HUMAN IMPACTS ON TIDAL WETLANDS: HISTORY AND REGULATIONS

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THE PREHISTORIC PERIOD

Human use of tidal wetlands could not have been important until about 1,500 to 2,000 years ago, when sea level rise slowed and tidal wetlands became a more permanent aspect of the landscape. There is recent archeological evidence that Native Americans living in southern New England had established seasonal settlements near these productive wetlands, particularly after the gradual adoption of horticulture circa 1000 AD. Digs along the lower sections of the Connecticut River indicate that during the next 600 years there was a shift toward larger, year-round settlements. It is believed that the ecological diversity and richness of these tidal wetlands were keys to sustaining multi-season occupation by larger groups of people.

THE COLONIAL PERIOD

The first European colonists in southern New England arrived in the early decades of the 17th Century, and immediately recognized the value of these vast, flat expanses of tidal grasslands. Salt Meadow Cord-grass *(Spartina patens)*, Spikegrass *(Distichlis spicata)* and especially Blackgrass *(Juncus gerardii)* where all preferred species for livestock fodder and bedding. Connecticut salt marshes were both hayed and, to a lesser extent, pastured continuously into the beginning of the twentieth century (Fig. 1). The Continental Marsh in Stonington, owned by the Davis family, was named as a reminder that hay from this marsh supplied General Washington's Continental Armies during the American Revolution. It is one of the few marshes which is still part of a working farm in which the marshes are periodically mowed.

Very early on farmers began digging shallow ditches into the marsh peat to drain standing water. This tended to increase yields of Salt Meadow Cord-grass and made access with equipment easier. Today, salt marsh hay is only harvested on a few marshes, and is sold at a premium as a weed-free garden mulch.

Fig.1 A meandering tidal creek and hay stacks on a salt marsh. Painting "Sudden Shower" by Martin Johnson Heade (ca 1870), private collection.

By 1900, nearly 50% of the marshes between Southport and the Connecticut River had been ditched. Ditches were also used as boundary markers between properties. In some marshes such as Leetes Island and Sluice Creek in Guilford, complete drainage was achieved through the installation of tidal gates (doors hinged at the top which are suspended across a bridge or culvert to eliminate the inflow of salt water, Fig. 2).

The conversion of tidal coves and embayments into millponds began in the 1700's, primarily in central and western Long Island Sound where the greater tidal range provided more tidal energy for the mill operation. Sherwood Mill Pond, Holly Pond, and Sluice Creek are each examples of former millponds. The inlets to these coves were modified through the installation of tide gates which allowed tidal flow into the cove but closed at high tide. Water was returned to the Sound through a narrow channel called a sluiceway, which contained the waterwheel for the mill. In many places the gates caused prolonged flooding of areas of salt marsh, contracting the once extensive vegetation to a narrow fringe along the elevated borders of the millpond. This pattern can still be observed today at Gorham Pond in Darien. Although tidal mills no longer exist along the coast, many of the original water control structures have been retained in order to create permanent ponds. The reduced tidal flows to these sites often cause water quality problems and increased sedimentation.

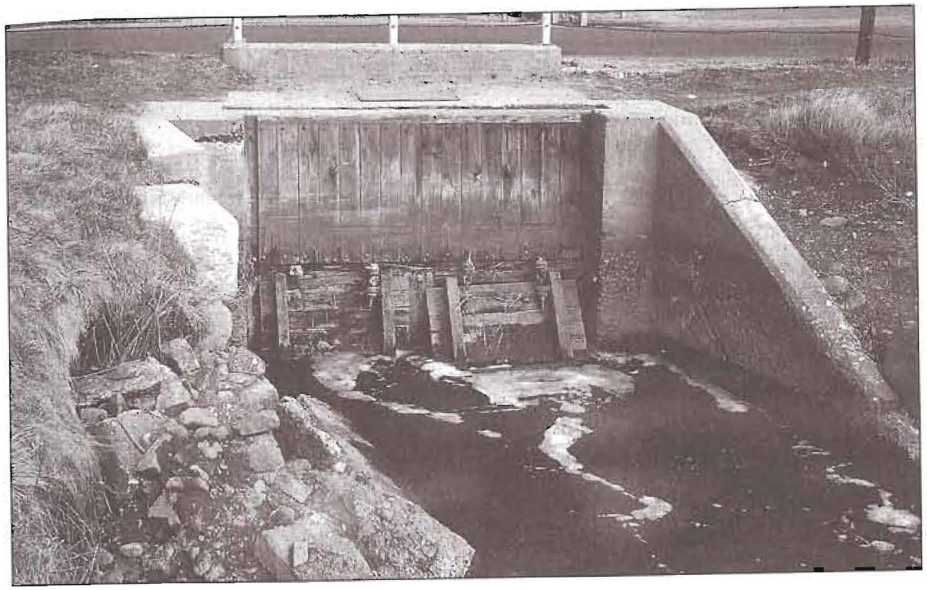

Fig. 2 A pair of tidal gates on Sybil Creek, Branford (R. Rozsa)

POST-COLONIAL PERIOD

Since colonial times, transportation facilities have caused notable direct losses of wetlands. Among the earlier projects were the construction of the shoreline railroad in the mid 1800s and the shoreline trolley in the late 1800s. However, major impacts came in the mid 1900s with the large east-west roads such as Interstate 95. Fill was placed in tidal wetlands to create an elevated base for the various projects. The last major loss of marsh in highway construction was on I-95 when a portion of the Sherwood Island State Park salt marsh was filled for a parking lot, as documented in Arboretum Bulletin No. 12 (1961). Some of the largest wetland areas filled for transportation facilities include what are now the Quinnipiac River railroad yard and Bridgeport Airport. The latter is entirely constructed on fill placed over tidal wetlands.

In recent years, concerns have been expressed regarding secondary impacts of modern, narrow bridge spans. Most of the wetland or water is now crossed via filled causeways and the actual new bridges span a much smaller distance than did the older, trestle bridges they replaced. It was thought that the newer causeway/bridges restricted tidal flow, which in turn reduced the amplitude of the tide and promoted increased sedimentation. Recent investigations in eastern Connecticut found no significant changes in tidal hydrology or increased sedimentation behind at least two of these narrow span bridges.

Boats were a primary means of travel and commerce until the early part of this century. Extensive areas of wetland were filled and bulkheaded, creating upland to support shipping facilities, or were dredged providing deep water for navigation. The sediments dredged from harbors were often dumped on nearby wetlands. Many examples exist: Morris Creek in East Haven; West River in West Haven; Great Meadows in Stratford; East River in Guilford; and Mumford Cove in Groton. As the need for waterborne commerce diminished, the recreational boating industry blossomed and numerous wetlands were dredged and filled to create sheltered water bodies for marinas.

Mosquito Control

Virtually all salt marshes adjacent to the Sound were altered by a variety of mosquito control activities. Mosquito control practices began after the Civil War as homeward bound soldiers brought malaria to Connecticut. The disease soon reached epidemic proportions, and wetlands of all types were filled or drained to prevent malaria transmission by Anopheles mosquitoes. With the elimination of malaria as a health threat, control efforts targeted the large broods of nuisance mosquitoes that originated on tidal wetlands, especially salt marshes. Hundreds of kilometers of mosquito ditches were hand dug to drain marsh surface waters, especially the intermittent pools or pannes which are the preferred breeding habitat for salt marsh mosquitoes (Fig. 3). While ditching did not destroy the salt marshes, it did change the abundance of certain plants and animals. In some wetter high marshes where the pannes were dominated by Stunted Smooth Cord-grass *(Spartina alterniflora* - short form), they were replaced by Salt Meadow Cord-grass. The loss of pannes also probably contributed to reduced populations of the Seaside Sparrow *(Ammodramus maritimus)* which today is an increasingly rare species. Use of the salt marsh by waterfowl, shorebirds and wading birds also declined as their preferred shallow water habitats disappeared. In other cases, the levees created along the edge of the ditches actually improved wildlife habitat, since tidal water could not readily drain off.

By the 1940's nearly all of Connecticut's salt marshes were ditched, with much of the labor supplied by government programs to put unemployed men to work during the Great Depression. In some towns the original ditches were not maintained after their initial construction, but are still very much in evidence. A good example is Great Meadows, Stratford, where sixty years after being dug, all ditches are still visible on aerial photographs and some are still functioning to remove surface water. Clearly salt marshes recover very slowly from such physical alterations (Fig. 4).

In 1985, Connecticut abandoned maintenance ditching in favor of a lower impact and more ecologically sound approach known as open marsh water

Fig.3 Many miles of mosquito ditches were hand-dug during the Great Depression. (DEP)

Fig.4 The extent of mosquito ditching is best seen in aerial photographs. (DEP OLISP)

management (OMWM). Mosquitoes are now controlled by Fundulus and other native minnow species which live in newly created, permanent, deep water ponds. The ponds are constructed only at those locations where mosquitoes regularly breed, and act as reservoirs to keep the fish on site and alive during low tide periods. The small fish leave the pond during high spring tides to feed voraciously on mosquito larvae on the high marsh. In some situations ditches are plugged with a sill to maintain a continuous source of water for the minnows. In addition to controlling mosquitoes, OMWM is also a simple yet effective marsh restoration technique. The abandoned ditches will slowly fill, allowing restoration of pre-ditching hydrology, and the construction of ponds replaces those that existed prior to their draining by the ditching.

Tide gates were also used in an attempt to control mosquito breeding by draining the salt marshes. Unfortunately, this caused significant impacts to tidal wetlands and eliminated the critical tidal link between marshes and the adjacent estuary, and thus limited productivity. Ironically, the only effect of tide gates on mosquito populations was to replace breeding by salt marsh mosquitoes with breeding by freshwater mosquitoes.

Flood Reduction and Landfills

Tidal gates have also been used to reduce coastal flooding in locations such as Pine Creek in Fairfield. Several thousand hectares of Connecticut wetland have been degraded in this manner. Draining causes the soil salinity to become fresh or nearly fresh and soil moisture to decrease. This creates ideal conditions for the replacement of the native marsh grasses by the tall Phragmites or Common Reed *(Phragmites australis)*. This grass not only reduces plant and animal biodiversity, but creates a fire hazard (Fig. 5). Drainage enhances peat decomposition and leachate from this process and can also have negative effects on water quality (see the accompanying Tidal Wetland Restoration article).

Tidal wetlands were often a preferred location for municipal landfills. Examples include Farmill River in Shelton, Fletchers Creek in Milford, Pine Creek in Fairfield, Seaside Park in Bridgeport, Short Beach in Stratford, Sybil Creek in Branford and North Cove in Old Saybrook. On a positive note, a landfill proposal for Nells Island in Milford led to the protection of this, the largest unditched salt marsh in Long Island Sound, and its designation by the State of Connecticut as the Wheeler Wildlife Management Area.

TIDAL WETLANDS LAWS

Level terrain, proximity to coastal water, saturated soil conditions and inexpensive purchase prices made tidal wetlands an easy target for development and alteration, especially in the twentieth century (Fig. 6). As early as the

Fig. 5 Drained tidal marshes favor Phragmites, which is very flammable. (T. J. Steinke)

Fig. 6 Projects like this salt marsh filling in Old Saybrook, 1970, are no longer permitted thanks to the Tidal Wetlands Act. (W.A. Niering)

1930s, wildlife biologists and hunters recognized the ecological value of tidal wetlands for species groups such as waterfowl and shorebirds, which led to the first concerted effort to protect tidal wetlands through acquisition. Examples include Barn Island, Great Island, Great Harbor Marsh, and Nells Island. Later, in the 1950s and 1960s, scientists and conservation groups began to recognize the ecological significance of tidal wetlands and the alarming rate at which these wetlands were being filled or dredged. In 1965, the Connecticut General Assembly appropriated $100,000 for marshland acquisition. In the same year, Massachusetts passed protective salt marsh legislation, and a group of concerned Connecticut citizens formed the "Save the Wetlands Committee," with the goal of providing similar legal protection for Connecticut marshes.

A look at the actual loss of wetlands helps put the push for legal protection of wetlands in perspective. Present day estimates place the total tidal wetland acreage for all of Long Island Sound at just over 8,456 hectares (20,895 acres) with Connecticut's portion 84% or 7,126 hectares (17,608 acres). Historic tidal wetland area in Connecticut around the turn of the century is believed to have been from 9,000 to 10,725 hectares (22,265 to 26,500 acres). Unfortunately, none of these historic estimates are accompanied by a methodology that explains exactly which wetlands were included in the calculations. The Connecticut Department of Environmental Protection (DEP) recently completed a wetland trend analysis by calculating wetland acreage for the same areas on both the 1880's Coast and Geodetic Charts and the DEP's 1970 wetland maps. Table 1. shows a clear trend from Fairfield, the most urbanized county, to more rural New London. Towns with over 60 percent tidal wetland loss include Stamford, Fairfield, Bridgeport, Stratford, New Haven and New London, many of which were major port areas in the past. Based on this new analysis, the average annual loss rate for the State over this 90 year period was approximately 28 hectares/year (70 acres/year). The total loss of wetlands State-wide was 30%.

TABLE 1- The amount of tidal wetland, by counties, in the 1880s and the 1970s, and the difference (losses) in hectares. One hectare equals about 2.5 acres.

	Fairfield	New Haven	Middlesex	New London	Total
1880's	2195	3097	1628	1523	8443
1970's	855	2320	1255	1486	5916
LOSSES	1340 (61%)	777 (25%)	373 (23%)	37 (2%)	2527 (30%)

The long-term loss and destruction of tidal wetlands ceased with the adoption of the Tidal Wetlands Act in Connecticut in 1969 (see Appendix) and in New York in 1973. These laws do not prohibit development in tidal wetlands, but rather require individuals proposing to conduct activities in wetlands to obtain authorization from the DEP (or the Department of Environmental Conservation in New York). In order for authorization to be issued in Connecticut, an applicant must demonstrate, and the Commissioner must find, that the proposed activity is consistent with all applicable statutory standards and criteria. Chief among these standards is to "preserve the wetlands and prevent the despoliation and destruction thereof in order to maintain their natural functions." Accordingly, activities which destroy and degrade wetlands, such as filling and dredging, cannot be authorized. The Connecticut standards further require an analysis of alternatives, which is used to identify means to mitigate any wetland impact. That regulatory programs can result in wetland protection is shown by the fact that in Connecticut permitted wetland losses currently average less than one-tenth hectare per year.

In both Connecticut and New York, detailed maps showing the boundaries of wetlands were initially used to identify regulated areas. Under regulation are the traditional tidal salt marshes found near the shore of Long Island Sound, tidal brackish marshes in areas where salt water mixes with freshwater, and tidal freshwater marshes, which on the Connecticut River may occur some 65 kilometers (40 miles) inland of the Sound. Lack of funding to update tidal wetland maps, and the need to regulate wetlands of fact regardless of mapped status, led to an amendment to the Connecticut Tidal Wetlands Act in 1990. The amendment eliminated the mapping requirement and clarified that the boundary of regulated tidal wetlands includes that area which is identified as meeting the statutory tidal wetland definition on the ground at the time an application is filed.

The Connecticut Coastal Management Act (CMA) supplements the State's direct regulatory authority by requiring application of the same preservation oriented standards through municipal planning and zoning, and by requiring State review of federal activities. Specifically, any federal activity, and activities within coastal towns subject to planning and zoning review, must be found consistent with the tidal wetlands standards of the CMA in order to obtain authorization.

SUGGESTED READING

Tedone, D., editor. 1982. A History of Connecticut's Coast: 400 Years of Coastal Industry and Development. Coastal Area Management, Hartford, Connecticut. 75 pp.