Special Technology Development Program
Progress Report

PROJECT NUMBER: NA-2001-01 AWARD NO: 01-DG-11244225-285

PROJECT TITLE: Quantifying Hemlock Forest Health in the Mid-Atlantic States Using Remotely Sensed Change Detection Techniques

PROJECT STATUS: Continuing

EXPECTED PROJECT DURATION: 2 years 10/1/00 – 9/30/02

EXPECTED COMPLETION DATE OF THE PROJECT: 2002

SUBJECT: Monitoring Remote sensing

STATUS OF SUBJECT SPECIES: non-native noxious

PROJECT OBJECTIVES: To use remotely-sensed change detection techniques to quantify the spatial extent and severity of hemlock dieback in the Mid-Atlantic states associated with the infestation of the insect, hemlock woolly adlegid (HWA) (*Adleges tsugae*).

BRIEF DESCRIPTION OF THE PROJECT:

Note: Funding did not become available until September 1 2001. The following summary reports progress since that time.

1. Searched the archives of the USGS EROS Data Center for leaf-off (late fall through early spring months) Landsat satellite imagery from the early 1980's to the present. We selected scenes that were snow- and cloud-free for much of the study area. Six scenes of Landsat 5 TM data for northern NJ and eastern PA were previously purchased terrain-corrected. These scenes provided the data for analysis and modeling of hemlock condition, described below. More recently, we required additional Landsat 7 ETM scenes for states in southern New England and the Mid-Atlantic, to extend our monitoring efforts to those regions.
2. Developed a predictive model of hemlock condition as four classes (Healthy-Light, Moderate, Severe, and Dead) based on multivariate Discriminant Analysis of satellite imagery and field (ground) data. Based on field data, the model is assessed as 82% accurate. We verified the applicability of the model to other time periods and to sites outside the study area, namely the Delaware Water Gap National Recreation Area (DEWA) of the NPS in eastern PA and western NJ (in progress).
3. In cooperation with personnel from the USDA Forest Service (Brad Onken and Michael Montgomery), we developed a simple canopy-rating method for hemlock forest plots, based on the condition of individual hemlock trees in a 10 BFA prism plot, roughly representing one Landsat pixel in area. Personnel from the USDS Northeast Area

Research Station and from Rutgers University have collected field data from more than 100 hemlock forest plots throughout DEWA and northern NJ. Data collection is still in progress and will continue into November.

4. Future goals include monitoring hemlock condition throughout the New England and Mid-Atlantic regions using the methods and models developed from this research effort. In addition, we will address on-going challenges in the remote sensing of forest health, pertaining to image processing and change-detection methodology. We will continue to refine the collection of ground data in cooperation with state and federal forest health agencies.

CHANGES TO ORIGINAL PROJECT SCOPE OR OBJECTIVES: None

ADDITIONS TO ORIGINAL PROJECT SCOPE OR OBJECTIVES: None

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COOPERATOR INVOLVEMENT: Listed above

PRODUCTS AND DUE DATES:

The end products of this research effort will consist of:

Year 1

1. An operational methodology for mapping hemlock forest and quantifying forest condition using multiple dates of Landsat TM change detection techniques.

2. An assessment of the operational efficacy of the methodology and models elsewhere in the Mid-Atlantic region using existing field data.

Year 2

1. A base map of pre-infestation (1984) hemlock stands in the Mid-Atlantic study area.
2. A change map showing the severity of hemlock decline across the study area along with an estimate of the uncertainty.
3. An estimate of the extent and severity of hemlock decline in the study area, along with area estimates by damage class by state.

STATUS OF PRODUCTS/PRESENTATIONS: (see 1-3 in project description above)

ACCOMPLISHMENTS TO DATE:

Products:

Publications: Discriminating *Tsuga canadensis* Hemlock Forest Defoliation Using Remotely Sensed Change Detection, Journal of Nematology (in review)

Technology Transfer:

FIRST FISCAL YEAR FUNDED:

	Item	**Requested Funding**	**Expended Funding**	**Unused Funding**
FIRST YEAR				
Administration	Salary			
	Overhead			
	Travel			
Procurements	Contracting			
	Equipment			
	Supplies			
Year Totals				
SECOND YEAR				
Administration	Salary			
	Overhead			
	Travel			
Procurements	Contracting			
	Equipment			
	Supplies			
Year Totals				
CURRENT YEAR		**Requested FHP STDP Funding**	**Other Source Funding**	**Source**
Administration	Salary			
	Overhead			
	Travel			
Procurements	Contracting			
	Equipment			
	Supplies			
Year Totals				
PROJECT TOTALS				

FUNDS OBLIGATED FROM BEGINNING OF PROJECT THROUGH CURRENT FISCAL YEAR: