# Forest Damage – Bark Beetle Identification Using Remote Sensing in Latvian Territories – Summary

**The problem:**
In the last few years, the number of natural disturbances induced by the European spruce bark beetle (*Ips typhographus L.)* in Latvia has increased, posing a danger to the forest ecosystems of the country. Thus effective forest damage-bark beetle identification systems are needed to minimize the risk of outbreak and economic loss.

**The solution:**
Remote sensing - the analysis of the physical characteristics of an area by measuring its reflected and emitted radiation at a distance - presents a potential alternative to the often costly and laborious field campaigns to identify this pest. Very few studies of remote sensing methods for bark beetle detection in Latvian forests, however, have been developed, and only limited information on infested areas is publicly available.
This means that, for the creation of new datasets and the development of serviceable identification systems, data with high spatial resolution, which can identify individual infested trees, is needed. This inhibits the use of conventional multispectral remote sensing data such as Landsat-8 and Sentinel-2 imagery.

**Unique approach:**
A suitable data source, however, is the aerial imagery, consisting of true-colour RGB and colour-infrared CIR orthophotos, and LiDAR point cloud data obtained by the Latvian Geospatial Information Agency for the entire country roughly every three years. In this study, for the first time, the ability of this data to help identify red-attack stage infestations of the European spruce bark beetle has been evaluated.

**Methodology:**
A random forest algorithmic model was developed and validated using for shadow and forest clearing masked orthophotos.
The masks were derived from the orthophoto and LiDAR data via different image processing techniques. And the ground-truth data for training and testing the model were obtained by manually classifying RGB orthophotos by foliage colour, using known infestation areas from field surveys.

**Results:**
The model was able to discriminate between healthy and red-attacked trees on a pixel-by-pixel basis with an accuracy of 99% for the study area.
This study highlights the potential use of such local remote sensing imagery – which many European countries currently produce - as an effective tool for red-attack stage bark beetle outbreak identification. Additionally, it highlights the necessity of increased temporal resolution of this data, as well as more detailed in-situ data for future implementation and augmentation of this method in Latvia.