Models for Cranberry Bog Stream & Wetland Restoration

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Outline

• Cranberry cultivation
• Eel River project
• Tidmarsh Farms project
CRANBERRY CULTIVATION
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Cranberry “bog” recipe:

• Acidic, sandy soil
• Impermeable layer
• ~April-Nov growing season
• Sand supply
• Fresh water
CRANBERRY CULTIVATION

2014 cranberry production by state (USDA, 2014)

- Wisconsin: 67.2 million lbs
- Massachusetts: 43.1 million lbs
- Washington: 16.2 million lbs
- New Jersey: (Note: production not specified)
Cranberry Bog Restoration Considerations

- Water table depth
- Excess sand
- Channel uniformity
- Ditches and berms
- Flow control structures
- Sediment balance
- Plant species uniformity
- Pesticides/herbicides/fertilizers
Species of interest (in MA)

- Alewife
- Blueback herring
- Brook trout
- American eel
- Atlantic White Cedar
- Red maple
- Sphagnum moss
2010
40 acres

Eel River

2015
250 acres

Tidmarsh
Sawmill Dam
Bog complex
Flow

Eel River Site
Eel River Hydrology

- Eel River is dominated by groundwater flow

USGS gage data for Eel River and nearby streams
Eel River Soil

Peat depth through bog complex (ground penetrating radar)
Sand Depth

- 100 Probes, 9 test pits
- Average depth of sand 20 inches
Existing Seed Bank
Key Restoration Components

- 6000 feet of low gradient wetland stream channel
- 2000 feet of gravel riffle-pool stream channel
- 1200 feet of steep (3%) boulder step pool channel restoration
- Large wood to define channel and create habitat
- Grade control riffles

- Some sand removal
- Dam, berm, flow control structure removal
- Wetland microtopography
- Atlantic White Cedar restoration
Restoration Elements

Grade control riffles

Constructed channels
**Restoration Elements**

**Atlantic White Cedar Swamp**
(Bogs 4-7) – 20 acres  
Forested riparian wetlands  
(Bog 1, dam) 15 acres

**Fen meadow**  
(Bog 3) 4 acres

**Red Maple swamp**  
(Bog 2) 10 acres
Atlantic White Cedar Seed Collection

- Broadest possible genome from local populations
- 4 sites within 10 miles of Plymouth
- Private lands, public sites
Deer Browse Protection

- Enclosed bog 4-7 (22 acres)
- 6,000 feet of 9 ft reusable fencing
Eel River Lessons Learned

- Raising the water table through grade control
- Minimal sand removal
- Sand reuse in old borrow pits as Eastern Box turtle habitat (bare sandy slopes)
- Natural channel design
- Large wood placement for wetland and in-stream habitat
- Largely passive planting plan
- Active Atlantic White Cedar plantings
- Microtopography grading
- Separation of wetland ecosystems by bog cell
- Dam removal
- Water control structure removal
- Pedestrian walk paths and footbridge
- Wildlife passage at culverts
- Raptor habitat
TIDMARSH FARMS SITE

LEGEND
- Restoration Site Boundary (approximate)
- Beaver Dam Brook Watershed (USGS)
Tidmarsh is a 600-acre property near Plymouth, Massachusetts. After over a century as a large operational cranberry farm, Tidmarsh is now being restored to natural wetland. Researchers in the Media Lab’s Responsive Environments group are developing sensor networks that document ecological processes and allow people to experience the data at different spatial and temporal scales. Small, distributed, low-power sensor devices capture climate, soil, water, and other environmental data, while others stream audio from high in the trees and underwater. Visit any time from dawn till dusk and again after midnight; if you’re lucky you might just catch an April storm, a flock of birds, or an army of frogs.

Many current projects in the group are making use of the Tidmarsh site and the data. The flagship project is a cross-reality sensor data browser constructed using the Unity game engine to experiment with presence and multimodal sensory experiences. We’re looking for new ways to explore and experience data about the environment. Built on LiDAR-scanned terrain data, the virtual Tidmarsh experience integrates real-time data from the sensor networks with real-time audio streams and other media. The soundtrack is based on real-time sensor data—flashes and ukulele notes occur when new data comes from each sensor. The music is driven by the sensor readings: higher pitches indicate warmer temperatures, for example. You can visit Virtual Tidmarsh yourself on Mac, Windows, or Linux by grabbing the app from our downloads page.
Tidmarsh Farms Restoration Elements

- Channel creation
  - Restoring relic channels (1)
  - New channel (2, 3, 4, 6, 7)
- Large wood within channels
- Microtopography, depressions
  - Expose peat/seed
  - Onsite spoils
- Spring connections
- Raise groundwater with grade controls
- Atlantic white cedar (cell 3, 4, beaver brook headwaters)
- Open shrub fen
- Ditch plugs
- Access/crossings
American Rivers
USDA NRCS (Natural Resources Conservation Service), Wetland Reserve Program
USFWS (U.S. Fish and Wildlife Service)
American Rivers-NOAA Community-Based Restoration Program
GOMC-NOAA Habitat Restoration Partnership
Massachusetts Environmental Trust (MET)
Town of Plymouth
Mass Audubon
Inter-Fluve, Inc.
Salicicola
Public Lab

SUPPORTERS
Manomet Center for Conservation Sciences
Manomet Village Steering Committee

RESEARCH INSTITUTIONS affiliated with the LIVING OBSERVATORY
University of Massachusetts-Amherst, Department of Geosciences
University of Massachusetts-Boston, Freshwater Ecology Laboratory (FEL)
Mt Holyoke College, Restoration Ecology Program
Massachusetts Institute of Technology, Media Laboratory
- 40 acres
- 2010 construction
- Alternative cranberry bog reclamation
  - Channel
  - Wetland
  - Multi-species

- 250 acres
- 2015-2016 construction
- Apply experience from Eel River
- Multi-stakeholder process
  - Private landowner participation, MIT Media Lab, agencies, etc