



Massachusetts Forest Health Mapping Standardization, Analysis and Access



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Project Overview

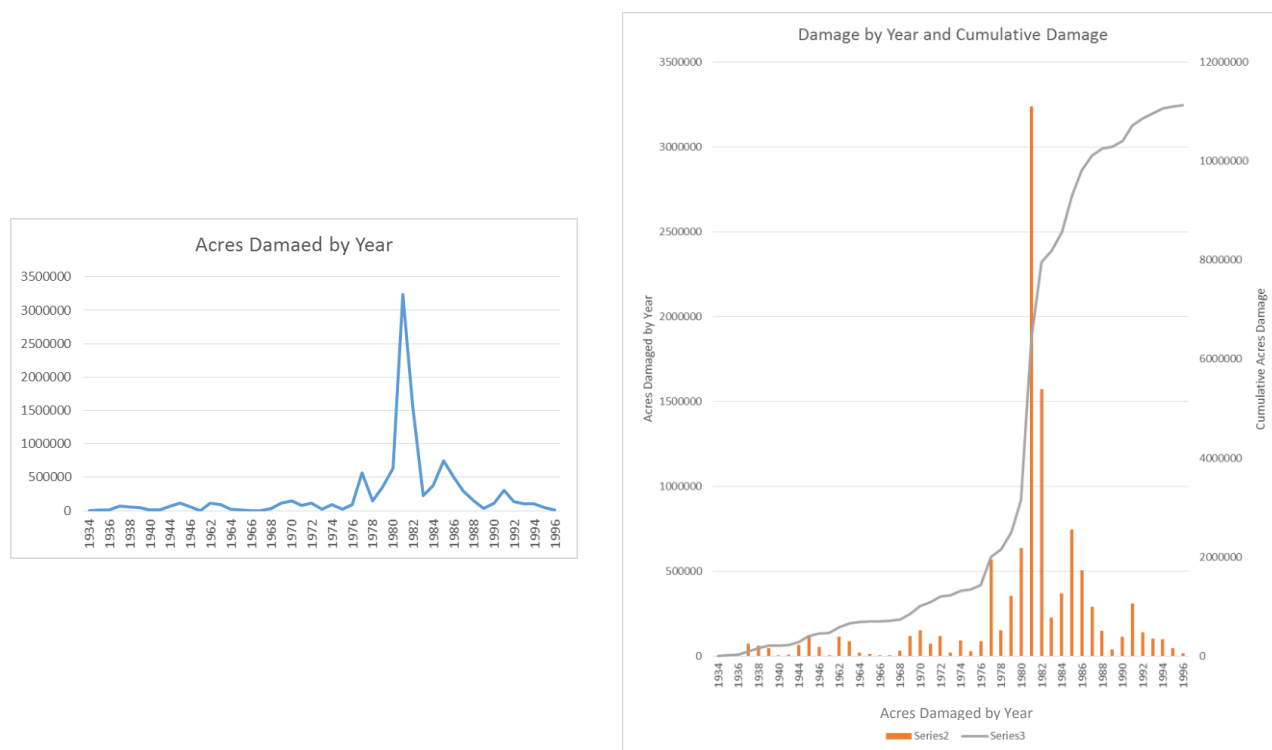
The Vermont Monitoring Cooperative (VMC) collaborated with the Massachusetts Department of Conservation and Recreation on a forest health data pilot project. The goals of this project are to expand digital holdings of forest disturbance mapping back in time, and to demonstrate ways that that data could be integrated into the existing VMC holdings. There were four main components this project. The first component of this project was standardizing historical forest health data for the state of Massachusetts. The second component of this project was aggregating the current forest health data and generating damage occurrence heat maps for high impact species. The third component of this project was exploring datasets with seasonal dryness and wetness indexes for use in forest health analysis. The final component of this project was to generate a list of researchers who have conducted forest health related research and field work in Massachusetts to compliment the aerial survey data.

Task	Products
Task 1 Standardization and Aggregation of Historical Data	<ul style="list-style-type: none"> Standardized aggregated dataset of all historical forest health surveys from 1934-1996
Task 2 Aggregation and Analysis of Data	<ul style="list-style-type: none"> Aggregated dataset of 1997-2015 forest health data Damage occurrence frequency maps of: <ul style="list-style-type: none"> Defoliation Mortality Gypsy moth total damage Gypsy moth mortality Gypsy moth defoliation
Task 3 Climate Datasets	<ul style="list-style-type: none"> List of possible datasets
Task 4 Outreach to Researchers	<ul style="list-style-type: none"> List of researchers with relevant projects and data



Task 1: Historical Forest Health Data.

Yearly flights surveying Massachusetts' forests for damage due to pests and weather were conducted over much of the last century. This historical data has been digitized and was obtained from a link that no longer exists. The old address was <http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/insect-infestation-bugs.html> and MassIT indicated that this page would not be reposted on the new website. This data includes the years 1934-1941, 1944-1946 and 1961-1996 and according to the above site, 1942 and 1943 were recorded as having no defoliation. These maps were downloaded and converted from an old file format of Arc Coverage files into a file geodatabase. They were then attributed according to the US Forest Service Aerial Survey Data GIS Handbook based on the information available in the existing attributes. These feature classes were merged into a single feature class containing all of the damaged area for all years. Statistics were then calculated across the whole dataset on cumulative acres of land



damage and on acres of damaged land per year (see Figure 1).

Figure 1. Summary statistics of the acres damaged in the historical data.

Products:

- Standardized feature classes for each year 1934-1941, 1944-1946, and 1961-1997
- Aggregated, standardized feature class containing data for all years
- Statistics on acres damaged per year



- Statistics on acres damaged by each species per year

Task 2: Current Forest Health Data

The current yearly forest health data spans 1997-2015. It is considered current because the way it is attributed follows the US Forest Service Aerial Survey Data GIS Handbook. The yearly shapefiles were converted to feature classes and then aggregated into a single feature class containing the complete data for each year. There were some Damage Causal Agent codes in this dataset that did not correspond to codes in the official list. Any duplicate codes or codes that have changed were updated in this dataset. Statistics on cumulative and yearly areas damaged also calculated for this dataset. Repeat damage occurrences were extracted from this feature class to create sample heat maps of key species and damage types (see Figure 2).

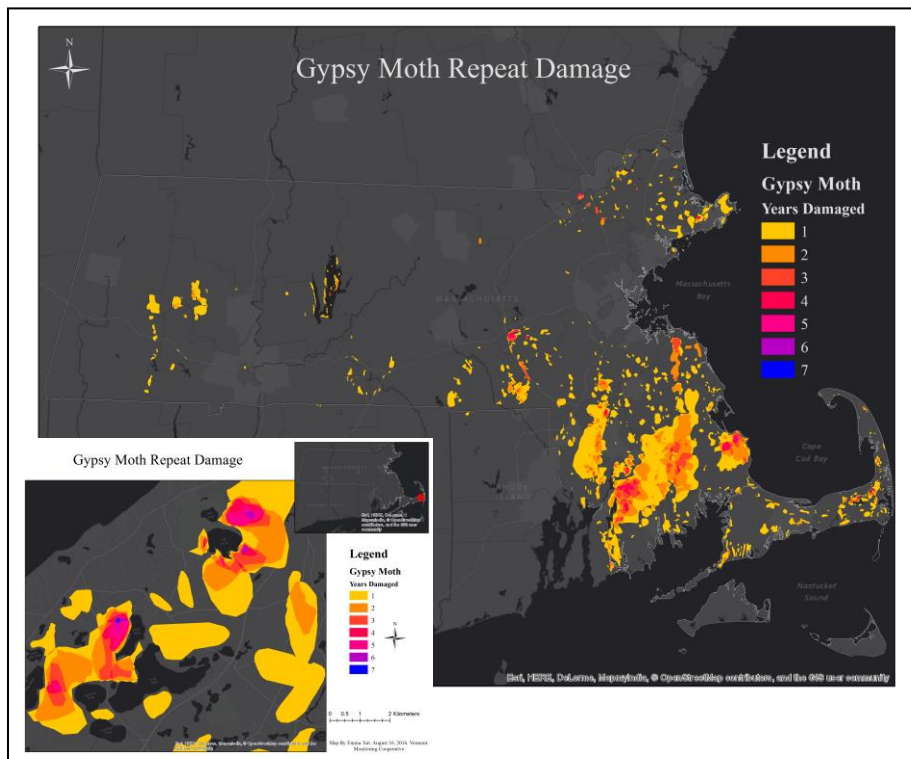


Figure 2: Sample “heat maps” of gypsy moth damage

Products:

- Aggregated dataset of all current forest health data 1997-2015
- Sample heat maps of key damage agents and damage types
- Statistics on acres of damage per year
- Statistics on acres of damage per species
- Statistics on acres of damage per year per species



Task 3: Seasonal Wetness/Dryness Index

- Northeast Regional Climate Center: The NRCC monthly maps have a precipitation departure dataset, showing the departure from the norm. These rasters have a 5km cell size.
<http://www.nrcc.cornell.edu/>
- PRISM Climate Group: PRISM has many climatic datasets available as well as tools for comparing them. These datasets are also have a course cell size.
 - Anomalies – deviations from the norm – for a variety of climatic variables and allows monthly, annual or quarterly comparisons.
<http://www.prism.oregonstate.edu/comparisons/anomalies.php>
 - A drought indicator that looks specifically at precipitation deviations from the norm.
<http://www.prism.oregonstate.edu/comparisons/drought.php>
 - annual precipitation and temperature maps for current (1981-2015
<http://www.prism.oregonstate.edu/recent/>) and historical (1895-1989
<http://www.prism.oregonstate.edu/historical/>) data
 - 30-year climate normal for precipitation, mean temperature, minimum temperature and maximum temperature. <http://www.prism.oregonstate.edu/normals/>
- NOAA provides values for the current month. Gives anomalies as well as percent of normal.
http://www.cpc.ncep.noaa.gov/products/Global_Monsoons/American_Monsoons/NAMS_precip_monitoring.shtml

There are several things that could be done with this data. The PRISM anomaly data only comes as a PNG image file type so it would have to be georeferenced if it were to be used in analysis. It may be possible to contact PRISM to obtain a spatially referenced TIFF file of the image. If this data is available as a spatially referenced image than the outbreaks in the aerial survey data could be analyzed in comparison to the anomalies. If this information is not available as spatially referenced data, the annual temperature and precipitation maps could be compared to the 30 year normal to see what years were above and below these normal. This data could then be compared to the aerial survey data to see if there is a correlation between outbreaks and climate data.



Task 4: Outreach

VMC has also conducted some outreach to researchers who have conducted field studies relating to forest health in Massachusetts asking for relevant information and spatial data that could complement the existing aerial survey data (see Table 1).

Table 1. Researchers who have conducted Forest Health and Ecosystem related studies in Massachusetts

Name	Institution	Area of Study
Roy Van Driesche	UMASS Department of Environment Conservation	Entomology focused on invasive species
Joseph Elkinton	UMass Department of Environmental Conservation	Invasive forest insects
David Orwig	Harvard Forests	Hemlock Woolly Adelgid
Nicholas J. Brazee	UMASS Department of Plant, Soil and Insect Sciences	Armillaria Root Rot
Andrew J. Shatz	Clark University Graduate School of Geography	Asian Longhorn Beetle
John Rogan	Clark University Department of Biology	GIS focused tree canopy loss
Relena Rose Ribbons	Harvard Forests	Climate Change and Environmental Disturbance
Mark C. Hellmer	Amherst College Department of Geology	Ice Storm Damage

Potential Next Steps

With the completion of this initial pilot work, there are a couple of potential avenues for further activities to strengthen the historical record of mapped disturbance data.

- Incorporate the existing digital data into the regional Forest Health Atlas covering Maine, Massachusetts, New Hampshire, New York and Vermont (separate funding);
- Analyze forest health trends and pest outbreaks alongside climate data to look for trends.
- Digitize and incorporate older forest plot data





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