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TWENTY-FIVE YEARS OF TIDAL WETLAND RESTORATION IN CONNECTICUT

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BACKGROUND

The Connecticut Tidal Wetlands Act (Act) of 1969 established a regulatory or permit program for the conduct of activities conducted in tidal wetlands. Only those activities that "preserve tidal wetlands" may be permitted. Present day permitted losses are a mere 0.25 acres per year as contrasted to an estimated 70 acres per year, prior to 1969. The Act had no provisions for addressing wetland degradation resulting from historic activities especially hydromodifications (i.e., tide gates, undersized culverts and fill). To address that deficiency, the Connecticut Coastal Management Act of 1980 established a policy that encourages the restoration of degraded tidal wetlands. This policy became the basis for the Coastal Area Management Program to pursue the systematic restoration of degraded tidal wetlands over the ensuing 25 years.

KEY PROGRAM ELEMENTS

The Connecticut tidal wetland restoration program is an example of a highly successful program that is centralized within a state agency. Described below are some of the salient core concepts and program elements.

Restoration Approach. Returning tidal action to set degraded wetland on a trajectories towards becoming a self-maintaining ecosystems, with biophysical attributes similar to the pre-disturbance habitat, sensu lato. Restoration, sensu stricto, is neither attainable nor desirable (Warren et al., 2002). Though it is impossible to restore a wetland to its precise historical biological matrix and microrelief for example, it is possible to reestablish the broader ecosystem type (e.g., salt marsh to salt marsh). Restoration of tidal flow to Great Harbor, Guilford has created a functioning tidal marsh. However 50 years later, the dominant habitat type is low marsh whereas the pre-disturbance marsh was predominantly high marsh. Long-term research (Warren et al., 2002) of restoring marshes demonstrates that specific ecological services reach reference marsh value on varying time frames. In the instance of the gastropod *Melampus bidentatus,* populations on restoration marshes approximate reference marsh after two decades.

The restoration approach is autogenic and minimalistic. The primary restoration action is the reestablishment of tidal hydrology to mimic the natural marsh taken into account the amount of subsidence. The restoration of plant and animal communities occurs spontaneous. Planting is usually unnecessary and expensive. Most planting programs are done based solely on elevation, a very poor and crude guide for a complex system where factors such as microrelief and edaphic factors control key properties for plant success such as position of ground water table. Restoration of polyhaline and high sulfide

conditions on the irregularly flooded high marsh causes the gradual but progressive replacement of *Phragmites australis* by the native vegetation over the course of one to two decades. On regularly flooded low marsh, this process can occur in five years. Regardless of how fast or slow the restoration of vegetation is, most of the restored marshes in Connecticut are not yet in equilibrium with sea level.

Project Goals. Today, many in the field of restoration, scientists, practitioners and funding agencies obsess over the need for specific restoration goals that can be subsequently measured and quantified. Connecticut's goal for wetland restoration projects in general is to cause a cessation of degradation and improve the overall health of the marsh, even if only by degrees. It is important not to confuse environmental restoration with compensation wherein a regulatory may permit the loss of wetland so long as it is replaced by restoring degraded habitat and the permit requires a demonstration of that the restoration is successful through the use of various metrics over a short period of time.

Science. The restoration program has a strong foundation in wetland science and a long-term partnership with the wetland scientists at Connecticut College. A particularly important study defined the biophysical characteristics of degraded tidal wetlands (Roman, 1978). From this research it became apparent that it would be necessary to regulate the volume of tidal flow reintroduced to take into account subsidence in order to recreate a tidal hydrology similar to a natural marsh. In the case of the 200 acre Hammock River marsh, one of four tide gates was opened in 1985 to prevent the drowning of vast expanses of emergent vegetation.

In hindsight, it was fortuitous that a reliable source of funding was not available for the conduct of annual research at marsh restoration sites for the restoration timeframe is multi-decadal. Instead as funds became available, wetland scientists could study several restoration sites of different ages, which has allowed for the development of restoration trajectories (Warren et al., 2002).

From the state DEP plant ecologists saw the need to apply standardized plant community classifications such as Nichols (1920) and wetlands classifications such as Cowardin (1980). Salt and brackish marsh is used sensu Nichols to mean polyhaline or mesohaline/oligohaline respectively. It was obvious then and continues to be the case today that the non-native haplotype of *Phragmites australis* does not invade salt marshes. This conventional distinction between salt and brackish marshes makes it possible to predict the success or failure at restoring the native vegetation.

Site Plan Review Committee. From the inception, a team of scientists, federal/state managers (wildlife, fisheries) and state/federal permit staff inspected proposed restoration sites and commented on preliminary restoration plans. Advice from permit staff was and is particularly important with regards to resolving issues that would delay or prevent the issuance of permits. This team approach was particularly important in the early days as

restoration was a largely unproven concept and the team having witnessed the successes has provided a positive feedback loop into support for restoration.

Permit Streamlining. In the 1980's, the New England Division of the Corps of Engineers had a general permit that was customized for each New England state. With the early Connecticut successes in restoration and the participation of the all the federal agency staff that comment on Corps permits, there was general support to amend the general permit to make wetland restoration and eligible category II. Category II activities are subject to 'screening' wherein, if the project were found to have acceptable impacts and did not conflict with federal law, the activity might be approved as general permit eligible and a letter of authorization provided. Today this program is called the Programmatic General Permit and restoration projects are only eligible if reviewed and approved by the aforementioned site plan review committee.

In the late 1980's, CT DEP created a 'general permit' called the Certificate of Permission (COP) and conservation activities of the CT DEP such as wetland restoration were eligible. COP's are issued in 45 to 90 days.

Mosquito Control Partnership. In 1984, an opportunity was afforded DEP to assist the state mosquito control program in securing Corps of Engineers permits for mosquito control. It was agreed to abandon the harmful practice of mosquito ditching (nearly every marsh in Connecticut had been intensely grid ditched) and overlay the less harmful open marsh water management (OMWM) practices. In 1985, DEP convinced Mosquito Control to restore tidal flow to a marsh drained to reduce mosquito breeding and in exchange DEP for endorse any OMWM measures needed to abate mosquito breeding. One of four tide gates was opened to the 200 acre Hammock River marsh and to everyone's surprise and delight, there was no mosquito breeding. The lesson learned here was that even partial flow restoration to a subsided marsh would create low marsh habitat subject to daily tidal flow, a flooding regime that is not conducive to mosquito breeding. Restoration of tidal flow to diked and drained marshes became a mosquito control technique. Mosquito Control would perform the majority of marsh restoration projects conducted through 1993 for mosquito abatement but with the added environmental benefit of restoration the wetland ecosystem.

Wetland Restoration Team. With the economic problems in the northeast in the early 1990's, the Connecticut Department of Health determined it could no longer fund the Mosquito Control program. DEP made arrangements to transfer the mosquito control staff and equipment to DEP thus forming a dedicated wetland restoration project in 1994.

Dedicated Restoration Fund. There was a time when the Connecticut legislature would pass special acts to fund the study of individual degraded coves and later pass another special act to funds construction. In 1983, the legislature created a pilot Coves and Embayment Restoration program managed by DEP. The pilot was a success and the Coves and Embayment Restoration Program was established in 1986. The program required towns to pay for restoration activities and then be reimbursed up to 50%. In

1989, this program was later modified, eliminating the match requirement, a distinct advantage for towns lacking the financial resources to participate in the original program. An unanticipated benefit of a dedicated state fund would emerge in the 1990's with the growing number of federal restoration programs that required non-federal match. Connecticut was in a position to use dedicated state restoration funds as match against federal restoration funds. Another advantage of the state program is that funds can be used for preliminary engineering and design. Most federal programs will only fund construction.

Federal Partnerships. Before the proliferation of federal restoration programs in the 1990's, the first federal agency to fund restoration in Connecticut was NOAA's Office of Ocean and Coastal Resource Management which approved the use of Section 306a funds, the first year funds became available under that program, for the restoration impoundment IV at the Barn Island Wildlife Management Area, Stonington. However, the first partnership with a federal restoration program was in 1990 with the US Fish & Wildlife Service under a program that is today called Partners for Fish and Wildlife. The Service provided staff and equipment from refuges to 'move dirt' and unearth buried tidal wetlands at Mumford Cove, Groton. Later, recognizing that Connecticut had an advanced restoration program with its own equipment and staff, the Service would provide annual funding for restoration through a simple Memorandum of Agreement. Presently, our federal partnership list includes the Natural Resources Conservation Service, USEPA (support the use of 319 funds for restoration), Corps of Engineers, and the NOAA Restoration Center. A particularly important partnership is with the EPA Long Island Sound Study, a National Estuary Program, which provides Connecticut and New York, which fund a staff position. Staff in turn can help projects by applying for funds from the established federal restoration programs.

Adaptive Management. Adaptive management is the fine-tuning of the original restoration plan to advance the original goals of the project. In most marshes dominated by salt (polyhaline) communities, there is a mesohaline and oligohaline border adjacent the uplands created by groundwater seepage. Tidal flow restoration to a former salt marsh dominated by *Phragmites australis*, causes the replacement of *Phragmites* by the native vegetation except in mesohaline and oligohaline areas. Absent detailed pre-disturbance vegetation and salinity maps, it is impossible to forecast the location and extent of *Phragmites* dominated marsh at a restoration site. Treatment of persistent colonies of *Phragmites* after the initial flow restoration is just one type of adaptive management, which does not increase the area of restoration but does enhance functions and values.

Monitoring and research shows that the restoration of the native vegetation can take one or more decades. In the majority of salt marsh restoration projects, so long as there is evidence of the reduction of height and stem density of *Phragmites*, DEP resists the urge to implement *Phragmites* control measures. For in these cases, nature, at no additional cost to society, is affecting vegetation recovery and thus allowing DEP to direct limited restoration funds of new projects.

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