Automatic generation of shallow ditch network in forest using LiDAR data and multispectral satellite imagery

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Introduction

- Due to climate change winter temperatures and precipitation are expected to increase, while snowfall is expected to be reduced. In these conditions water is more likely to accumulate in depressions, depending on sediment and soil type.
- Aim of this study is to develop methods for automatic surface drainage system generation using LiDAR (Light detecting and ranging) data and Sentinel-2 multispectral satellite imagery to improve water regime in forest.

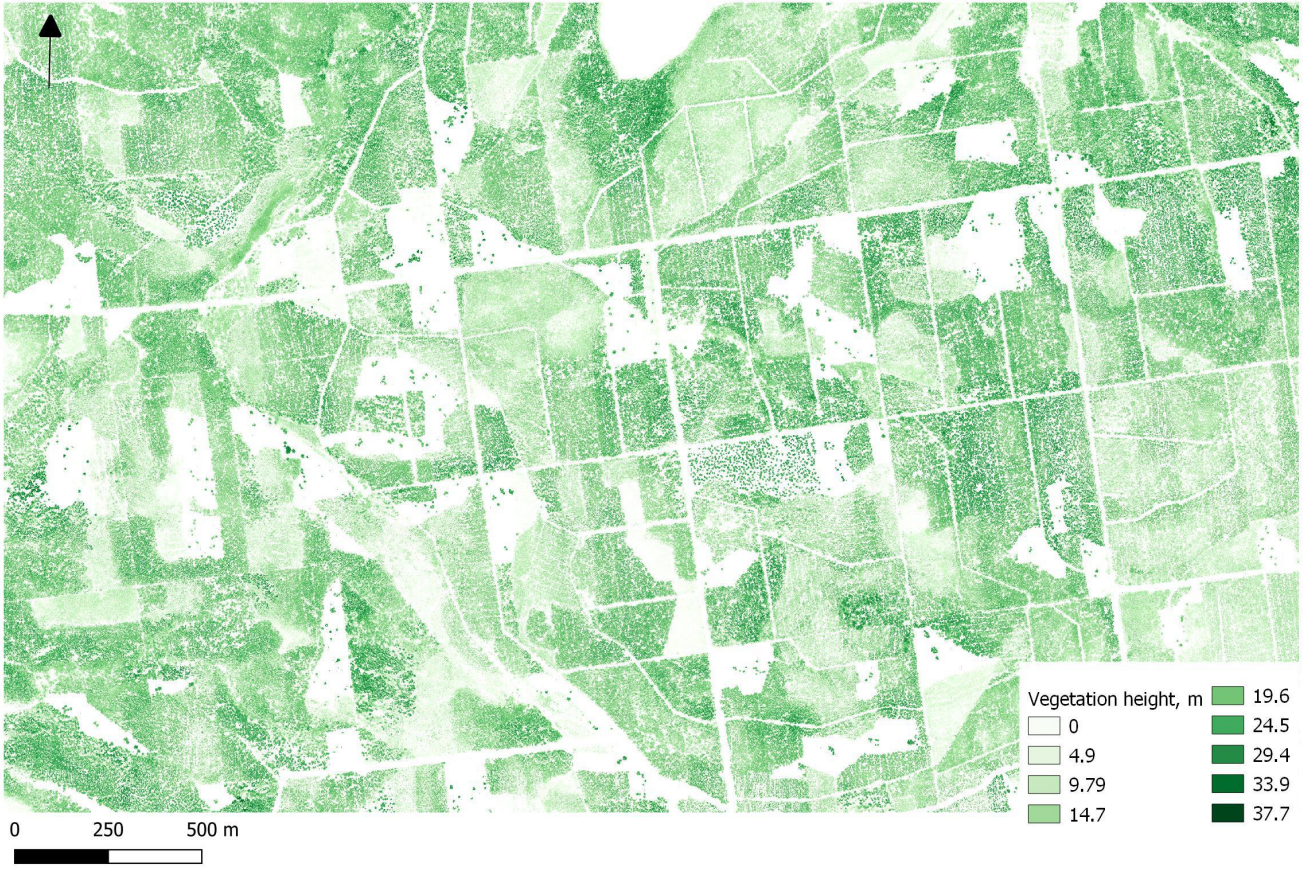
Materials and methods

LiDAR data is used for mapping of depressions in DEM (digital elevation model), for generation of surface water runoff and CHM (canopy height model) raster maps. Multispectral satellite imagery is used for detecting and separating coniferous forest stands, deciduous forest stands and other land cover types.

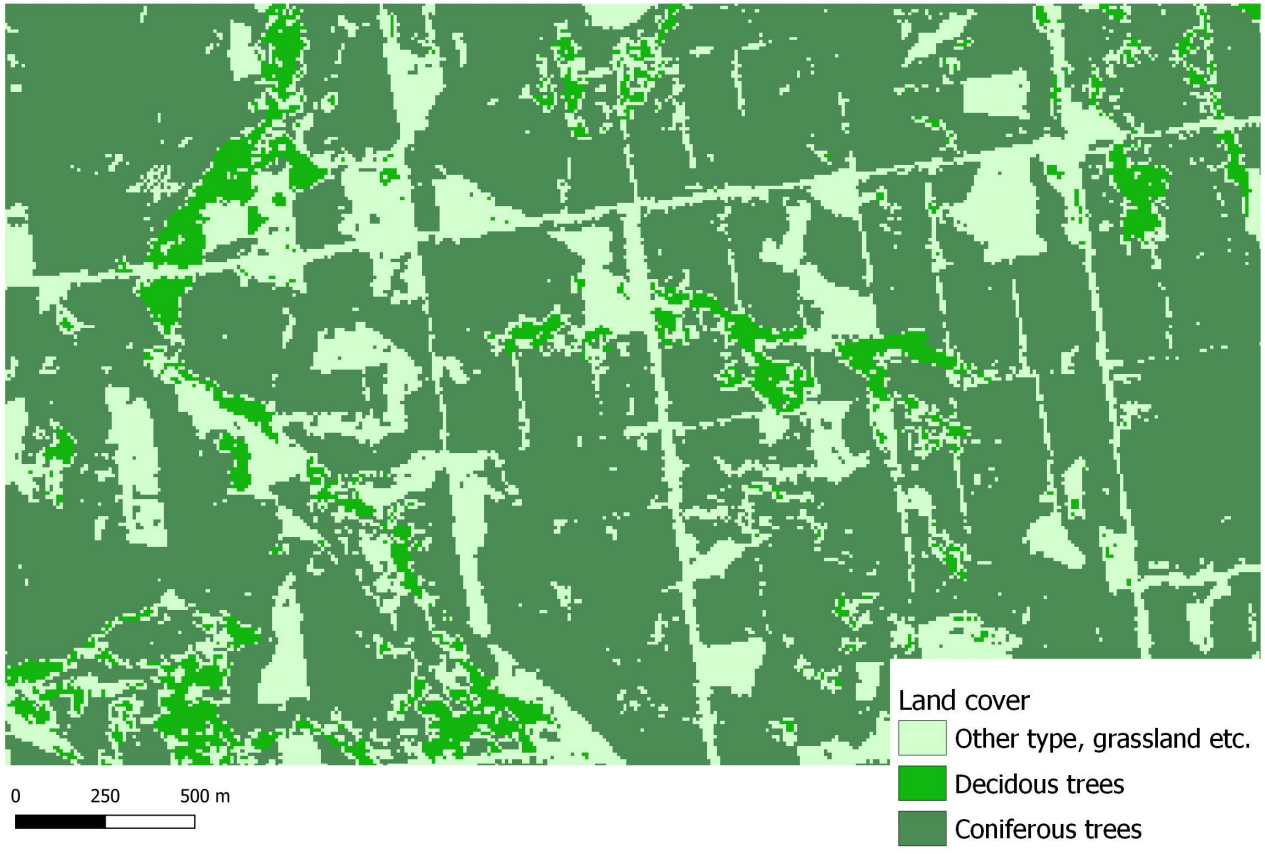
Parameters applied in the smallest cost model

- Species composition – smaller costs in deciduous stand areas;
- Relative tree height – smaller cost in areas with smaller trees;
- Natural streams – smaller costs in areas with natural streams;
- Slope – smaller cost in flat areas.

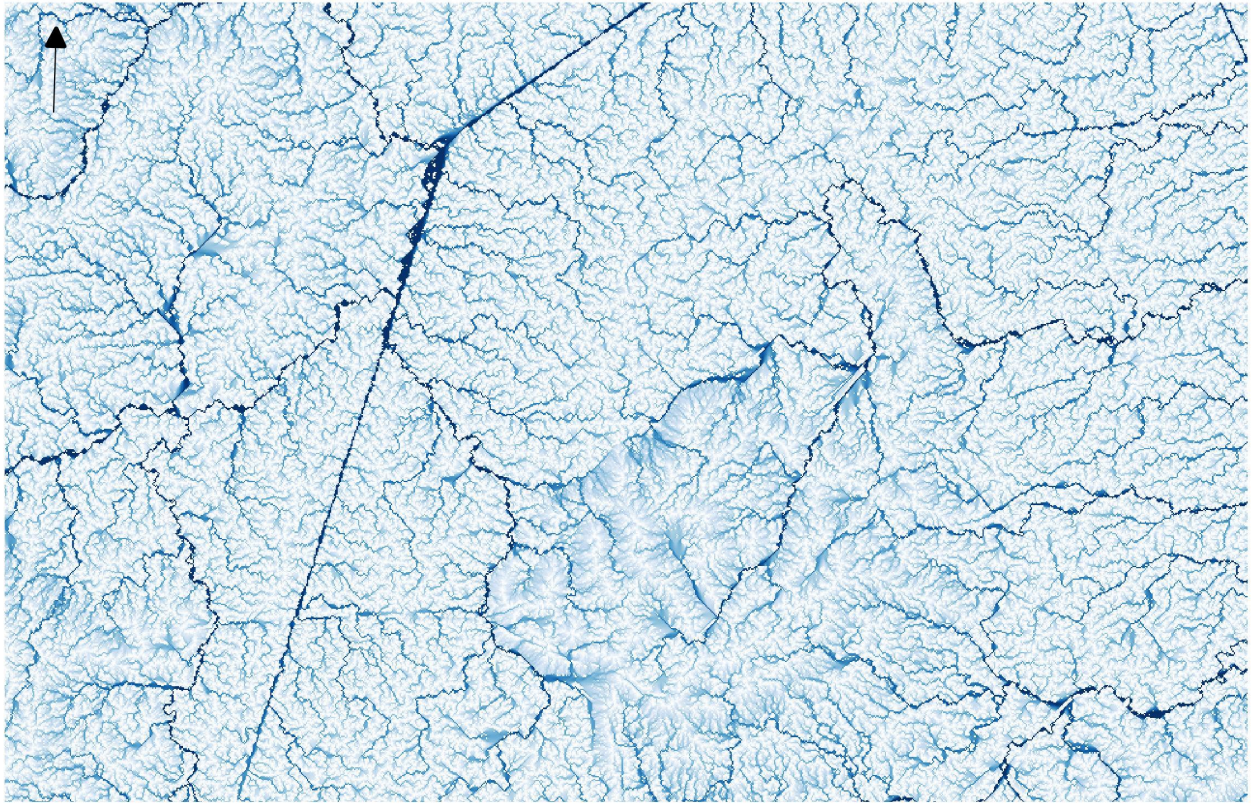
Canopy height model



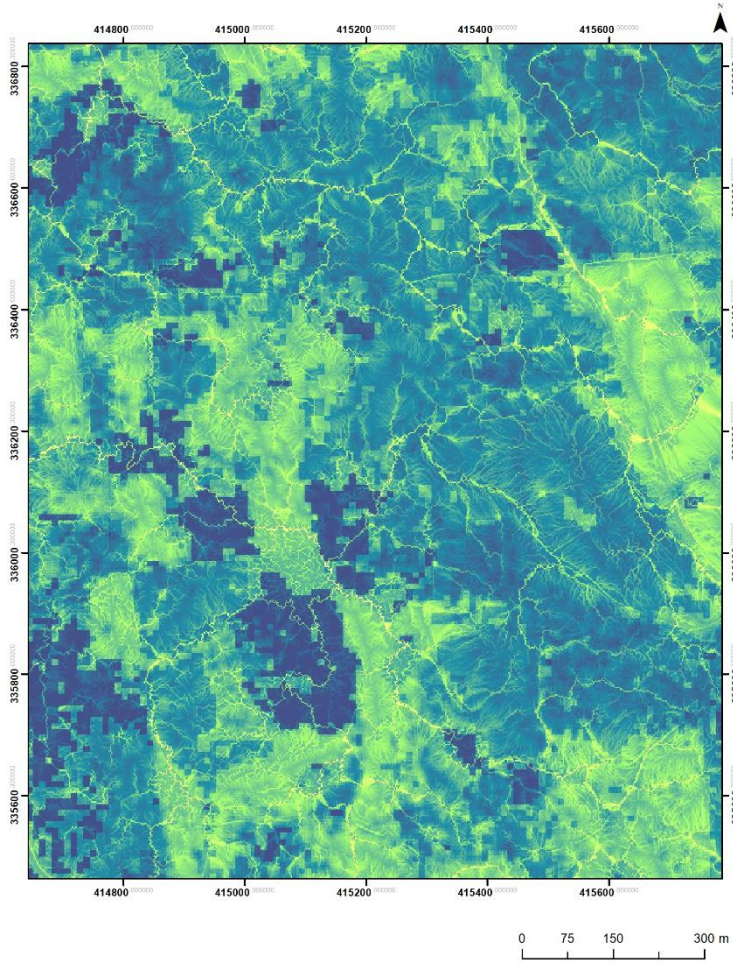
Land cover type model

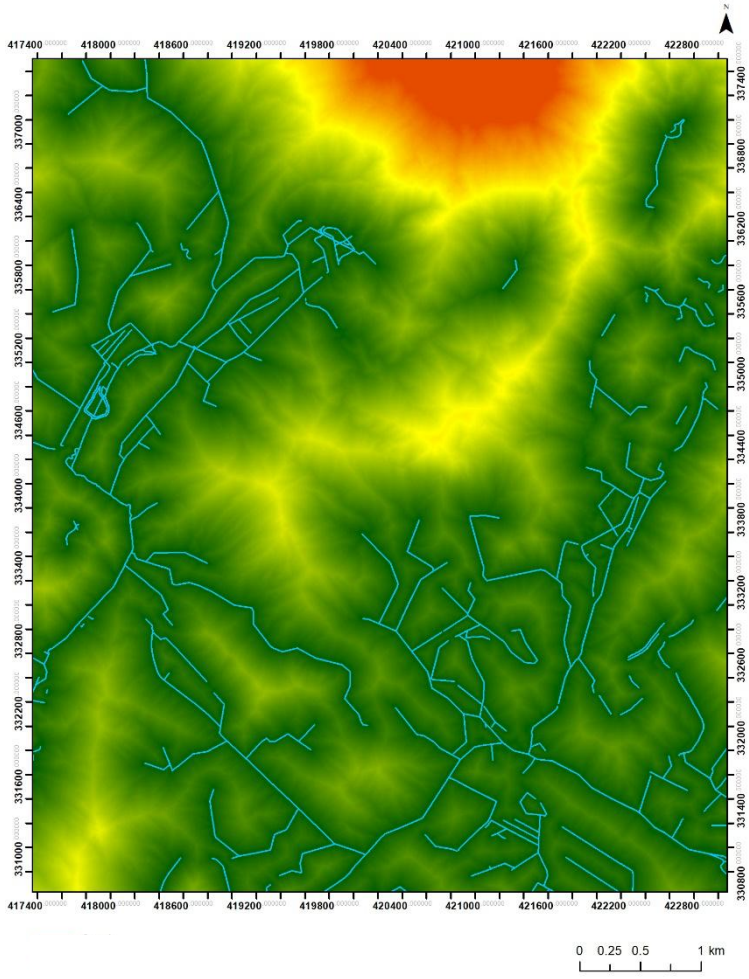


Surface flow accumulation

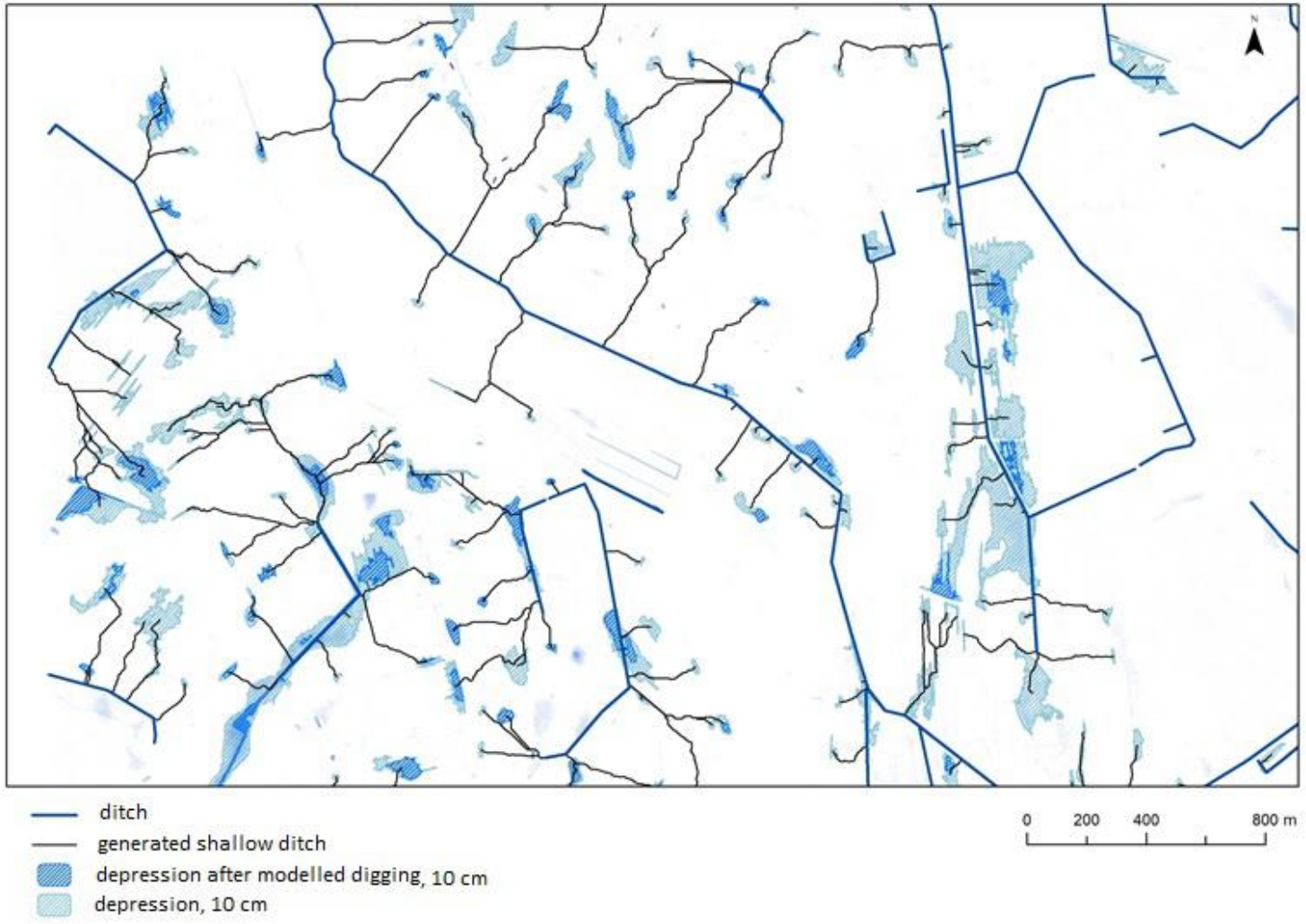


Cost surface





Results


N
ditch
generated shallow ditch
depression after modelled digging, 10 cm
depression, 10 cm
0
200
400
800 m

Conclusions

- LiDAR data and multispectral stellite imagery can be used in forest operation planning;
- Method can be applied in Latvia conditions;
- Shallow ditches are enough to drain depressions in flat terrain;
- For more accurate modelling results, correct hydrographical network with all of it’s elements are needed.

Thank you!