

HYPERSPECTRAL REMOTE SENSING AND ITS APPLICATIONS

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Abstract

Hemlock woolly adelgid and other forest pests, including invasives species, are a problem for our forests and ecosystems. Surveying and monitoring these problems are done at great cost in both money and time. With the use of hyperspectral remote sensing, vegetation identification and vegetation stress can be analyzed remotely, saving time and surveying a larger area. Hyperspectral Remote Sensing is the process of gathering spectral signatures remotely. Everything has its own signature, similar to that of a fingerprint, making each unique. Helicopter Applicators Incorporated utilizes an AISA Eagle 1K sensor system to gather and analyze these spectral signatures.

Helicopter Applicators Incorporated (HAI) was established in 1974 as an aerial application company, and has since branched into the field of remote sensing. HAI now utilizes a radiometric infrared camera, three-chip digital daytime camera, and hyperspectral sensor system. These systems are mounted on helicopters in gyro-stabilized turrets. The AISA Eagle 1K has a wider swath ability which allows it to be flown higher and therefore gather more data in less time, while at the same or better resolution than other sensors. With customized hardware and software, HAI offers a full end product.

To demonstrate this, Helicopter Applicators was involved with two vegetation management projects in 2004. To perform a mission such as this, HAI is provided a GIS-ready shapefile which is used for data acquisition. The

data-cubes are then calibrated and corrected to produce reflectance files. These files are then analyzed spectrally to produce results identifying species and/or stress levels, based upon ground truth spectra or coordinates previously gathered. The images are then geo-rectified and made into GIS-ready files. The species or stress levels are also made into GIS vectors individually so that results can be evaluated from flight to flight, comparable from year to year.

HAI flew 400 linear miles in the Kiski-Conemaugh Watershed for invasives identification. West Virginia University gathered spectra via a handheld spectrometer. The mission was to search for 13 invasives species and then compare results to volunteer data throughout the watershed. HAI conclusively located mile-a-minute, tree of heaven, garlic mustard, purple loosestrife, Norway maple, and phragmites. The second mission was in the Catskill Mountains in New York in cooperation with The University of New Hampshire. HAI flew two polygons to determine hemlock locations and hemlock health, based on GPS ground truth by UNH. Results are still pending but preliminary results are encouraging with both classification and health distributions being qualitatively appropriate. Despite the lack of conclusive results from these two missions, both have shown that hyperspectral imaging will be valuable for detection and delineation, especially with the bands and flexibility of this sensor flown by Helicopter Applicators Inc.