Six Ramsar remote sensing case studies were developed in 2002 as part of the NASA Socioeconomic Data and Application Center's (SEDAC) Ramsar Wetlands Data Gateway, developed in support of the Ramsar Convention on Wetlands of International Importance. That web service has been discontinued but the case studies are available from the documentation page for SEDAC's Sea Level Rise Impacts on Ramsar Wetlands of International Importance, v1 (2000–2010) data set at https://doi.org/10.7927/H4CC0XMD

USA: Connecticut River Estuary and Tidal River Wetlands Complex

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Web: http://dep.state.ct.us/olisp/ramsar/Connrivr.htm

1. Introduction

The lower Connecticut River, beginning near its mouth and continuing upstream for a distance of approximately 58 kilometers (36 miles), contains one of the least developed or disturbed large-river tidal marsh systems in the entire United States, and the most pristine large-river tidal marsh system in the Northeast. From a regional standpoint, there are no other areas in the Northeast that support such extensive or high quality fresh and brackish tidal wetland systems as do those in the Connecticut River estuary. These tidal river waters and marshes provide essential habitat, not only for several federally-listed and candidate species and globally rare species, including Bald Eagle, shortnose sturgeon, Piping Plover, and Puritan tiger beetle, but also for dozens of state-rare and endangered species. Waterfowl concentrations in this section of the river, especially those of American Black Duck, are among the highest and most significant in the region. Several important restoration programs for anadromous fish species, including Atlantic salmon and American shad, are underway in the Connecticut River, especially at its mouth and major tributary confluences with the mainstem.

Remote sensing using low altitude aerial photography have been used to delineate submerged aquatic vegetation (SAV) and the highly invasive grass, Phragmites australis (i.e., non-native haplotype M). The objective for SAV was to create a distribution maps and data regarding bed attributes to establish a baseline which would support future trend analysis. SAV is regarded as one of the best biological indicators of water quality. Data on species abundance and distribution would also permit monitoring for new invasive species and assessing trends of existing non-native species such as Myriophyllum spicatum.

Phragmites is displacing the native emergent tidal wetland plant communities, especially the brackish series, resulting in reduced biodiversity, reduced structural diversity, increased breeding by avian generalists and reduced breeding by avian marsh specialists. The objectives of mapping Phragmites include creation of a baseline for trend detection and setting restoration priorities of wetlands.

2. Description of results

The Connecticut Chapter of The Nature Conservancy did SAV mapping through a grant from the Connecticut Department of Environmental Protection's (DEP) Long Island Sound License Plate Grant. Low altitude (1:12000) black and white aerial photography was acquired in the summer of 1994 using NOAA's Coastal Change Analysis Program protocols. Photointerpretation was combined with extensive GPS (Trimble Pathfinder Pro XL) field survey (1994 and 1995) to acquire bed boundaries and point location data (i.e., dominant species, percent cover, species present, salinity, water depth, sediment type). The photography was georeferenced with Geographic Transformer software, Arcview shapefiles were produced for bed boundaries and data point locations. An Arcview Project was produced that allows the user to view the digital aerial photographs, SAV boundaries and point data.

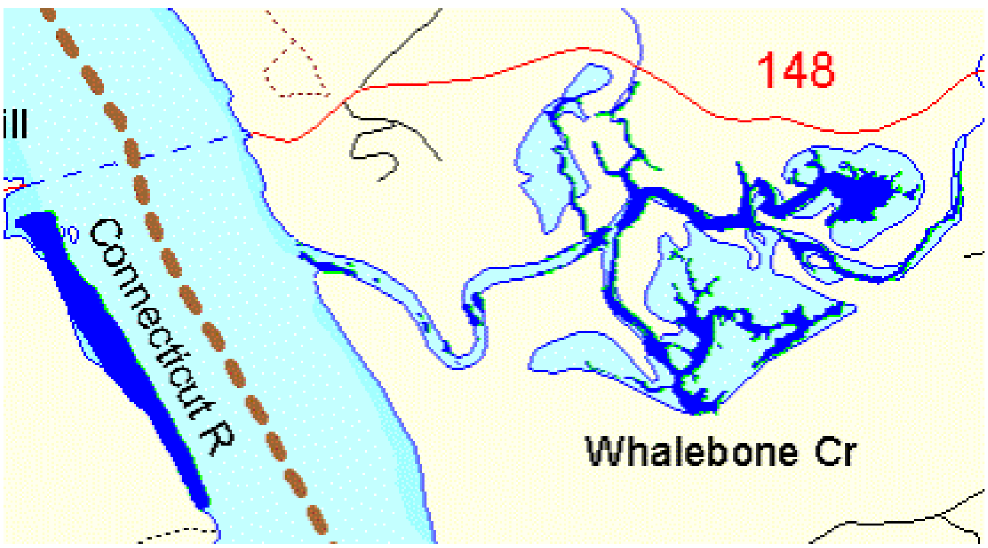

Figure 1*. SAV beds for Whalebone Creek shown in blue.*

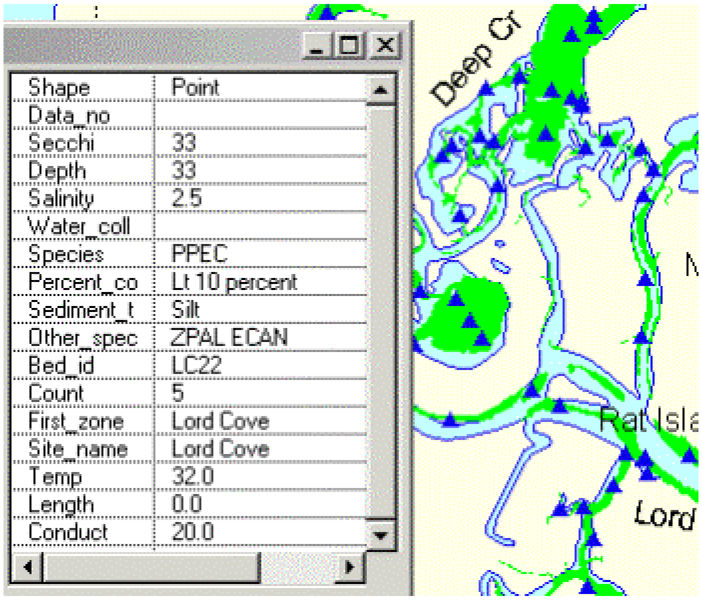

Figure 2*. SAV beds (yellow) and sampling points (blue triangle). Table generated using GetInfo button in Arcview. The dominant SAV at the selected point is Potamogeton pectinatus (PPEC) which had a percent cover of 10%. Associated SAV species include Zannichellia palustris and Elodea canadensis.*

Phragmites mapping was done by Dr. Nels Barrett and Sandy Prisloe using the 1994 photography described above and 1968 black and white low altitude (1:12000) aerial photography. This project was funded through a grant from DEP's Long Island Sound License Plate program. Stereo pairs were used for the photointerpretation vegetation boundaries. Boundaries and ground-control points were drawn in ink on mylar overlays. The photographs and overlays were georeferenced. The bed boundaries were screen digitized from the stereo-interpreted boundaries and adjusted using the georeferenced images in the background using ArcView software.

Figure 3. *Areal extent of Phragmites in 1994 (red) versus 1968 (yellow).*

3. Conclusions

Analysis of Phragmites distribution data indicate that invasion is occurring at the fastest rates in the mesohaline and oligohaline zones. Photointerpretation of aerial photographs by Connecticut College scientists demonstrate that Phragmites colonizes the creek banks first, this may be merely a function of microlevees acting to trap flotsam containing seeds and rhizome fragments. The general absence of this invasive grass from the fresh-tidal marshes, especially the most upstream marshes which experienced long periods of inundation during the spring freshet, may be a function of the hydroperiod is too wet for the survival of rhizome fragments. If the general absence of Phragmites in upstream freshtidal marshes is merely the lack of sufficient time to colonize the more interior marshes, periodic mapping of the distribution of this grass may help to determine the role of hydroperiod and time. If hydroperiod is truly a limiting factor in certain areas, this might allow managers to invest limited funds and restoration efforts to a smaller subset of marshes. Where restoration activities are being implemented, future photointerpretation can be used to evaluate the efficacy of control measures.

Remapping of SAV on the Connecticut River is the next step toward assessing trends and identifying new management issues. A new invasive aquatic plant has been found upstream in several tidal and non-tidal waterbodies associated with the mainstem that has the potential to become highly invasive in the Ramsar area. That plant is water chestnut (Trapa natans). These populations have been subjected to multi-year harvesting plan to eradicate existing populations. There is no evidence yet that Trapa has become established downstream. SAV remapping combined with field survey would be helpful in identifying new populations and the need to implement additional harvesting plans.