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The Early Detection of the Emerald Ash Borer (EAB) Using Advanced Geospacial Technologies

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Abstract. The objectives of this study were to exploit Light Detection And Ranging (LiDAR) and very high spatial resolution (VHR) data and their synergy with hyperspectral imagery in the early detection of the EAB presence in trees within urban areas and to develop a framework to combine information extracted from multiple data sources. To achieve these, an object-oriented framework was developed to combine information derived from available data sets to characterize ash trees. Within this framework, individual trees were first extracted and then classified into different species based on their spectral information derived from hyperspectral imagery, spatial information from VHR imagery, and for each ash tree its health state and EAB infestation stage were determined based on hyperspectral imagery. The developed framework and methods were demonstrated to be effective according to the results obtained on two study sites in the city of Toronto, Ontario Canada. The individual tree delineation method provided satisfactory results with an overall accuracy of 78 % and 19 % commission and 23 % omission errors when used on the combined very high-spatial resolution imagery and LiDAR data. In terms of the identification of ash trees, given sufficient representative training data, our classification model was able to predict tree species with above 75 % overall accuracy, and mis-classification occurred mainly between ash and maple trees. The hypothesis that a strong correlation exists between general tree stress and EAB infestation was confirmed. Vegetation indices sensitive to leaf chlorophyll content derived from hyperspectral imagery can be used to predict the EAB infestation levels for each ash tree.