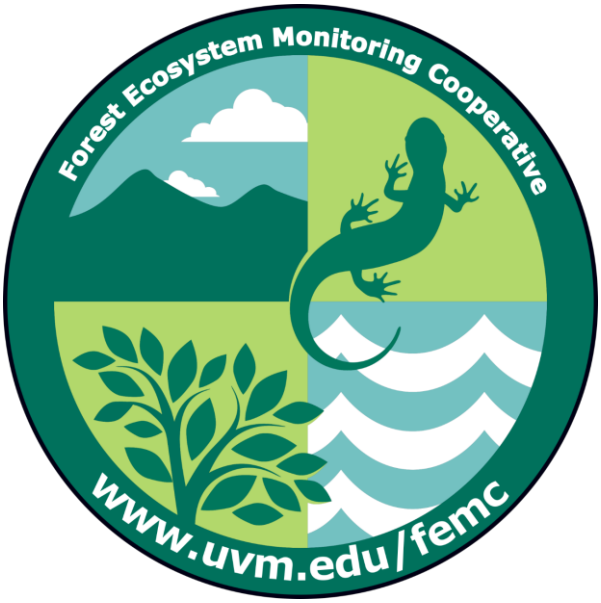

Rhode Island Sprint Project 2021

Data Rescue and Archive of Statewide Forest Health Data

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DOI: XXXXXX

Project Overview

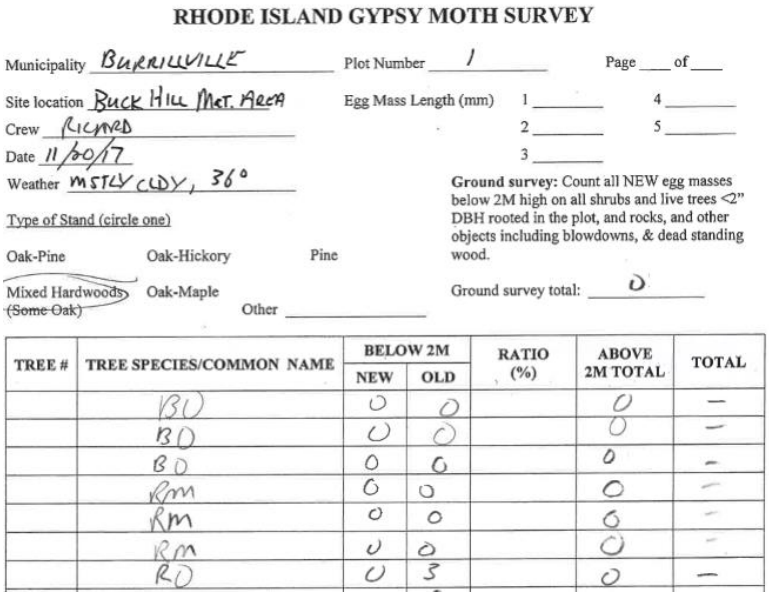
The Forest Ecosystem Monitoring Cooperative (FEMC) partnered with the Rhode Island Department of Environmental Management (RI DEM) for a Sprint Project in 2021 with the goal of digitizing forest health documents. This digitization process resulted in the transfer of field sheets from a statewide spongy moth (*Lymantria dispar dispar*, LDD) egg mass survey to a spreadsheet format, allowing RI DEM staff to easily examine long-term LDD outbreak cycles and develop informed forest management strategies.

We scanned all 2,035 pages provided by RI DEM, digitizing all Rhode Island Spongy Moth Egg Mass Survey field sheets, 1,655 (81%) pages. In addition to supporting documentation for the egg mass survey, 5% of the pages consisted of LDD defoliation data and historical pest suppression reports from the 1980's. The resulting data from the rescue effort is archived along with supporting documentation within the FEMC Data Archive to ensure easy access and security.

FEMC has communicated with RI DEM and the FEMC Rhode Island State Partner Committee throughout the project to ensure that the data structure is usable by RI DEM, and that this project meets the broader needs of the state. FEMC has worked under the guidance of FEMC's Rhode Island State Coordinator Alana Russell from the University of Rhode Island to complete this project.

Methods for Digitizing Rescue Material

The FEMC Rhode Island State Partnership Committee identified data rescue as a statewide need, directing FEMC staff to preserve long-term forest health data. The committee identified two boxes of documents as data at risk of loss and sent the material to FEMC staff to inventory. From the inventory, the Rhode Island State Partnership Committee determined that the Spongy Moth Egg Mass Survey field sheets (Figure 1), belonging to RI DEM Forest Health Program Coordinator Paul Ricard, should be digitized.



RHODE ISLAND GYPSY MOTH SURVEY

Municipality BURRILLVILLE Plot Number 1 Page ___ of ___

Site location BUCK HILL MGT. AREA Egg Mass Length (mm) 1 ___ 4 ___

Crew RICHARD 2 ___ 5 ___

Date 11/30/17 3 ___

Weather MSTLY CLDY, 36° **Ground survey:** Count all NEW egg masses below 2M high on all shrubs and live trees <2" DBH rooted in the plot, and rocks, and other objects including blowdowns, & dead standing wood.

Type of Stand (circle one)

Oak-Pine Oak-Hickory Pine

Mixed Hardwoods (Some Oak) Oak-Maple Other ___ Ground survey total: 0

TREE #	TREE SPECIES/COMMON NAME	BELOW 2M		RATIO (%)	ABOVE 2M TOTAL	TOTAL
		NEW	OLD			
	BO	0	0		0	—
	BO	0	0		0	—
	BO	0	0		0	—
	RM	0	0		0	—
	RM	0	0		0	—
	RM	0	0		0	—
	RO	0	3		0	—

Figure 1. Example of Rhode Island Spongy Moth Egg Mass Survey field sheets.

Workflows

Scanning and Archiving

1) FEMC technicians scanned egg mass survey pages and defoliation records.
   2) FEMC staff created folders for the Egg Mass Survey and Defoliation Records, and subsequent folders by study focus. The files were organized into corresponding folders and tracked in the ***RI Rescue_File Management.xlsx*** spreadsheet.
3) When scanning was complete, staff uploaded a selection of the files to an Egg Mass Survey archive page and a Defoliation Records archive page within the FEMC Data Archive. The datasets and scans, which contain sensitive plot information, are not made public and requests for download are granted by Alana Russell or FEMC.

Transcribing

1) Scanned pages are accessible when signed into the FEMC Data Archive project page under the documents/images tab https://www.uvm.edu/femc/data/archive/project/ri-ldd-moth-egg-mass-survey/files. The scanned sheets are unpublished and requests for download are granted by Alana Russell or FEMC.
2) For each Egg Mass Survey field sheet, technicians entered all information of each row, excluding the site's egg mass length measurements.
3) FEMC staff then compiled all spreadsheets and standardized species codes or abbreviations.

Results

The rescued material was primarily spongy moth egg mass data and defoliation records. FEMC technicians scanned 2,035 pages from two boxes of documents provided by the RI DEM, digitizing all 1,655 (81%) pages of Rhode Island Spongy Moth Egg Mass Survey field sheets. These field survey sheets spanned from the 2004-2005 field season to 2019-2020 with data typically collected from September through March. We digitized data from 24,434 tree observations, with only 1,804 (7%) trees having at least one egg mass.

To provide additional context for the egg mass data with minimal effort, FEMC digitized Rhode Island Spongy Moth Egg Mass Survey plots from a georeferenced 1996-1997 highway map (Figure A1), and created a shapefile from a 1987 egg mass density figure (Figure A2). We also digitized defoliation maps from 2015, 2005, and 1986 (Figures A3-A5) as well as the locations sprayed with pesticide during the 1986 Aerial Suppression Program (Figure A6). The 1986 digitized historical defoliation map will be used to supplement FEMC's Forest Health Atlas (https://www.uvm.edu/femc/forest-health-atlas), which only provides Rhode Island LDD defoliation data as far back as 2000.

Many egg mass sites were missing from the rescue material. From the field seasons digitized, there were 500 (30%) missing pages, primarily from 2008-2009, 2009-2010, 2010-2011, 2015-2016, and 2019-2020 (Figure 2). Despite these missing sites, the egg mass data still appear to track LDD outbreak when compared to LDD outbreak detection from the USDA Forest Service Aerial Detection Survey.

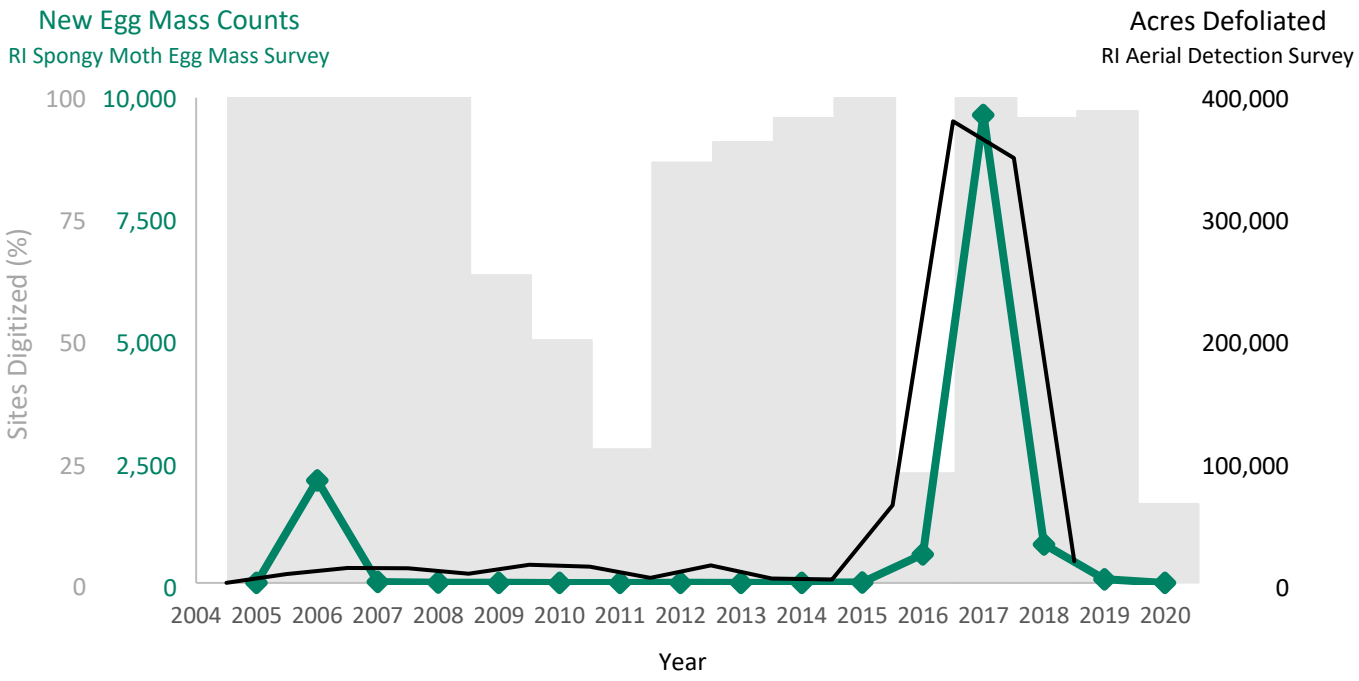


Figure 2. New egg mass counts (green) from the Rhode Island Spongy Moth Egg Mass Survey conducted in fall-winter compared to acres defoliated by spongy moth detected in the summer during the USDA Forest Service Aerial Detection Survey (black). Percent of egg mass sites available to digitize is shown in gray.

Archived Material

The rescued material was primarily spongy moth egg mass data and defoliation records. Sensitive plot information and personal correspondences are available by request, and requests for download are granted by Alana Russell (*alana_russell@uri.edu)* or FEMC.

The Project Archive Pages

Rhode Island Spongy Moth Egg Mass Survey
The Rhode Island Spongy Moth Egg Mass Survey archive page is available at https://www.uvm.edu/femc/data/archive/project/ri-ldd-moth-egg-mass-survey. This project contains plot locations, digitized and scanned field sheets from 2004-2020, a report from the 2014-2016 data, survey instructions, a blank survey sheet, and historical egg mass densities from 1984-1987.

Rhode Island Spongy Moth Defoliation Monitoring Records
The Rhode Island Spongy Moth Defoliation Monitoring Records archive page is available at https://www.uvm.edu/femc/data/archive/project/rhode-island-historical-ldd-moth-records. This project contains defoliation documents from 1986, 2015, and 2016, and digitized LDD defoliation maps from 2005 and 2015.

Appendix

Table A1. Sites present and missing for the Rhode Island Spongy Moth Egg Mass Survey from all 1,784 field sheets provided by the Rhode Island Department of Environmental Management.

Field Season	Sites	Sites Missing	Pages Digitized
2004-2005	1-142		142
2005-2006	1-63, 65-142, 2A, 2B, 2C, 2D, 2E, 2F, 57A, 76A, 76B, 76C, 77A, 77B, 77C, New1, New2, New3	64	157
2006-2007	1-142		142
2007-2008	1-142		142
2008-2009	1-42,72-141	43-71, 142	90
2009-2010	72-142	1-71	71
2010-2011	87-91, 94-100, 102-108, 112-116, 122-126, 130-134, 137-141	1-86, 92, 93, 101, 109-111, 117-121, 127-129, 135, 136, 142	39
2011-2012	1-7, 9-19, 21-31, 34-50, 52-83, 85-92, 94-100, 102-108, 112-116, 122-126, 130-135, 137-142, 57A	8, 20, 32, 33, 51, 84, 93, 101, 109-111, 117-121, 127-129, 136	123
2012-2013	1-100, 102-108, 112-116, 122-126, 130-135, 137-142	101, 109-111, 117-121, 127-129, 136	129
2013-2014	1-25, 27-78, 80, 81, 83-119, 121-130, 132-139, 4A, 58A, 130A	26, 79, 82, 120, 131, 140-142	136
2014-2015	1-142		142
2015-2016	9, 11, 12, 15, 17, 26, 28-30, 36-39, 44, 68, 72, 73, 75, 80, 87-89, 99, 100, 107, 108, 112-114, 118,123, 124	1-8, 10, 13, 14, 16, 18-25, 27, 31-35, 40-43, 45-67, 69-71, 74, 76-79, 81-86, 90-98, 101-106, 109-111, 115-117, 119-122, 125-142	32
2016-2017	1-42, 44-118-131, 133-141, 65A, 117A, 118A, 119A	43, 132, 142	142
2017-2018	1-17, 19-31, 33-57, 59-136, 139-141	18, 32, 58, 137, 138, 142	136
2018-2019	1-17, 19, 20, 22-26, 28-141	18, 21, 27, 142	138
2019-2020	4, 6, 12, 15, 29, 53-55, 59, 68, 71, 72, 85-88, 104, 110, 113, 120, 122, 123, 135	1-3, 5, 7-11, 13, 14, 15-28, 30-52, 56-58, 60-67, 69, 70, 73-84, 89-103, 105-109, 111, 112, 114-119, 121, 124-134, 136-142	23
		Total	1,784

Egg Mass Geospatial Data

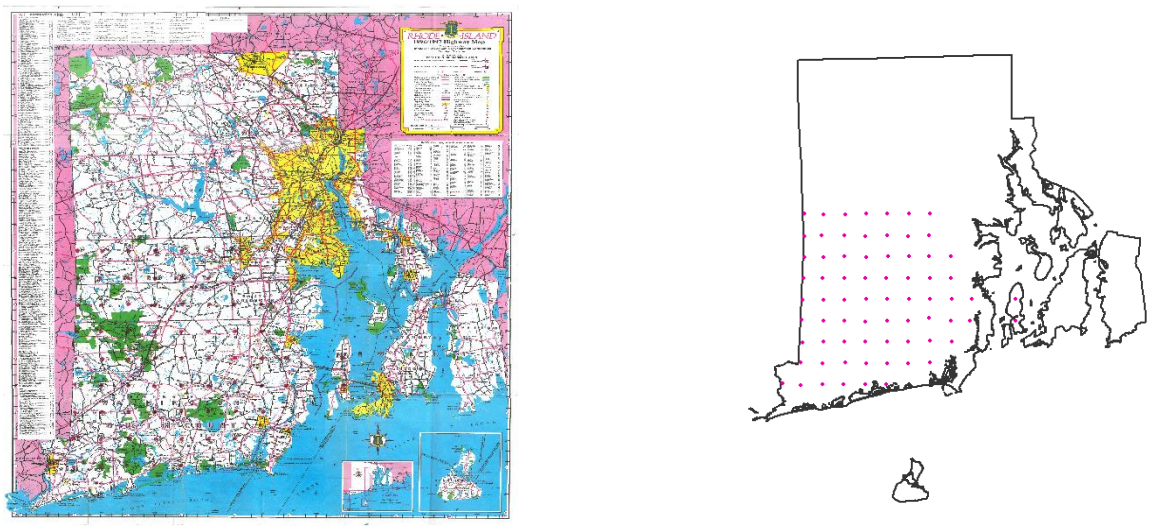


Figure A1. Georeferenced Rhode Island highway map with digitized plots for the Rhode Island Spongy Moth Egg Mass Survey.

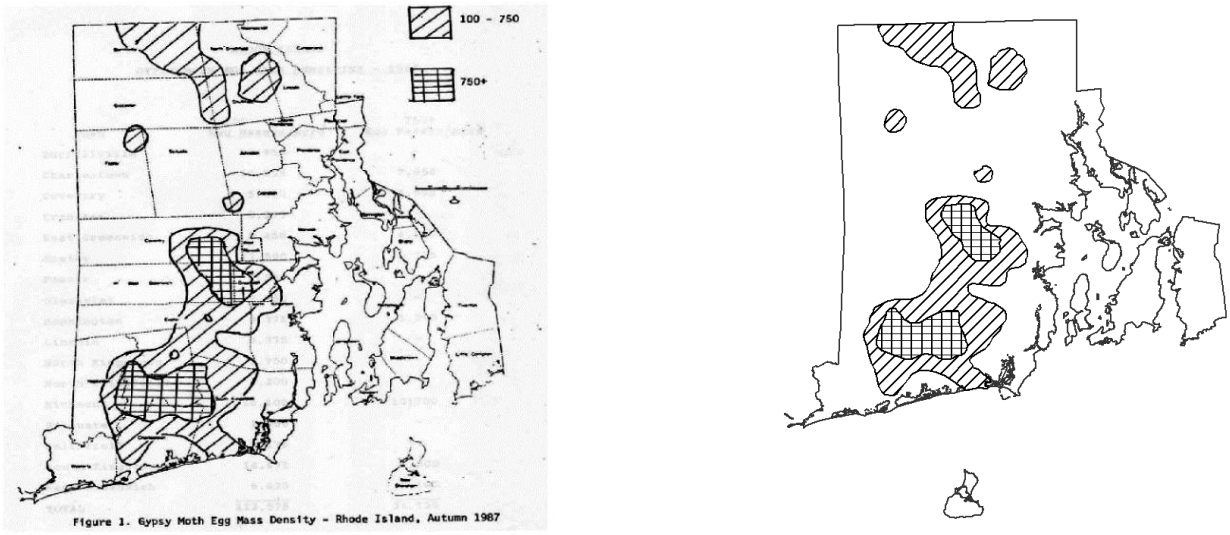


Figure A2. Spongy moth egg mass densities across Rhode Island in 1987.

Defoliation and Suppression Geospatial Data

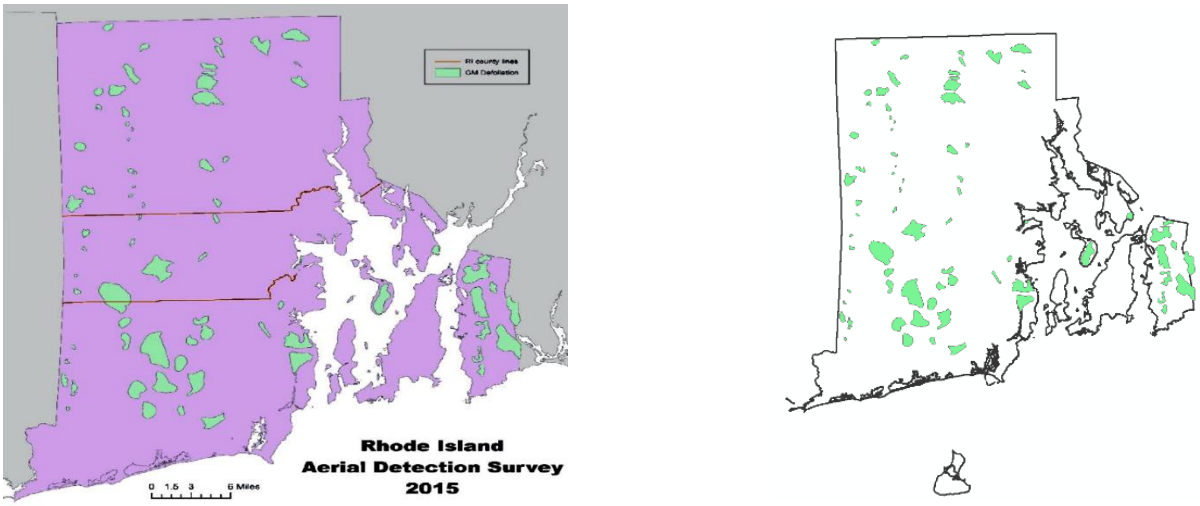


Figure A3. Aerial Detection Survey map of spongy moth defoliation across Rhode Island in 2015.

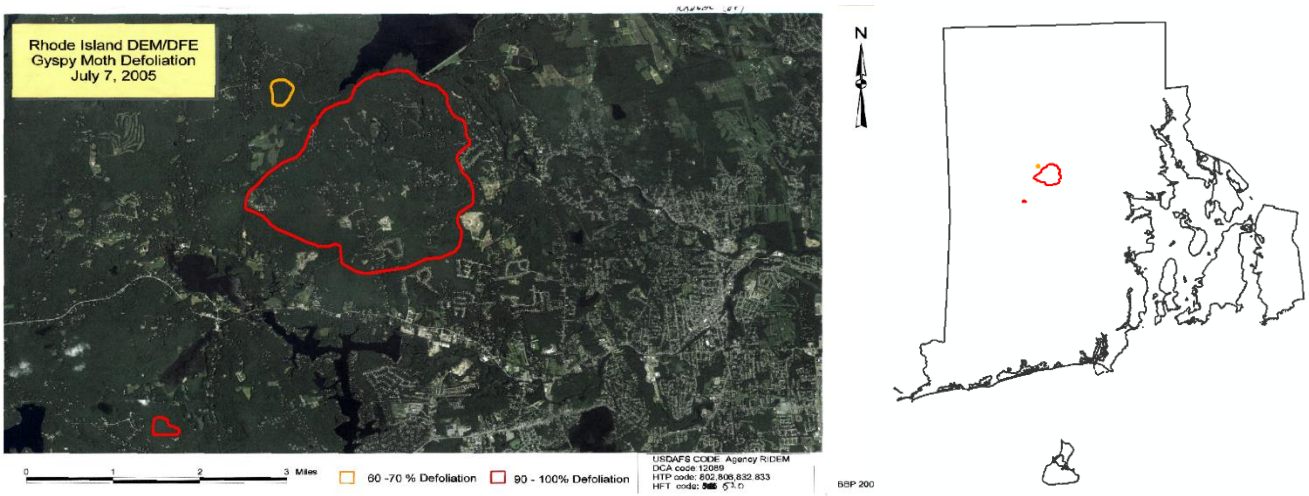


Figure A4. Spongy moth defoliation mapped around Coventry, Rhode Island on July 7, 2005.

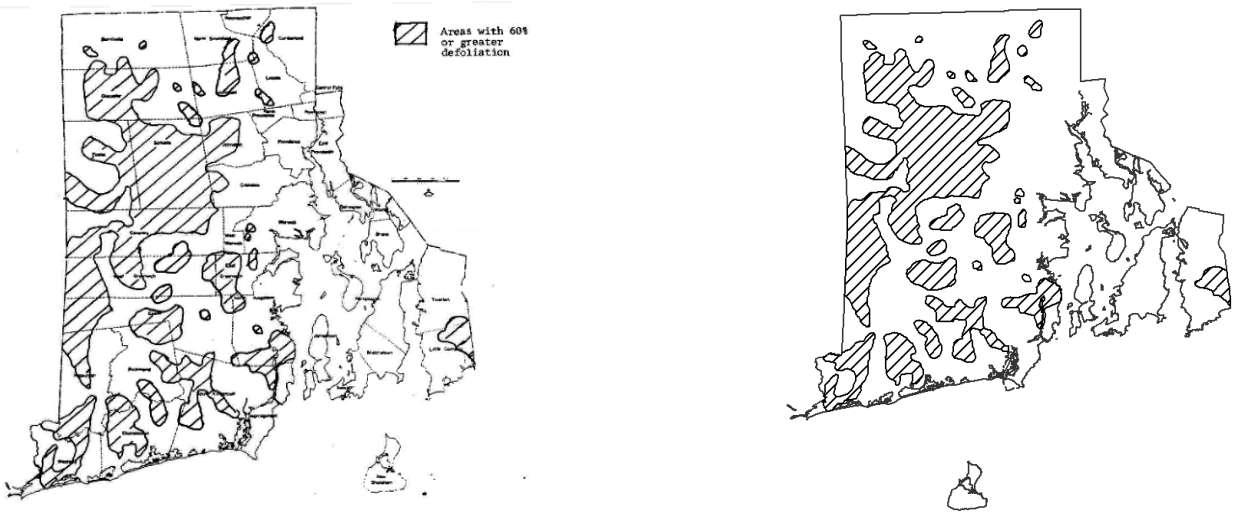


Figure A5. Aerial Detection Survey map of spongy moth defoliation across Rhode Island in 1986.

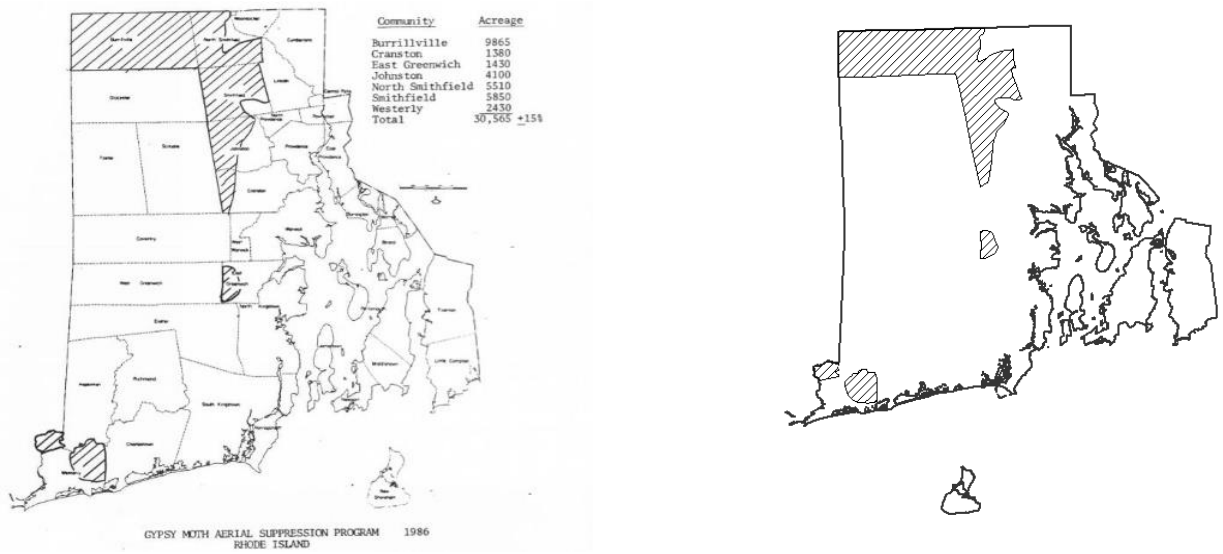


Figure A6. Acres sprayed during the Aerial Suppression Program to control spongy moth outbreak across seven communities in Rhode Island in 1986.

Providing the information needed to understand, manage, and protect the region's forested ecosystems in a changing global environment

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