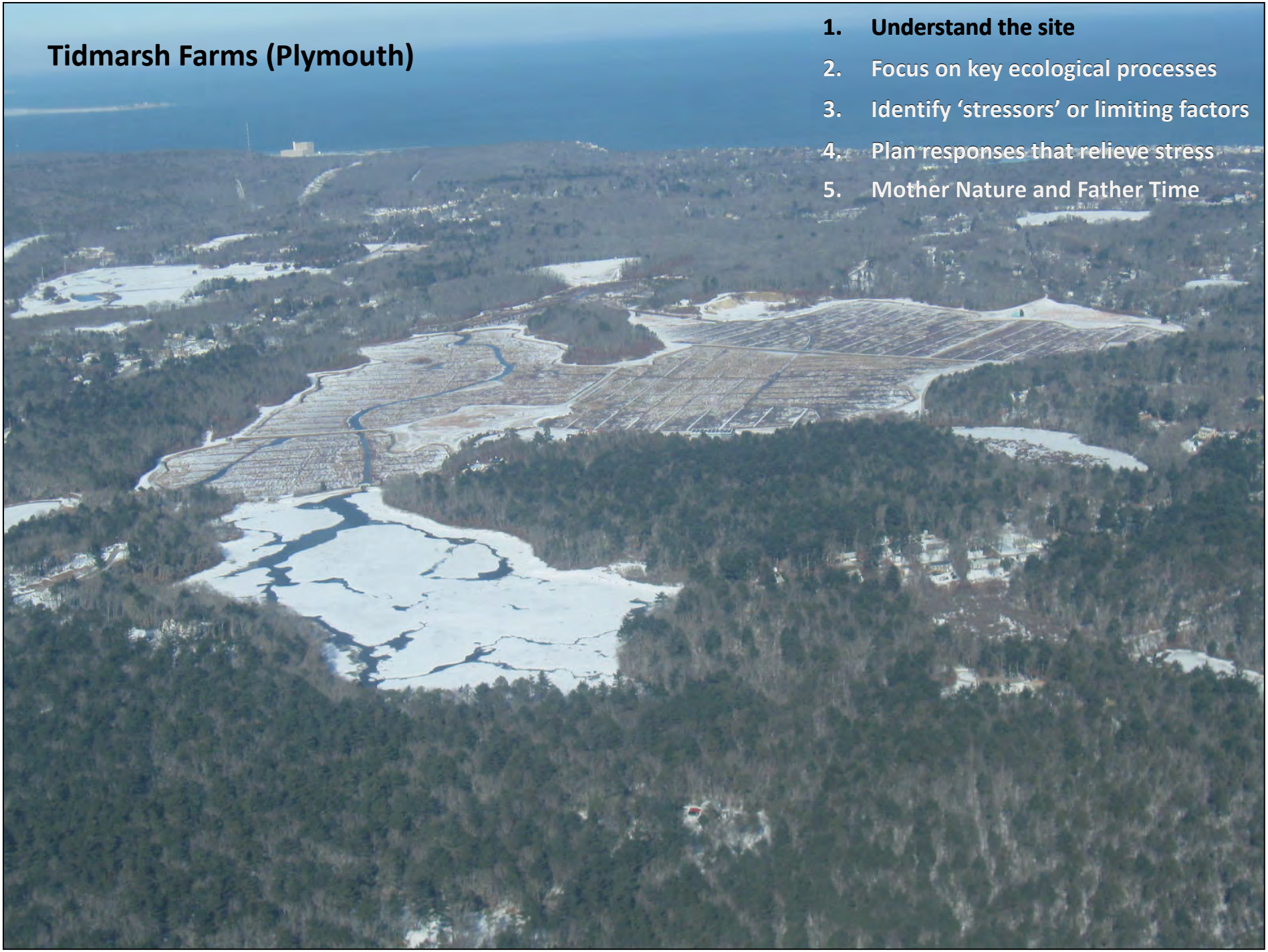
Massachusetts Department of Fish and Game
Division of Ecological Restoration
Invested in Nature and Community

Practical 'Process-Based' Restoration Framework

1. Understand the site potential
    - Work with the land and not against it
2. Focus on key ecological processes[1]
    - Physical drivers of habitat formation and maintenance
3. Identify 'stressors' or limiting factors for these processes
4. Plan responses that relieve stress
5. Mother Nature and Father Time[2]

Eel River (Plymouth) – Liberated movement of water

[1] *See Beechie et al. (2010), Process-based Principles for Restoring River Ecosystems*
[2] *Commonly attributed to William Mitch, OSU*


Tidmarsh Farms (Plymouth)
1. Understand the site
2. Focus on key ecological processes
3. Identify ‘stressors’ or limiting factors
4. Plan responses that relieve stress
5. Mother Nature and Father Time


Tidmarsh Farms before restoration (2010)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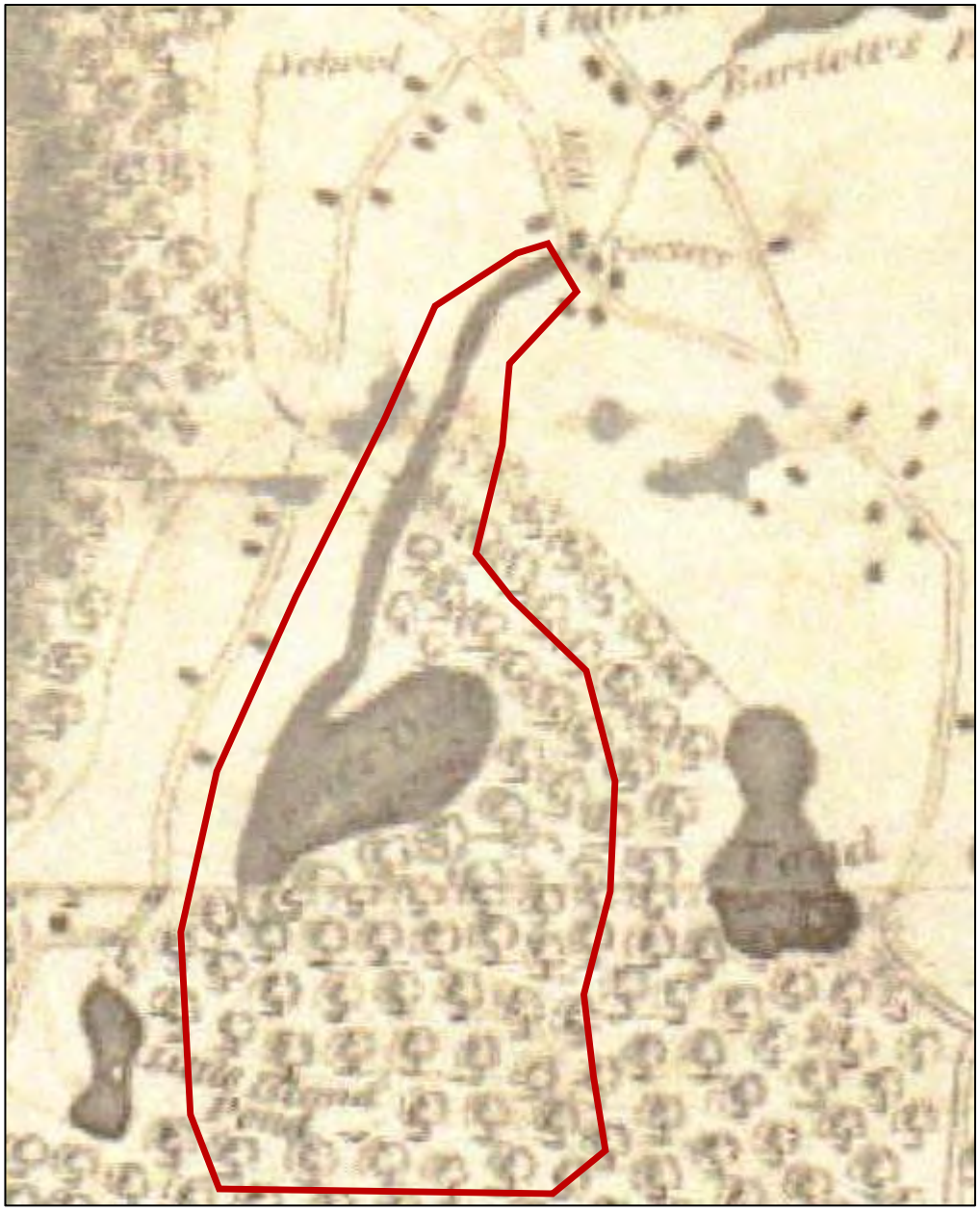

1830 Map – Plymouth Town Hall (G. Davenport)

Credit: G. Davenport

1. Understand the site
2. **Focus on key ecological processes[1]**
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Our focus is on the **movement and storage of water** on the land

(a physical process)

- Other key processes are linked (e.g. movement of sediment, organic matter, nutrients, organisms)

1. *See Beechie et al, 2010. Principles for Process-Based River Restoration*

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Tidmarsh Restoration Project
October 2016

DESIGN SUMMARY

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Restoration Overview – This table summarizes the primary stressors identified as factors limiting ecological recovery at Tidmarsh Farms, the associated restoration responses, and desired outcomes in the medium to long term. This 'process-based' approach focuses on the physical movement and storage of water, sediment, organic matter, and organisms across the site.

Limiting Factor	Proposed Response(s)	Desired Outcome
1. Anthropogenic sand layer that separates plants from the water table	• Fill perimeter irrigation ditches • Plug interior (lateral) irrigation ditches • In-stream subsurface grade control riffles • Break apart dense cranberry mat to liberate springs	• Increase soil moisture • Increase storage of water on the site • Establish conditions for self-sustaining wetlands
2. Barriers to free movement of fish, wildlife, and water	• Remove Beaver Pond Dam • Remove interior water control structures and cell-spanning dikes • Partially remove dam at the Arm; install large culvert • Install wide bridge at Cell 1-2 dike • Slope perimeter to facilitate wetland to upland wildlife movement	• Free movement of aquatic and terrestrial organisms • Free movement of water, sediment, and organic matter
3. Physical Simplification	• Rebuild channels and add wood; reconnect floodplains • Roughen flat farm surfaces and add large wood • Remove sand a expose peat in select locations for isolated wetlands • Construct several large pond	• Improved habitat quality and diversity across the site • Stage is set for future natural habitat formation and maintenance
4. Legacy pesticides (sand layer) and nutrients	• Increase amount of organic matter on the bog surface • Avoid intense microtopography around new ponds to avoid unintended OC pesticide mobilization and uptake • Increase hydro residence time (acknowledging potential trade-offs) *Note – full sand removal not feasible*	• Legacy pesticides stay on site • Minimize new exposure and uptake routes; enhance binding to organic carbon • Increase nutrient uptake and reduce nutrient export
5. Biological simplification	• Site is already self-healing and will continue • Control invasives • Selective planting over time (e.g. ~6,500 AWC) • 'Head start' T&E species (i.e. Red bellied cooter)	• Diverse and self-sustaining biota • Rare, threatened, and endangered species on site

Before restoration (2011)

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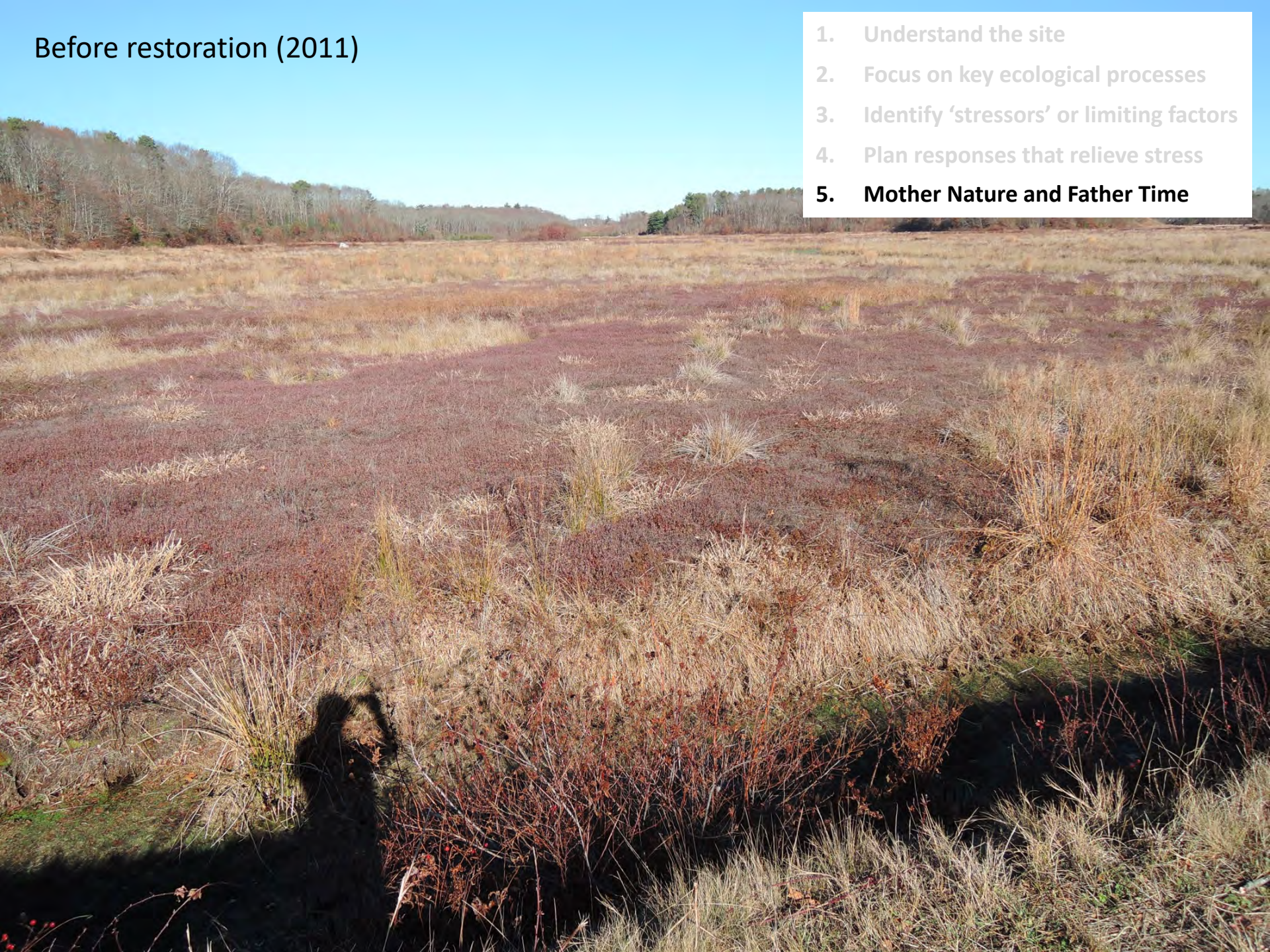

During restoration (March 2016)

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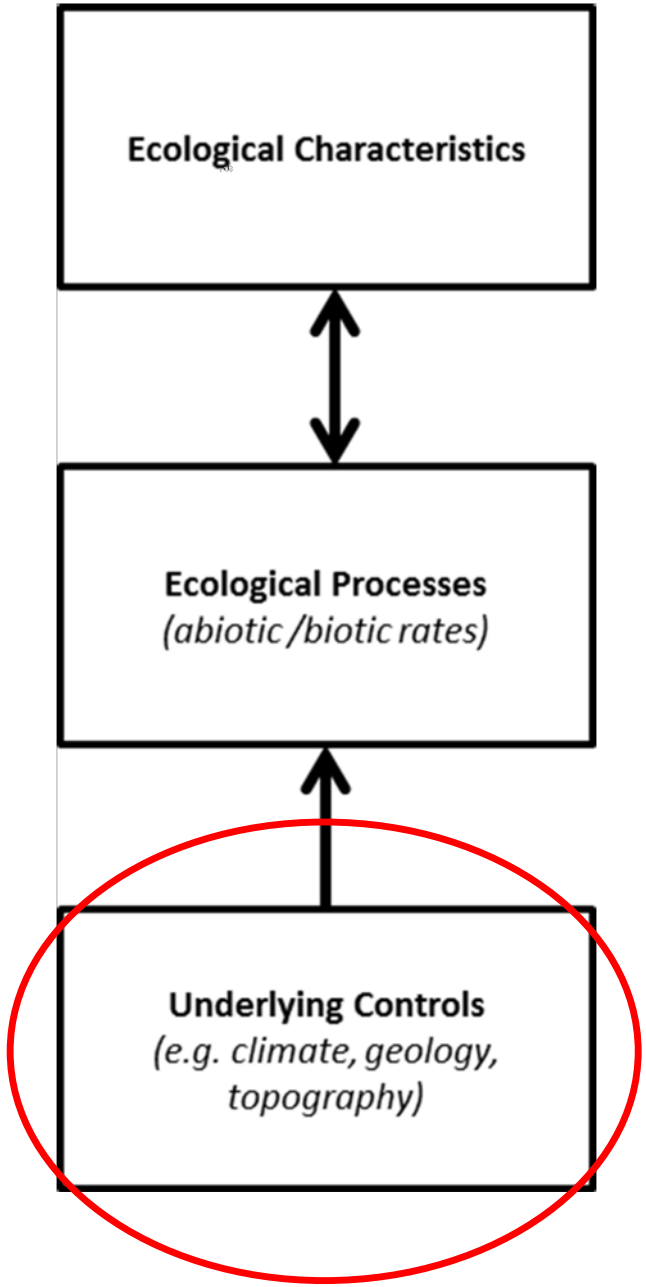
Post restoration (July 2016)

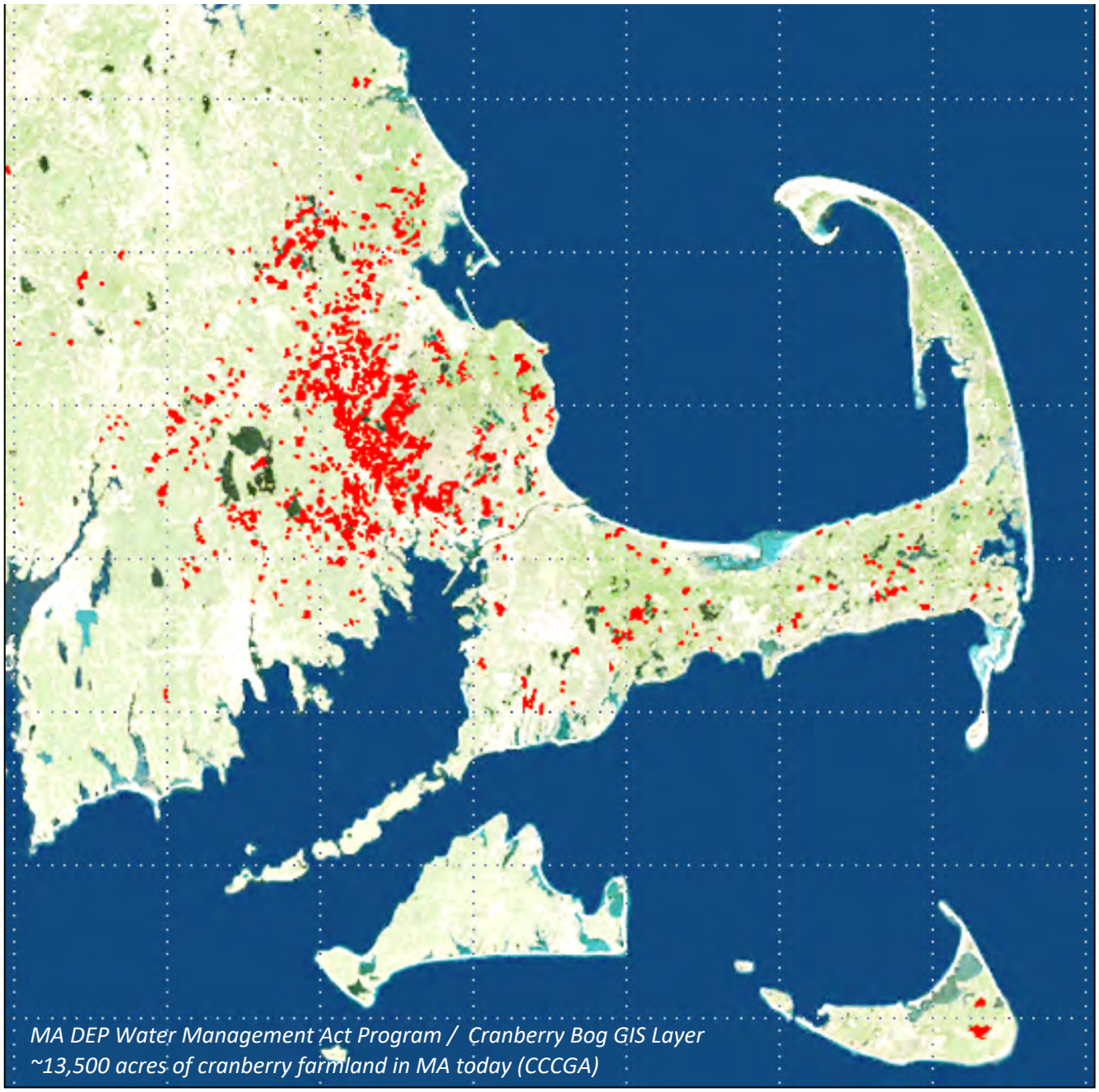

Post restoration (October 2016)

Assertion #3:

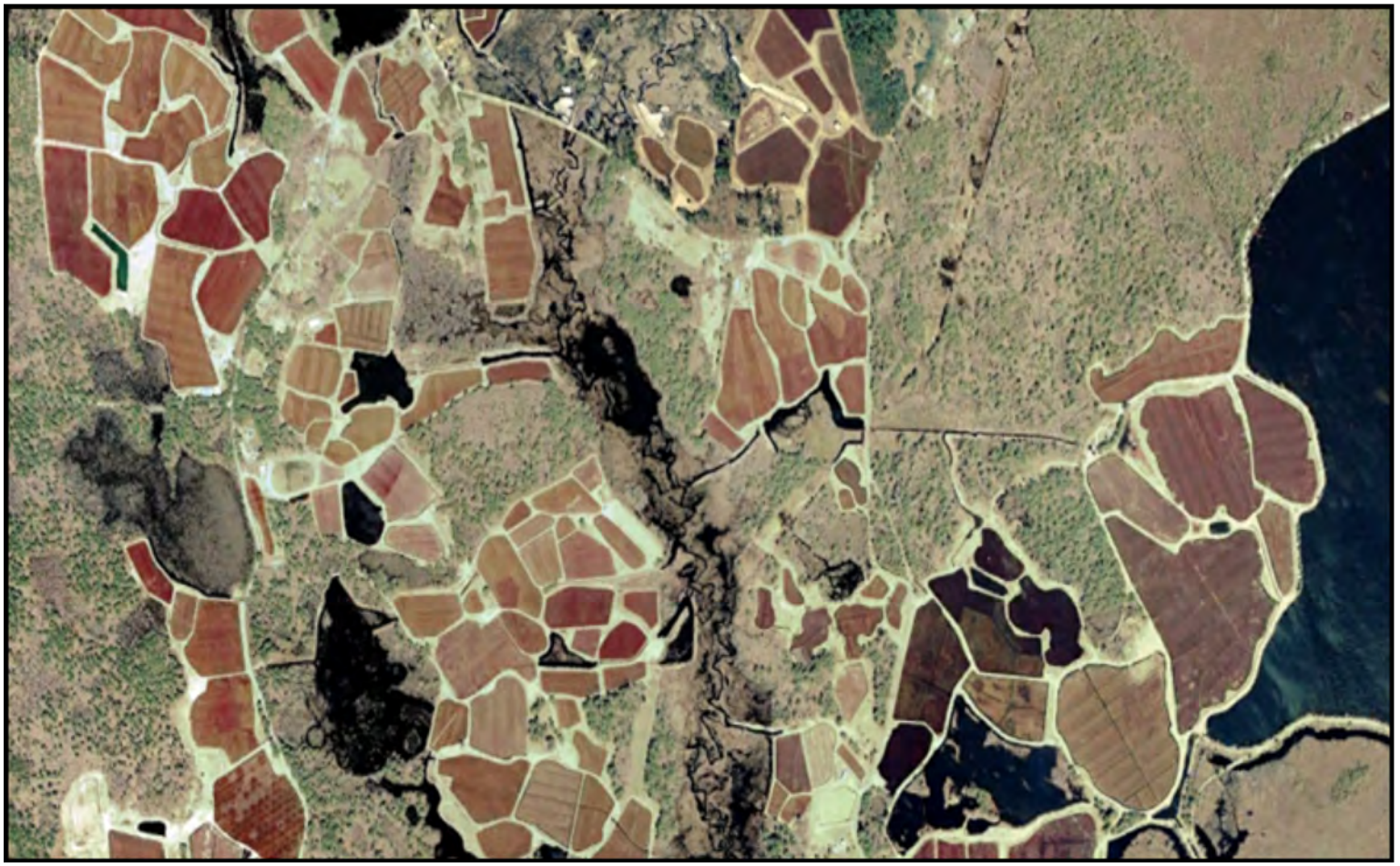
Restoring the **natural movement and storage of water** helps aquatic ecosystems respond to climate change



Where are opportunities for effective river and wetland restoration?



- Collapsing prices
- Retirements
- Political attention
- Land in transition



This alternative helps with current and future water challenges…

Eel River Headwaters (Plymouth) – former cranberry farm – 7 years post restoration

Massachusetts has a new state program dedicated to this work…

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Cranberry Bog Program

DER is helping to restore healthy wetlands on retired cranberry bogs.

Approximately 13,250 acres of cranberry farms exist in Massachusetts today. Falling prices and other factors are leading some farmers to consider other alternatives for their land, as well documented by the Massachusetts Legislature's Cranberry Bog Revitalization Taskforce. For some, a 'green exit strategy' involving land conservation and habitat restoration makes sense. Over the past 10 years, working with local, state, and federal partners (such as the USDA Natural Resource Conservation Service), DER has helped to restore wetlands and streams across hundreds of acres of retired cranberry farmland. To learn about our Cranberry Bog Program, please explore the pages below or contact Alex Hackman at 617-626-1548 or alex.hackman@state.ma.us.

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Many roles to play

Healthy and dynamic
Restored Wetlands

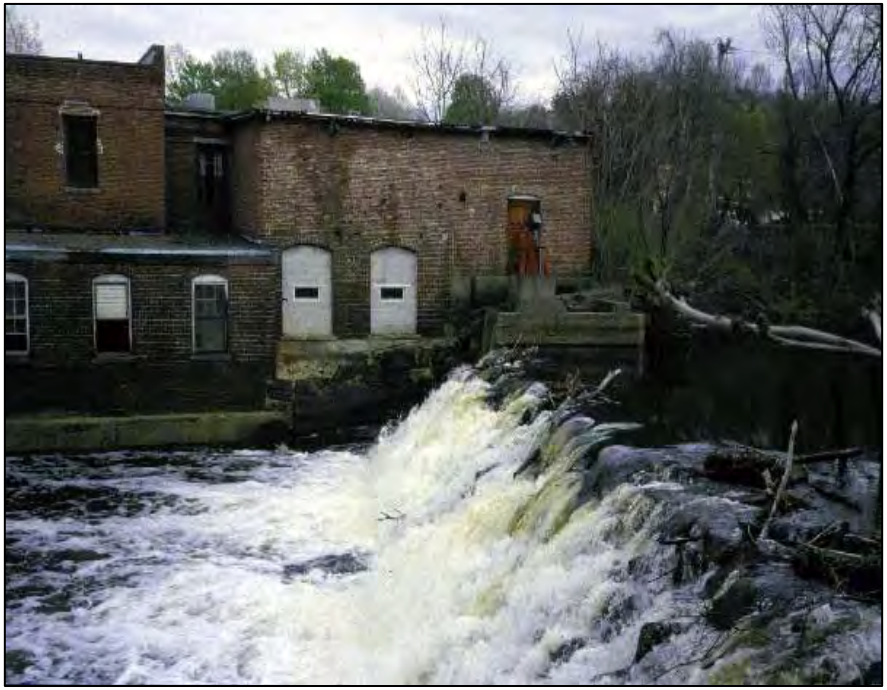
Learning

LIVING OBSERVATORY

Protected Land
(e.g. Conservation easement via NRCS WRE)

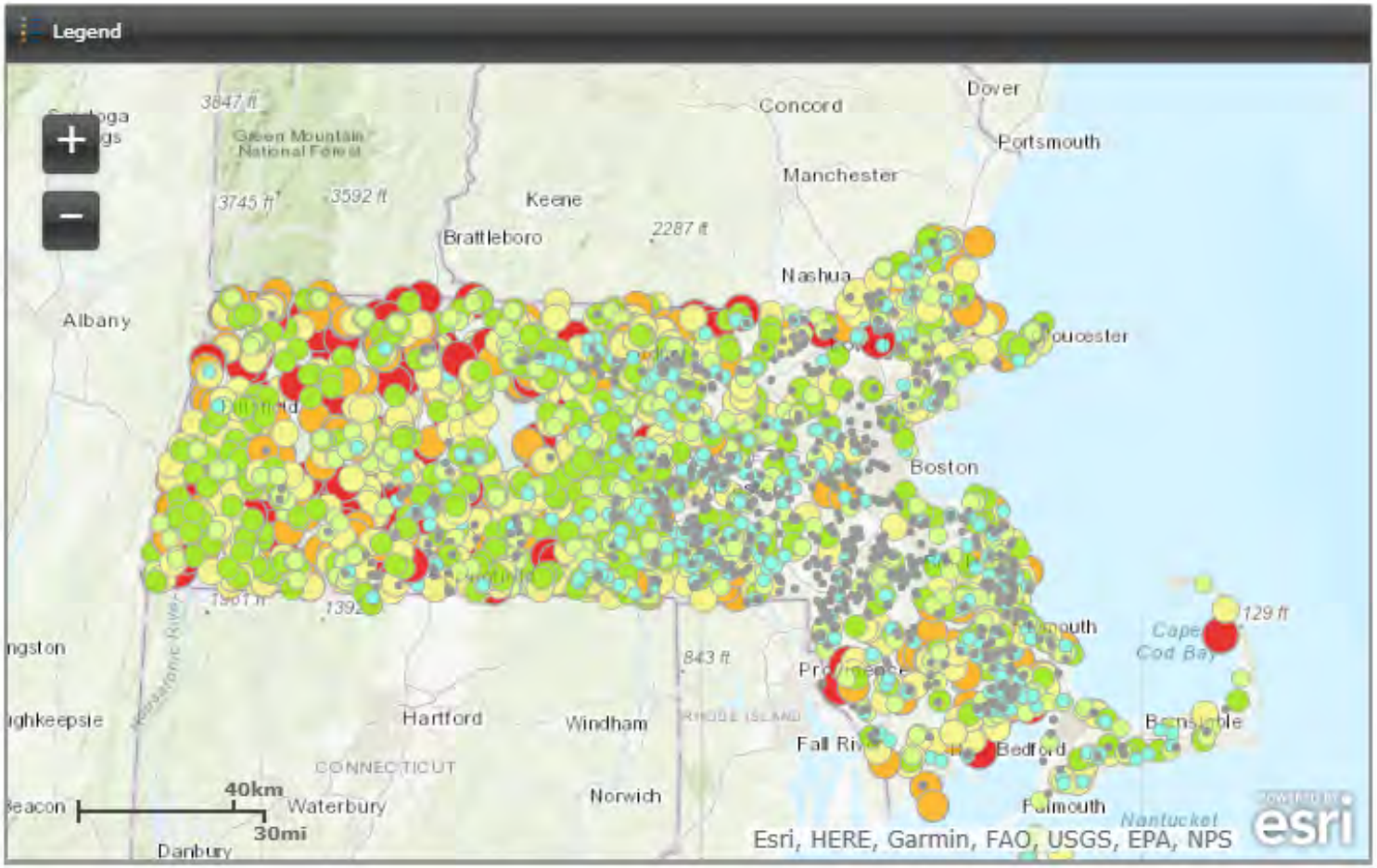
Managed Public Open Space

Another opportunity: Old dams that have no active use

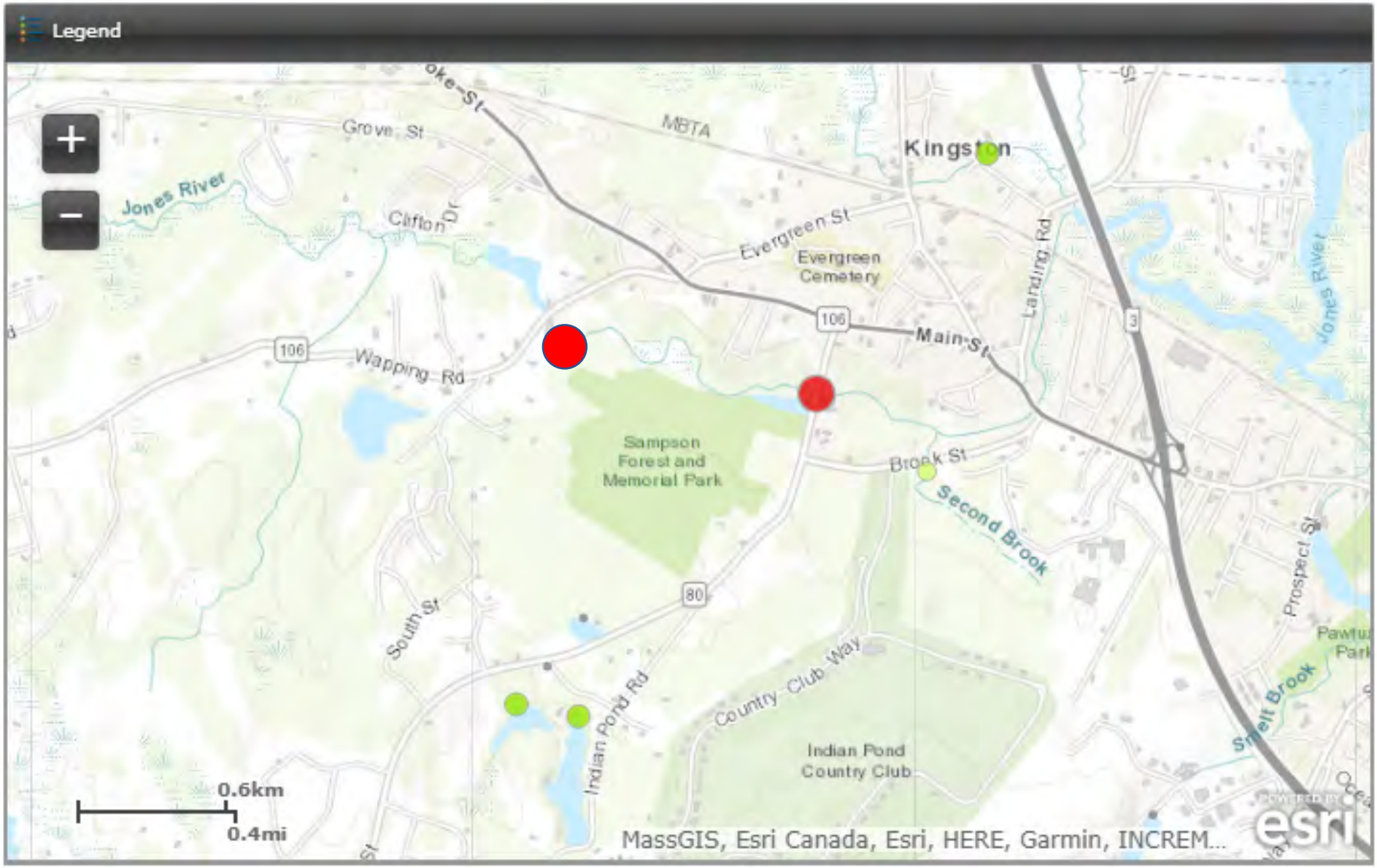


DER's Restoration Potential Model Tool

DER's Restoration Potential Model (RPM) Tool displays information that can be used to evaluate the relative ecological benefit of removing any known dam in the Commonwealth.



Jones River (Kingston)

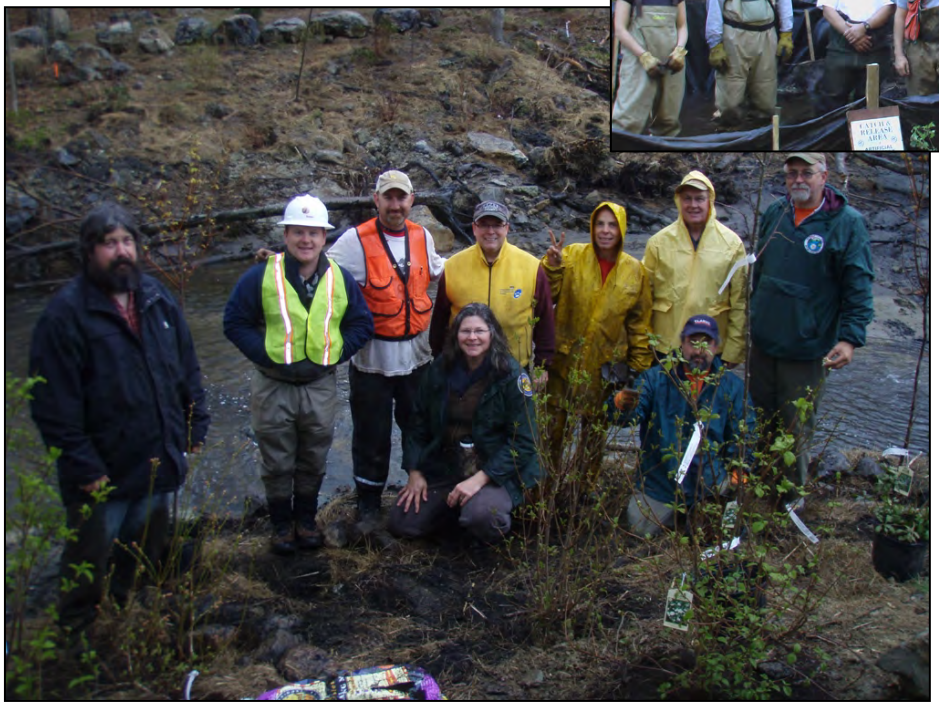



Wapping Road Dam


09/20/2011

Healthy and dynamic rivers and wetlands:

- **Purify water** (e.g. denitrification)
- **Maintain baseflow in streams**
- **Store floodwater**
- **Provide fish and wildlife habitat**
- **Preserve biodiversity**
- **Store carbon**
- **Provide recreational opportunities**
- **Inspire with beauty and harmony**
- **When restored…offer MIRACLES**



You now have:

- A good definition of ecological restoration
- A recipe for doing it well
- Opportunities to help address current and future water challenges

Your next potential roles:

- Help identify specific opportunities
- Use your new framework to think about other helpful opportunities (e.g. replace undersized culverts)
- Talk to elected officials (get MVP certified)
- Build community support for healthy rivers and wetlands

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Former commercial cranberry farm (Tidmarsh Farms) <1 year after wetland restoration