

Perennial Pepperweed Partnership

Project Summary and Findings - New Hampshire
2021 - Grant Year #1



Project Staff

Haley Andreozzi

UNH Extension

Malin Clyde

UNH Extension

Wells Costello

NH Sea Grant/UNH Extension

Alyson Eberhardt

NH Sea Grant/UNH Extension

Charlotte Thompson

UNH Extension

Perennial Pepperweed Partnership: Overview

UNH Extension and New Hampshire Sea Grant received funding from the US Fish & Wildlife Service to improve monitoring and surveillance for Perennial Pepperweed (PP) in coastal areas of New Hampshire towards a long-term goal of eradicating PP in New Hampshire within five (5) years. The following is a summary of work conducted by UNH Extension/NH Sea Grant staff and UNH student interns from Jan. 1, 2021 – September 20, 2021 (Year 1 of a 2-year grant).

NH-Based Activities 2021

Protocol Development

One of the primary goals for Year #1 of the PP partnership was to establish a method for surveillance and mapping of PP in New Hampshire using readily available tools which would result in transparent data easily shared among partners and the public. The state of New Hampshire uses EDDMapS.org for reporting, tracking and validating invasive species sightings. However, prior to summer, 2021 established populations of PP in NH were most often directly reported to the USFWS office at Parker River, and only sporadically recorded through EDDMapS. An additional goal of Year #1 was to ensure that all existing and newly-identified populations of PP in New Hampshire would be documented through EDDMapS.

2021 Nature Groupie Interns

Sydney Gendreau

UNH 2021

Julia Matthews

UNH 2021

Olivia Pitta

UNH 2022

New Resources Created

- [Perennial Pepperweed Partnership Webpage](#)
- [Perennial Pepperweed in New Hampshire and Maine ID Card](#)
- [Video: Identifying Perennial Pepperweed](#)

Team members Alyson Eberhardt and Haley Andreozzi led the development of a new survey protocol to be piloted by a team of three undergraduate interns in summer, 2021. The resulting protocol (see Appendix A) incorporated established techniques from Mass Audubon, data requirements of USFWS partners at Parker River NWR, capabilities of EDDMapS mobile tools, and safety considerations for interns (with consideration towards volunteer surveyors in the future). Key features of the 2021 version of the protocol include:

- All surveys conducted on public roads, rights-of-way, and marshes below mean high tide, which are public in NH; Purdie v. Attorney General, 732 A.2d 442, 446 (N.H. 1999)
- Create point data for observed PP populations
- Create polygon data for all surveyed areas
- All observations (whether positive or negative for PP) include a photo as reference
- Include information on how closely observed

(walked, binoculars, boat), access information and hazards.

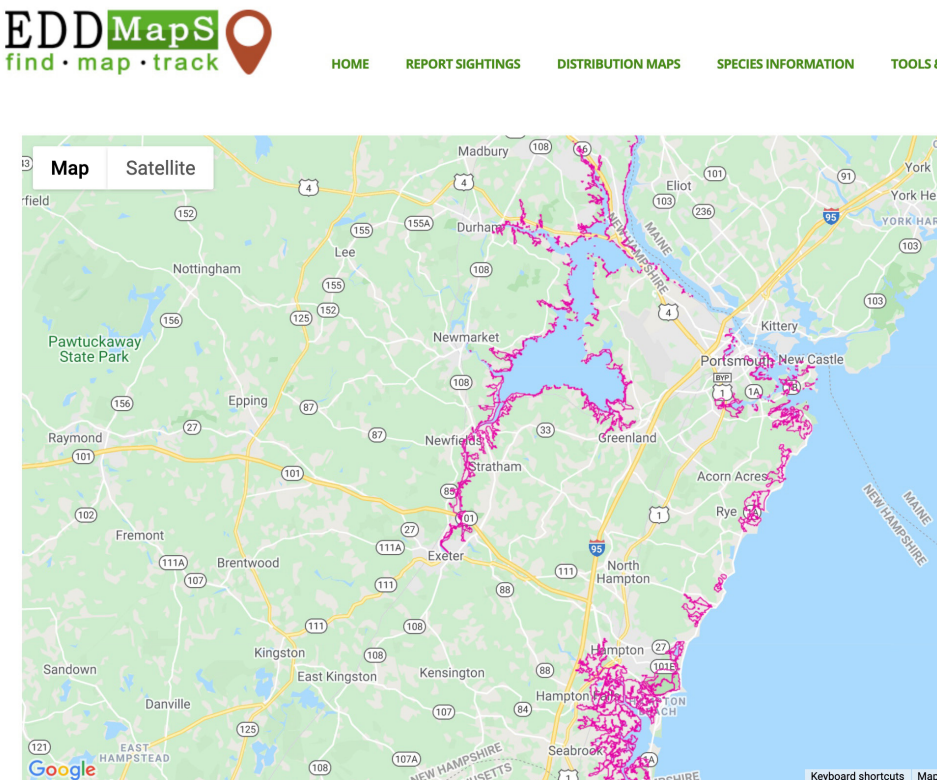
- All data reviewed and confirmed for accuracy on EDDMapS and resulting data is viewable and downloadable by the public through EDDMapS.com

In addition to recording observations through EDDMapS, interns maintained paper data sheets for both points and polygons (see data templates, Appendix A-1 and A-2).

Initially, 2013 Salt Marsh Habitat: New Hampshire marsh polygon data was obtained from NOAA Digital Coast website and uploaded into EDDMaps (see figure 1). We assumed the marsh numbering system would allow us to easily refer to and cross reference marsh units for PP monitoring. This proved not to be the case. The color of the marsh data layer blocked visibility of aerial photos in the app, and there was no way to easily switch the marsh data layer on and off in the app. Furthermore, there was no way to view the marsh polygon numbering system in the app, so we

weren't able to cross-reference this layer to our own protocol during data collection. Due to these limitations, we eliminated use of the marsh polygons in the app, and instead used paper maps of marsh units and staff experience to schedule which marshes to visit, when.

Figure 1



Intern Recruitment and Training

While the original funding proposal included support for two interns (who would spend 50% of their summer field season surveying for PP), UNH Extension was able to provide additional funding for a third intern. UNH undergraduate students Sydney Gendreau, Julia Matthews and Olivia Pitta ([see intern bios here](#)) were hired as the 2021 Nature

Groupie Interns, working full time for eight weeks, June 2 – August 4, 2021.

Interns received training in basic field skills, personal safety, stewardship tool use, trail maintenance techniques, invasive plant management and plant ID. Coordinating with the Maine PP team, all interns also received field training in coastal ecology, pepperweed ID and management, and practice using each states' protocol. NH interns also gained experience and training in basic GIS mapping to display EDDMapS data. All interns attended the June 9, 2021 PP workshop (see below), and from June 22-24, all project interns (NH and ME) traveled to Massachusetts to work with USFWS staff and interns on pepperweed mapping and control at the Parker River National Wildlife Refuge.

Public Outreach & Education

With a goal of expanding the pool of professionals and volunteers able to recognize PP in the region, UNH Extension coordinated an online workshop, aimed at coastal partners in Maine and New Hampshire on

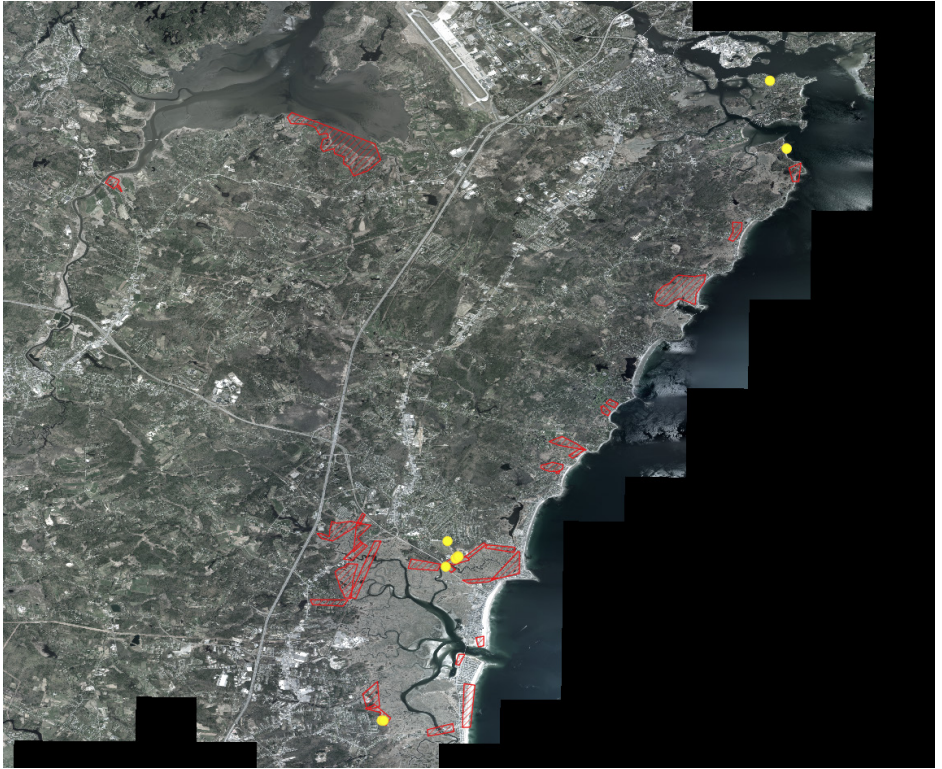
June 9, 2021. Thirty-six participants registered for the 1-hour training, with thirty attending the event live. Participants learned about why PP is a problem in New England, its ecology and habitat requirements, the history of spread in MA, NH and ME, and about the new Perennial Pepperweed Partnership (see Appendix B for workshop agenda and slides). Post-workshop, all registrants received a recorded version of the workshop, and links to new outreach materials developed for this project including:

- [Webpage for PP Partnership](#)
- [New field ID card](#)
- [New ID video](#)

Registrants also received an invitation to attend one of two scheduled field trips to see and hand-pull PP in the field. The field trips (7/13 in Seabook, NH and 7/14 in Hampton, NH) each hosted nine (9) participants including staff, interns and volunteers. Field sessions included hands-on identification of PP, question and answer with interns, project staff and/or partners, and active management (hand-pulling) at each site.



Figure 2



Intern Field Surveys

Interns spent a total of four (4) weeks surveying marsh habitats for the presence of PP (does not include time spent training), representing 50% of their summer field experience. Surveying started at the south end of the NH coast due to the potential for spread from Massachusetts infestations, and worked north through coastal marshes in Seabrook, Hampton and Rye where all existing coastal populations of PP have been identified to date. Survey work focused on the upland edge of high marsh habitats. Significant data gaps occurred in the zone around Seabrook Nuclear Power Plant (where marsh access is restricted) and in the northern section of the coast as time ran out and as PP lost its flowers and became harder to identify quickly in the field. Anecdotal observation suggested that pepperweed flowered and started to go to seed approximately 2 weeks earlier than expected this year. The team also piloted surveying by boat in the Great Bay (boat and driver courtesy of Melissa Paly, Conservation Law Foundation Waterkeeper for Great Bay).

Management of PP sites

All four known PP sites on the NH coast were re-visited, recorded as new observations in EDDMapS, and 100% of observed plants removed by hand-pulling in June and July. Management was conducted during field workshops in Hampton and Seabrook to expand the number of volunteers and staff involved in

Figure 3

A screenshot of the EDDMapS website interface. At the top, there's a navigation bar with links for HOME, REPORT SIGHTINGS, DISTRIBUTION MAPS, SPECIES INFORMATION, TOOLS & TRAINING, MY EDDMAPS, and ABOUT. Below this is a 'Query Results' section. It includes a 'Go Back' button and a 'Save query' button. The 'Your query parameters' section lists: Country: United States; Species: perennial pepperweed (Lepidium latifolium), perennial pepperweed (Lepidium latifolium); State: New Hampshire; Ending Observation Date: 9/30/2021; Starting Observation Date: 6/1/2021. The 'Results summary' section states: 'Your query returned 39 locations with records. 39 locations have the exact coordinates shared publicly. Based on most recent information this includes 0 infested acres. 41 new locations were added in the time period for this query. 47 records have been made at these locations. 6 records are revisits updating the status of 6 locations.' Below the text is a search bar and a map of New Hampshire with several blue location pins. A legend in the top right corner indicates 'Treated (10)' with a blue pin icon.

active management of PP. The known PP sites in New Castle and Rye were visited by Rockingham County Conservation District staff and treated by hand-pulling as well as recorded in EDDMapS by Kevin Lucey of NH DES earlier in the season (before interns got that far north). Four known sites were also re-visited on September 14, 2021 by Malin Clyde of UNH Extension and Kevin Lucey of NH DES to check for re-growth and pull remaining stems. Quantities of PP in rosette form were found at all four sites in September, with two sites containing PP in flower. Fall treatments were also documented through EDDMapS.

Kevin Lucey (NH DES) opted against herbicide treatment for Hampton and Seabrook sites this year, continuing to rely on hand-pulling with an expanded group of volunteers.

Mapping and Results

Interns visited, mapped, and recorded data for each of the known PP sites in Seabrook and Hampton. **No new populations of PP were identified through 2021 field surveys.** Figure 2 shows all surveyed polygons, as recorded through EDDMapS and exported into GIS. Red hatched zones are areas surveyed for PP; yellow dots are point data of known PP sites.

Figure 3 shows the EDDMapS interface of all PP records in New Hampshire observed and recorded during the 2021 summer field season. Data include 39 locations made up of: negative sites (surveyed polygons with no PP), and treated sites (positive points where PP was pulled).

Data has been reviewed by the project team for accuracy and consistency and categorized as public in EDDMapS; additional edits and review will occur in fall, 2021 after consultation with USFWS staff at Parker River NWR, end users of data for ArcGIS system, and data provided in desired format. Available EDDMapS download options include .CSV (spreadsheet), .KML (Google Earth format), or Shapefile (GIS format).

Figure 4 - Examples of social media posts related to PP



Figure 5



Outreach by Interns

Interns contributed to PP outreach over the summer, sharing photos and posts on Nature Groupie social media (Fig. 4) and writing a blog post (Fig. 5), “[5 Tips for Surviving Summertime Field Work on the New England Coast](#)”

Lessons Learned – Year #1

- Due to the low prevalence of PP sites in NH, starting work with the Parker River NWR crew doing PP treatment was essential training for interns to confidently learn identification skills for PP, how to ID look-alikes (see Appendix C for intern look-alike cheatsheet), and in which habitats the plant is found (high marsh upland edges and roadsides). These habitat cues and skills were essential for efficient monitoring throughout the rest of the summer.
- Interns will benefit from more time spent with supervising staff at the beginning of the monitoring season – at least 1 week of supervised field work – to gain confidence in using the protocol, navigating marsh habitat, and assessing safety and risks.
- EDDMapS was a sufficient tool for tracking monitoring data: photos uploaded easily, data was retrievable in useful formats, and fields were flexible enough to accommodate necessary information. Limitations identified by interns and staff included:
 - » The fields available for data entry in EDDMapS are limited, so some data (phenology, search method, more habitat options) needed to be entered as text in the “notes” section of each record, which was tedious and hard to maintain consistency across records. Editing data in the office on a desktop was often necessary.
 - » Dropping a point in the field was not always accurate, and sometimes required adjustment of the location of the points in the desktop version.
 - » Polygons were not available for viewing after they had been created for a record on the app, making it difficult to see all the surveyed polygons in one place. Interns created a system to view



polygons by downloading EDDMapS data and then uploading it into QGIS to enable tracking searched zones throughout the summer.

- » The zoom capability of the EDDMapS app is restricted, so interns found it difficult to zoom in close enough to create very accurate polygons. It is possible to edit polygons in the desktop version.
- » Interns suggested it would have been helpful to add points of entry and exit onto the searched polygons to aid in future monitoring visits (there was a lot of trial and error to figure out the best public access to each marsh unit). We couldn't figure out the best way to record this data within the app.

Interns had several tips and recommendations for the protocol:

- Since several pieces of information required use of the “notes” field, interns found consistency to be challenging. Reviewing EDDMapS records at the end of the week and editing records to improve consistency (using notes from paper data sheets)

may be a necessary step in the protocol.

- Protocol would have benefitted from including information about visibility in the field, as morning fog often hampered monitoring efforts over large areas (hard to see, even with high-powered binoculars). Limited visibility may affect quality of monitoring over large areas.
- Recording access and exit points to each marsh polygon on the data sheets or EDDMapS observations would make future re-visits more efficient.
- Given the small number of PP sites in NH, a precise count of the number of stems in each site (counted during pulling) should be added to the protocol. This the best way to understand and track the effects of management strategies (and it's currently do-able, with less than 1,000 stems estimated at the largest site in Hampton).

Improvements to our use of maps and mapping will also benefit future monitoring efforts:

- Instead of systematically searching NH marshes south -> north as we did this year in an effort to capture potential spread from MA populations, monitors should first deploy to known, existing PP sites in NH, and work outwards from these sites. Even though the team did not identify any new PP sites, it seemed logical that further infestations are most likely to occur near known sites, and thus these areas should get more intense monitoring when PP is in flower and easiest to ID.
- Use of digital maps (Google, EDDMapS, etc.) ended up being insufficient for intern needs. Providing field crews with large map(s) of marsh areas showing existing PP sites, priority marshes (high, med, low?), entrance and exit locations, and parking suggestions would aid future monitoring efforts.

Lessons About Access:

- Interns recommend that monitors have at least two cars every day and to use a ferrying system (cars on either end of the marsh) to avoid excessive backtracking.
- Access to Great Bay fringing marsh was challenging. Since public access to shorelines is fairly limited around the Bay (few roads lead to the water), we enlisted the Great Bay Waterkeeper to attempt surveying by boat on July 21. Even with high-powered binoculars, visibility over the low marsh to the upper edge of the high marsh was poor, making it impossible to determine whether PP was present or not. Furthermore, shallow depths in the Bay limited motorboat access to a short (2-hour) window around high tide, severely limiting the amount of shoreline surveyed in a day.
- Ideally, the next attempt to survey Great Bay fringing marsh should be attempted by kayak during the time when PP is in flower for highest possibility of visibility. With its long distance from known sites, monitoring in Great Bay might occur





less frequently, and could potentially involve volunteer kayakers trained in PP identification. Furthermore, some Great Bay zones could be searched on foot at low tide such as Adams Point, Hugh Gregg Center, Fox Point (Newington), Great Bay NWR, and the Portsmouth Country Club (with permission). These areas could serve as bellwether indicators for PP dispersal into Great Bay.

Safety and Field Experience Lessons

- Interns learned they needed to start field work early (7 a.m.) to do as much as possible before temperatures got too hot. Full days in the field were not often possible, and interns needed alternative projects to complete during challenging weather.
- Walking in the marsh was unpredictable and walking slowly and deliberately was critical to avoid falling into deep water. Stream crossings and low marsh required extra caution.
- Knee-high boots and hats were the most essential equipment (boots were provided for any intern that did not own them). Interns suggested that bug head nets would have been useful and should be made

available to future monitors.

- Interns shared the following lessons learned from the PP monitoring project:

“The most important thing we learned was to trust our instincts out in the field. Some days were very difficult and mentally and physically exhausting. We found that we needed to make executive calls on navigating larger areas with safety as a priority. Also, as we got further into the project, we gained confidence in understanding the habitats where pepperweed would grow and could then put more time into those areas.”

Appendices

- [A - NH Field Mapping Protocol for NH Interns 2021](#)
 - » [A-1 Search Areas Data Sheet \(for polygon data\)](#)
 - » [A-2 Presence Record Data Sheet \(for point data\)](#)
- [B - Agenda for Online Workshop 6/9/21](#)
- [C Look-Alikes “cheat sheet”](#)

Perennial Pepperweed Project

Field Mapping Protocol for NH Interns 2021

Objective

The objective of these protocols is to map the extent and specific location(s) of perennial pepperweed in coastal New Hampshire. Additionally, the protocols are designed to track areas surveyed for perennial pepperweed, but where it is currently not present. The data collected will inform future control and monitoring efforts.

Mapping strategies

- Marsh edges, dunes surveyed by foot (High Resolution Tidal Wetland Maps will be used to identify and prioritize marsh areas to be mapped; categories of interest: terrestrial border, high marsh, wrack)
- Tidal crossings surveyed by car (these areas were surveyed in the 2018 Tidal Crossing Assessment)
- Some areas (difficult to access from land, fringing marsh, no public access) may be mapped by boat as resources allow
- Mapping will begin at the MA-NH border and work north

Data Collection

Interns will receive training on data collection methods prior to being asked to inventory and map locations on their own. Interns will collect data as a team under the supervision and with periodic visits from UNH Cooperative Extension/NH Sea Grant staff.

Areas to be mapped will be accessed by public roads or rights of way; no one is to step foot on private property. Interns (and staff when accompanying them in the field) will have clear identification of their UNHCE/NG affiliation (e.g., vest, shirt, hat).

Data will be collected using EDDMaps (Early Detection and Distribution Mapping System), a web-based mapping system for documenting invasive species distribution. Data will be recorded in EDDMaps in the field using the iOS/Android app. Data will also be recorded on paper data sheets for quality assurance and control.

Data Entry in EDDMaps

- Polygon data will be entered and submitted for all areas surveyed and to indicate null data, using the **Draw a Polygon** option.

- In addition to the polygon, point data will be entered and submitted to map specific locations of perennial pepperweed plants/populations, if found, using the **Drop a Marker** option. *Separate points will be entered if plants/populations are more than 50 yards apart.*

For both **polygons** and **points**, the following data will be collected and entered:

- **Species Common Name** – Select *Perennial Pepperweed*
- **Species Scientific Name** – Select *Lepidium latifolium*
- **Photos** – Images of the following will be attached to each submission:
 - Overall habitat/ survey area (including for null data)
 - Individual plants, if found (bring flag and use in photos for scale and location). Use best practices for photographing plants for identification purposes.
- **Location** – GPS Coordinates in decimal degrees (auto-populated by EDDMaps)
- **Time Spent in Minutes** – Select one of the following: 5, 10, 15, 30, 45, 60
- **Habitat** –it is expected that “Edge: Roadside” and “Other” will be primarily used; however, other options exist
- **Density** – <5%, 5-25%, 25-50%, >50%
- **Area** – Acres or square feet (automatically calculated for polygons; estimate for points/locations of pepperweed)
- **Status** – Positive, Treated, Negative
- **Notes** – The information below should be included in the notes section to entered in the following order, separated by a semi-colon (;):
 - **Survey Method** – Enter one of the following: Walked, Binoculars, Boat
 - **Site Access** – Enter any helpful information for future observers regarding parking, nearest crossroad, potential hazards (e.g. poison ivy)
 - **Habitat:** if “other” was entered, enter one of the following to indicate the habitat type: salt marsh, edge: upland/wetland, dune
 - **Phenology (For Points Only)** – indicate any of the following that apply regarding the phenology of the plant: Leaves, Flowers, Fruits, Seeds, Dead
 - **Other Notes** – provide any additional information that might be useful/important

Data Entry on Paper Data Sheets

Data will be recorded on paper data sheets for each polygon and point entry into EDDMaps

- **ID** – A unique identification number is generated for each entry. These will need to be added once you return from the field as they are not available in the app
- **Time in EDDMaps** – Time stamp that is generated at the data entry screen in EDDMaps in HH:MM format
- **Photo** – Enter a check mark to confirm you have taken a photograph(s)
- **Latitude/Longitude** – Enter coordinates for latitude and longitude as they are displayed on the EDDMaps data entry screen for point data. The format displayed is decimal degrees. For polygons, record a latitude and longitude from a point within the polygon from a GPS app (open the maps application on your device (typically Maps on Apple and Google Maps on Android, select the dot that indicates your location, and the latitude and longitude are displayed.)
- **Accuracy** – Accuracy of the GPS signal as it is displayed in the EDDMaps data entry screen. The unit is meters.
- **Time Spent in Minutes** – Circle one of the following as entered into EDDMaps: 5, 10, 15, 30, 45, 60
- **Habitat** – Circle one of the following as entered into EDDMaps: “Edge: Roadside” or “Other”
- **Density** – Circle one of the following as entered into EDDMaps : <5%, 5-25%, 25-50%, >50%
- **Area** – Indicate the area as entered into EDDMaps in acres or square feet (automatically calculated for polygons; estimate for points/locations of pepperweed)
- **Status** – Circle one as entered into EDDMaps: Positive, Treated, Negative
- **Notes** – The information below will be included in the notes section in the following order to align with the notes submitted in EDDMaps:
 - **Survey Method** – Circle one of the following: Walked, Binoculars, Boat
 - **Site Access** – Record any helpful information for future observers regarding parking, nearest crossroad, potential hazards (e.g. poison ivy)
 - **Habitat:** If “other” was recorded, circle one of the following to indicate the habitat type: salt marsh, edge: upland/wetland, dune
 - **Phenology (For Points Only)** – Circle any of the following that apply regarding the phenology of the plant: Leaves, Flowers, Fruits, Seeds, Dead
 - **Other Notes** – provide any additional information that might be useful/important
- **Search Area/Polygon ID** (point data sheet only) – When at the computer, enter the unique ID number generated by EDDMaps for the polygon where the point was recorded
- **Number of points recorded in this search area** (polygon data sheet only) – Record the number of data points entered into EDDMaps within this polygon

- **List point IDs** (polygon data sheet only) - When at the computer, enter the unique ID numbers from EDDMaps for each point data entry within this the salt marsh polygon

Perennial Pepperweed (*Lepidium latifolium*) Search Areas [Polygon Data]



Date:

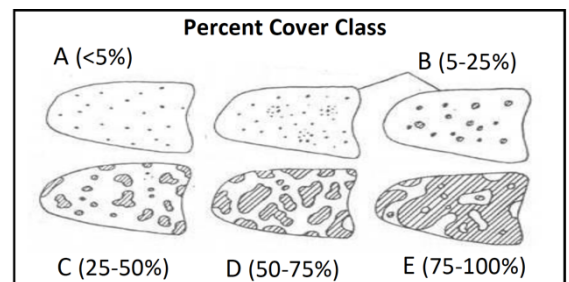
Town:

Observer(s):

ID		Time in EDDMaps (HH:MM)		Photo (✓)	
Latitude/Longitude (decimal degrees)				Accuracy (m)	
Time Spent in Minutes (Circle one)	5	10	15	Habitat (Circle one; if <i>Other</i> , provide more information below)	Edge: Roadside
	30	45	60		Other
Density (See diagram below; Circle one)	<5%	5-25%	25-50%	Area (Write value and circle unit)	Acres
	50-75%	>75%			Square feet
Status (Circle one)	Positive		Negative		
Notes					
Survey Method (Circle one)	Walked		Binoculars		Boat
Site Access (Parking, crossroads, hazards, etc.)					
Habitat (Circle one if <i>Other</i> was selected above)	Salt Marsh		Edge: Upland/wetland		Dune
Other Notes					

Number of Points recorded within this search area: _____

List Point IDs below:



Perennial Pepperweed (*Lepidium latifolium*) Presence Record [Point Data]

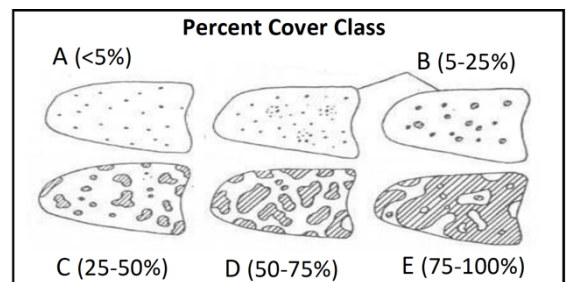
Date:

Town:

Observer(s):

ID		Time in EDDMaps (HH:MM)		Photo (✓)	
Latitude/Longitude (decimal degrees)				Accuracy (m)	
Time Spent in Minutes (Circle one)	5	10	15	Habitat (Circle one; if <i>Other</i> , provide more information below)	Edge: Roadside
	30	45	60		Other
Density (See diagram below; Circle one)	<5%	5-25%	25-50%	Area (Write value and circle unit)	Acres
	50-75%	>75%			Square feet
Status (Circle one)	Positive		Negative		
Notes					
Survey Method (Circle one)	Walked		Binoculars		Boat
Site Access (Parking, crossroads, hazards, etc.)					
Habitat (Circle one if <i>Other</i> was selected above)	Salt Marsh		Edge: Upland/wetland		Dune
Phenology (Circle all that apply)	Leaves	Flowers	Fruits	Seeds	Dead
Other Notes					

Search Area/Polygon ID where this point is located: _____



APPENDIX B

Perennial Pepperweed Workshop

Wed, 6/09/21, 9:00 am – 10:00 am, Online via Zoom

Workshop Information and Registration: <https://extension.unh.edu/events/perennial-pepperweed-workshop>

Proposed (draft) agenda for 60 minute session:

Time	Person	What to Cover	# of Slides
9:00 – 9:05	Malin	Welcome and introduction slide with all speakers & organizations	1
9:05 – 9:15	Nancy Pau or Luke	Why should we care about PP – story of Great Marsh invasion & management	2-4 max
9:15 – 9:25	Alyson	What is the plant and how it relates to coastal ecology in NH and ME	2-4 max
9:25 – 9:35	Kevin and Jesselyn	History and existing locations of PP in NH and ME – how currently managed, need to broaden effort to make monitoring and management sustainable long term	2-4 max
9:35 – 9:45	Malin	About the Perennial Pepperweed Partnership – what we're doing, goals, intern work, why we've invited partners	N
9:45 – 10:00	Nancy O.	PPP in ME 2021 – what interns will be doing, other invasive plants monitoring (e.g. stiltgrass)	2-4 max
10 – 10:15	All	Describe field trip opportunities/dates in NH and ME Sign up for Field Trips (July) on Box Note Q&A	Link to Box note

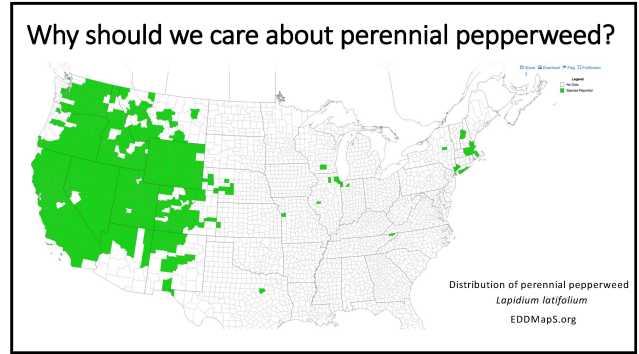
Please contact Malin if you want clarification of what you should cover. Slides are optional, but should be sent to Malin ahead so we can use a single presentation and take turns on the audio piece. I would like to include as many voices as possible (to represent our collaborative approach), which also means everyone has to be brief and concise 😊. We will strictly adhere to the time table, so please plan your talking points/slides accordingly. Thank you!

Deadline for submitting PP slides to Malin: Monday, June 7 at 5pm

Either email to malin.clyde@unh.edu, or send a file download link.



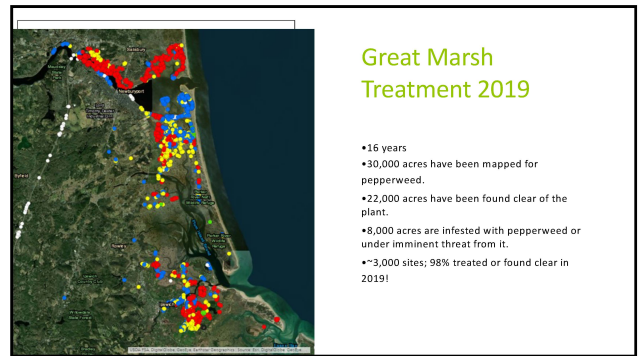
1



2



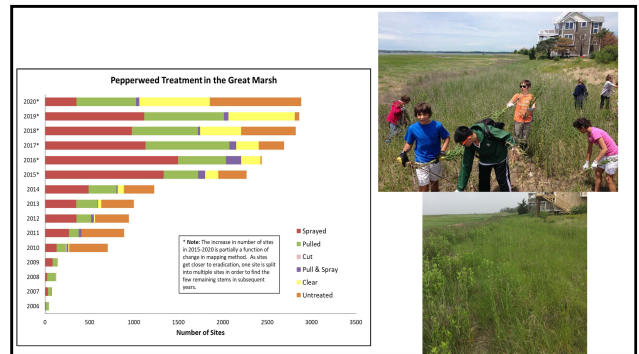
3



4



5



6

Stop the Spread

- Share ID and control techniques
- Help to develop community-based programs in Early Detection areas
- Data repository
- Contain spread

7

Perennial Pepperweed & it's Habitat

8

Perennial pepperweed *Lepidium latifolium*

- Perennial
- Alternate leaves
- Small white flowers, 4 petals
- Blooms mid-June to early July
- Small round/flattened fruits
- Reproduces by seed or vegetatively
- Wetlands, grasslands, roadsides

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Steve Dewey, Utah State University, Bugwood.org

9

Ecology

- Stems are woody at the base, form a dense thicket
- Roots systems can be extensive
- Store large amounts of energy as carbohydrates for future growth
- Can alter soil properties - salt pump
- Outcompetes native species

John M. Randall, The Nature Conservancy, Bugwood.org

10

Past Management Efforts in NH & ME

11

Odiorne Cobble Dune 2006	Hampton WWTF 2008	Hampton Route 101 2009	Seabrook Lower Collins Rd 2012	Newcastle River Road 2013	North Hampton I-95 2013

PEPPERWEED HABITATS IN NH

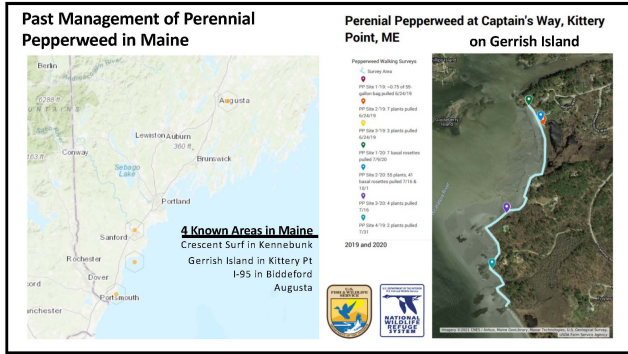
- Cobble Beach (1)
- Spartina Patens Marsh (2)
- Marsh Elder (1)
- Roadside (2)

VECTORS OF DISTRIBUTION

- Tidal Flow
- Passenger Cars
- Construction Vehicles
- Dumping /Gathering

New Hampshire Coastal Program

12



13



14

About the Perennial Pepperweed Partnership

- 2 years, funded by USFWS
- Expand surveillance & management in NH & ME
- Goal of eradication
- 2021: interns
- 2022: public outreach & volunteer engagement

15

New Hampshire Pepperweed Team: 2021

Olivia Pitta

Sydney Gendreau

Julia Matthews

UNH Extension / NH Sea Grant Team

Haley Andreozzi

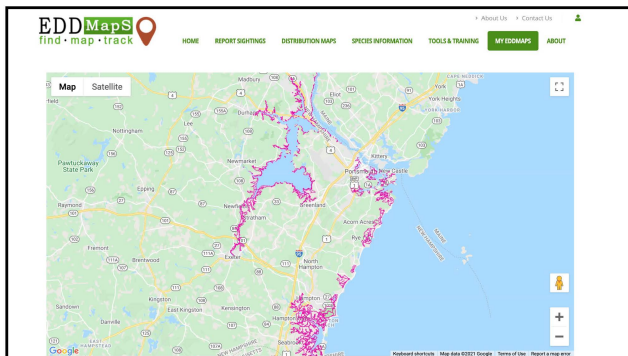
Mallin Clyde

Wells Costello

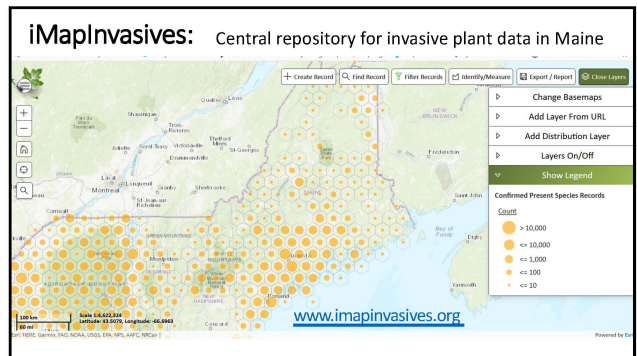
Alyson Eberhardt

Charlotte Thompson

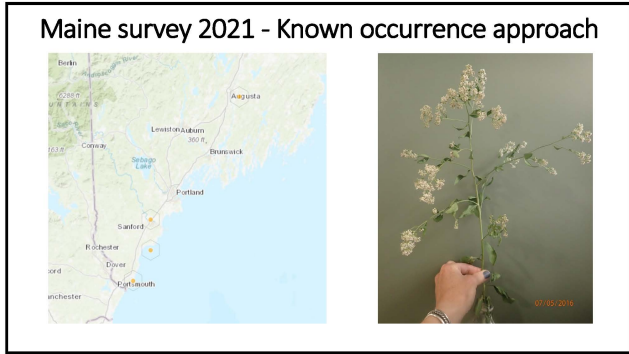
16



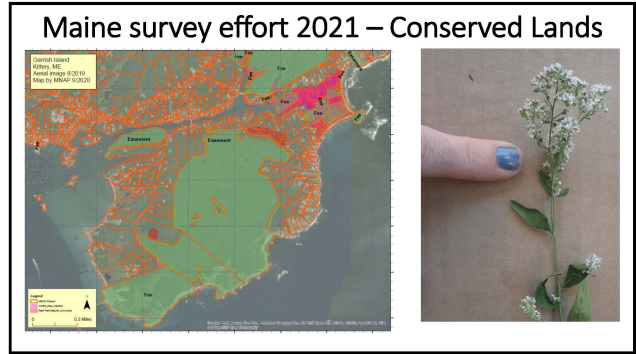
17



18



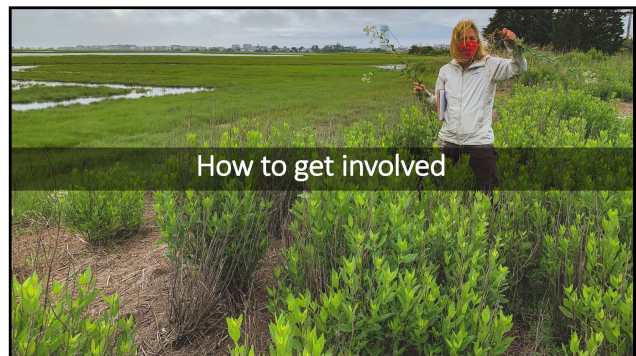
19



20



21







24



25

Perennial Pepperweed Lookalikes

Common Name	Scientific Name	Description	Photo
White Meadowsweet	<i>Spiraea alba</i>	Small, white flowers, serrated leaves, woody stem	
Hoary alyssum	<i>Berteroa incana</i>	Small, white flowers, tiny, pointy whirled leaves	
Daisy Fleabane	<i>Erigeron annuus</i>	Lookalike when budding, small daisy flowers when in bloom, long, narrow leaves.	
Common Soapwort	<i>Saponaria officinalis</i>	Medium white flowers, found in dunes,	
Yarrow	<i>Achillea millefolium</i>	Fern like leaves, small clustered white flowers, common on roadsides	