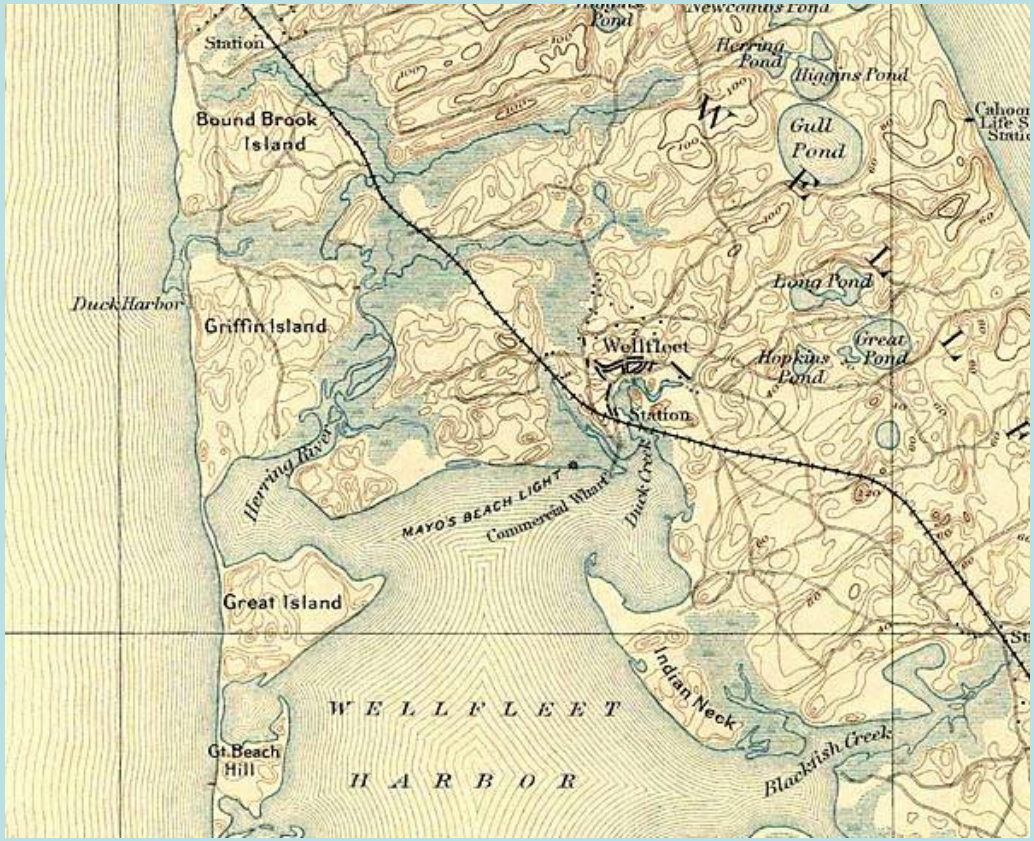
Wellfleet's Herring River - History and Future of the Vegetation Landscape

Stephen Smith (CCNS)



- Prior to 1908, there was an estimated 1,000 acres of salt and brackish marsh habitat upstream of the Herring River dike

• between 1908 and 1969, much of the area upstream of the dike had converted to freshwater wetlands and upland (primarily as a result of tidal restriction)

Dike-related changes (continued)

1903 – below Old County Road

1982 – below Old County Road

Dike-related changes (continued)

Bound Brook

1938 – emergent marsh

1994 – wet shrubland and forest

Responses to a "mini" restoration

- In 1969, a minor amount of tidal exchange was facilitated through the dike by virtue of clapper valve deterioration
- By 1975, *Spartina alterniflora* (salt marsh cordgrass) had become re-established across areas that had been invaded by cattail (Snow 1975)

Photo: 1974 – dike rebuild

* Snow, A. 1975. Recolonization of salt marsh species at the Herring River Marsh, Wellfleet, Massachusetts. NPS Report. CCNS.

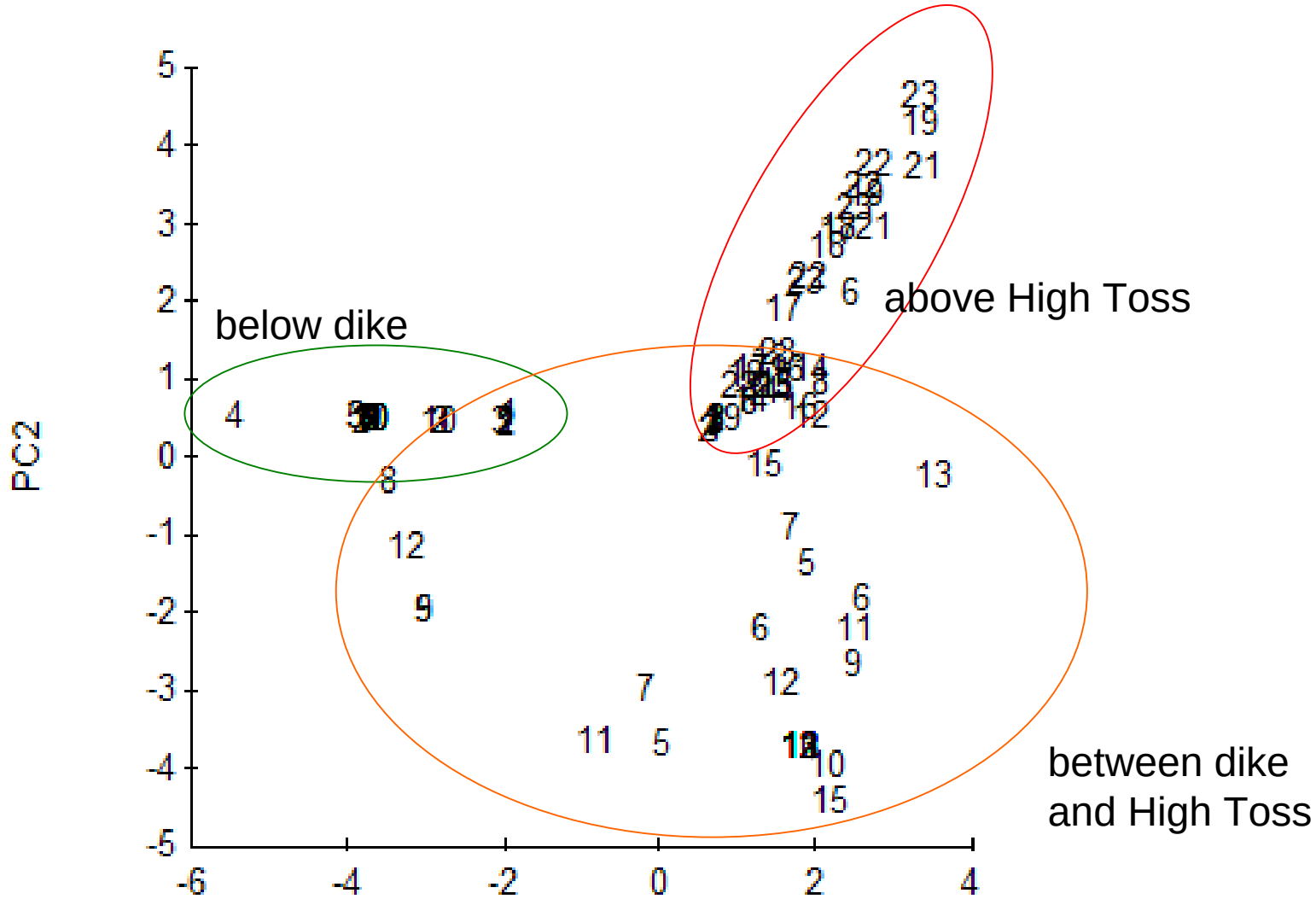
• By 1983, *Phragmites*, a salt-tolerant invasive exotic, had replaced a substantial amount of *Spartina* and, further upstream, *Typha* (cattail)

• *Phragmites* changes vegetation structure, soil chemistry, topography and a variety of other environmental conditions
• *Phragmites* is considered to have little ecological value

2004-2005: In anticipation of restoring the Herring River system, NPS established network of vegetation monitoring plots (23 transects, 99 plots)

• Data collected: cover by species, *Phragmites* heights and stem densities

Principle Components Analysis of species composition shows three different kinds of communities related to position relative to the dike



Numbers are individual plots labeled with their transect number

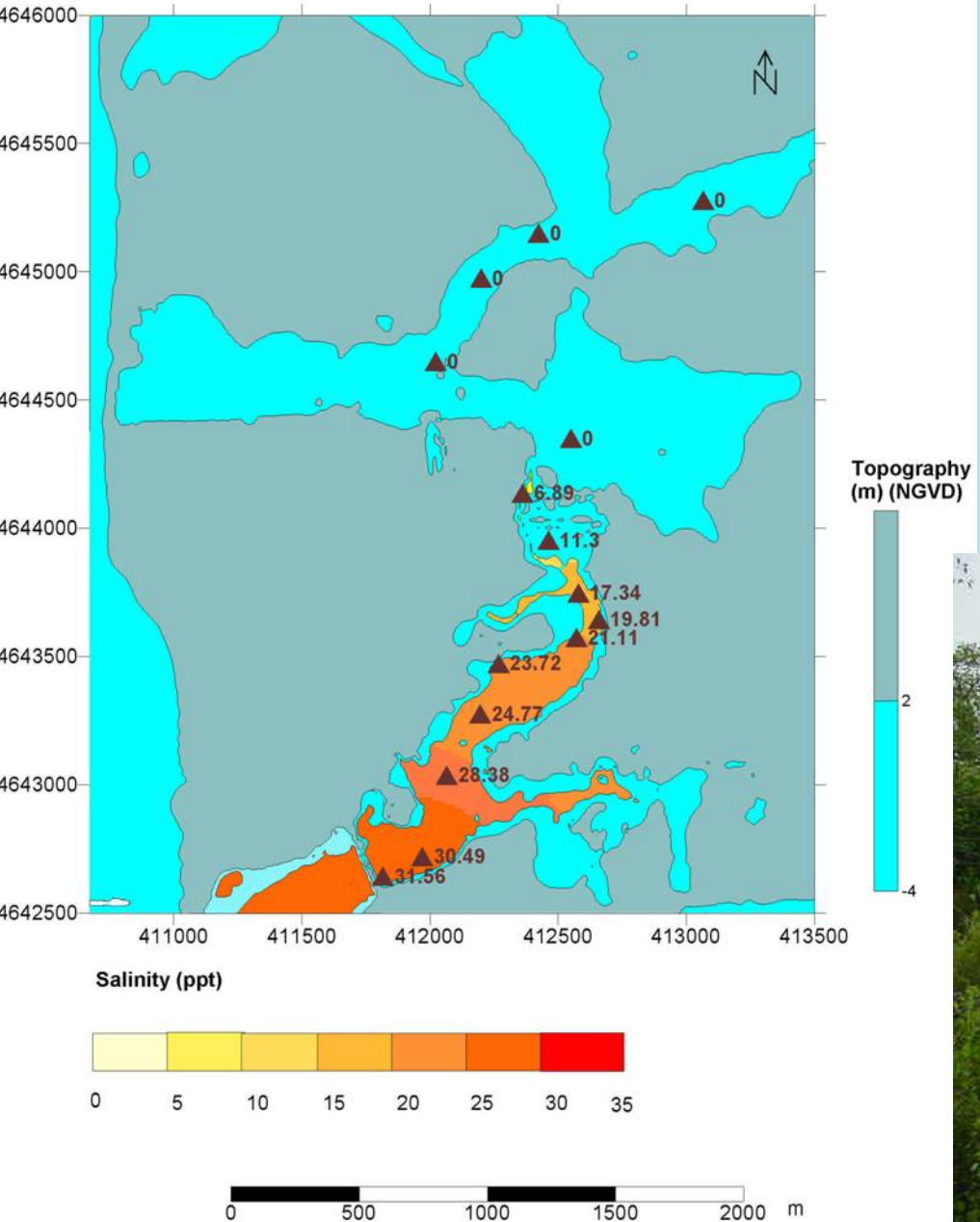
healthy (below dike)

• chlorosis in *Spartina alterniflora* above dike – due to poor drainage (roots are oxygen-starved and subject to high concentrations of sulfides even during low tide)

chlorotic (above dike)

chlorotic – above dike

Factors influencing vegetation above High Toss: low to no salinity, enhanced drainage, acid sulfate soils

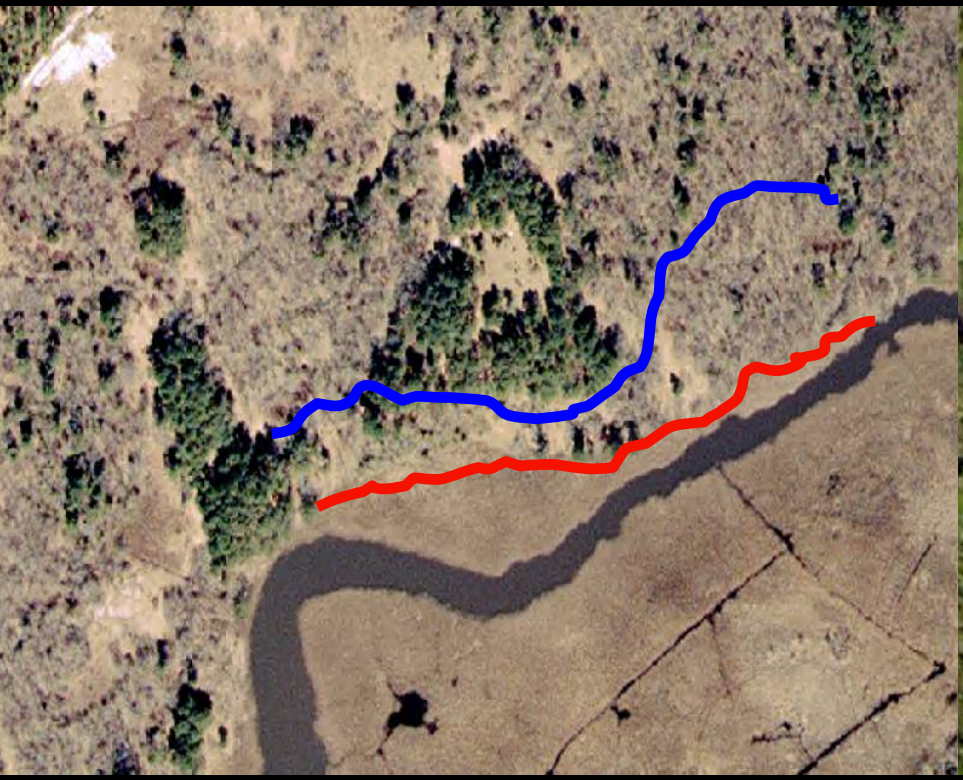


Impacts on rare species

• *Spartina cynosuroides* (salt reed grass) (State Listed as Special Concern) once existed above the dike on the west side of the river (last seen in 1968)

* Tidal restoration may allow for re-establishment of this species (through re-introduction of seed and/or plants)

Ancillary vegetation monitoring - analysis of aerial photography



Georeferenced vertical image

Oblique-angle image

Gross spatial changes in vegetation communities can be tracked using vertical and oblique angle images

How will dying and dead woody vegetation be managed?

Rapid mortality of salt-intolerant woody vegetation (herbaceous simply won't emerge if restoration is initiated in winter)

Possible alternatives:

- leave in place (will decompose, fall over in time)
- cut, pile, and burn (helps with seed dispersal)
- chip and leave in place

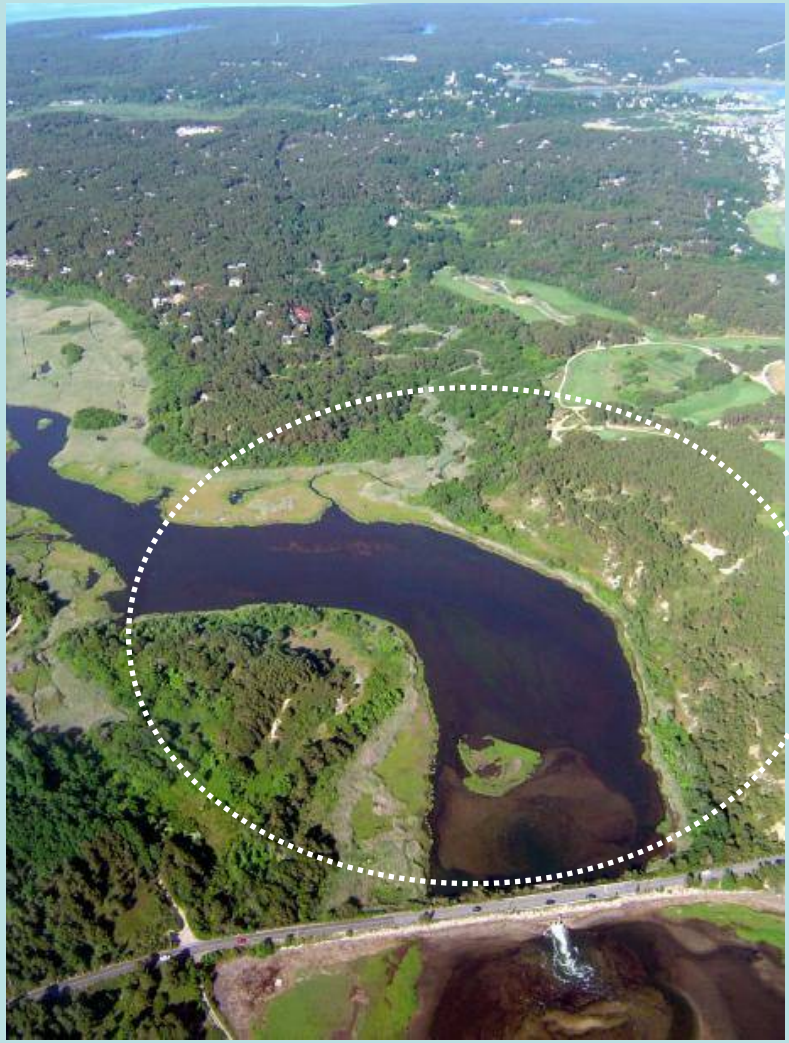
Seagrasses: *Ruppia maritima* is present in area just upstream of dike and has increased in response to increased tidal flow since 1984 - Further expansion of *Ruppia* and perhaps *Zostera* (eelgrass) may occur with tidal restoration

Ecological value:

• consumed by waterfowl, worms, snails, microorganisms, which themselves eaten by fish, crabs, and wading birds

• good substrate for the settlement of shellfish (e.g., scallops, mussels) larvae.

• provides nursery area for fish species that seek protection from predators within the beds.



It is possible that increased *Cladophora* growth will occur in some places upstream of the dike as NH_4 is forced off acid sulfate soils

However:

• dilution of N concentrations by the large volumes of low-nitrogen Cape Cod Bay water may actually prevent extensive *Cladophora* growth

• release of NH_4 would, in part, fertilize the salt tolerant native vegetation and, consequently, enhance its rate of expansion

• release of NH_4 would have little effect if the opening is done in the winter/early spring when temperatures inhibit plant growth

• a phytoplankton or macroalgae bloom event would most likely be a temporary response to the sudden change in water quality conditions. Eventually any NH_4 driven off acid sulfate soils by cation exchange will be flushed from the system and tied up in plant and animal biomass and subsequently be made unavailable for growth

Dynamics of seed dispersal in Herring River favors more rapid establishment of halophytes than in other restoration projects

- More seeds will go upstream, rather than being washed up along the dike (ratio of length of dike:opening size is much smaller)

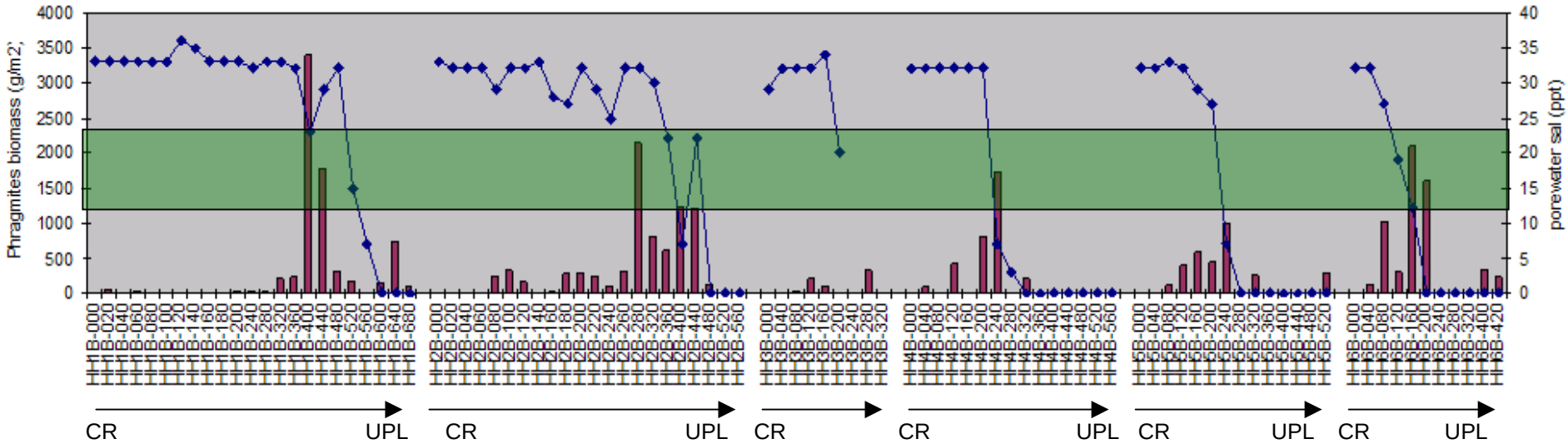
There is a precedent for this …

Salt marsh vegetation colonized the system quickly after the “mini” restoration in 1969 (Snow 1975)

Herring River favors better control of *Phragmites* migration than in other restoration projects

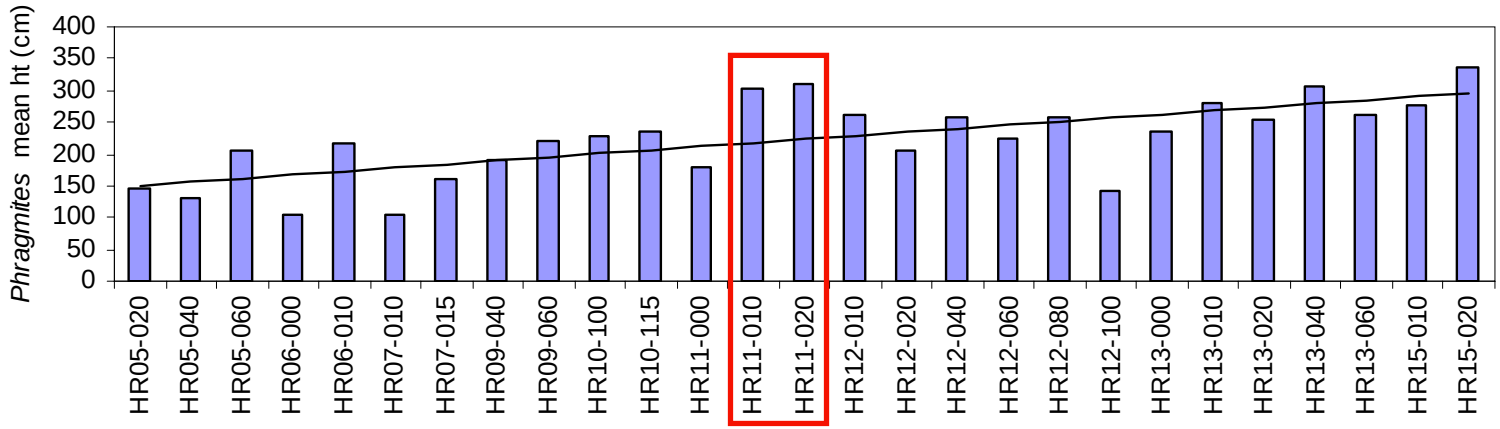
In Hatches Harbor, *Phragmites* has been able to grow into areas with lower salinities along a wide front

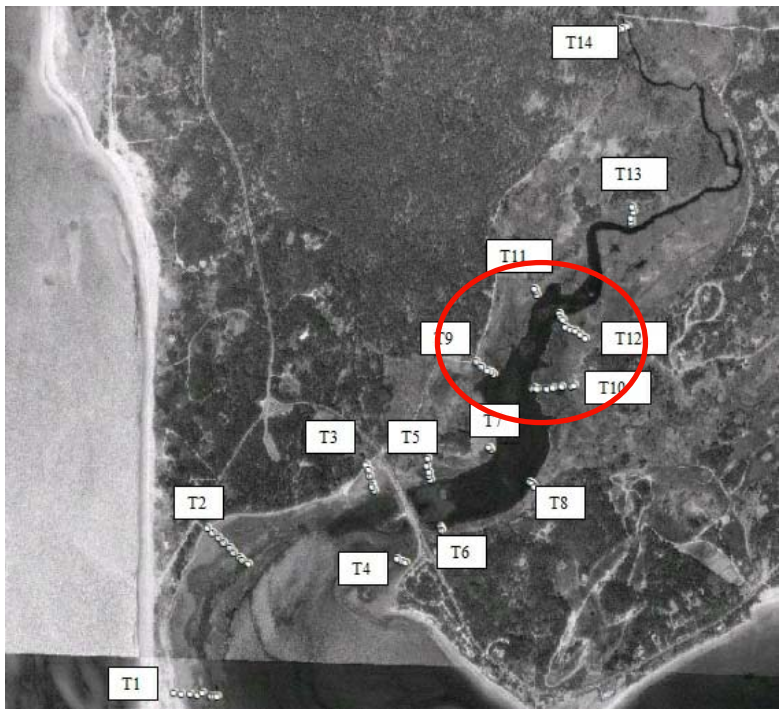
Phragmites' preferred niche is ~12-25 ppt salinity



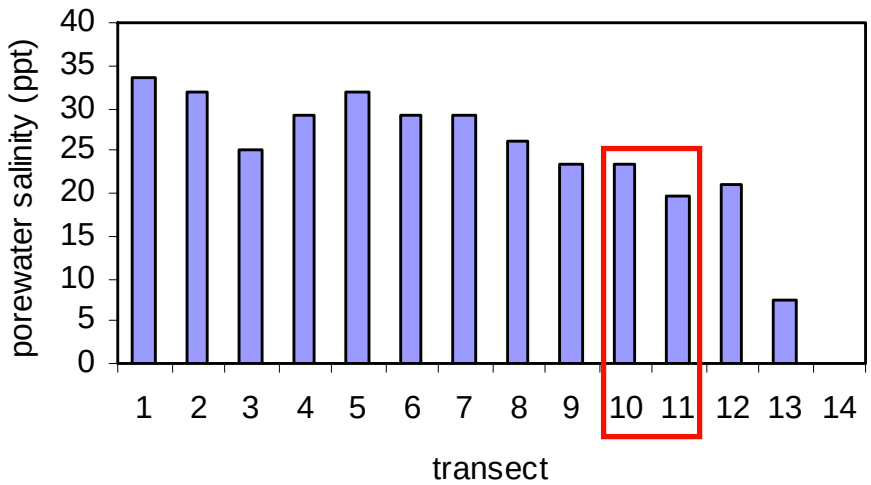
Hatches Harbor *Phragmites* data – peak biomass along each transect occurs in 12-25 ppt salinity range

Phragmites vigor with distance upstream of dike (Herring River 2005)





Phragmites biomass in Herring River begins to peak at 20-25 ppt



Unlike Hatches Harbor, *Phragmites* in the Herring River has little chance/room to migrate upslope and so is relatively “contained”. The upstream extent of the population is constricted within an elevation bottleneck

Phragmites “front” will be monitored closely and controlled if necessary

Phragmites will decline rapidly where there are high porewater salinities (< 25 ppt)

Decline in East Harbor *Phragmites* after one growing season

Other exotics that will be eliminated or substantially reduced by tidal restoration

- *Oriental bittersweet*
- *Honeysuckle*
- *Velvet grass*
- *Multiflora rose*
- *Black locust*
- *Watercress*
- *Cheatgrass*
- *Curly dock*
- *Climbing nightshade*

- *many others!*

Martin and Hanley 2001. Status of Exotic Plants at Cape Cod National Seashore. NPS Report. CCNS.

General conclusions:

• diking has converted ~1,00 acres of salt amnd brackish marsh to freshwater marsh and uplands

• recolonization of floodplain by native salt marsh species could be rapid due to geomorphology of system and presence of seed sources upstream of dike

• mortality of salt-intolerant species will occur quickly and should be managed to promote seed dispersal into interior portions of the system

• The spread of *Phragmites* upstream will be easy to control due to its physical restriction upstream. However, migration may not occur at all if salinities between the dike and High Toss exceed 25 ppt.

• Tidal restoration will substantially reduce or eliminate populations of many exotic species