HYPERSPECTRAL REMOTE SENSING FOR EARLY DETECTION OF INVASIVE PESTS

Jennifer Pontius[1], Mary Martin[2], Lucie Plourde[2], and Richard Hallett[1]

[1]USDA Forest Service, Northern Research Station
271 Mast Road, Durham, NH 03824
jennifer.pontius@unh.edu

[2]Complex Systems Research Center, University of New Hampshire
Morse Hall, Durham, NH 03824

ABSTRACT

Use of hyperspectral technologies to assess vegetation stress has been well-documented over the past several decades. However, taking these technologies from research to management applications has proven challenging. A multi-agency effort was conducted in 2006 to examine the capability of a commercially available sensor (SpecTIR VNIR) to map ash decline due to the exotic emerald ash borer (EAB) in Michigan and Ohio. Previously successful calibration techniques involved relating detailed decline measurements on the ground to known stress-sensitive indices and wavelengths from airborne hyperspectral imagery. Following these methods, a six-term linear regression model based on chlorophyll and stress-sensitive indices predicted a 0-10 continuous decline rating with an $R^2 = 0.71$ and an average jackknifed residual of 0.61. Translation of this continuous rating to a five-class variable (commonly used in forest health assessment) resulted in 97% accuracy. The ability of this instrument to assess early decline is based upon calibration with field measurements of photosynthetic activity, a drop in which is typically the first symptom of forest stress. Use of this measurement enables early identification of infestations and could be used to improve the efficacy of control and monitoring efforts. While this decline prediction is not stress- or species-specific, it will enable land managers to target field efforts and monitor forest health across larger geographic scales.