

FUSION OF HYPER-SPATIAL (LIDAR) & HYPERSPECTRAL DATA IN FOREST STUDY

The fusion of AISA hyperspectral data and LIDAR data makes it possible to characterize forest canopy in terms of tree species and health, tied to the stand height and structure.



Sidney Island

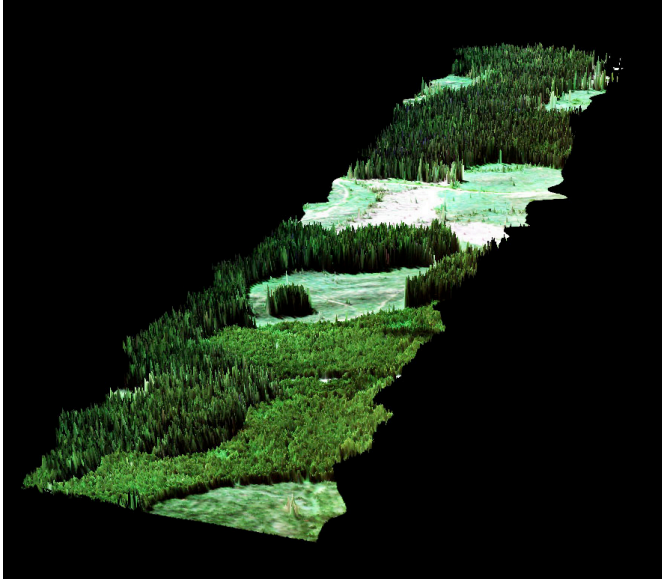
In this forestry application example, the University of Victoria, Canada, flew over Sidney Island and collected data with an AisaDUAL system and a LIDAR system. AisaDUAL collects hyperspectral image data in the range of 400 - 2500 nm. Orthorectification was made to the LIDAR data. The spatial resolution of the hyperspectral data was 2 meters. LIDAR and AISA hyperspectral data were acquired concurrently allowing co-registration between the two data sets.

At first a two-step process is applied to LIDAR data. During first step a Digital Surface Model (DSM) is created. That model includes not only bare earth model, but also elevation of trees and other features with any height. DSM is resampled to same resolution with hyperspectral image and used for orthorectification of hyperspectral AISA data. The second step of LIDAR data processing is vegetation-ground classification, where software from company TERRASOLID, Finland, is used in this case.

For both visualization and analysis purposes the hyperspectral data is overlaid on the surface model created from LIDAR data. This will aid in identification of desired targets, like tree-tops. Eventually targets are classified, like for tree species and health, using for example Spectral Angle Mapper replenished with some other sophisticated methods.



Cut block at the top of the island. The largest tree in the centre is approximately 4 meters



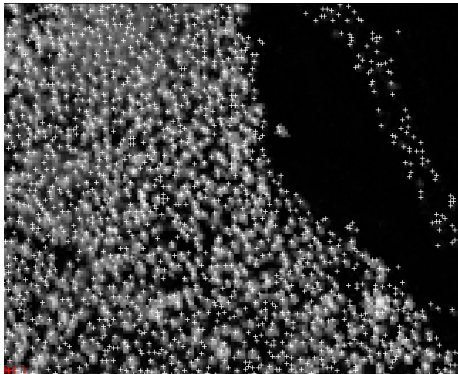
Part of a single flight line

In this second example, an area of 60,000 hectares from central British Columbia was analyzed. The spatial resolution was 2 meters. The first image shows part of a single flight line. AISA data is draped onto the LIDAR canopy height model (LIDAR data normalized for topography).

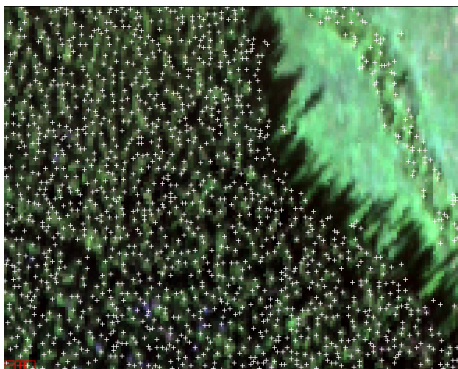
For the analysis, canopy height model with tree tops extracted was created from the LIDAR data. The sunlit portion of the tree is not always the top. Therefore, also a 2x2 pixel search was done to locate the highest pixel in the hyperspectral data and to extract a spectrum for each tree.

From this, a tree list with X, Y and Z data as well as the spectrum for each tree was created, and used for analysis, like tree species and health classification.

All the analytical tools in this work were developed by the University of Victoria using IDL.



Small sample of the LIDAR canopy height model with tree tops.



AISA data with tree tops as defined by the canopy height model. From this image, tree lists (X,Y,Z) with associated spectra for each tree have been developed. These spectra are being used to assign species to the individual trees.