

**Dissertation Release**

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## **Drones assist in farming and identifying forest damage**

**Title of the dissertation** Drone-based spectral and 3D remote sensing applications for forestry and agriculture.

**Contents of the dissertation** Practising sustainable agriculture and forestry requires information on the state of forests and crops to support management. In precision agriculture, crops are observed in order to treat them precisely in the right place and at the right time, saving both production costs and the environment. Similarly, in forests, information on the composition and state of forest health are crucial to enable their sustainable management. In particular, climate-change-driven insect pests have increased, but economic and ecological losses can be reduced by the right actions if up-to-date and precise information on the health of forests is available.

In recent years, drones with cameras have evolved into a flexible way to collect remote sensing data locally. Spectral cameras provide accurate information about the reflection properties of objects, and photogrammetric methods also provide a cost-effective way to collect three-dimensional (3D) data from an object. The objective of this work was to develop and assess drone-based 3D and spectral remote sensing techniques to classify the health status of individual trees and to estimate crop biomass, various biochemical parameters such as nitrogen content, and grass-feeding quality. The work developed a processing chain in which spectral and 3D features were extracted from remote sensing data. Then, combining the features with observations and reference measurements collected from plants, machine learning models were developed for tree health classification and estimation of crop-related parameters.

This work was the first to demonstrate the ability of drone hyperspectral data to map the health status of a forest by classifying individual trees infested by bark beetles. The results of the work also showed that drone-based mapping offers a great tool to estimate agricultural crop parameters which can be applied to the optimization of various precision agriculture tasks.

**Field of the dissertation** Geoinformatics

**Doctoral candidate** Roope Näsi, M.Sc. (Tech.), born in 1989 in Alahärmä, Finland

**Time of the defence** 14 December 2021 at 12:00 hours

**Place of the defence** Online via Zoom; <https://aalto.zoom.us/j/63856992143>

**Opponent** Dr Zbynek Malenovsky, University of Tasmania, Australia

**Supervisor** Professor Riku Vahala, School of Engineering, Aalto University, Finland

**Electronic dissertation** <https://aaltodoc.aalto.fi/handle/123456789/111325>

**Doctoral candidate's contact information** Roope Näsi., Aalto University, Finnish Geospatial Research Institute FGI, roope.nasi@nls.fi, phone +358 29 531 4860