

Use of Multi-date Landsat TM Imagery to Map Eastern Hemlock (*Tsuga canadensis*) Decline Due to Hemlock Woolly Adelgid (*Adelges tsugae*) in Shenandoah National Park

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Hemlock woolly adelgid (HWA) was first observed in Shenandoah National Park (SNP) in the mid-1980s. Since then, this exotic insect has expanded its range throughout the park. Most stands were heavily defoliated within several years of infestation. However, several hemlock stands appear to be not affected or only moderately affected to the present date. To investigate this discrepancy in hemlock stand condition, we are analyzing satellite imagery from 1984, 1988-9, 1991-2, 1994, and 1997.

The first step is to map the initial extent of hemlock stands, using the earliest available imagery (1984). This map is crucial because it will act as a "mask", defining the extent for

future analyses. We are combining topographic factors, such as relative phenology, slope, northness (aspect), and landform index, with spectral reflectance from Landsat Thematic Mapper (TM) imagery to delineate hemlock from other coniferous forests.

Next, a vegetation index, calculated from TM data, will be used to display hemlock health for each time period. Differences in health from year to year will be quantified. The rate and intensity of defoliation will be analyzed spatially.

The final analysis will result in a hemlock vulnerability model based on the relationship of the intensity and rates of defoliation to landscape and stand factors. It is hoped that this model will aid managers in predicting the area and intensity of future HWA caused hemlock damage.

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