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Coastal Habitat Restoration Team

Unraveling the Mystery of Dune Die-Off in New England:
Potential Causes and a Strategy for Recovery

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[4] - UNIVERSITY of NEW HAMPSHIRE

INTRODUCTION

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Project Overview and Goals

- Dunes are the first line of defense to many climate-related coastal risks
- Despite their importance, their resilience is influenced by many natural and anthropogenic factors
- A little known but growing risk includes death of beach grass by nematodes, termed “Dune Die-Off”
- Planning and actions are needed to avoid or minimize risks to coastal dunes *and* associated communities and infrastructure
- Identifying Stakeholder concerns and their level of understanding is critical to prepare for, or avoid, these risks

STAKEHOLDER CONCERNS

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Climate Change/SLR/Erosion

Rare Species

Source: Boston Globe 2007

Resource Area Access

Need for: Restoration/Outreach/Education

STAKEHOLDER CONCERNS

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Dune Die-Off: A New and Growing Concern

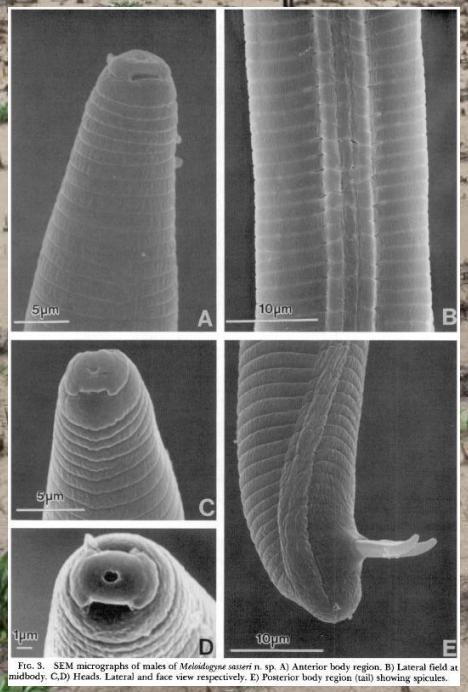

FIG. 3. SEM micrographs of males of *Meloidogyne sasseri* n. sp. A) Anterior body region. B) Lateral field at midbody. C,D) Heads. Lateral and face view respectively. E) Posterior body region (tail) showing spicules.

PHASES OF DUNE DIE-OFF

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DIE-OFF MAPPING RESULTS

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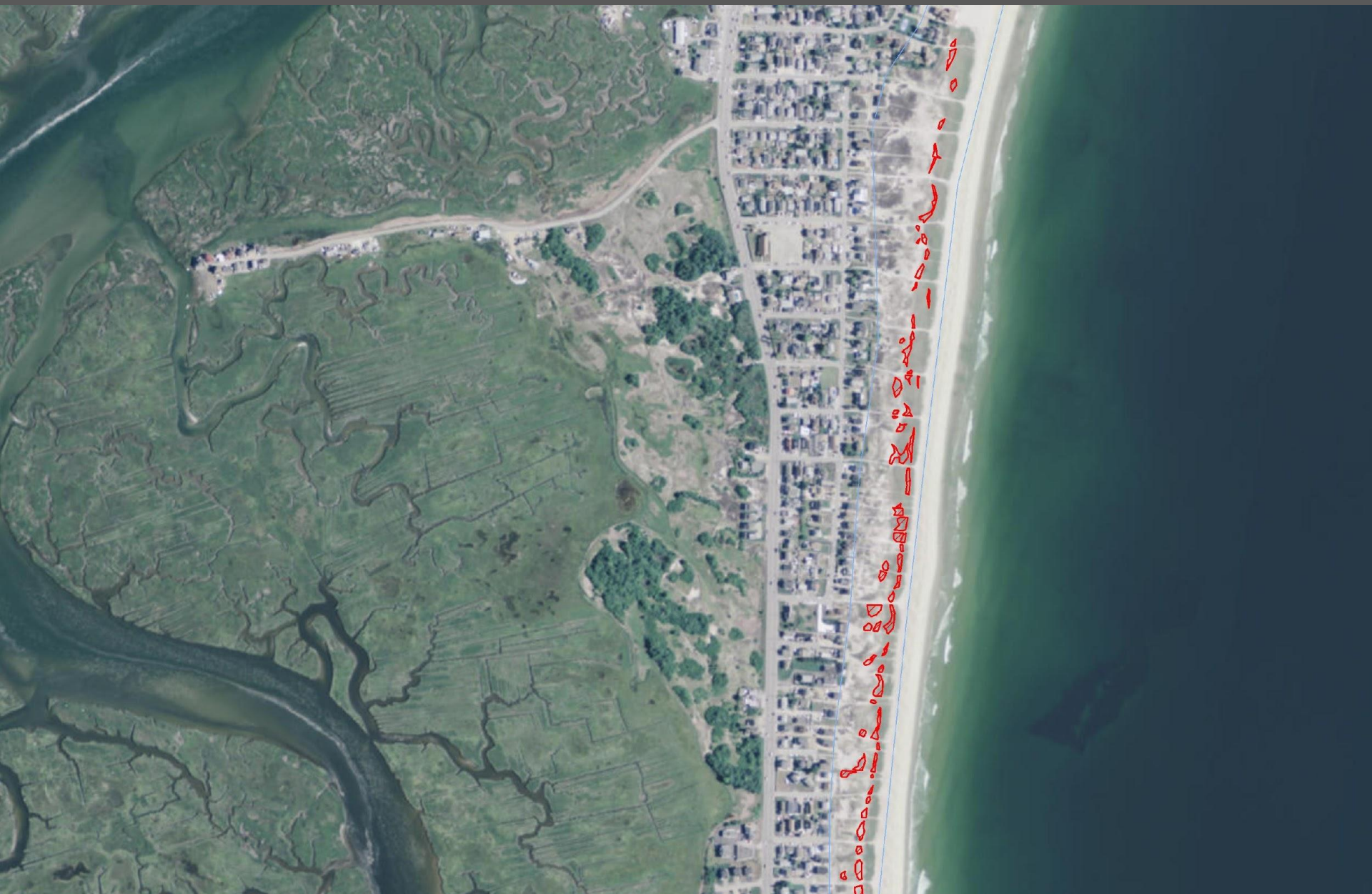

IDENTIFYING PATTERNS

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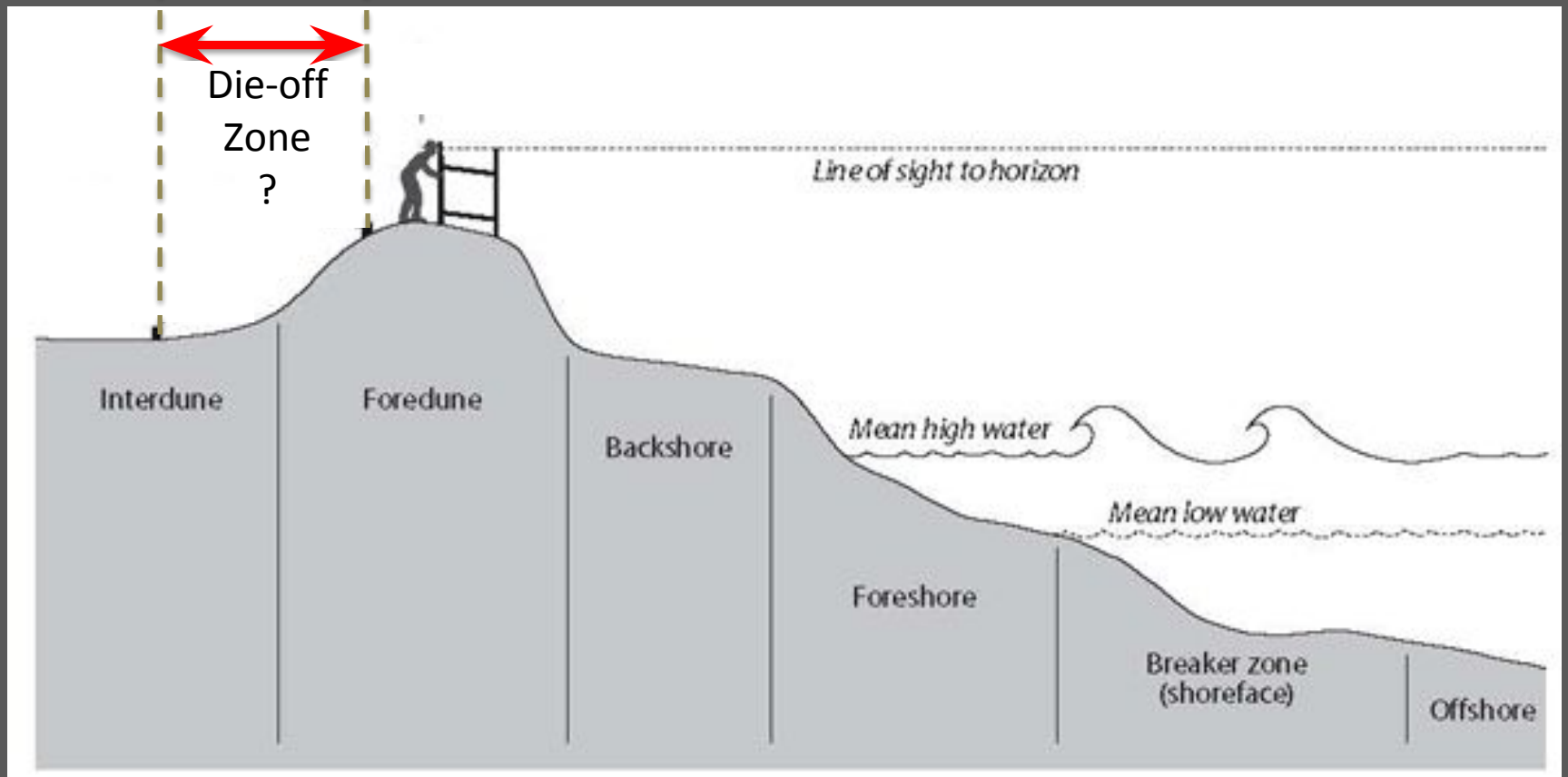

Adapted from: A Typical Dune and Beach Profile Courtesy of WHOI Sea Grant Program, 2001, Marine Extension Bulletin "Beach and Dune Profiles: An Educational Tool for Observing and Comparing Dynamic Coastal Environments" by Jim O'Connell

DUNE DIE-OFF STUDIES

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Soil Amendment Studies

Die-off Screening

DUNE DIE-OFF STUDIES

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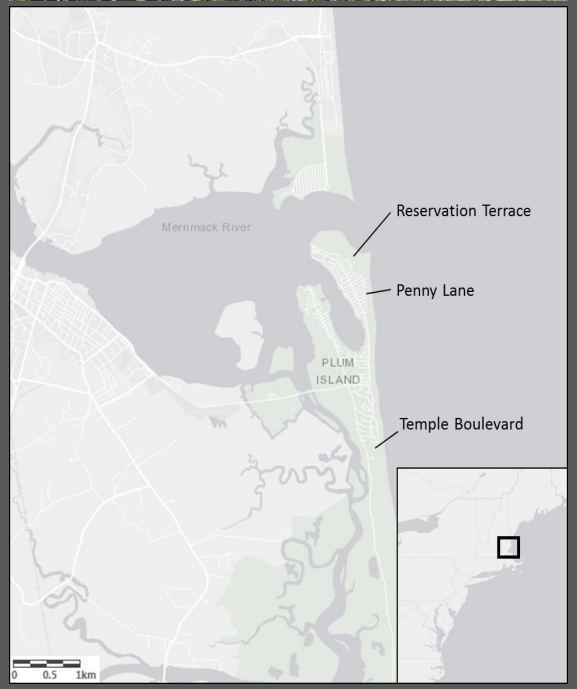
Soil Amendment Studies



C = Control; **F** = Fertilizer; **L** = Lime; **F+L** = Fertilizer + Lime

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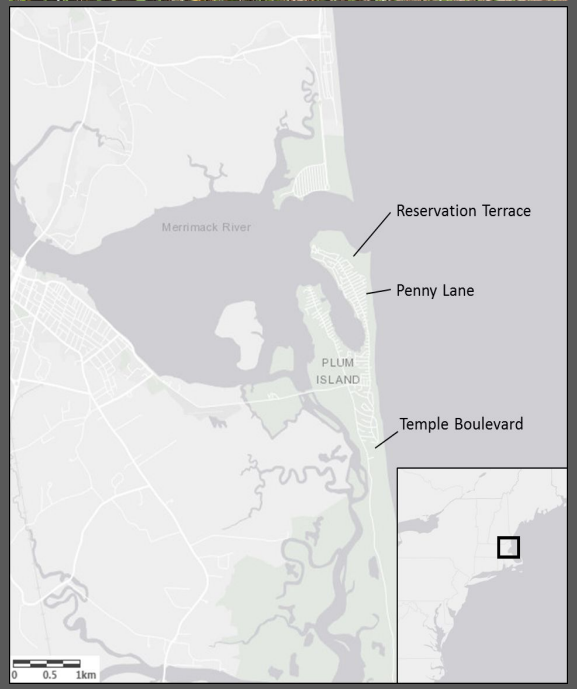
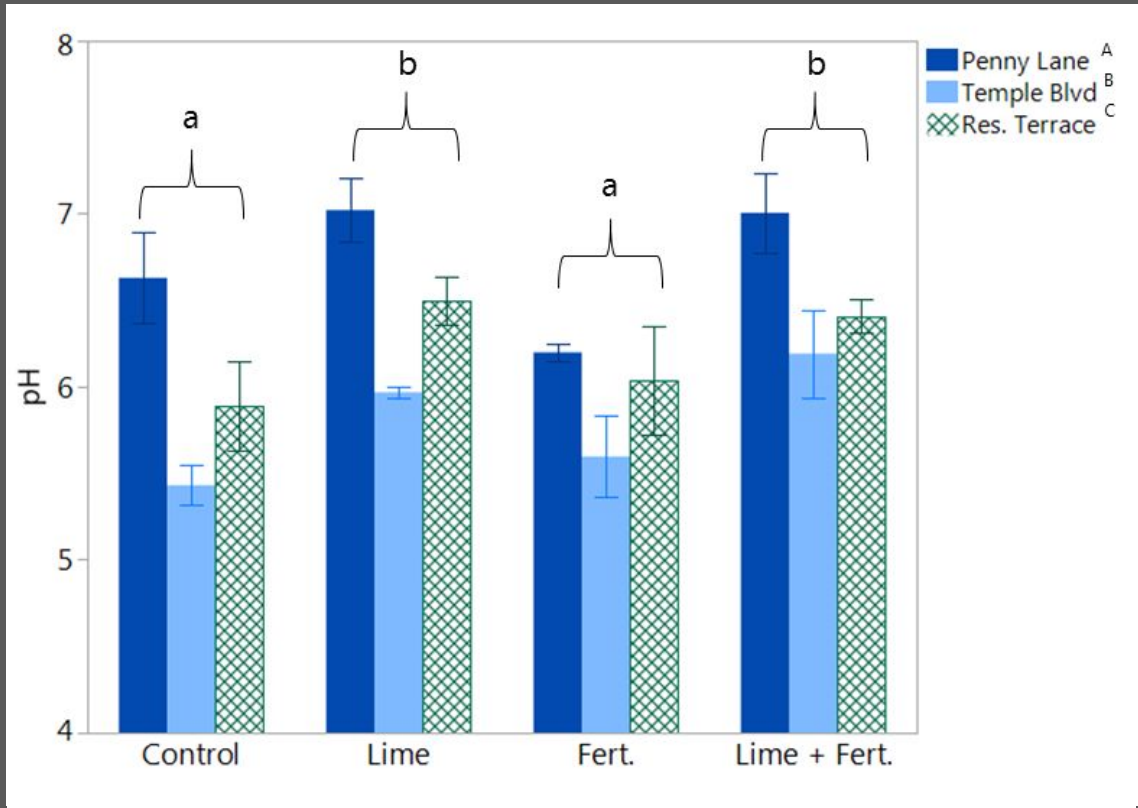
Soil Amendment Studies





The effect of soil amendments on pH for the three sites. Error bars represent standard error. Lowercase letters denote significant differences between treatments when blocked by site. Uppercase letters denote significant differences between sites.

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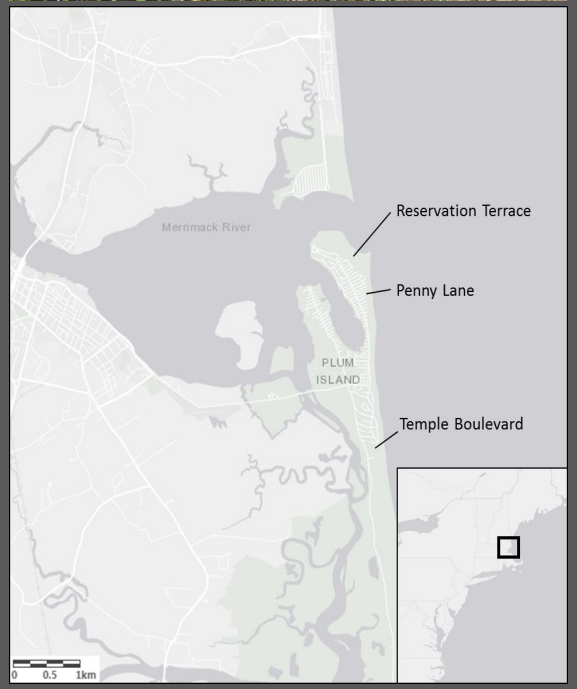
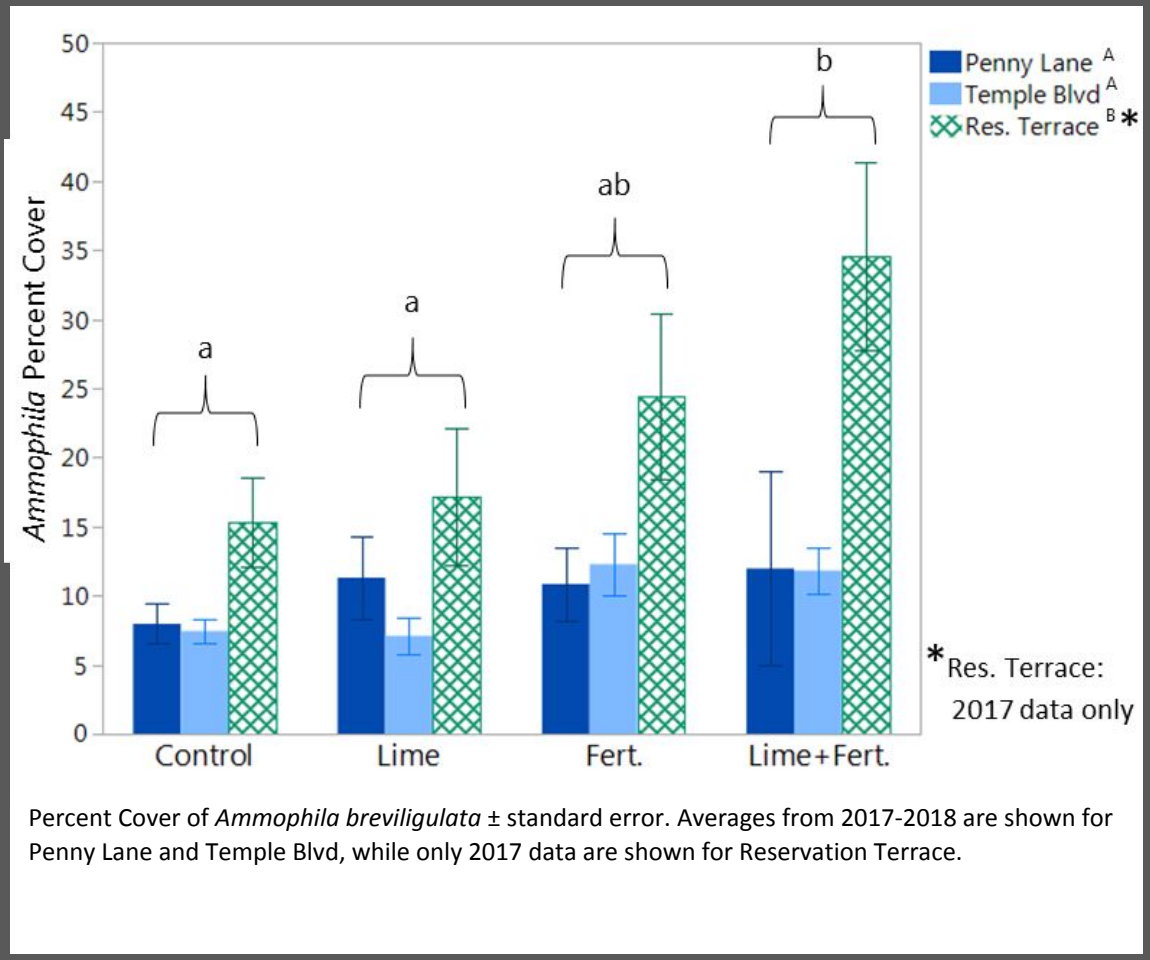
Soil Amendment Studies





Percent Cover of *Ammophila breviligulata* ± standard error. Averages from 2017-2018 are shown for Penny Lane and Temple Blvd, while only 2017 data are shown for Reservation Terrace.

DUNE DIE-OFF STUDIES

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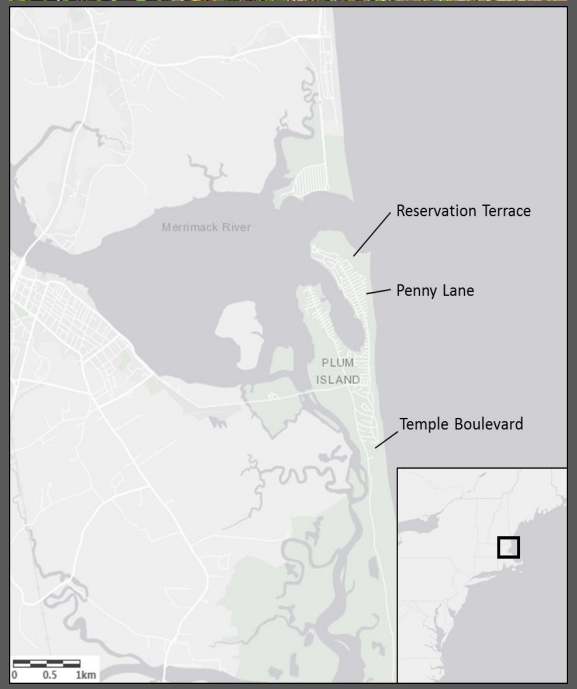
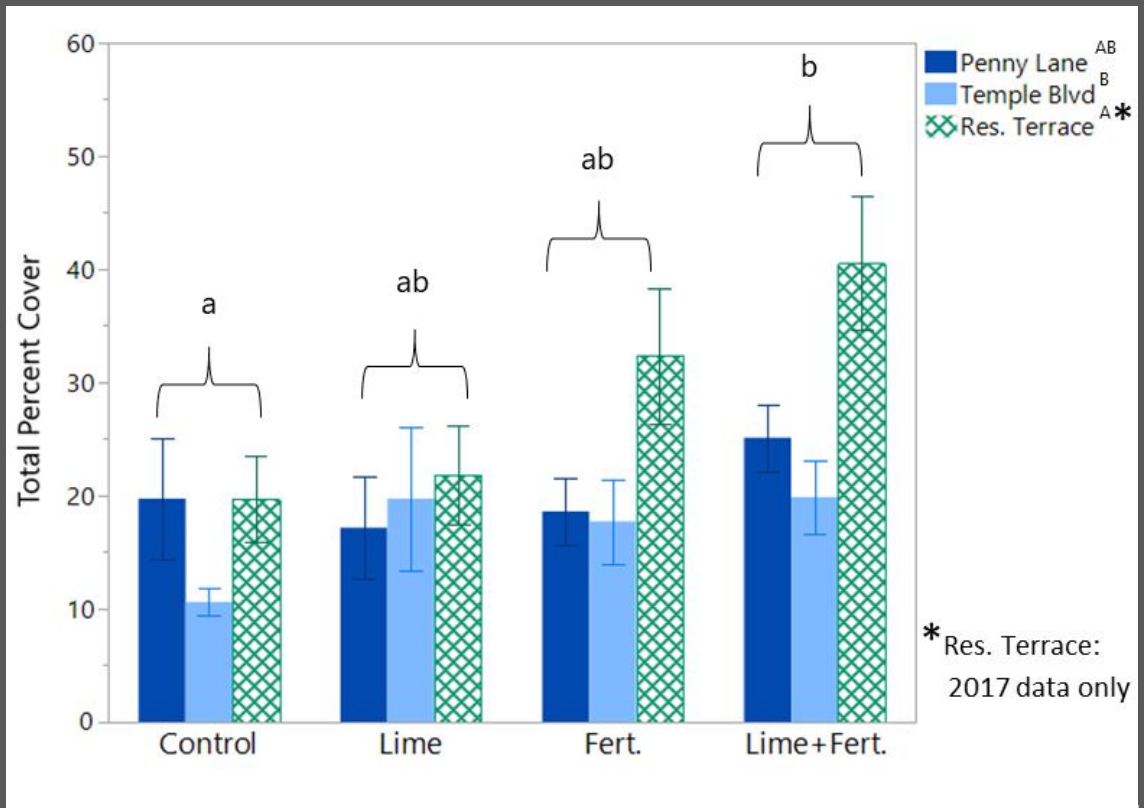
Soil Amendment Studies





Total Percent Cover ± standard error of all plant species for Penny Lane and Temple Blvd (2017-2018 averaged) and Res. Terrace (2017 only). Res. Terrace was not measured in 2018 because the site was destroyed by winter storm erosion. Different lowercase letters denote significant differences between treatments when blocked by site, and uppercase letters denote significant differences between sites

Results suggests soil amendments <u>can</u> hasten dune recovery

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Soil Amendment Studies

Die-off Screening

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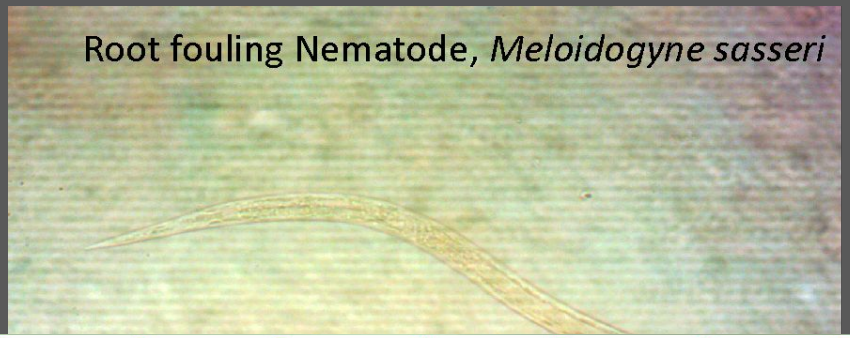
Taxonomy Based Screening

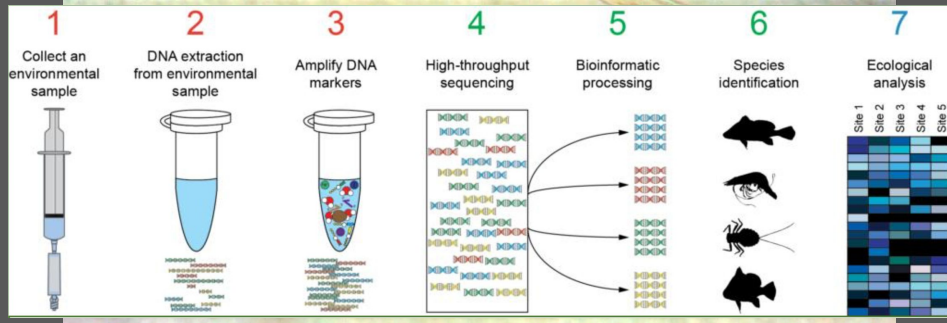
Control
(Healthy Dune)

Experiment$_1$
(Die-Off)

Experiment$_2$
(Nursery Stock)

Expected Causal Agent





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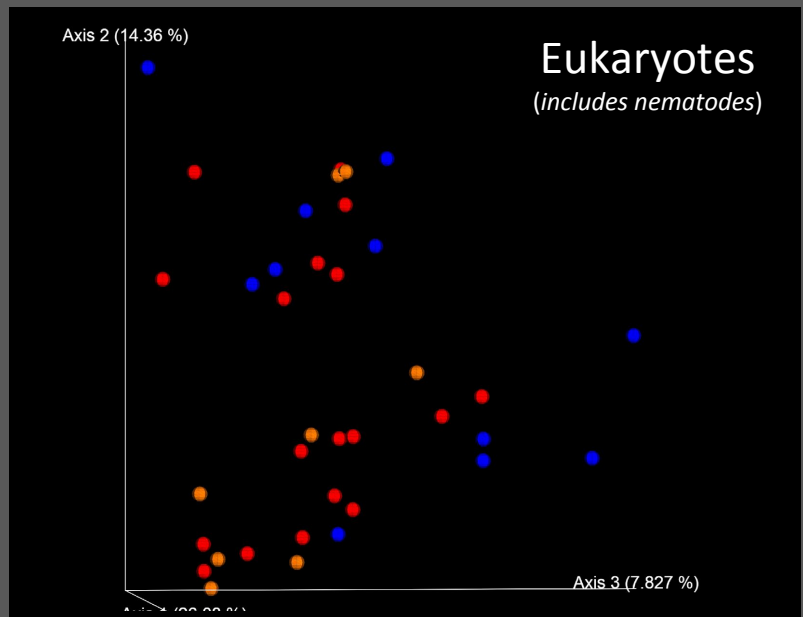
Genomic Screening

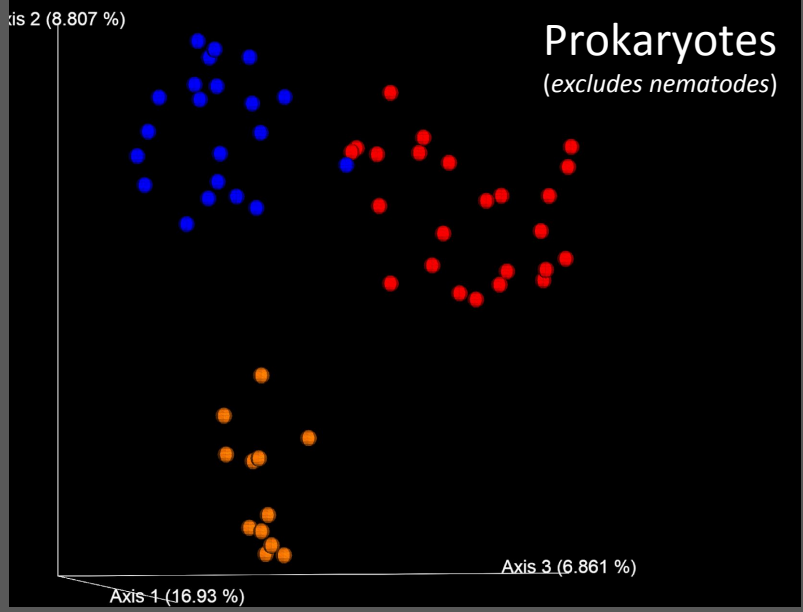
Control
(Healthy Dune)

Experiment$_1$
(Die-Off)

Experiment$_2$
(Nursery Stock)



Eukaryotes
(*includes nematodes*)



Prokaryotes
(*excludes nematodes*)

DUNE DIE-OFF STUDIES

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Genomic Screening

Unlike nematodes, Ascomycota and Basidiomycota unique to die-off samples

- Nematodes may causing initial injury, allowing for pathogenic fungal infection, *OR*
- Alternatively, fungal infection may render plants susceptible to nematodes

* *More study needed to discern vectors and confirm causal agents*

BROADER IMPACTS

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Phase I of Project:

- Engaged community, stakeholders
- Provided a voice for landowners to define coastal concerns
- Identified and mapped die-off in NH-MA Seacoasts

Phase II of Project:

- Developed low-cost, effective treatment to hasten dune recovery
- Leveraged an additional study
- Determined that nematodes may not be the sole causal agent of die-off.

ACKNOWLEDGEMENTS

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This project would not be possible without participation of the Seacoast Communities of NH and MA, countless student volunteers, and UNH's Coastal Research Volunteers