GLOBE Estonia Learning Expedition

Land cover on Käsmu peninsula

Supervisors: Kent Gregor Mahla,

Imbi Henno

Lauri Pehlak, Eliise Juur, Jelizaveta Štšura, Natalie Svobodova, Eliska Drackova, Rosmarii Ilp, Anette Einmann, Kätrin Kaunimäe, Mattias Ilp

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Abstract

Due to the fact that satellite images, which are one of the tools used to study ground cover, provide information about the color and location of vegetation but cannot give exact data on the type of vegetation and habitat, it is necessary to take these measurements manually in the field. The aim of our study was to observe the influence of the distance to the sea on the ground vegetation and tree canopy cover and differences between the dimensions of trees, as well as the abundance of rare plants. We observed and collected data from two different research areas in Käsmu, Lääne-Viru country, in Northern Estonia - in the forest “near the sea” (Area 1) and in a “boulder field” (Area 2). Land cover data was gathered on August 3, 2022. Measurements were taken using different easily accessible instruments, including the GLOBE land cover measuring software. Our group compared two squares of land 30 by 30 meters in size in both research areas. In these research areas, we proceeded to take different measurements like canopy cover measurements, tree height and circumference measurements, the MUC code of the area and other necessary data. We found that the “boulder field” (Area 2) which is further from the sea had more dense canopy cover and only evergreen trees, while in the forest “near the sea” (Area 1) the trees were higher and thicker, the canopy cover was less dense and the deciduous trees were prominent. We identified only one rare plant (*polypodium vulgare*), meaning we do not have enough data to map the correlation between the abundance of rare plants and the distance from the sea. The data we obtained as a result of our research can be used in future expeditions for comparison purposes.

Keywords: land cover, satellite imaging, forest, sea, Käsmu.

1. Introduction

Satellite images capture a picture that is a reflection of the ground (Figure 1). In the satellite image we can only see dark and light greens but it doesn't determine what forest or land covers are captured. In order to determine the type of forest on the satellite picture we have to go to that place and determine MUC code and coordinates. The aim of the land cover research is to determine what color on a satellite picture corresponds to the type of vegetation.

The research of the land cover was contacted in Estonia, Käsmu village, Lainela Holiday Village (Figure 2).

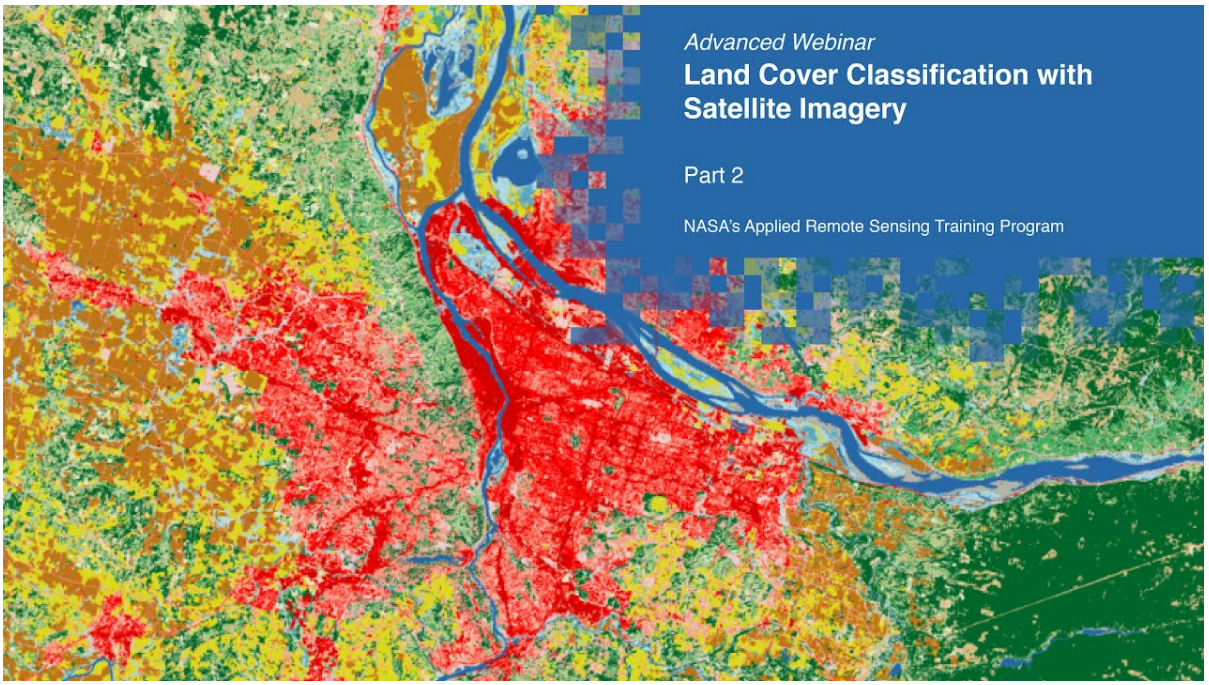

Figure 1. Satellite image where we can determine the areas of vegetation but not the type of vegetation (NASA, 2017).

Figure 2. Our location in Estonia. Source: Google Maps

2. Research questions

In order to investigate the land cover of the area, we asked the following questions:

1. How does the distance to the sea affect the height and thickness of the trees?
2. How does the distance to the sea affect the density of canopy cover?
3. How does the distance to the sea affect the percentage of evergreen and deciduous plants in the area?
4. How does the distance to the sea affect the amount of rare plants found in the area?

3. Research methods and materials

To conduct our research, we needed the following tools:

- Compass
- GPS receiver
- Smartphone
- Measuring tape (50m), rope
- Flags for marking (5pcs)
- GLOBE Observer app
- GLOBE Data Entry app
- Plant identifier
- MUC Field Guide
- Tubular densiometer
- GLOBE land cover protocol*

4. Methods of investigation

We conducted our research in two areas (Figure 3.) - “near the sea” (Figure 4.) and far away from the sea, in a boulder field (Figure 5.). Both of the areas had a MUC code of 0192. The first research area had coordinates of N: 59° 36’ 50” and E: 25° 54’ 48” and was at an elevation of 10.3 meters. The second research area had coordinates of N: 59° 36’ 40” and E: 25° 54’ 23” and was at an elevation of 20.6 meters.

Figure 3. Map with the expedition route and research areas marked. Source: Estonian Land Board (2023) with authors’ own additions

Figure 4. The first “near the sea” research area.

Figure 5. The second “boulder field” research area.

To obtain data for our research, we took the following measurements:

- Canopy cover density,
- MUC code,
- Percentage of evergreen and deciduous trees,
- Ground cover description,
- The height and circumference of the trees,
- Plant species identification.

In order to measure the canopy cover density, we used a densiometer. First, we identified an area of 30 by 30 meters in size using a measuring tape and drew diagonals using marker flags and rope (Figure 6). After that, two people worked as a team to measure the canopy cover density: one person looked up through the densiometer after each 2 steps along the diagonal and the second one marked a + or - on a data collection sheet according to what the first

person saw (Figure 7).

Figure 6. Rope and marking flag.

Figure 7. Students measuring the canopy cover.

We identified the MUC code using the instructions in the MUC field guide.

Ground cover measurements were taken similarly to the canopy cover density measurements. Again, 2 people were involved - the first person looked at the ground under their feet every 2 steps along the diagonal and the second person marked down “Green”, “Brown” or “No vegetation” according to what the first person saw.

We measured the circumference of the trees using measuring tape. That was done by wrapping the tape around the selected trees at approximately 1 meter height above the ground. The height of the trees was measured using the Globe Observer app.

The data about the plant species was obtained using the plant identifier (Figure 8), and the data about the percentage of evergreen and deciduous trees was obtained through approximations according to eyesight.

Figure 8. Plant identification process depicting the only rare plant found in common polypody (*Polypodium vulgare*).

5. Results and Discussion

In this chapter both research areas are taken into account when making conclusions. Our area 1 “near the sea” is closer to the sea and area 2 “boulder field” is further from the sea.

How does the distance to the sea affect the height and thickness of the trees?

The tallest and thickest trees grew near the sea. As we can see from Table 1, the trees in area 1 were 19-22 m tall and their circumferences ranged between 125-197 cm, making the average of 162 cm. Trees in the boulder field were not taller than 19 m and their circumferences ranged between 67-94 cm, making the average of 77 cm.

How does the distance to the sea affect the density of canopy cover?

The canopy cover is denser in area 2. Our results show that the boulder field's canopy cover is 90% and 100% of the trees were evergreen trees. The canopy cover of the area near the sea is 50% and 84% of it was evergreen trees and 16% deciduous trees.

How does the distance to the sea affect the percentage of evergreen and deciduous trees in the area?

Area 2 had more evergreen trees and area 1. had more deciduous trees. In Table 1 our results show that research area 1 was covered 16% by deciduous trees and area 2 was covered 0% by deciduous trees. Area 2 was covered 100% by evergreen trees and area 1 was covered 84% by evergreen trees.

How does the distance to the sea affect the amount of rare plants found in the area?

We found one rare plant on our trail from area 1 to area 2 but not inside the 30 by 30 meter research squares, meaning we do not have enough data points to answer our research question. We found 25 plant species in research area 1, and in research area 2 we found 15 plant species. Identified plant species can be found in Appendix 1. During our research we found on our trail growing next to rock one rare plant, which was common polypody (*Polypodium vulgare*) which is depicted in Figure 8. Rare plants were not common in our selected research areas. After the expedition we understood that we should have asked a research question about biodiversity making us able to use our collected data about ground cover found in table 2.

Table 1. Expedition results about tree canopy cover, tree height and circumference.

Results	Research area 1, near the sea		Research area 2, boulder field	
Tree Canopy				
Trees	50 %		90 %	
Evergreen	84 %		100 %	
Deciduous	16 %		0 %	
Pinus sylvestris	Tree height	Circumference	Tree height	Circumference
Tree 1	19 m	196 cm	18 m	69 cm
Tree 2	23 m	164 cm	19 m	94 cm
Tree 3	22 m	125 cm	18 m	67 cm

Table 2. Expedition results about ground cover.

Results	Research area 1, near the sea	Research area 2, boulder field
Ground Cover		
Green	84%	89%
Brown	16%	10%
No vegetation	0%	1%

References

Estonian Land Board. (2023). *X-GIS 2.0 [core_aluskaardid]*. Maaameti Aluskaart (Estonian Land Board's Basemap). https://xgis.maaamet.ee/xgis2/page/app/core_aluskaardid

NASA. (2017, January 31). *ARSET - Land Cover Classification with Satellite Imagery*. NASA Applied Sciences. http://appliedsciences.nasa.gov/join-mission/training/english/arset-land-cover-classification-satellite-imagery

The GLOBE Program. (n.d.). *Protocol eTraining—Biosphere*. Retrieved 27 December 2022, from https://www.globe.gov/get-trained/protocol-etraining/etraining-modules/16867717/3099387

Expedition photos: I. Henno

Appendix 1

Plants we found in the first research area:

Mustikas / Vaccinium myrtillus / European blueberry

Piibeleht / Convallaria majalis / Lily of the valley

Palu-härghein / melampyrum pratense / common cow-wheat

Harilik jänesekapsas / Oxalis acetosella / common wood sorrel

Ahtalehine põdrakanep / Epilobium angustifolium/ Chamaenerion angustifolium

Karutubakas / Pilosella officinarum/ Pilosella Hill

Muulukas / Fragaria viridis / creamy strawberry

Sügisene seanupp / Leontodon autumnalis/ Scorzoneroides autumnalis

Roomav madar / Galium aparine / sticky willy

Raudrohi / Achillea / yarrow

Harilik laanlill /Trientalis europaea / chickweed wintergreen

Võilill / Taraxacum / dandelion

Mets-tähthein / Stellaria holostea / greater stitchwort

Suur teeleht / Plantago major / Plantago major

Harilik pohl / Vaccinium vitis-idaea / mountain cranberry

Harilik teeleht / Plantago major /

Harilik Pihlakas / Sorbus aucuparia / rowan

Harilik Vaher / Acer platanoides / Norway maple

Kadakas / Juniperus communis / common juniper

Metsvaarikas / Rubus idaeus / raspberry

Harilik Mänd / Pinus sylvestris / Baltic pine

Everybody gangsta, til Kent starts spinning.

Valge Ristikhein / Trifolium repens / white clover

Hunditubakas / Hieracium / hawkweed

Mets-haruputk / Anthriscus sylvestris / mother-die

Harilik hiirehernes / Vicia cracca / tufted vetch

Harilik kerahein / Dactylis glomerata / cock's-foot

Plants we found in the second research area:

Mustikas / Vaccinium myrtillus / European blueberry

Piibeleht / Convallaria majalis / Lily of the valley

Raudrohi / Achillea / yarrow

Põdrasamblik /Cladina/ quill lichen

Kanarbik / Calluna vulgaris / heather

Harilik kukemari / Empetrum nigrum / crowberry

Kuldvits / Solidago L. / goldenrods

Palusammal / Pleurozium schreberi / red-stemmed feathermoss

Kaksikhammas / Dicranum / wind-blown mosses

Laanik / Hylocomium splendens / glittering woodmoss

Põdrakanep / Chamaenerion / willowherbs

Mets-härghein / Melampyrum sylvaticum / small cow-wheat

Harilik harakkuljus / Linnaea borealis / twinflower

Kask / Betula / birch

Kuusk (beebi) / Picea abies / spruce

Hunditubakas / Hieracium / hawkweed

Harilik pohl / Vaccinium vitis-idaea / mountain cranberry

Kadakas / Juniperus communis / common juniper

Harilik Mänd / Pinus sylvestris / Baltic pine

Kivi-imar / Polypodium Vulgare / Common polypody