RHODE ISLAND NARRAGANSETT BAY PROJECT AREA: TRENDS ANALYSIS METHODOLOGY

Prepared for:
Rhode Island Department of Environmental Management
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and
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Prepared by:
Irene Huber and Todd Nuerminger
Natural Resources Assessment Group
University of Massachusetts
Amherst, MA
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INTRODUCTION:

The Natural Resources Assessment Group (NRAG) at the University of Massachusetts, Amherst, entered into agreement with the U.S. Fish & Wildlife Service's (FWS) National Wetlands Inventory (NWI), Northeast Region, in cooperation with Rhode Island Department of Environmental Management, Narragansett Bay Estuary Program (NBP) to provide a trends analysis of coastal wetlands and deepwater habitats and land use/land cover within the 500-foot buffer zone of coastal wetlands and deepwater habitats for the Narragansett Bay project area using stereoscopic aerial photointerpretation.

NRAG is a technical services group in the Department of Plant and Soil Sciences, specializing in the inventory and analyses of wetlands, upland vegetation and land use using remote sensing techniques for use in digital data sets.

Coastal wetlands, deepwater habitats and coastal resource features for the Narragansett Bay estuary were inventoried by NRAG in 1996, to include maps of submerged aquatic vegetation (SAV), primarily eelgrass. The 1996 inventory is the base data for further analyses, including buffer zone characterization, potential coastal wetland restoration sites and hardened shorelines (Huber, 2000). Trends analysis is the final phase of the study.

Trends analysis was undertaken in two phases:
1) Bay-wide trends from 1950 to 1990 era of coastal wetlands and deepwater habitats and of land use/land cover within the 500-foot buffer zone.
2) Featured area trends of coastal wetlands and deepwater habitats for six sites of concern selected by NBP, spanning two eras: 1930 to 1950 and 1950 to 1990 eras (Appendix A).

The University of Rhode Island, Environmental Data Center (URI/EDC) was contracted for digitizing of trends data. Additional GIS technical support was provided by a NRAG GIS specialist.

STUDY AREA:

Narragansett Bay occupied eastern Rhode Island and the upper Mount Hope Bay/Taunton River portions of southeast Massachusetts. Limits of the project area were defined in part by geography, the limits of brackish water and Bay hydro-geomorphology. See Figure 1. Trends analysis was limited to the Rhode Island portion of the project area, located on portions of 11 U.S. Geological Survey 1:24,000 scale topographic quadrangle maps: Providence, East Providence, East Greenwich, Bristol, Fall River, Wickford, Prudence Island, Tiverton, Narragansett Pier, Newport and Sakonnet Point.

METHODS:

1. Aerial Photography and Data Preparation:

Source imagery for the base inventory (1990 era) was 1:40,000 scale true color transparencies flown August 1996, supplemented by 1:12,000 scale true color transparencies flown July 1996, by the James W. Sewell Company, Old Town, Maine.

Source imagery for trends analysis was researched by Helen Cottrell of NBP and obtained and indexed for photointerpretation by NWI National Headquarters in St. Petersburg, FL.
The 1950 imagery is 1:20,000 scale black and white transparencies dated variously October and November, 1951 and May 1952.
The 1930 imagery is 1:28,000 scale black and white transparencies dated primarily October and December 1938, supplemented by smaller portions flown October, 1941.

Photography was data-prepared by NRAG with Grafix Wet Media DuraLar .004 gauge 9-inch by 9-inch mylar overlays, affixed with drafting tape at corners. Mylar overlays were pin- and notation- registered, as needed.

A southwestern portion of the East Providence quad (Bullocks Cove) lacked 1950s coverage, and was not trend-analyzed.

2. Photointerpretation and Rectification:

NRAG photointerpreted wetland and deepwater habitat changes with Bausch & Lomb Stereo Integration Scopes (SIS), allowing analyses of aerial photos from different eras and different scales, resolved to one stereoscopic view. Base data in the form of original ink-on-mylar photointerpretation was retained on the 1990 imagery. Change polygons were interpreted, delineated and labeled on 1950 imagery overlays, and again on the 1930 overlays for the demonstration sites. Use of the SIS enabled the most detailed stereoscopic viewing of wetlands. Interpreted change overlays were then rectified to 1:24K scale stable base mylars using a Bausch & Lomb Zoom Transfer Scope (ZTS) onto frosted mylar manuscripts suitable for digitizing.

Land use/land cover trends in the 500 foot buffer zone were documented with a Bausch & Lomb Stereo ZTS, using 1:24K manuscripts of the rectified 1990 base land use land cover data. These were overlain by frosted mylar manuscripts, where interpreted change polygons were delineated, labeled and made suitable for digitizing. Use of the stereo ZTS allowed efficient stereo viewing of upland changes, adequate for land use/land cover interpretation.

3. Minimum Mapping Units

With the exception of wetland loss polygons, the minimum mapping unit for change polygons was .25 acre.

4. Classification

Estuarine and marine habitats and freshwater wetlands within the 500-foot buffer zone have been classified according to Cowardin et al. (1976) *Classification of Wetlands and Deepwater Habitats of the United States* and following the U. S. Fish and Wildlife Service's NWI mapping standards. All trends involving wetlands and deepwater habitats utilized this classification.

Land use and land cover has been classified using a modified Anderson (1976) method suited to the needs of this project. Table 1 lists the buffer zone land use/land cover codes used for trends analysis of land use/land cover trends and for wetland loss.

Table 1. *Land Use/Land Cover in the 500-foot Buffer Zone* (Anderson, 1976).

Level 1	Level 2	Level 3
1 Urban or Built-up Land	11 Residential	111 Single Family
		112 Multi-family
		113 Mobile Home Parks
		114 Lawns (includes non-residential lawns)
		115 Other (e.g., military barracks)
	12 Commercial and Services	121 Commercial and Institutional Structures (plazas, malls, schools, universities, military bases)
		122 Recreational structures (e.g., beach pavilions, water slides)
		123 Marinas
		124 Junkyards
		125 Paved surfaces associated with commercial and services
		126 Unpaved surfaces (sandy parking lots in beach areas)
		127 Wharves, piers & shipyards
	13 Industrial	
	14 Transportation, Communications and Utilities (includes lighthouses) (for roads, map 4-lane highway corridors; no 2-lanes)	
	15 Industrial & Commercial Complexes	
	16 Mixed Urban or Built-up Land	
	17 Other Urban or Built-up Land	171 Golf courses
		172 Cemeteries
		173 Other (zoos, urban parks, ski areas, forts)
		174 Landfills
2 Agricultural	21 Cropland	
	22 Orchards, Nurseries, Vineyards, Ornamental Horticulture)	
	23 Confined Feeding Operation	
	24 Pasture and Hayfields	
	25 Other	
3 Rangeland	31 Herbaceous Cover	
	32 Shrub and Brush Cover	
	33 Mixed	
4 Forest	41 Deciduous Forest Cover	
	42 Evergreen Forest Cover	
	43 Mixed	
5 Water, and		
6 Wetlands	Use Cowardin (1979) for freshwater wetlands in the buffer zone**	
7 Barren Land	71 Dry Flats	
	72 Beaches (classified under Cowardin, 1979)	
	73 Sand Areas other than Beaches (dunes, backdunes) (Note: Dunes were mapped on original wetlands layer as "D")	
	74 Bare exposed rock	
	75 Strip Mines, Quarries and Gravel Pits	
	76 Mixed Barren Land	
	77 Transitional (active earthwork)	

Note: **Freshwater wetlands within the 500-foot buffer zone classified under Cowardin (1979) included palustrine wetlands, some of which were tidally-influenced freshwater hydrology and others strictly freshwater types.

Additionally, NRAG developed Cause Codes for wetland-to-wetland trends and wetland gain trends (Table 2). These cause codes were based on interpretable conditions suggestive of cause and as indicated from application of special modifiers from the Cowardin classification system. Causes of wetland loss and upland-to-upland changes in the 500-foot buffer zone can be derived directly from the Anderson codes.

Table 2. *Cause Codes for Wetland Changes and Gains in Trends Analysis*

CODE	**CONDITION(S)**
AG	agriculture
AJG	artificial jetties and groins, construction or removal of
BT	boat traffic
CED	coastal erosion and deposition processes
D	ditching
DR	ditching removed or re-vegetated
IM	impoundment
IMR	impounding structure removed
IS	*Iva frutescens* succession
MC	marsh plant colonization (may be associated w/ deposition/accretion)
OC	oyster colonization
OD	oyster de-colonization
PI	*Phragmites australis* invasion
PR	pier removal
PTI	*P. australis* and *Typha angustifolia* invasion
S	spoil deposition; not effectively filled
SR	structure removed
TR	tidal restriction
TRP	tidal restriction w/ *P. australis* invasion
UK	unknown cause
VG	vegetation change, wide variety (successional changes, clearing or cutting; sea level changes)
WTR	water treatment
XM	excavation, marina-related
XU	excavation, unknown use
XR	excavation re-vegetated

Application of cause codes is based on conditions interpreted over the project area during photointepretation and use of special modifiers in classification; it is not based on in-depth study of any particular site.

Multiple coding may occur.

Use of BT (boat traffic) cause code is limited to interpretable loss of fringe marsh in marina areas. It is expected more fringe marsh loss attributable to boat traffic occurred, but was beyond the scope of this analysis, which was based on polygonal data only. Fringe marsh was mapped as linear data for the original 1996 inventory of coastal wetlands and habitats.

The CED (coastal erosion/deposition) cause may be used offshore of areas with considerable earthwork and construction, such as the Quonset Point demonstration area. In areas of disturbance, CED processes may be aggravated by human disturbance in the upland. Anderson coding in adjacent polygons may provide additional clues as to the causes of change.

MC was used for areas where unconsolidated estuarine habitats changed to marsh; in cases where a water regime change also occurred, CED may also be ascribed.

Change between marsh types (e.g., regularly-flooded to irregularly-flooded) were ascribed VG (vegetation change).

Some areas appeared to have undergone dramatic changes that are not readily ascribed to any one particular cause. An example is The Cove in Portsmouth, located at the southwest corner of the Fall River quadrangle, where orchards or nurseries existed in the 1950s and it appears some type of excavation or leveling of the upland occurred, with subsequent deposition of sands and marsh development.

Within the Calf Pasture Point demonstration site (East Greenwich and Wickford quads), salt marsh occurred in the 1930s that was inland of the 1990s based 500-foot buffer zone. Loss of the marsh area is documented, but the land use/land cover characterization is not available since it is located beyond the limits of the 500-foot buffer zone.

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Craig Polzen also provided internal GIS support to NRAG during final data quality control.

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