GLOBE Regional Learning Expedition

Land cover in Käsmu

Kirke Pärnat, Tuuli Randmäe, Sheamus Murphy, Helena Lindgren, Helen Luup, Tirk Märss, Mirko Aija, Terezie Pitrová, Cedrik Pavienský

Supervisors:
Brian Campbell
Merli Ilves (Support)

Estonia
2023

Table of contents

Abstract

The aim of our study was to figure out the differences and similarities between manual land cover measurements and by using the Globe Observer App. We conducted our study on August 3rd 2022 near the Lainela Holiday Village in Käsmu, Estonia.

We made our observations and collected data from one 30x30 meter site using materials provided by the GLOBE Program. We observed the land cover, tree heights and flora in the 30x30 area.

Our results from both manual and app measurements were quite similar with some differences.

Introduction

Lainela Holiday Village where the research was conducted is located by the Baltic sea in Käsmu peninsula, Northern Estonia (Figure 1). Käsmu peninsula is part of Lahemaa national park which is the biggest and oldest national park in Estonia. It is one of the most important forest protection areas in Europe where many animals live (Visit Estonia).

Satellite images are very valuable in giving us a big picture of the world but sometimes more detailed research has to be done on the site to find out the specific characteristics of the location that cannot be seen from the satellites. This is why our expedition team surveyed the land cover in a nearby forest and compared the data with what we saw from the satellite image and GLOBE Observer application.

Figure 1. Location of the research area in Estonia (Source: Estonian Land Board).

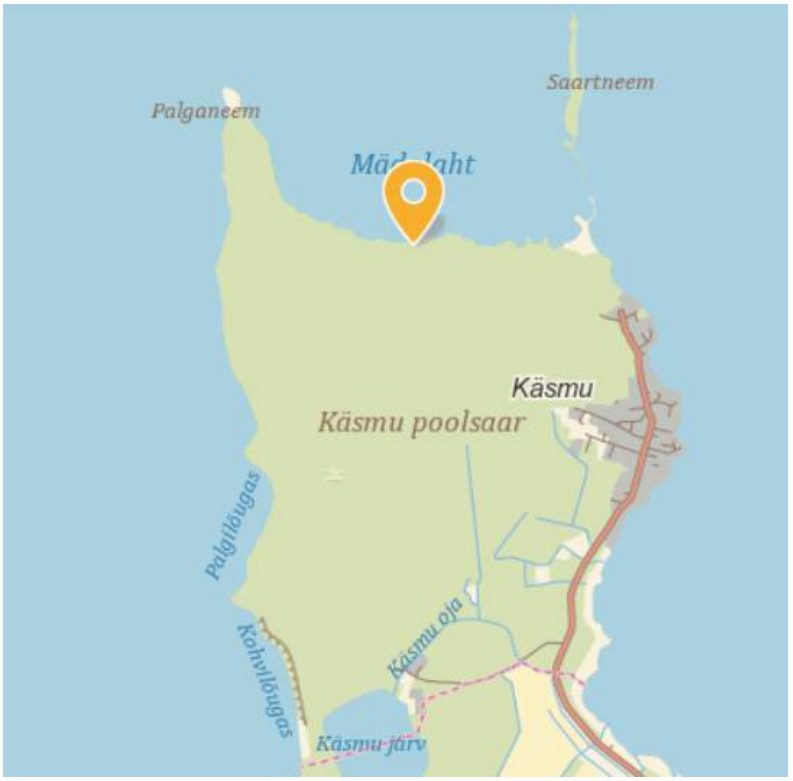

Figure 2. Location of the research area in Käsmu (Source: Estonian Land Board).

Figure 3. The satellite image of the walk to the measuring site (Source: Google Maps).

Figure 4. The area of the measuring site from a satellite image (Source: Google Maps).

From the satellite images we can see that the observation site is right next to the seaside and is very forested. From the satellite image we assumed that the trees are mainly coniferous and the land cover is rather sandy and there are not many plants.

Research questions

Our team formulated one main research question for the expedition:

- How can we compare the manual observations from the land cover site to the observations from the GLOBE Observer app and satellite data?

Research Methods and Materials

We walked to a space in the forest and marked out a 30m by 30m plot using a compass. We marked the corners and plot center with flags, then we used a string to mark our 30 by 30 area diagonals. After starting to mark the diagonals of the area we found that we had not brought enough string so we improvised and used sticks to cover the remaining distance.

Two different groups studied the MUC field guide to find out the land cover type of the plot. We took photos from the center of the plot showing North, South, East and West. Then we measured the density of the canopy cover with the densiometer where we had people documenting whether it was a positive or a negative. We then did the equations, found the answer and added that to our entry.

The data entry app had us more focused on the canopy. We then calculated the amount of green and brown shrubs. At the same time few people focused on identifying the flora of the site. After finishing our data collection of canopy and ground we went on to determine the height and circumference of a couple of trees.

Figure 5. North view of the site.

Figure 6. South view of the site.

Figure 7. East view of the site.

Figure 8. West view of the site.

The tools and equipment we used to research were:

- Compass,
- Smartphone,
- MUC Field Guide,
- GPS receiver,
- Measuring tape (50m),
- Flags for marking (5 pcs),
- String for plotting,
- Clinometer,
- Tubular densiometer,
- Eesti Taimede Kukeaabits,
- Google Lens,
- Plantnet,
- Globe Observer app.

We collected data from one plot with a 30m by 30m area. This plot was entirely forest land with an elevation of 7.7m, which was located nearby the shoreline of the Baltic sea.

Figure 9. Using the clinometer in the field.

Figure 10. Measuring eye height for clinometer measurements.

Figure 11. Measuring distance from the tree to the observer.

Results and discussion

As a result of our expedition we found out that the canopy cover at the land cover site was 62.68%. Based on the satellite image that seemed logical as we saw some gaps between the trees on the satellite photos as well.

Another thing that we wanted to confirm was the share of tree types. Based on the satellite image we guessed that it would be mainly coniferous trees. Our assumption was right because on our observation site we counted 52 evergreen trees - pines (93%) and 4 deciduous trees - birches (7%).

From the satellite image we could not see the ground cover so our observation on site gave us a more clear overview of the land cover. We counted the shrubs on the ground, finding 57 green and 14 brown. This means that for every 1 brown shrub there were 4 green shrubs.

We also learned to use the MUC Field Guide to classify the land cover. The result was:
MUC-0192 Closed Forest, Mainly Evergreen, temperate and subpolar needle-leaved, irregularly rounded crowns.

We can be sure of this result because 2 parallel groups of our team tried to find out the MUC code and got the same code. Also, other teams close to our location got the same MUC code which means that the MUC code on Käsmu peninsula is quite homogenous.

For our next result, we used 2 different measurement tools for finding the height of trees at our site. We measured 2 trees manually and the same trees also through the GLOBE Observer app.

These were our results:

- Tree #1
    - Manual (3 measurements):
        - 17.6m
        - 17.6m
        - 17.5m
        - Circumference - 88cm
    - GLOBE Observer App:
        - 18.35m

- Tree #2
    - Manual (3 measurements):
        - 5.2m
        - 4.9m
        - 5.0m
        - Circumference - 25cm
    - GLOBE Observer App:
        - 4.91m

The measurements that we did manually and through the app were pretty similar as we can see in our results. The manual and observer results were all within a few centimeters of each other. This shows that both methods for finding the tree heights are good for using in this kind of research.

Another interesting part of our research was describing the land cover with the flora on it. From the satellite image we thought it would be mainly sand cover and not too many different plants. However, we were surprised by our results.

We found 15 different species of flora, two of which we were unable to identify. We used the “Eesti taimede kukeaabits” for finding out the plant names and also Google Lens proved to be very useful. This also showed that combining different methods in research can be helpful and can make the work faster because the book was only in Estonian so it was difficult to use for the non-Estonian speaking members of our team. But with Google Lens they could also find the plant in their native language and from there we could derive the Latin name as well.

Latin name	**Estonian name**	**English name**
Vaccinium vitis-idaea	Harilik pohl	Lingonberry
Vaccinium myrtillus	Mustikas	Blueberry
Calluna vulgaris	Kanarbik	Heather
Pinus sylvestris	Harilik mänd	Pine
Betula pendula	Arukask	Birch
Hylocomium splendens	Harilik laanik	Glittering woodmoss
Pleurozium schreberi	Harilik palusammal	Red-stemmed feather moss
Empetrum nigrum	Harilik kukemari	Black crowberry
Trientalis europaea	Laanelill	Chickweed-wintergreen

Hieracium umbellatum	Sarik-hunditubakas	Canadian hawkweed
Sorbus aucaparia	Harilik pihlakas	Rowan
Melampyrum pratense	Palu-härghein	Common cow-wheat
Deschampsia flexuosa	Võnk-kastevars	Wavy hair-grass

Our general conclusion from the plants' observation showed that the ground cover is mainly covered with heather, blueberries and lingonberries which were also the easiest to identify. But upon closer research we found many others on the site which were not so common to us and therefore were quite surprising to see.

Figure 12. Unidentified from the area.

Figure 13. Unidentified from the area.

Conclusion

In our project we used both manual ways of getting data and electronic ways of getting data. We were able to get tree height, flora and land cover with both methods. With the manual data method we found that it had more to do and more to figure out. The tree height had everyone doing something, whether that was measuring distance or looking through the clinometer. For flora we had a reference book to figure out what different types of flora we had, and with land cover we used a densiometer and our own knowledge.

With electronic data, it was mainly just one person working on it. Either taking pictures or using an app on their phone to figure it out. It was a positive result of our study that the Globe Observer app can provide trustworthy results and is a good tool to use in this kind of research. It turned out that both methods can work equally as well as we saw with our results. Using the app might even produce faster results and is more convenient to use. Overall, we can see that the manual data collection takes more effort but can be more accurate sometimes, although both ways of gathering data can be used.

After the expedition, we also held a discussion with another team who did atmospheric measurements next to our site. We shared our results and examined what could be the collaboration points for the future and for example for the IVSS project of 2023. For example, studying land cover and atmosphere together on one site could be useful for studying microclimates. We also discussed that it would be useful to do a similar observation and yearly measurements in different countries to compare the results. For example in the USA, Lithuania and Czech Republic, where some of our team members were from.

References

Estonian Land Board. (2022). Estonian map. X-GIS(1) - Maainfo (maaamet.ee)

Kukk, T., (2018)., *Eesti Taimede Kukeaabits*. Varrak.

The Globe Program. *MUC Field Guide a key to Land Cover Classification*. The Globe Program.

Visit Estonia home page. (2022). National parks and nature centres. Explore 6 diverse national parks | Visit Estonia