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Wild boar damage mapping in agricultural grass and wheatlands using unmanned aerial vehicle data

There has been an increase in wild boar population growth in Sweden leading to more wild boar damage to agricultural lands. To aid the creation of differentiated and precise mitigation strategies for this conflict, this master thesis developed three methods that automatically transform Unmanned Aerial Vehicle (UAV) data into high spatial scale (centimeter-level) damage mappings using data from agricultural grass and wheatlands in Boo, Hjortkvarn Municipality, Sweden.

Two developed methods, called object and pixel-based classification, focused on using two-dimensional UAV data to create wild boar damage mapping in grass and wheatlands. The object-based method has been found useful by related studies for this specific application but has the disadvantage of being computationally heavy. It was therefore interesting to also investigate the pixel-based classification which is a computational lighter approach. The input data for these methods consisted of ortho-mosaics containing wavelength bands Red, Green, Near Infrared, Red Edge, and five derived bands which were the Normalized Difference Vegetation Index and four texture-based bands. The methods applied the machine learning classifiers Random Forest (RF) and Support Vector Machine (SVM). The best overall performance was achieved by the object-based SVM classification with an overall accuracy of 91% and 85% for grass and wheatlands respectively. The SVM had put the most importance on the texture values during the classification. There was an agreement of about 80% between the object and pixel-based damage mapping where similar damage locations were mapped but the pixel-based mapped the damages in those areas less dense.

The third method developed in this thesis was a point cloud height threshold classification. This method used a UAV photogrammetry-derived point cloud to create damage mappings for wheatlands. It is based on applying a threshold on the elevation difference between non-damaged (i.e. wheat plants) and damaged areas (i.e. damage pits). The performance showed an average detection of the validation data of only 19% where it failed to map most of the damages. The performance could be explained by the too-low-density point cloud that was used for the damage mapping.

Prospects can be related to scaling up this application to the national level using Airborne data and to creating an automatic damage type discrimination that can classify the mapped damages to their exact type of damage (e.g., wild boar, machinery, drought, deer, etc.)

Keywords: Physical Geography and Ecosystem analysis, Unmanned Aerial Vehicle, Wild Boar, Agriculture, Machine Learning, Random Forest, Support Vector Machine, Geo-information Science, Remote Sensing, RStudio

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Master degree project 30 credits in GIS and Remote Sensing, 2024
Department of Physical Geography and Ecosystem Science, Lund University. Student thesis series INES nr xx