



Building Eelgrass Resilience in Parks from ME to NC

Reduce climate vulnerability of
eelgrass meadows across
National Parks units

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Northeast Coastal & Barrier Network, NPS

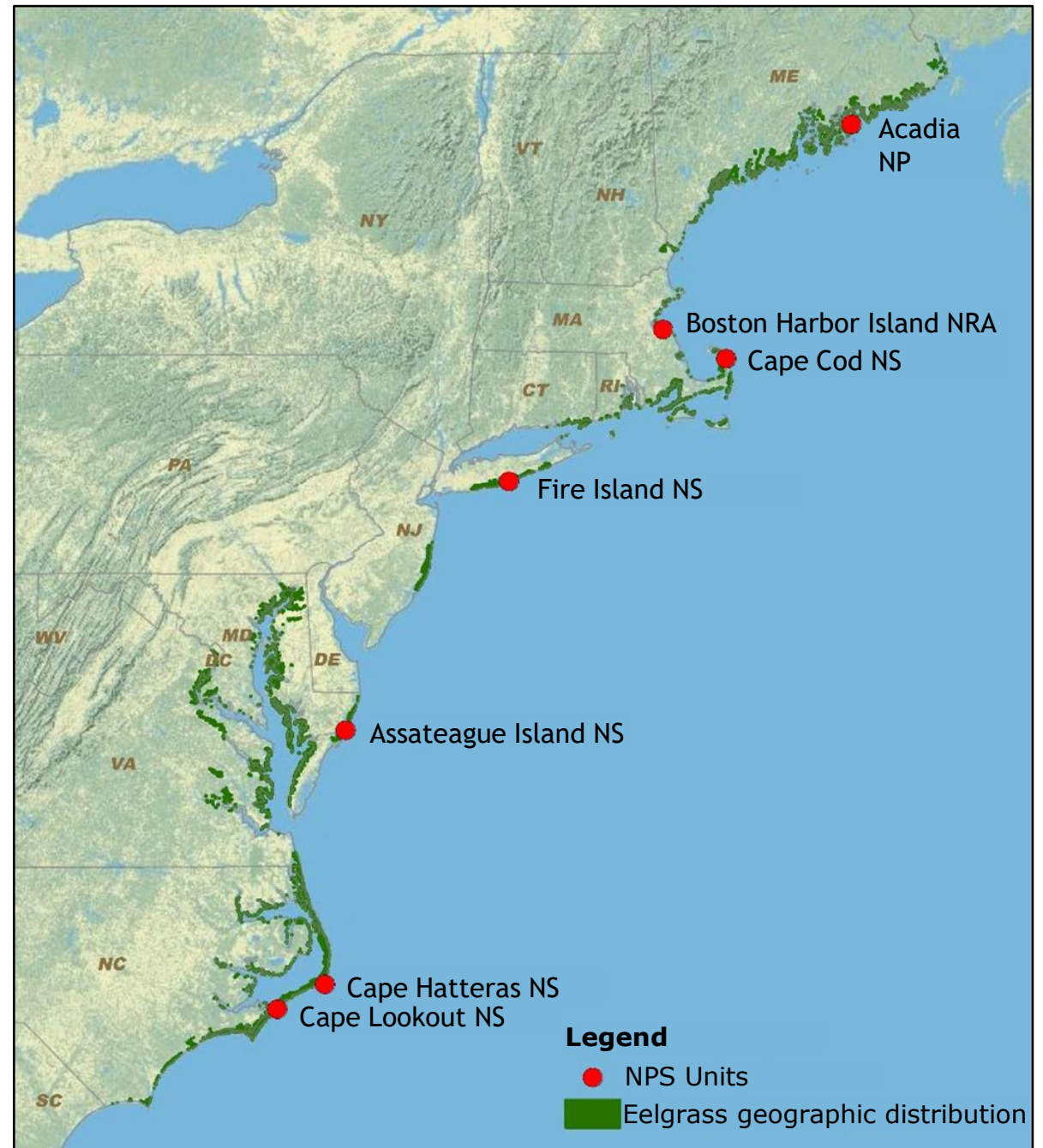
LIS Eelgrass Collaborative Workshop

May 30, 2024



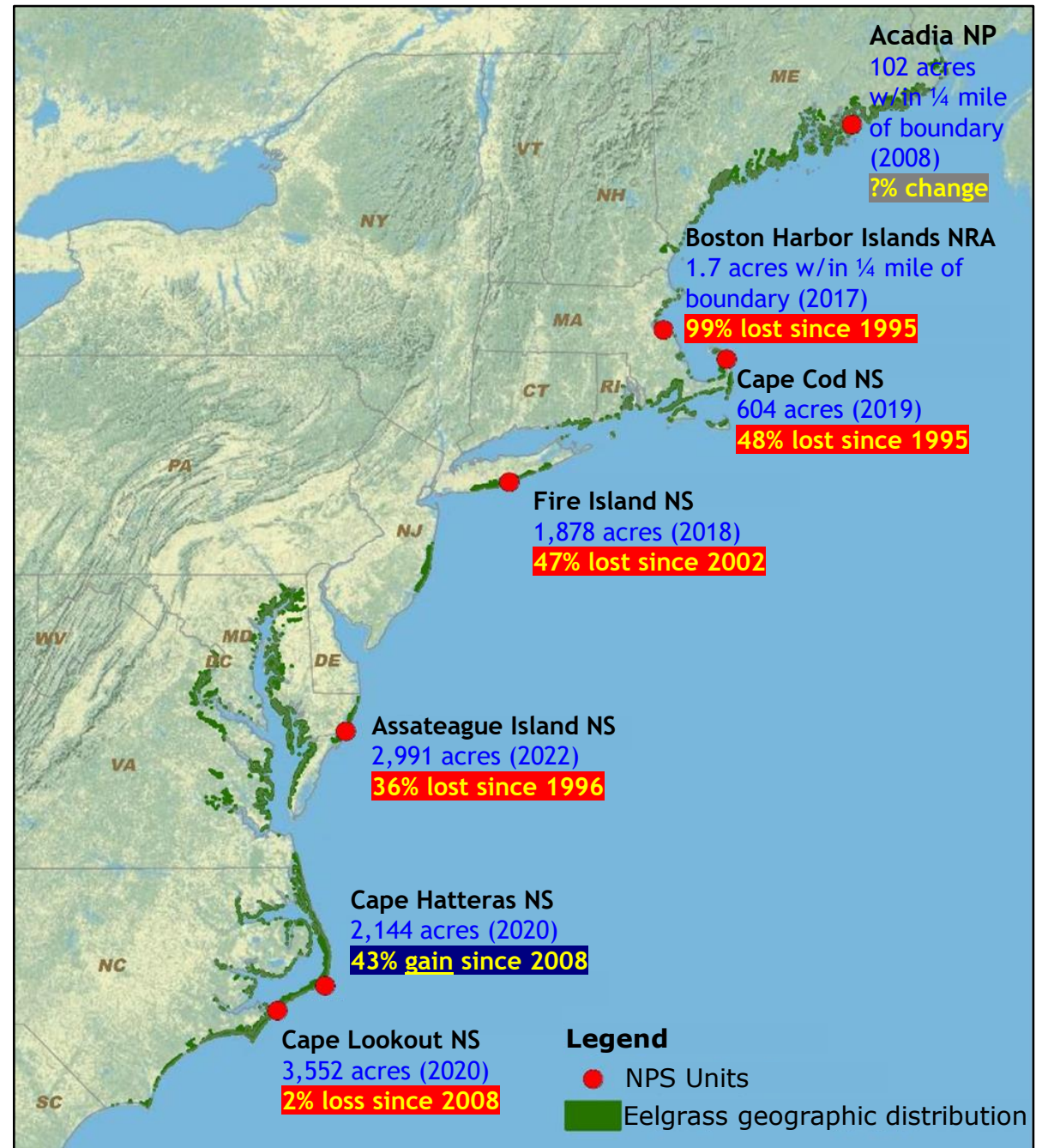
Eelgrass is a National Park Service Priority!

- ▶ Foundation species provides numerous ecosystem services, but is under threat
- ▶ Natural Resource Stewardship and Science (NRSS) and the Northeast Coastal and Barrier Inventory & Monitoring Network (NCBN) prioritize seagrasses
- ▶ Cape Cod NS and Fire Island NS - Resource Stewardship Strategies.
- ▶ Boston Harbor Islands NRA - supports restoration
- ▶ Assateague Island NS - General Management Plan and annual mapping



Eelgrass is declining at alarming rates in the Northeast National Parks

- ▶ Total change in NPS seagrass over ~30 years **-3,390 acres** (4+ NYC Central Parks)
- ▶ NPS I&M monitoring data indicate rising sea temperatures have contributed to declines in eelgrass... and seedbanks.
- ▶ Development of a large-scale collaborative effort to stop declining trends and build resilient eelgrass meadows across the region.



Many minds and hearts contributed this plan!

- ▶ Multi-agency, multi-institutional workgroups developed a collective vision for building resilience eelgrass across the region.
 - ▶ Multi-day virtual workshops hosted by TNC - 2022
 - ▶ Collaborative Climate-Adaptive Restoration of Eelgrass - led by Northeastern University - 2023
- ▶ Outcome: Reduce climate vulnerability of eelgrass meadows through the application of assisted gene flow approaches
- ▶ Ready to pounce on funding: internal NPS programs, IRA, BIL



A PATH FORWARD:

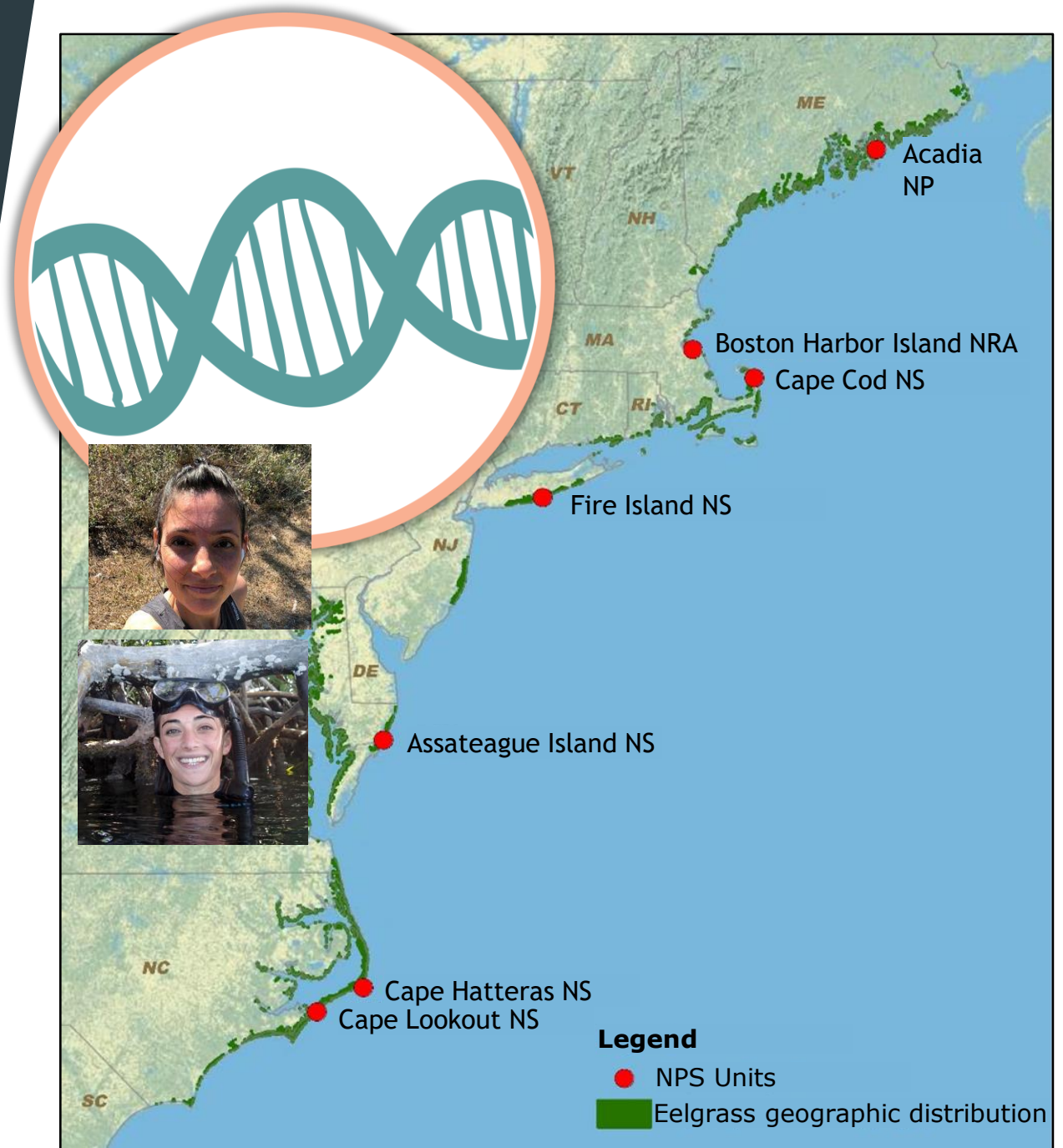
Building Eelgrass Resilience

ALONG THE MID-ATLANTIC AND NEW ENGLAND COAST



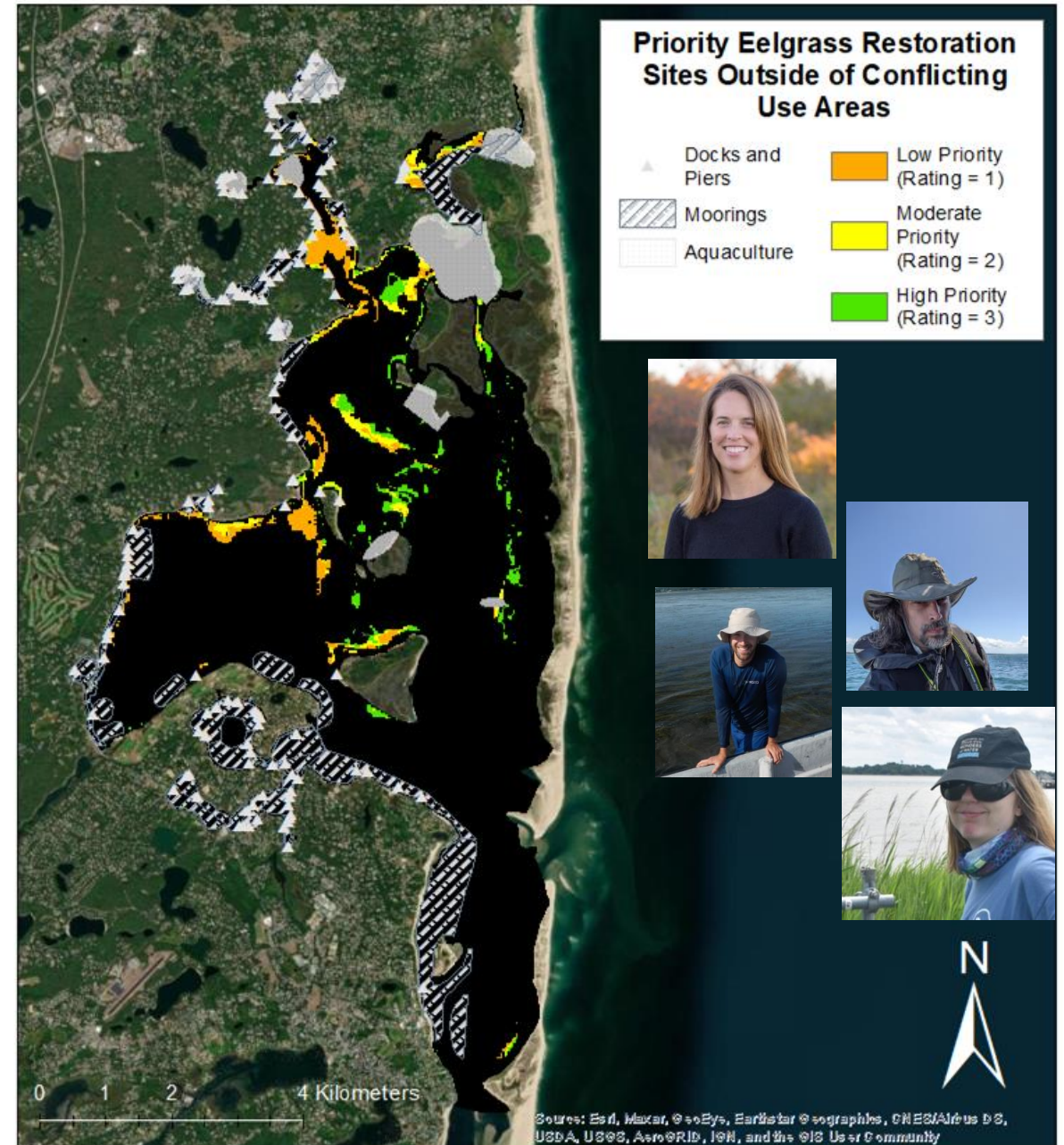
Part 1: Genomics

- ▶ Sample meadows in and around 7 National Park units from NC to ME (~70 meadows will be sampled and sequenced)
- ▶ Analyze samples for unique markers
 - Are specific populations adapted to high temp stress?
 - Can we identify those adaptations at the genomic level?
 - Can we use those traits to increase resilience of other populations?



Part 2: Site Selection for Rehabilitation and Restoration

- ▶ Not all sites are suitable
- ▶ Multiple parameters influence the establishment and growth of eelgrass
 - Light
 - Bathymetry
 - Sediment type
 - Hydrodynamics
 - Water quality (Nutrients)
 - Temperature
 - Historical distribution
 - Conflicting uses
- ▶ Model weighs parameters according to their degree of influence on eelgrass success and combines them in a multiplicative rating to prioritize sites



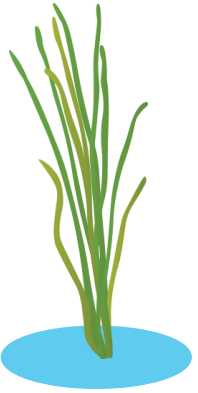
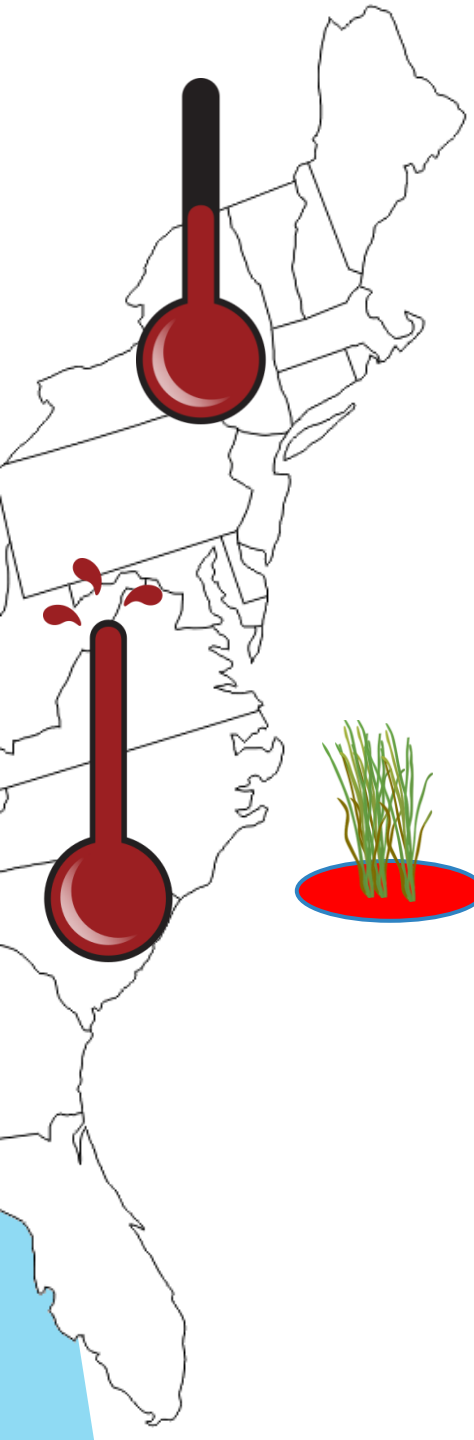
Part 3: Common Gardens

- ▶ Conduct pilot studies at 4-5 NPS units (Cape Cod, Fire Island, Assateague, Cape Hatteras/Cape Lookout)
- ▶ Identify thermotolerant individuals

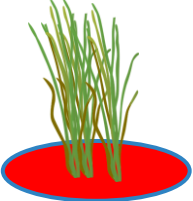


1) *Assisted gene flow* = move thermally tolerant plants to areas where we want to build climate resilience

2) *Common garden* = plants from different sources are grown under the same conditions to confirm adaptation to high temperatures

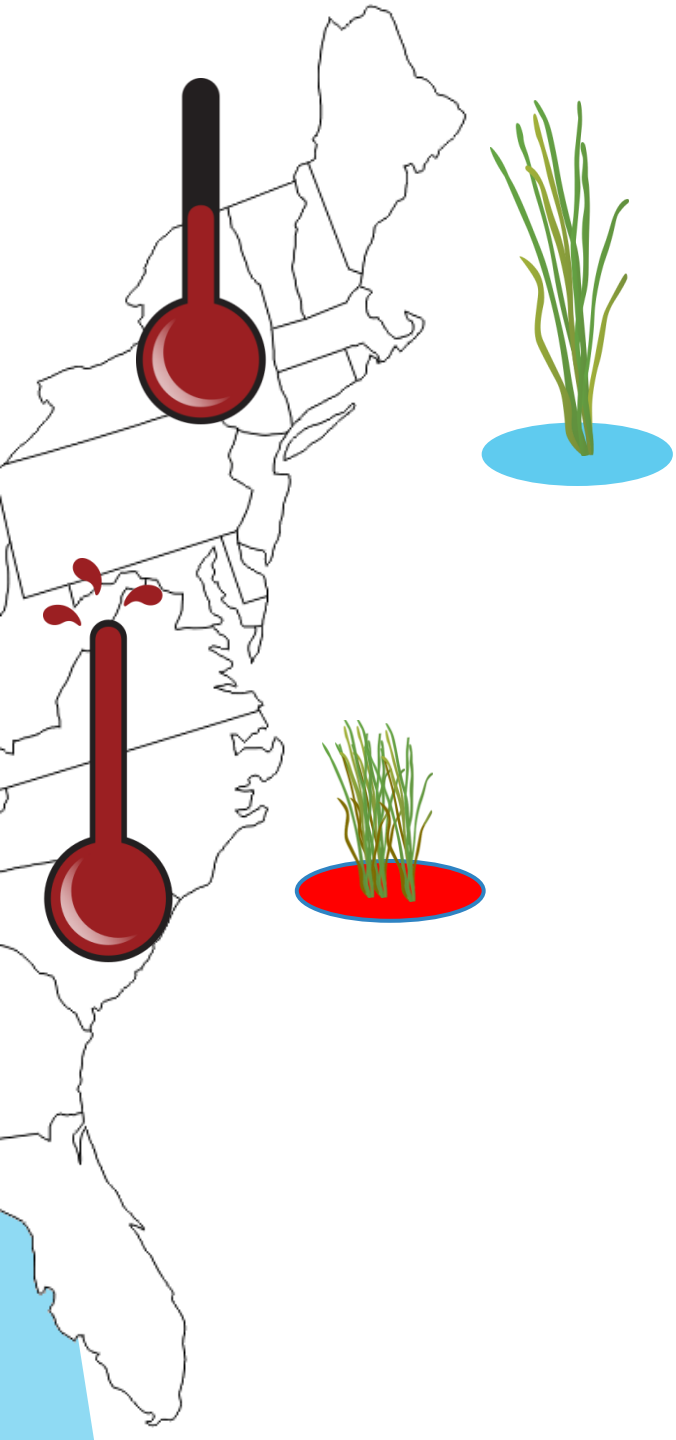


Cool-adapted



Warm-adapted (thermotolerant)





1) *Assisted gene flow* = move thermally tolerant plants to areas where we want to build climate resilience

2) *Common garden* = plants from different sources are grown under the same conditions to confirm adaptation to high temperatures



Reciprocal common gardens to confirm local adaptation of warm-adapted individuals

Part 4: Seed Strategy for North Atlantic Eelgrass

- ▶ Develop seed transfer zones for North Atlantic eelgrass, through population genetic surveys and examination of state and local regulations for the complete species range of eelgrass from NC to Maine
- ▶ Develop maps of specific meadows identified as containing genetically viable seed source populations for propagation and future restoration across seed transfer zones and develop management guidelines for the long-term maintenance of these meadows within parks.



THE FOUR GOALS of the “National Seed Strategy for Rehabilitation and Restoration”

GOAL 1



Identify seed needs, and ensure the reliable availability of genetically appropriate seed.

GOAL 2



Identify research needs and conduct research to provide genetically appropriate seed and to improve technology for native seed production and ecosystem restoration.

GOAL 3



Develop tools that enable managers to make timely, informed seeding decisions for ecological restoration.

GOAL 4



Develop strategies for internal and external communication.

What does this mean for NPS and beyond?

- ▶ Identification of eelgrass populations critical for regional and park-level species persistence and those comprising key traits found to be most resilient to climate stressors.
- ▶ Identification of eelgrass climate refugia within and optimal areas for eelgrass recovery and restoration, accounting for changing climate.
- ▶ Development of a framework for management and conservation of existing eelgrass meadows as well as restoration and rehabilitation of degraded meadows, across its range, NC to ME.
- ▶ Hope for eelgrass survival in the face of climate change.

