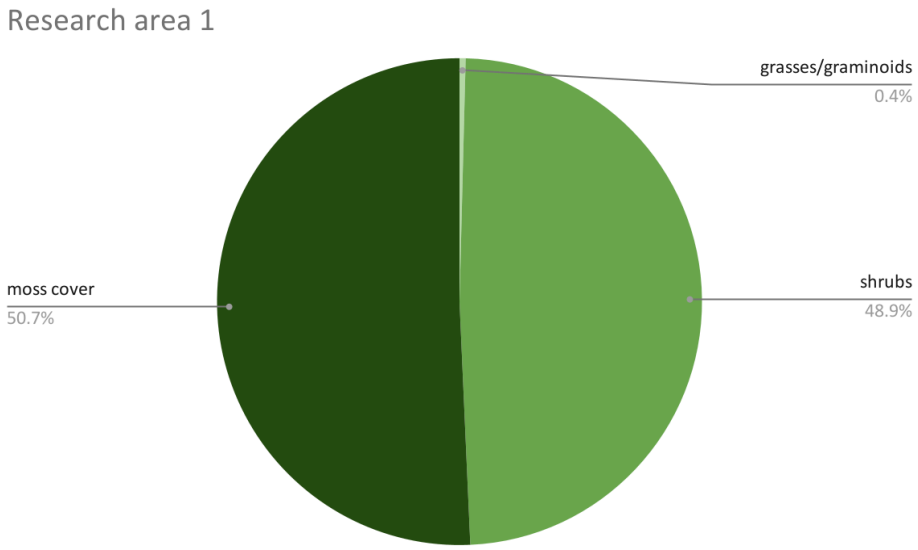

Figure 12. ground cover in the research area 1.

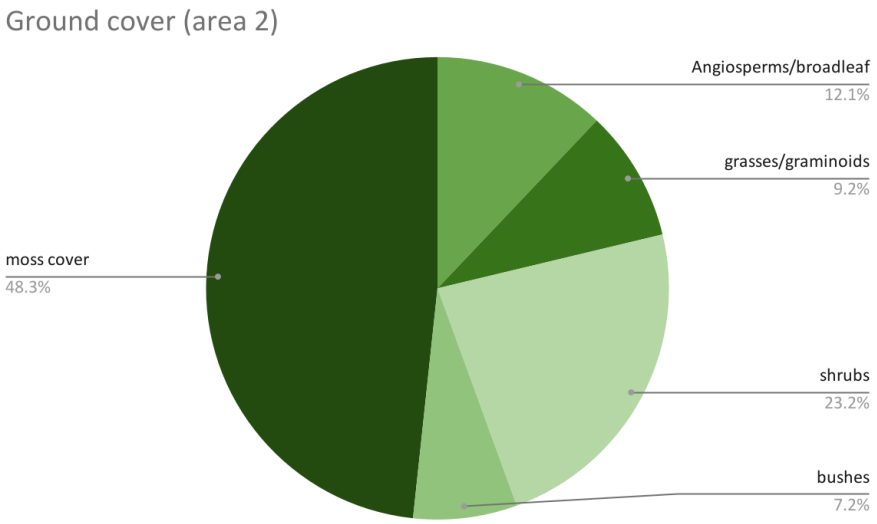

Figure 13. ground cover in the research area 2.

Conclusions

The validation of our hypotheses varied between the two research areas.

At the **first research area**, the hypothesis that there are many shrubs was not supported by our findings. However, the hypotheses stating that ground vegetation is less abundant than in the study session forest, the forest is sparser, and the shrub layer is less dense were confirmed. In contrast, the hypothesis that tree canopies are denser at the measurement site was not supported.

At the **second research area**, we found evidence to support the hypothesis that there are many shrubs, as well as that the tree canopies are denser. However, the hypotheses suggesting that ground vegetation is less abundant, the forest is sparser, and the shrub layer is less dense were not supported by the data.

These results indicate that vegetation structure can vary significantly between different locations, even within the same general area. Factors such as microclimate, soil composition, and human impact could contribute to these differences. Further investigation with additional measurement points could provide a more comprehensive understanding of the land cover characteristics in the Taevaskoja area.

Figure 14. Common tree-moss (Hylocomium splendens)

Figure 15. Common fan-moss (Ptilium crista-castrensis)

Figure 16. Creeping ladies' tresses (Goodyera repens)

Figure 17. Our research group and supervisor Imbi Henno (right)