APPROACHES TO DETECTING AND MONITORING THE EMERALD ASH BORER IN NORTH AMERICA

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The Emerald Ash Borer (EAB), Agrilus planipennis (Coleoptera: Buprestidae), is an invasive species of beetle, originating in China, that first appeared in the Great Lakes region of the United States and Canada in 2002. While its introduction is fairly recent, populations of EAB have been reported in Illinois, Michigan, Indiana, Ohio, West Virginia, Pennsylvania, Maryland, southern Ontario, and as far as Quebec as of 2008. The problem is currently too widespread for individual tree assessments to be effective because of the sheer size of the area the pest now occupies and, by relation, the innumerable ash trees it must now impact. Moreover, management strategies to arrest the spread by establishing ash-free zones or barriers (over 90,000 ash trees were destroyed in a swath from Lake St. Clair to Lake Erie) have proved unsuccessful. Because the pest crosses political borders with ease, measures and regulations to combat it become, not surprisingly, inconsistent from region to region. The requirement for an alternative approach in the identification and monitoring of infested ash trees has lead to investigating various types of remote sensed imagery to determine its potential in detecting both affected and healthy ash trees in an accurate, efficient, cost effective and repetitive manner.

A combination of the relatively low abundance of ash trees in most mixed natural forest ecosystems and overlapping habitat ranges for numerous ash species make automated identification of ash trees difficult with coarse spatial resolution imagery such as Landsat Thematic Mapper. Traditional forestry-based approaches to tree species identification using remote sensing have often implemented high spatial resolution airborne imagery that only covers relatively small areas and is generally expensive to acquire. Such identification with airborne imagery is often visual rather than automated, as the latter requires multispectral imagery.

In contrast, this current problem would require imagery with a much greater coverage area at a far more reduced cost while still having relatively high spatial and spectral resolution characteristics in order to be effective for implementation in a full scale operation. It is difficult to predict which of these required properties of remote sensing imagery are most vital for detecting ash species in natural stands and if these products are even capable of detecting the small spectral changes as a result of the EAB attacks.

A large inventory of remotely sensed imagery has been assessed based on these properties; a few of these have been selected to represent a broad range of image resolutions (spatial and spectral) and were deemed viable for their potential use in detecting ash damage and EAB spread. The following research assessed the ability to automatically detect ash in sites known to contain trees of varying degrees of damage, using the selected sets of images. The test sites were individually catalogued using a GPS in past field work. In addition, imagery was collected over a multi-year time span, starting with imagery from prior to EAB introduction and ending with imagery from the summer of 2008; this data was used to produce a temporal representation of ash spectral change as a result of EAB infestation. Finally, additional regions known to contain EAB (but regions that were not visited during past field work) were used to test these ash spectral signatures as well as several vegetation indices in their ability to accurately detect the pest.