THE PRACTICAL UTILITY OF HYPERSPECTRAL REMOTE SENSING FOR EARLY DETECTION OF EMERALD ASH BORER

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ABSTRACT

Hyperspectral remote sensing technology has been used in forest ecology research for the last decade to examine landscape scale patterns of foliar chemistry (nitrogen, cellulose, and lignin) (Martin and Aber 1997), stand productivity (Smith et al. 2002), and soil nitrogen dynamics (Ollinger et al. 2002). More recently, techniques have been developed to map the location of eastern hemlock stands and tree stress along the hemlock wooly adelgid infestation front (Pontius et al. 2005). To date, all of these efforts have relied on a NASA-operated sensor that is dedicated to support research projects.

Commercially available hyperspectral remote sensing imagery has become operationally viable. A successful demonstration project (jointly sponsored by APHIS and USFS) was conducted in 2006 over EAB infested areas of Michigan and Ohio (see the previous abstract, this publication, by Pontius et al.). It is possible to create detailed maps showing the location of *Fraxinus* spp. and to map pre-visual stress for forest tree species, including *Fraxinus* spp.

Early detection of EAB infestation is an important aspect of any management or eradication strategy. Hyperspectral remote sensing data in existing detection and management strategies to enhance our efforts in dealing with this pest. Complications include the expense of imagery, complex image processing techniques that require a high level of analyst expertise, and the time required to produce final maps.

In order to examine whether this technology is ready for integration into existing survey and detection efforts, we outlined a framework for a hypothetical project to be accomplished during the summer of 2008, with resulting species and stress maps available by January of 2009. The hypothetical project would map 2 million acres at 4-meter spatial resolution along the infestation front. In order for a project of this scope to be successful, it would require input from field personnel familiar with the targeted areas (Figure 1). The other variable to be considered when evaluating operational viability is cost. Currently, the imagery is commercially available, but the process for analyzing it is still in development and consequently not available on a commercial basis. The cost of this hypothetical project is approximately $350,000, or about 18 cents per acre.

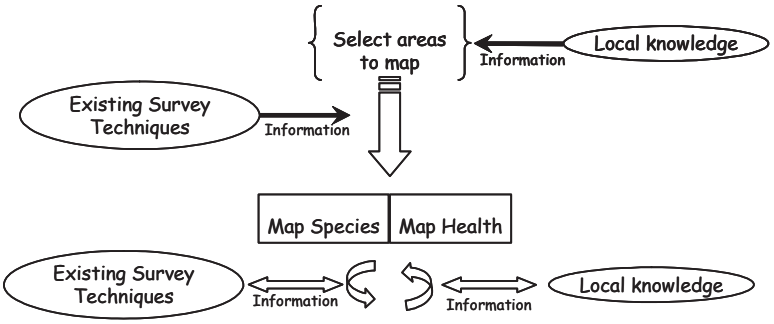

Figure 1. A conceptual model for integrating local knowledge and existing survey techniques into the selection of areas to map. Existing survey techniques and local knowledge are also integrated into species and stress maps in order maximize the usefulness of the data products.

We have documented the conceptual framework along with all the relevant variables in order for a land management agency to evaluate the practicality of using hyperspectral remote sensing imagery to facilitate early detection of EAB infestation.

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