

NEW HAMPSHIRE VIEW 2023 - 2024 ACTIVITIES

NewHampshireView’s high impact activity for this year was an analysis to evaluate the potential of satellite remote sensing to assess eastern hemlock health in NH in cooperation with the NH Division of Forests & Lands (Figure 1). A combination of ground sampling and satellite imagery (Landsat and Sentinel 2) was employed to first create a land cover map of the areas in southern NH infected by the Hemlock Wolly Adelgid (an invasive pest) and then to map hemlock health into three decline classes (low, medium, and high). Figure 2 shows the hemlock dominated vs. non-hemlock forest area mapped from Landsat imagery. The ground data collected was divided into half used for training the Random Forest classifier and half used as reference data for an independent validation. The Landsat and Sentinel 2 imagery original bands along with selected ratios and other derivative bands were analyzed to produce the best possible hemlock health classification. The error matrix shown in Table 1 presents the results of the best classification. In this case, the Landsat imagery produced a more accurate hemlock health map with an overall accuracy of approximately 71% than did the Sentinel 2. This result is somewhat surprising given that the spatial resolution of the Sentinel imagery is better than the Landsat imagery. However, hemlock tends to grow in large patches where spatial resolution may not be an important factor.

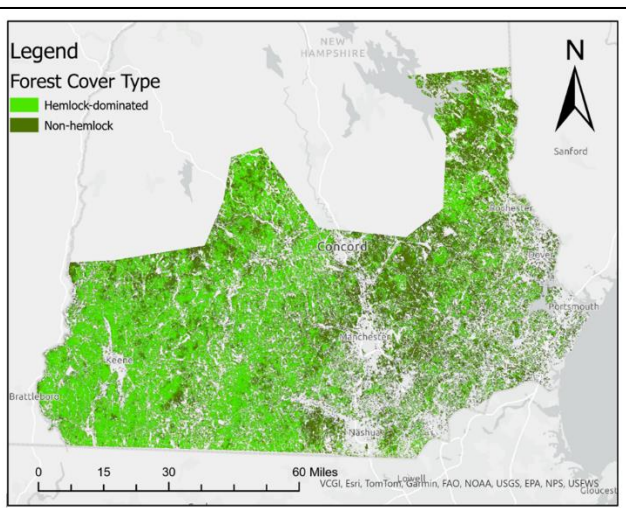


Figure 2. A map developed from Landsat imagery showing the distribution of hemlock dominated vs. non-hemlock forest cover in southern New Hampshire.

NHView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. AmericaView is funded by USGS grant agreement G23AP00683.

Hemlock Wolly Adelgid Detections

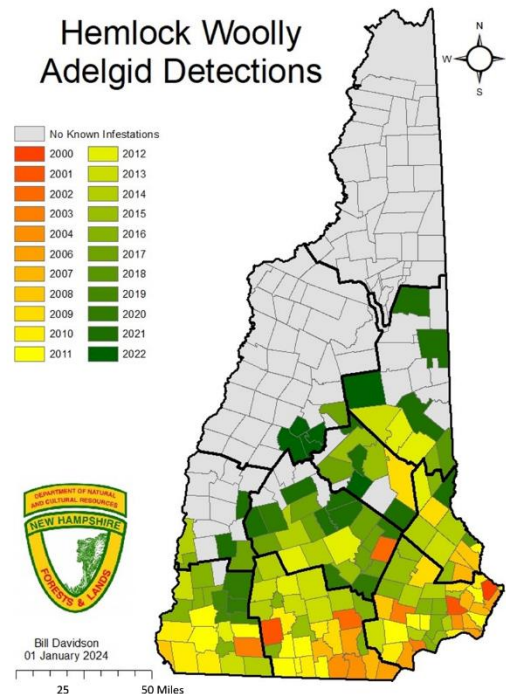


Figure 1. Map showing year the hemlock woolly adelgid was detected in the New Hampshire town.

Once the analysis was performed for the current date, the training data was then used to perform a multi-temporal analysis of the Landsat imagery for the years from 2000-2022. These results were compared to the temporal map in Figure 1 to verify the validity of the image analysis. In this way, this technique can be used to monitor the Hemlock Wolly Adelgid infestation as it progresses north in New Hampshire as a result of warming winters.

Classification Data	Reference Data			Row Totals	User's Accuracy
	Low Decline	Medium Decline	High Decline		
Low Decline	41	5	0	46	89.13%
Medium Decline	6	16	7	29	55.17%
High Decline	4	10	21	35	60.00%
Column Totals	51	31	28	110	
Producer's Accuracy	80.39%	51.61%	75.00%		70.91%

Table 1. An error matrix showing the results of the Landsat classification of the three hemlock health decline classes.

BENEFITS TO NHVIEW

- NHView Director, Russ Congalton, presented four talks on NHView work this year; one at the GeoWeek Conference in Denver, a second was an invited lecture at the University of Wyoming, the third was an invited presentation at the National Renewable Energy Lab in Boulder, CO, and the last was an invited presentation to MAXAR Corporation.
- NHView funded a graduate intern, Molly Cahill, to work in the Basic and Applied Spatial Analysis Lab (BASAL) to aid our research. Molly's work on hemlock wholly adelgid is reported on the front of this fact sheet.
- Shea O'Connor, an undergraduate researcher in the BASAL lab, presented her land cover mapping research at the University of New Hampshire Undergraduate Research Conference.
- NHView continued its support of the University GeoSpatial Support Center (GSC). This facility provides consulting and workshops on remote sensing and geospatial analysis to students, staff, and faculty. Molly Cahill presented four workshops in Spring 2024. (see pictures to the right)
- NHView supported our colleagues in the New Hampshire Division of Forest & Lands by providing expertise and aiding with analysis of imagery collected to monitor forest conditions throughout the state.



Consulting and workshops in the GeoSpatial Support Center

NHVIEW CONSORTIUM MEMBERSHIP

- **Department of Natural Resources & the Environment, UNH**
The Basic and Applied Spatial Analysis Lab (BASAL) conducts basic research on spatial data uncertainty/map accuracy and applied research applying the tools of remote sensing, GIS, and spatial data analysis to solve natural resource problems.
- **NH GLOBE Partnership, UNH**
Carries out GLOBE teacher training in atmosphere, land cover, hydrology, soil and earth system science with a focus on land cover mapping and geospatial technologies.
- **EOS-EarthData, UNH**
A digital library of Earth science data that serves scientists, educators and the public.
- **NH GRANIT GIS Repository, UNH**
A cooperative project to create, maintain, and make available a statewide geographic data base serving the information needs of state, regional, and local decision-makers.
- **Diamond Library, UNH**
The library maintains an extensive map and aerial photo collection for NH and houses the GeoSpatial Support Center.
- **Forest Watch, UNH**
A New England environmental education activity using field, lab, and satellite data analysis methods for assessing the state-of-health of local forest stands.
- **Cooperative Extension, UNH**
Offers short courses in geospatial technologies including GIS, GPS, and field mapping.
- **NH Department of Natural and Cultural Resources – Division of Forests and Lands**
State agency responsible for the forest resources of the state.
- **Dartmouth College**
- **NH Planning Commissions**

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