

# Development of a methodology for calculating carbon units of heterogeneous territories based on machine learning

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## Abstract

This poster presents a methodology for calculating carbon units of heterogeneous territories based on machine learning. The aim of the work is to reduce the time spent on assessing the carbon reserve of heterogeneous territories through automated interpretation of multi-scale terrain images using deep neural networks. The study takes into account the specifics of calculating the stock of carbon units for heterogeneous territories, where the type of areal objects can be different: forest, swamp, tundra wasteland, littoral, meadow, and others.

The paper describes the hierarchical structure of areal territories and the structure of the relationship of multi-scale images. An approach is given to identify and classify terrain objects in order to more accurately calculate the carbon reserve of the territory.

## Methodology

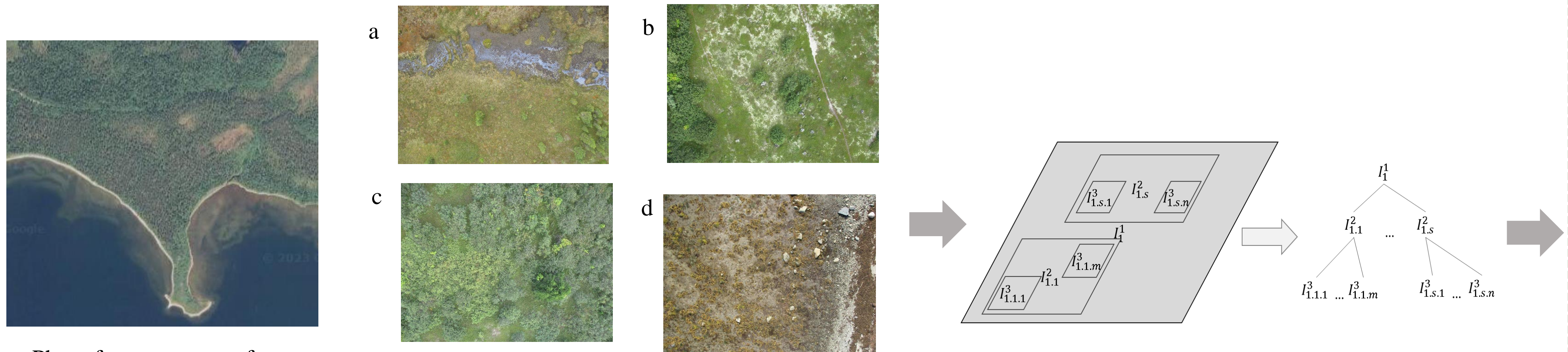
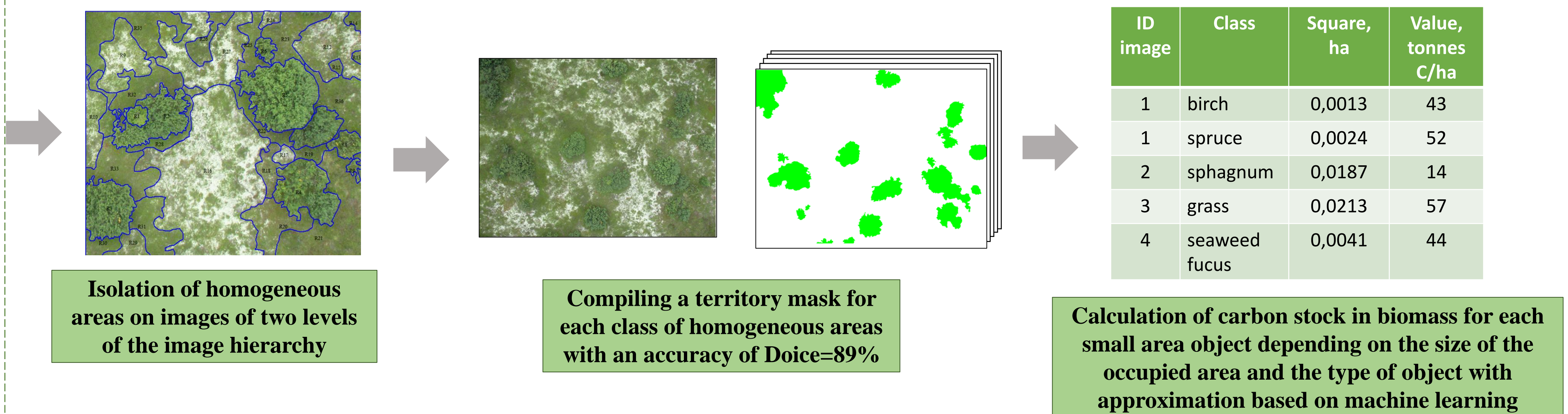


Photo from a spacecraft

UAV images to identify homogeneous objects of the territory:  
a - swamp, b - tundra wasteland, c - forest, d - littoral.

Creating a Snapshot Hierarchy Diagram

Collection of images for the study area of different scales



Isolation of homogeneous areas on images of two levels of the image hierarchy

Compiling a territory mask for each class of homogeneous areas with an accuracy of Doice=89%

Calculation of carbon stock in biomass for each small area object depending on the size of the occupied area and the type of object with approximation based on machine learning

## Conclusion

The resulting methodology provides detailed data on individual heterogeneous objects of heterogeneous territories, which increases the amount of information about the territory in comparison with existing areal approaches to accounting for terrain objects. The results of the study will be in demand to automate the monitoring of carbon polygons being created in Russia and the world. The obtained data on the stocks of carbon units of heterogeneous territories will be accurate, and, accordingly, will allow developing on their basis a methodology for economic regulation of legislation in the field of reducing greenhouse gas emissions by enterprises.

As part of the practical application of the results of the study, it is planned to include information on carbon units used by enterprises to reduce environmental harm in general information on the production cycle of products in order to confirm the degree of environmental friendliness of the product cycle and certification.