EU protected mire habitat mapping and quality assessment by airborne remote sensing data

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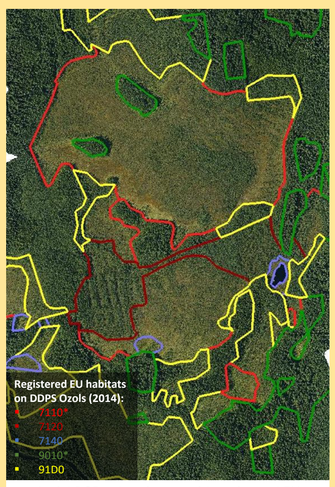
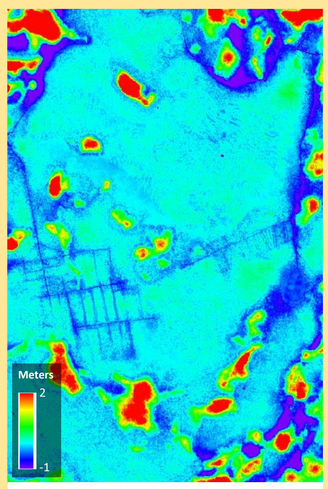
ABSTRACT
Various reasons require precise habitat mapping and quality assessment. For European Union countries it is obligatory each sixth year to report of EU protected habitat distribution and their quality. Habitat mapping and quality assessment is important for habitat restoration actions to monitor the habitat improvement results and for evaluation of human impact on nature values. Habitat mapping and quality assessment is important for habitat restoration actions to monitor the habitat improvement results and for evaluation of human impact on nature values. Mostly, habitat mapping and quality assessment is done by habitat experts in field studies. However, mire habitat assessment in field studies can be challenging and time consuming due to habitat complexity especially for large peatland ecosystems.
The study aim was to develop standardised method for EU protected mire habitat mapping and quality assessment based on airborne remote sensing data analysis.

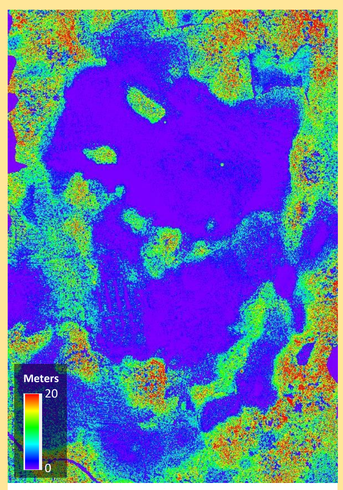
RESULTS OF MEŽOLE NATURE RESERVE



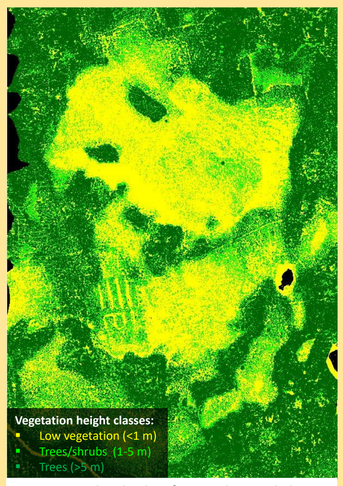
Aerial RGB colour image with registered EU protected habitats on Latvian Nature Data Managment System (DDPS Ozols) in the area



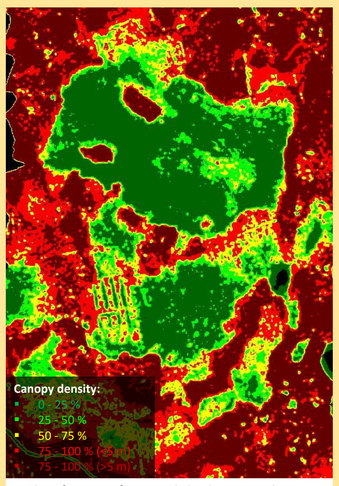
Local differences on digital terrain model that highlightes elevations and declines in the area



Normalised digital surface model that describes vegetation height in the area



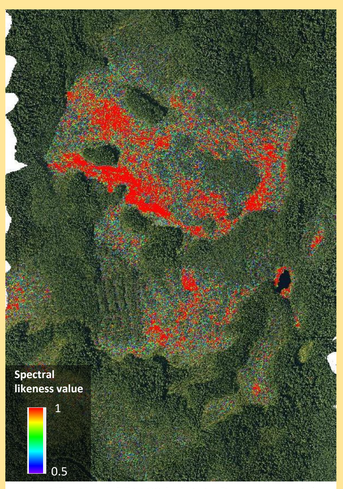
Vegetation height classification that can help to identify habitat borders and fast growing trees indicating effect of drainage



Classification of tree and shrub canopy density that can help to identify habitat borders

Classification of tree types. Identification of dead trees can help to assess impact of hydrological regime

Identification of periodically wet hollows after using match filtering to find automatically similar spots to collected field locations of the bog element



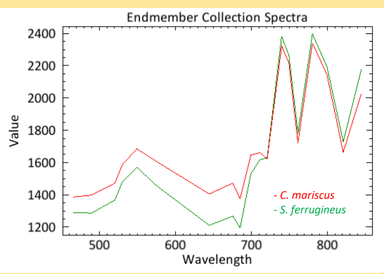
Identification of 7110* habitat after using match filtering to find automatically the habitat according habitat expert classification of the bog

Identification of 7140 habitat after using match filtering to find automatically the habitat according habitat expert classification of the bog

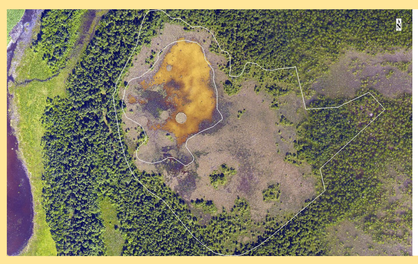
Five EU protected habitat types was studied in two peatland areas in Latvia during 2014: 1) Mežole Nature Reserve (7110* Active raised bogs; 7120 Degraded raised bogs still capable of natural regeneration; 7140 Transition mires and quaking bogs); 2) Lake Engure Nature Park (7210* Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; 7230 Alkaline fens).

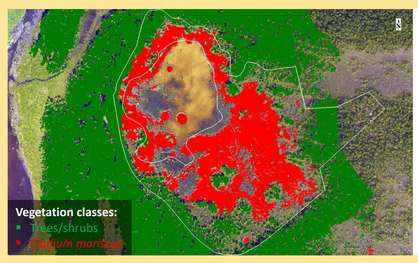
High resolution airborne remote sensing data was collected over study areas in July, 2014 with airborne surveillance and environmental monitoring system (ARSENAL). ARSENAL is aircraft equipped with hyperspectral data sensors, LIDAR and high resolution visual camera. For vegetation analysis the most informative spectral bands of visible and near infrared spectral region were obtained. LIDAR data was used to estimate vegetation structure. Visual, high resolution images were acquired for validation purposes and sample data collection in field expeditions. On each study area one field expedition that consisted of habitat expert with remote sensing data usage experience and several voluntary students of nature sciences was organised for reference data collection. Experienced mire habitat expert Liene Auniņa prepared list of criteria for habitat mapping and quality measures.

RESULTS OF LAKE ENGURE NATURE PARK

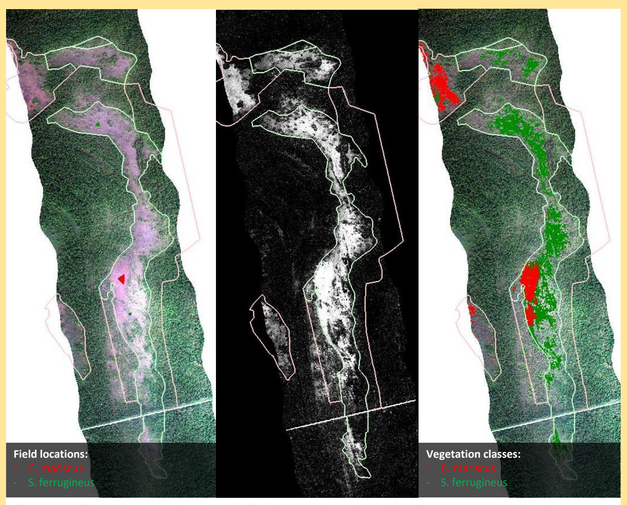


Analysed spectral similarity among reference data locations on spectral images of *Cladium mariscus* and *Schoenus ferrugineus* collected on field.
Spectral information of both plants has similar pattern, however wavelengths are different in 650...730 nm range. The difference allows to classify the species seperately on remote sensing data.


Aerial RGB colour image with registered EU protected habitat 7210* on Latvian Nature Data Managment System (DDPS Ozols, 2014) in one part of the area



Aerial RGB colour image covered with classification of tree/shrub cover and with swamp sawgrass *Cladium mariscus* cover in the area



Process of *Schoenus ferrugineus* and *Cladium mariscus* identification on remotes sensing data in the area. Left image: field sample locations for both species on aerial RGB image. Middle image: Mixture tuned match filtering image of S. ferrugineus. Right image: Final classification image for both species indicating areas with the highiest probabilty of the particular species occurence.

CONCLUSIONS

The study indicated that the remote sensing data method is suitable and accurate for open mire landscapes to detect habitat and mire structure spread. It detected analysed species highly accurate and therefore can help to define more precise habitat borders. Disadvantage of the method is detection inability of ground vegetation under tree cover. However, advantage is precise mathematical calculations of tree cover, high and the structure spread which is usually done by habitat expert guess in field conditions. Such expert measure cannot be repeatable, remote sensing data analysis allow to standardize, repeat the measure and the same data analysis and calculation method to apply for another peatland which gives more accurate comparison. The developed method can improve accuracy of habitat mapping and quality assessment and significantly ease, shorten field job of habitat experts and could be cost-effective especially for large, complex peatland areas. The developed airborne remote sensing method for habitat mapping and quality assessment is adjustable also for other habitat types.

The study was part of a project "Inovatīvas attālās izpētes metodes adaptēšana ES nozīmes aizsargājamo biotopu kartēšanai un stāvokļa novērtēšanai" (No. 1-08 /159/ 2014) that was supported by Latvian Environmental Protection Fund.