

Marsh and Shrub Wetlands

Associated Species: American Black Duck, American Bittern, American Woodcock, Blanding's Turtle, Common Moorhen, Eastern Red Bat, Great Blue Heron, Least Bittern, New England Cottontail, Northern Harrier, Osprey, Pied-Billed Grebe, Ringed Boghaunter, Rusty Blackbird, Sedge Wren, Silver Haired Bat, Spotted Turtle

Federal Listing: Not listed

State Listing: Not listed

Global Rank: Not ranked

State Rank: Tall graminoid emergent marsh (S4), Northern medium sedge meadow marsh (S3), Peaty marsh (S4), Short graminoid – forb emergent marsh/mud flat (S4), Medium-depth emergent marsh (S4), Deep emergent marsh aquatic bed (S4S5), Cattail marsh (S4), Aquatic bed (S4S5), Herbaceous seepage marsh (S3), Mixed tall graminoid- scrub- shrub marsh (S4S5), High-bush blueberry – winterberry shrub thicket (S4), Buttonbush basin swamp (S4), Alder alluvial shrubland (S3), Alder - dogwood arrowwood alluvial thicket (S4), Meadowsweet alluvial thicket (S3), Alluvial mixed shrub thicket (S4), Seasonally flooded red maple swamp (S4S5), Seasonally flooded boreal swamp (SU), Meadowsweet - robust graminoid sand plain marsh (S3S4), Meadow beauty sand plain marsh (S1), Three-way sedge - manna-grass mud flat marsh (S2S3), Spike-rush- floating- leaved aquatic mud flat (S1), Sharp-flowered manna-grass shallow peat marsh (S1), Montane sandy basin marsh (S1)

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ELEMENT 1: DISTRIBUTION AND HABITAT

1.1 Habitat Description

The marsh and shrub wetland habitat described here corresponds to the emergent marsh-shrub swamp and sand plain basin marsh ecological systems described by NHNHB (NHNHB, Sperduto 2004). Emergent marsh and shrub swamp systems have a broad flood regime gradient that is often affected by the presence or abandonment of beaver (*Castor canadensis*) activity (Sperduto 2004). Generally, the trophic regime of these systems is moderately to strongly minerotrophic, with soils consisting of poorly drained decomposed muck and mineral with a pH between 5 and 6 (Sperduto 2004).

The emergent marsh-shrub system is often grouped into three broad habitat categories: wet meadows, emergent marshes, and scrub-shrub wetlands. Wet meadows often are dominated by herbaceous vegetation (especially sedges) often less than 1 m in height and saturated for long periods during the growing season, but seldom flooded (Pedevidano 1995, NHDES Wt 101.91). Because wet meadows are a subset of an overall herbaceous emergent vegetation category, they will be discussed in this profile along with marshes unless stated otherwise. NHNHB terminology will be used to describe different wet meadow communities (Sperduto 2004, Sperduto and Nichols 2004). Examples of 'wet meadow' natural communities in New Hampshire may include tall graminoid emergent marsh, northern medium sedge meadow marsh, and short graminoid-forb emergent marsh/mud flat (Sperduto and Nichols 2004). Representative wildlife that use wet meadows include ribbon snake (*Thamnophis sauritus sauritus*), sedge wren (*Cistothorus platensis*), northern harrier (*Circus cyaneus*), northern leopard frog (*Rana pipiens*), king rail (*Rallus elegans*), common moorhen (*Callinula*

chloropus), and spotted turtle (*Clemmys guttata*; Benyus 1989).

Marshes are dominated by emergent herbaceous vegetation and have a water table that is generally at or above the surface throughout the year, but can fluctuate seasonally (Pedevillano 1995, NHDES Wt101.51). Examples of marsh natural communities in New Hampshire include cattail marshes and deep-emergent marsh-aquatic beds (Sperduto and Nichols 2004). Wildlife associated with emergent marshes include Blanding's turtle (*Emydoidea blandingii*), spotted turtle (*Clemmys guttata*), pied-billed grebe (*Podilymbus podiceps*), American black duck (*Anas rubripes*), northern harrier (*Circus cyaneus*), American bittern (*Botaurus lentiginosus*), king rail (*Rallus elegans*), Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), least bittern (*Ixobrychus exilis*), common moorhen (*Callinula chloropus*), great-blue heron (*Ardea herodias*), red-winged blackbird (*Agelaius phoeniceus*), muskrat (*Ondatra zibethica*), mink (*Mustela vison*), and spring peeper (*Pseudacris crucifer*) (Benyus 1989, Pedevillano 1995).

Woody vegetation, predominantly saplings and shrubs, dominates shrub-swamps. They frequently flood in the spring or contain pockets of standing water (Pedevillano 1995). Examples of natural communities in New Hampshire include: highbush blueberry-winterberry shrub thicket, buttonbush basin swamp, and alder-dogwood-arrowwood alluvial thicket. Wildlife associated with shrub swamps includes Blanding's turtle (*Emydoidea blandingii*), spotted turtle (*Clemmys guttata*), New England cottontail (*Sylvilagus transitionalis*), Canada warbler (*Wilsonia canadensis*), American woodcock (*Philohela minor*), gray catbird (*Dumetella carolinensis*), moose (*Alces alces*), and many breeding amphibians (Benyus 1989, Pedevillano 1995).

Although no invertebrate species are discussed here specifically (see ringed boghaunter profile under Peatlands habitat), numerous groups of invertebrates use marsh and shrub wetlands for one or all life stages including but not limited to worms (e.g., leaches, flatworms, earthworms), mollusks (snails, clams, and mussels), crustaceans (e.g., scuds, decapods), mayflies, caddisflies, dragonflies and damselflies, and water beetles.

1.2 Justification

Eighteen species of conservation concern addressed in the New Hampshire Comprehensive Wildlife Strategy depend on this habitat and a number of other species use this habitat for foraging, nesting, breeding, and cover. Also, several state or federally rare natural communities are associated with this habitat (Taylor et al. 1996).

Wetlands are rich habitats that provide a number of critical functions such as flood control, pollutant filters, shoreline stabilization, sediment retention and erosion control, food web productivity, wildlife habitat, recreation, and education (Tiner 1984, North American Waterfowl Management Plan 1986, New Hampshire Office of State Planning 1989). Expenditures related to waterfowl alone generate several billion dollars annually in North America (North American Waterfowl Management Plan 1986).

Although the number of wetlands filled in New Hampshire has been small compared to the overall amount of wetlands available in the landscape, impacts to 'non-impacted' wetlands from surrounding land use is of great concern, especially in southern New Hampshire. New Hampshire's population grew by 17% between 1990 and 2004, double the rate of all other states in New England, and growth is projected to continue at a rapid rate (Society for the Protection of New Hampshire Forests 2005). Protecting landscapes with relatively undisturbed freshwater wetlands will be critical for maintaining biodiversity and ecological functions in the Northeast (Sundquist and Stevens 1999, Hunt 2005).

1.3 Protection and Regulatory Status

The following rules, regulations, and acts represent those that are most likely to affect freshwater marshes and shrub wetlands in New Hampshire. This is not intended to be a complete list of all possible regulations.

International

- North American Wetlands Conservation Act (1989): enacted to support the goals of the North American Waterfowl Management Plan of 1986.

Federal

- Clean Water Act-Section 404; administered by the USACE and USEPA: regulates discharge of dredge or fill material into “waters of the United States” including wetlands.
- Migratory Bird Treaty Act (1918)
- Migratory Bird Conservation Act (1929): authorizes federal acquisition of land for migratory waterfowl refuges.
- Emergency Wetlands Resources Act (1986): requires the Secretary of Interior (through USFWS) to produce updated reports every ten years on the status and trends of wetlands and deepwater habitats in the conterminous United States (Dahl and Johnson 1991); Section 303- requires inclusion of wetlands in statewide comprehensive outdoor recreation plans (SCORP).

State

- Fill and Dredge in Wetlands; NHDES (NHDES, RSA 482-A)- requires applicant to obtain a permit to fill or dredge jurisdictional wetland habitats. The NHDES has placed emphasis on preserving bogs and marshes based upon rarity and difficulty in restoration of value and functions (NHDES Wt 302.01). For all major (> 1,800 m²) and minor (270- 1,800 m²) impact projects, the applicant must assess impacts to plants, fish, and wildlife including rare, special concern species, state and federally listed threatened and endangered species, species at the extremities of their ranges, migratory fish and wildlife, and exemplary Natural communities identified by the NHNHB (NHDES Wt 302.04). The NHDES Wetlands Bureau does not require construction setbacks from non-tidal freshwater wetlands (except under RSA 485-A).
- Water Pollution and Waste Disposal Statute (RSA 485-A)- subsurface wastewater disposal systems must be greater than 15 m (50 ft) from poorly drained (hydric B) soils and 23 m (75 ft) from very poorly drained (hydric A) soils.
- Exotic Aquatic Weeds (RSA 487:16-a), NHDES - the sale, distribution, importa-

tion, purchase, propagation, transportation, or introduction of exotic aquatic weeds into the state is prohibited.

- New Hampshire Endangered Species Conservation Act (RSA 212-A)
- Nongame Species Management Act (1988) (RSA 212-B)—the NHFG Nongame and Endangered Species Program has responsibility and authority to conduct research, management, and education related to those species not hunted, fished, or trapped.
- Waterfowl Conservation Program (RSA 214: 1-d) - funds from the NHFG Waterfowl Conservation account may be used for the development, management, preservation, conservation, restoration, acquisition, and maintenance of migratory waterfowl habitat.
- Native Plant Protection Act (RSA 217-A); NHNHB

Local

- Designation of Prime Wetlands (RSA 482: a-15): towns may designate individual wetlands as ‘prime’ based on NHDES protocol (NHDES Wt 700). Projects located in or adjacent to designated prime wetlands under RSA 482-A:15 are considered major impact projects and require a full application to NHDES.
- Local wetland regulations and zoning vary considerably. Recommended buffer distances are summarized in Chase et al. (1995).

1.4 Population and Habitat Distribution

Emergent marsh-shrub swamp systems are widespread throughout New Hampshire (Sperduto 2004), although the White Mountain region likely has a lower density than other areas. Sand plain basin marsh systems occur mostly east-central and southern New Hampshire but may occasionally occur further north (Sperduto 2004). For the distribution of natural communities in each Ecoregion subsection, see Sperduto and Nichols (2004).

1.5 Town Distribution Map

See attached.

1.6 Habitat Map

Marsh and Shrub Wetland maps were completed by the NHNHB as part of the CWCS. Wetlands from the National Wetlands Inventory (NWI) layer were selected based on comparing vegetation classes and subclasses as well as water regimes with descriptions for the natural communities within the marsh and shrub habitat (Sperduto and Nichols 2004), as well as expert review (D. Sperduto, NHNHB, personal communication). Wetlands on tidal flat organic or peat soils, and those described as acidic, excavated, and partially drained or ditched were excluded. Individual wetlands were assigned to natural communities based on their proximity to streams, isolation, elevation, ecoregion subsections, vegetation and hydrology. Wetlands that overlapped known peatlands from NHNHB surveys were eliminated from the layer (see Peatlands Profile-Element 1.6). Various attributes (e.g., quality, protection status, size, etc.) were assigned to the completed habitat map by NHFG and NHNHB.

Limitations: NWI classifications may be erroneous, particularly in underestimating peatlands; this would result in some peatlands included in the Marsh and Shrub Wetlands map. Also, incorrect water regime classifications in the NWI layer would result in incorrect natural community predictions. Mapped wetlands need some field survey to assess the quality of natural community predictions. Digital soil data were only available for part of the state, excluding Merrimack and Belknap counties as well as the White Mountains. Thus, any elimination of wetlands using soil data did not occur in these regions, so the habitat may be overpredicted in these regions.

1.7 Sources of Information

NHNHB publications, State and Federal agency web sites, NatureServe website, textbooks and peer-reviewed literature, and GIS layers from various sources (e.g., GRANIT, Complex Systems at UNH) were used for habitat mapping.

1.8 Extent and Quality of Data

Marsh and Shrub wetlands are distributed statewide. Natural communities that make up this system often

have a more refined distribution. See mapping limitations in section 1.6.

1.9 Distribution Research

- Field-verify the prediction of mapped wetlands, especially for high priority sites and where rare natural communities may occur (e.g., meadow beauty sand plain marsh (S1), spike-rush - floating-leaved aquatic mud flat (S1), sharp-flowered manna-grass shallow peat marsh (S1), montane sandy basin marsh (S1)). Rare and at-risk wildlife should be incorporated into habitat-based inventories.
- The Marsh and Shrub Wetland mapping could be potentially improved as new and updated GIS layers become available. Periodic updating and refining of this layer will be necessary to ensure appropriate conservation actions are being taken for the highest priority wetlands and update changes to wetland communities due to natural (e.g., succession) or anthropogenic (e.g., wetland filling) causes.
- Beaver impoundments are of particular value for a variety of wildlife species. Although these habitats may be included in the mapped Marsh and Shrub wetlands, they also may be found in forested wetlands and open water habitats. Because these habitats are extremely valuable and existing layers such as NWI maps are probably insufficient, a specific effort to assess these habitats is worthwhile. Satellite imagery, color infrared aerial photographs, and other existing GIS data layers could be used to assess the current and potential (based on landscape modeling) distribution and abundance of beaver flowages in New Hampshire.

ELEMENT 2: SPECIES/HABITAT CONDITION

2.1 Scale

Mapped Marsh and Shrub Wetland polygons (see section 1.6) were combined into 'marsh complexes'. Individual marsh polygons were included in a complex if they were less than 250 m from an adjacent marsh. Marshes that were bisected by a major road (e.g., interstate, state route) were not considered part of the same complex. The condition and quality of Marsh and Shrub wetlands were assessed within these complexes based on available GIS data.

Marsh and Shrub wetlands have a statewide distribution and are relatively abundant, making it impossible to discuss each marsh complex separately. Therefore, the abundance of these habitats was summarized at a larger scale (e.g., Ecoregion subsections).

2.2 Relative Health of Populations

Marsh area (ha) was greatest in the Gulf of Maine Coastal Plain and least abundant in the Vermont Piedmont, White Mountains, and Northern Connecticut River Valley ecoregion subsections (figure 2).

2.3 Population Management Status

Waterfowl, beaver, muskrat, and other furbearers are managed by the NHFG.

2.4 Relative Quality of Habitat Patches

Because of the number and complexity of Marshes found in New Hampshire, complexes were assessed based entirely on available or easily created GIS data layers. For example, wetland size may be important for some area-sensitive birds (Hunt 2005). For amphibians, hydroperiod is an important factor influencing both species richness and abundance (Babbitt et al. 2003). Therefore, we grouped wetland complexes that had ephemeral wetlands, semipermanent and permanent wetlands, or both ephemeral and semipermanent wetlands. Because of the number of attributes assigned to polygons, individual variables will not be discussed here.

Southeastern New Hampshire is part of the middle-upper Atlantic coast waterfowl area, which stretches from South Carolina north along the Atlantic coast through Nova Scotia (North American Waterfowl Management Plan 1986). The Atlantic Coast Joint Venture, a subgroup of the North American Waterfowl Management Plan, has identified 3 waterfowl focus areas for New Hampshire: Lake Umbagog region, Great Bay area, and a 5 km area adjacent to and including the Connecticut River (North American Waterfowl Management Plan 1986). These areas are likely to be significant habitat areas for many other species as well. Wetlands associated with the Merrimack River and its tributaries are important

areas for wildlife and priority areas for future protection efforts.

2.5 Habitat Patch Protection Status

Protection status was calculated for areas within 250 m of each marsh complex statewide and summarized for each Ecoregion subsection. The total mean area protected in the buffered complexes was 13 percent \pm 27 SD (range 0-100%); mean fee ownership was 10 percent \pm 13 SD (0-100%) and land in easement was 3 percent \pm 13 SD (0-100%). Only 30 % of individual buffered complexes had greater than 5 % land area protected, 11% of complexes had greater than 50 % protected, and 8% of complexes had greater than 70% land protected statewide.

The percent protection among buffered complexes varied among ecoregion subsections (figure 3). The White Mountains subsection had the greatest percentage of buffered complex land in protection (58%); however, this subsection has the lowest percentage of overall marsh complex area (9%). Conversely, the Gulf of Maine Coastal Plain Lowland had the greatest percent of overall land consisting of marsh buffered complex (55%), but the percent in protection was low (14%).

2.6 Habitat Management Status

From 1997 to 2004, 121 ha of wetlands were created, restored, or enhanced as part of mitigation for 397 ha of wetlands impacts (S. Crystall, NHDES, personal communication). Restoration of freshwater wetlands in New Hampshire has been largely a result of wetland violation enforcements (L. Sommer, NHDES, personal communication). Most mitigation resulted from protection of uplands and wetlands through conservation easements (S. Crystall, NHDES, personal communication).

The NHFG owns and manages 19 waterfowl impoundments, and manages an additional 12 impoundments on other properties. Water control structures on each of these impoundments allow for aquatic vegetation manipulation. Most management consists of moist soil management where water is removed every 7-10 years, from approximately 20 June through mid-September with the goal to enhance the growth of aquatic plants (E. Robinson, NHFG, personal communication). In addition, some forest

management has occurred to encourage beaver occupation on state-owned properties (B. Lemire, NHFG, personal communication).

According to RSA 210:9, no person shall destroy or disturb or interfere in any manner with the dams or houses of beaver, without first obtaining a special permit from the executive director of the NHFG; an exception is allowed for the protection of property from damage or submersion. For several years, the NHFG provided technical assistance to landowners in order to maintain beaver flowages and reduce concerns over property damage, but funding for this assistance has not been available recently. A handout describing beaver control techniques (e.g., install beaver piping) is available at NHFG and the UNH Cooperative Extension.

In the coastal watershed, a management plan was completed that identified action plans for water quality, land use, habitat protection and restoration, and public outreach and education (New Hampshire Estuaries Project 2000). This management plan has set the groundwork for many of the actions that will be addressed for other habitats and areas of New Hampshire. Also, the Great Bay Resource Protection Partnership has protected 84 properties and 2,628 ha (6,494 acres) in the coastal watershed (R. Stevens, Great Bay National Estuarine Research Reserve, personal communication). Many of these protected properties provide habitat for at-risk wildlife species including Blanding's and spotted turtle and American black duck. Management plans are being developed for each of the properties.

2.7 Sources of Information

Condition of wetlands was based largely on available GIS analyses.

2.8 Extent and Quality of Data

Condition of wetlands was based largely on available GIS analyses.

2.9 Condition Assessment Research

- Conduct GIS analysis to identify quality of marsh complexes (e.g., high, moderate, low). Attributes have been assigned to marsh complexes but weighting of these variables needs

to be completed as a next step. A subset of sites that are identified as high quality should be field verified. Marsh sampling should include an assessment of habitat availability for at-risk wildlife. This work can be conducted by NHFG with assistance from other wetland and wildlife experts. Ranked marsh complexes should be incorporated into NHDES wetland permit review and mitigation prioritization and selection.

- Develop and implement a bioassessment program for freshwater wetlands in New Hampshire (e.g., King et al. 2000, D. Neils, NHDES, personal communication).

ELEMENT 3: SPECIES AND HABITAT THREAT ASSESSMENT

3.1.1 Development (Habitat Loss and Conversion)

(A) Exposure Pathway

Most wetlands are filled for residential and commercial developments, road development or maintenance, agriculture and recreation (e.g., athletic fields). Direct filling has catastrophic and immediate impacts to the wetland habitat and the species that use it. Wetland alterations that do not result in complete filling also may have substantial impacts to wetlands and associated fauna, but effects may not be detected immediately.

(B) Evidence

The loss and degradation of wetland habitats is a major threat to most groups of wildlife including waterfowl (North American Waterfowl Management Plan 1986, 2000) and other birds (Hunt 2005), and reptiles and amphibians (Mitchell 2003).

More than 50% of original wetland acreage in the United States has been lost (Dahl 1990). In New Hampshire, Dahl (1990) estimated 9% (8,000 ha) of wetlands were lost between 1780 and 1980, the lowest percent of any state in the conterminous United States. In the conterminous United States between 1986 and 1997, urban and rural development accounted for 51% of freshwater wetland losses, followed by agriculture (26%), and silviculture (23%) (Dahl 2000). For freshwater emergent wetlands

converted to uplands during 1986-1997, 51% were on agricultural lands, 22 % were lost to development, 25 % to unidentified land use manipulations, and 2 % to silviculture (Dahl 2000). Freshwater emergent wetlands declined by 4.6 % during that time (Dahl 2000). Freshwater shrub wetlands, in contrast had a 6.6 % increase in acreage over this time period, largely because of emergent marsh and forested wetland conversion (Dahl 2000). However, the interaction between emergent marsh and shrub wetlands should not be misinterpreted. There was a net loss to freshwater wetlands, and 79,600 ha of shrub wetland were converted to uplands (Dahl 2000).

NHDES currently has regulations that limit the amount of wetland filling (RSA 482-A). Wetlands impacts averaged 50 ha per year from 1997 to 2004 in New Hampshire, with a low of 22 ha in 1997 and highs of 65 (2000) and 64 ha (2004) (S. Crystall, NHDES, personal communication). Wetland types were not described in impact totals and impacts to wildlife resulting from loss of uplands were not considered. Under NHDES regulations, marshes receive some priority for protection and large marshes are not likely to be filled. However, driveway and road crossing placement in wetlands in order to gain access to developable uplands occurs frequently (M. N. Marchand, NHFG, personal observation). New Hampshire is the fastest growing state in the northeast, and future rates of development and associated wetland impacts are likely to continue (Sundquist and Stevens 1999).

Several exemptions in state regulations allow wetland habitats and associated wildlife to be disturbed. For example, NHDES does not require a permit for the “removal of a beaver dam by hand or machine provided machinery does not enter the water or create any disturbance by filling or dredging to the adjacent waters, wetlands, or their banks; all dredged materials are placed out of department jurisdiction; and removal of the dam is done in a gradual manner that does not allow a sudden release of impounded water to cause erosion or siltation.” (NHDES Wt 303.05). Also, a reduced application (Minimum impact agricultural projects) may be filed for agricultural ‘improvements’ up to 1.2 ha (3 ac) of wet meadow (NHDES Wetlands Bureau Fact Sheet WB-6). Lake drawdowns are conducted in the fall and these drawdowns leave adjacent wetlands shallow or dry during the winter months (e.g., Northwood Lake).

3.1.2 Development (Fragmentation)

(A) Exposure Pathway

Depending on the extent of fragmentation and loss or degradation of upland habitat, wildlife may be affected differently. Most species associated with wetlands use a portion of surrounding uplands for foraging, dispersing, reproduction, egg laying, resting, cover, and overwintering (Semlitsch and Bodie 2003). Extent and area of upland use can vary widely among species. Impacts to upland habitats from development can result in direct mortality of individuals, create barriers to dispersal, fragment species populations, eliminate or reduce the quality of nesting or forage habitat, and increase predation of nests or young as a result of generalist predators benefiting from an abundance of forage.

(B) Evidence

Wildlife that uses a landscape of wetland and upland mosaics are not protected adequately by existing state regulations. Although wetlands are given special attention through state permitting and this activity is warranted, upland habitats are given little consideration. NHDES site-specific permits are required when 9,290 m² (100,000 ft²) of terrain are altered, but there is currently no review for wildlife impacts, including rare or endangered species, during this process. Maintaining undisturbed terrestrial buffers around wetland habitats is critical to protecting water resources and maintaining population viability for many species (Semlitsch and Bodie 2003). For example, loss of nesting cover has contributed to long-term declines of some duck species (e.g., American black duck, North American Waterfowl Management Plan 1986). The NHFG requires at least a 91 m (300 ft) undeveloped upland buffer in areas protected for nesting waterfowl. In an analysis of appropriate buffer distances for protecting water resources in New Hampshire, Chase et al. (1995) determined that a 30 m (100 ft) vegetated buffer around wetlands is likely to protect many water resources and habitat for some wildlife species. However, many reptiles and amphibians require much larger buffers (e.g., 127-290 m) to prevent population declines (Semlitsch and Bodie 2003). Some species (e.g., Blanding’s turtle) may travel several kilometers from occupied wetlands. Therefore, a landscape-level planning effort will be required to maintain the biodiversity of New

Hampshire's landscape.

3.1.3 Introduced Species (Introduced Plants)

(A) Exposure Pathway

Invasive plants are introduced to a wetland habitat, often following disturbance or soils being exposed (Weatherbee et al. 1999). Invasive plants compete with native vegetation, often dominating areas of wetlands by forming monotypic stands. Invasive plants often are less valuable to wildlife as habitat and may decrease the aesthetic, recreational, and monetary value of New Hampshire waterbodies (Pimentel et al. 2004, NHDES Environmental Fact Sheet BB-40). Harm to native flora and fauna may vary depending on the invasive species and needs further research.

(B) Evidence

Approximately 42% of federal threatened or endangered species primarily are at risk from alien-invasive species (Pimentel et al. 2004). Examples of invasive wetland plants known to occur in New Hampshire include purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), Japanese knotweed (*Polygonum cuspidatum*), shining buckthorn (*Rhamnus frangula*), water chestnut (*Trapa natans*), variable milfoil (*Myriophyllum heterophyllum*), Eurasian milfoil (*Myriophyllum spicatum*), and fanwort (*Cabomba caroliniana*). Over 40 surface waters (not including wetlands) in New Hampshire are affected by various species of exotic aquatic plants (NHDES Watershed Bureau). Numerous additional wetlands have been invaded by purple loosestrife or Phragmites. The exotic species program within the NHDES Watershed Management Bureau has largely focused on controlling or eliminating invasive plants from surface waters. Herbicides are currently used to treat some species (e.g., milfoil) that have been in lakes and ponds. Attempts to eradicate extensive areas using chemicals are rarely effective (NHDES Watershed Bureau). However, there is considerable interest in documenting new or established invasive species among terrestrial and aquatic habitats (e.g., Invasive Plant Atlas of New England, National Invasive Species Council)

Phragmites is native to coastal marshes in New England; however, it has expanded its range and benefited from salt applications along roadways (Weatherbee et al. 1999, Richburg et al. 2001). Purple

loosestrife has been introduced to 48 states, including New Hampshire, and is tolerant of a range of environmental conditions. It forms dense stands and has no natural enemies in North America (Pimentel et al. 2004, NHDES Fact Sheet BB-45). Individual purple loosestrife plants can produce millions of long-lived and easily dispersed seeds annually, and can re-sprout from broken stems or roots (NHDES Environmental Fact Sheet BB-45). The reported ecological effects of purple loosestrife have varied (Farnsworth and Ellis 2001). For example, an experimental removal of purple loosestrife in New York resulted in reduced purple loosestrife density, but a corresponding increase in native species richness did not occur (Morrison 2002). Therefore, removal programs should clearly identify goals before initiation (Morrison 2002). Recommended criteria for physical control of purple loosestrife have been described by the NHDES Exotic Species Program (NHDES Fact Sheet BB-45). Biological control of purple loosestrife by introduced beetles (e.g., *Galerucella* spp.) has shown some promise (Malecki et al. 1993, Katovich et al. 2001, Blossey 2003). The ecological effect of non-native invertebrates introductions on wetland flora and fauna is not well known but biological control appears to have some support in New Hampshire as a substitute for chemical control (Lionel Chute, NHNHB, personal communication).

3.2 Sources of Information

Literature reviews, state and federal agency websites, fact sheets, and reports were used to assess the exposure pathway and evidence of threats to marsh and shrub wetlands in New Hampshire. GIS data layers were gathered from the Complex Systems Research Center at UNH (GRANIT), NHDES, and NH Division of Transportation to assess threats.

Initially, a list of threats was identified by NHFG and sent out for review. A group of wetland and wildlife experts met on 27 January 2005 to rank threats to Marsh and Shrub Wetlands (participants included Kim Babbitt, Kim Tuttle, Pam Hunt, Carol Foss, Chris Martin, Laura Deming, Heather Hermann, Benjamin Nugent, and Matthew Carpenter). Ranked threats were sent out for further review, comments were incorporated and ranks were adjusted based on further expert input.

3.3 Extent and Quality of Data

Some threats to marsh and shrub wetlands and the associated flora and fauna are well established (e.g., wetland filling). Other threats need further study (See Element 3.4) or regional coordination (e.g., contaminants).

3.4 Threat Assessment Research

- Support a regionally coordinated effort to assess impacts of various contaminants (including sodium chloride) on wetland habitats
- Support research that identifies effects of invasive species (e.g., purple loosestrife) on native freshwater wetland fauna and flora and monitor new invasions through coordinated efforts with local (e.g., garden clubs) and regional efforts (e.g., Invasive Plant Atlas of New England).

ELEMENT 4: CONSERVATION ACTIONS

Protecting Marsh and Shrub Wetland habitat and surrounding uplands will be the most important effort to maintain marsh dependent organisms in New Hampshire. Marsh protection strategies (e.g., land acquisition, prime wetland designation, zoning ordinances, etc.) are incorporated into the discussion of Habitat Protection under General Strategies

4.1.1 Maintain natural establishment, occupancy, and abandonment of beaver flowages in the landscape, Regulation, Habitat Protection

(A) List of Direct Threats Affected: Wetland loss

(B) Justification

- There is presently no regulation or monitoring of beaver dam removals. Any action will be an improvement over existing conditions.
- Beaver flowages are critical habitat for a number of wildlife species. Natural flood regimes have been limited by increasing development that restricts beaver activity. Existing beaver dams that maintain impoundments may be removed if on private property with no regulatory review, including if rare species

are present, because NHFG is not necessarily notified.

- Beaver flowages should be maintained at a landscape level so natural abandonment and establishment can occur. Otherwise, existing beaver impoundments will need to be maintained by human-created dams as wetlands are abandoned by beavers. Otherwise, local populations of wildlife with poor dispersing abilities may be extirpated when embedded in a developed landscape. Development must be restricted in areas with future potential to become beaver flowages.
- Wetland filling is regulated by the NHDES for developers but large wetland complexes can be drained legally with little if any review. With the rapid loss of upland habitat in southern New Hampshire, landscapes that currently have the ability to maintain beaver flowages will be fragmented or lost. Therefore, regulations pertaining to managing and regulating beaver impoundments should be reviewed within 1 year of the completion of the New Hampshire Comprehensive Wildlife Strategy.
- Most regulations can be changed, although not easily, if determined to be ineffective.

(C) Conservation Performance Objective

To reduce or eliminate the loss of wetlands resulting from beaver dam removal and to maintain landscapes where potential flooding exists for the future.

(D) Performance Monitoring

Estimate the number and area of wetlands that are lost annually from removal of beaver dams and compare to the area of wetland filled because of NHDES Wetlands Bureau Dredge and Fill permitting. Assess the number of wetlands that are maintained through beaver piping or other water control structures.

(E) Ecological Response Objective

Maintain naturally functioning wetlands and connectivity for wildlife dispersal in the landscape.

(F) Response Monitoring

It is well established that beaver impoundments are important habitats for numerous wildlife spe-

cies. Therefore, monitoring individual wetlands is not necessary. However, species-specific monitoring (e.g., Blanding's turtle, pied-billed grebe), connectivity analyses, and satellite imagery wetland change detection analyses may indicate the importance and effectiveness of actions.

(G) Implementation

- Maintaining functional beaver flowages in the New Hampshire landscape will require several more specific actions.
- Identify staff and funding needed to coordinate the following actions.
- Use landowner incentive programs (e.g., LIP) to maintain water levels (e.g., beaver piping) on existing beaver impoundments where additional flooding may cause property damage.
- Educate public about the importance of beaver impoundments for wildlife and the risk of flooding if structures are built in areas with potential to become impounded.
- Model existing and potential beaver flowages and incorporate into environmental reviews and landscape level planning done by towns and regional planners.
- Evaluate NHFG and NHDES regulations to require a review process prior to any beaver dam removal. Work with Wildlife Control Officers to ensure that maintenance of beaver impoundments is a preferred option over removal.

(H) Feasibility

Wetlands are very expensive to create and ecological success is often not obtained. Maintaining landscapes with naturally fluctuating beaver impoundments will be a cost-effective way at maintaining high-quality wetlands in New Hampshire long-term. Changing existing regulations may be somewhat challenging because of concern over landowner rights.

4.1.2 Create a list of wetland restoration sites and implement high priority projects, Restoration and Management

(A) List of Direct Threats Affected: All threats listed under Element 3

(B) Justification

Creating a list of restoration sites is the first step in prioritizing wetland restoration actions.

- Restoration sites are those that are impacted by a threat listed on the Marsh and Shrub Wetland Threat Ranking Form. Creating a list of restoration sites will not in itself reverse the threat but will provide a mechanism to select and prioritize sites for limited restoration funding. Freshwater emergent wetlands can reestablish quickly under wet conditions and can be restored with some success (Dahl 2000), especially when compared to other wetlands types such as peatlands and forested wetlands.
- Restoration will be focused on specific impaired wetlands but selection and prioritization may be embedded within 10-digit watersheds that are classified as in need of restoration (NHDES Watershed analysis).
- Restoration can address any number of threats (e.g., roads as dispersal barrier, altered hydrology, invasive plant removal). State and federal wetlands permitting currently allows and encourages wetland restoration as part of mitigation for impacts. Selecting restoration sites can be difficult and time consuming for permit applicants and actions may not result in the best ecological project.
- Restoration sites should only be considered if removal of the threat likely would result in a positive ecological response. Lists of potential restoration sites can be updated on annual or continual basis.

(C) Conservation Performance Objective

To create and prioritize a list of impaired wetlands in New Hampshire in which ecological integrity will be improved.

(D) Performance Monitoring

The number of potential restoration sites submitted per town or watershed unit will be compiled. Each potential restoration site should clearly describe how the system is being impacted and what measures can be taken to improve ecological integrity. Sites will be prioritized and a portion will receive funding. The number of restoration projects that receive funding

will be summarized per town and watershed on an annual basis.

(E) Ecological Response Objective

To improve the functioning of wetland systems by restoring impaired wetlands. Improved wetland function will vary depending on the reason a wetland is impaired or not fully functioning. Successful ecological response thresholds will be developed for each group of threat (e.g., invasive species removal, restore hydrology, etc.)

(F) Response Monitoring

Response monitoring will be site-specific and relevant to meeting the objectives. Success will be determined by monitoring positive changes to the described impairment. Funding should include a monitoring component to ensure limited funds are effectively allocated.

(G) Implementation

(See Action RST-4, RST-5, RST-6 from the 2000 NHEP Management Plan)

Compiling a list of potential wetland restoration sites will likely involve several phases. Standardized information can be gathered from locations across the state through GIS analyses, many of which will result from New Hampshire's Comprehensive Wildlife Strategy mapping. Some of these mapping efforts may involve field visits as verification (e.g., ineffective road culverts for migratory wildlife). Inventory methodology was developed in the coastal watershed (NHEP 2003). Other regional and statewide monitoring efforts should be quarried for information. For example, the Invasive Plant Atlas of New England database can be searched for invasive species locations in New Hampshire and these sites can be assessed based on degree of infestation, significance of the habitat for wildlife, and likelihood of improving ecological integrity. A second phase may involve quarrying locals for their knowledge of potential restoration sites (town conservation commissions and planning boards, land trusts, conservation groups). A list that includes both sites predicted to need some restoration activity and those identified by locals must be compiled and prioritized. Types of impaired wetlands worthy of considering restoration might include: filled, excavated, graded, ditched, and drained wetlands, reduced water quality as result of runoff or pollutants, altered hydrology,

barriers to wildlife dispersal (e.g., ineffective road culverts), and invasive species presence. Criteria for prioritizing potential sites need to be developed. If mitigation funds become available for this purpose (i.e., In-lieu wetlands mitigation, NHDES), a selection board that includes members from state agencies (e.g., NHFG, NHDES, NHNH, NHDOT) and conservation groups (e.g., The Nature Conservancy, New Hampshire Audubon) would convene as needed. Top priority restoration projects would be funded and monitored for success. This list would also be available for towns or regional conservation groups to implement local restoration.

(H) Feasibility

A list of potential restoration sites was compiled for the coastal watershed as part of the NHEP management plan (NHEP 2000, 2003). Towns with more developed and active conservation commissions and planning boards are more likely to participate than some other towns with limited personnel or experience.

4.1.3 Assess the impacts of lake, pond, and wetland water level drawdowns on at-risk wildlife and plant assemblages in New Hampshire and implement any necessary changes to procedures, Restoration and Management.

(A) List of Direct Threats Affected: Wetland loss and alteration

(B) Justification

- Threats may vary depending on species and type of drawdown. Recommended procedure changes will be designed to reduce threats.
- Recommended procedure changes will occur when ecological responses are expected and can be measured.
- Water withdrawal procedures may be adjusted in specific areas where at-risk species are known or likely to occur. General recommendations can be incorporated into withdrawals statewide.
- With the loss of rapid rate of development in southern New Hampshire and the associated loss of wetlands as wildlife habitat, it is increasingly important to incorporate at-risk

species in managed systems.

- At-risk species and specific threats can be monitored and adjusted as appropriate.

(C) Conservation Performance Objective

To improve wetland ecosystem function and viability of at-risk species by implementing appropriate changes to current water withdrawal procedures.

(D) Performance Monitoring

Identify specific locations where hydrological alterations may impact at-risk wildlife. The number of wetland and lake drawdowns can be easily tracked, as well as the number of procedure changes that occur as a result of improved coordination among agencies and interested parties.

(E) Ecological Response Objective

Maintain or enhance marsh habitat for a diversity of species, especially at-risk wildlife.

(F) Response Monitoring

Wildlife surveys could be conducted before and after drawdown activities to determine potential impacts of current procedures and monitor long-term response of wildlife or communities to changing procedures. Specific monitoring (e.g., species presence, habitat use, productivity, survivorship, behavioral response) could occur for those species of the highest conservation concern (e.g., pied-billed grebe, Blanding's turtle) or those easily surveyed. Research may be encouraged in locations where the effects of existing procedures are not known.

(G) Implementation

Review procedures for wetland and lake drawdowns and identify sites where at-risk species may occur. Existing impoundments managed by NHFG are known and species maps can be used to identify wildlife that may occur on each area. Identify existing areas where management for at-risk wildlife can be improved. Future proposed impoundments should be reviewed by the NHFG Nongame and Endangered Species Program and incorporate at-risk species management. Lake and pond annual drawdowns are identified by NHDES. The effect of these drawdowns on adjacent marsh wildlife is expected to be detrimental. Use GIS to compare known lake drawdowns and rare species occurrences. Review procedures and justifications for

drawdowns and identify areas for enhanced wildlife habitat.

Specific recommendations to consider might include: avoiding late fall drawdowns to prevent mortality of hibernating amphibians and reptiles, conducting drawdowns gradually to allow wildlife to disperse, maintain channels to adjacent wetlands to facilitate safe dispersal of threatened turtles and other wildlife (Hall and Cuthbert 2004), and ensure that water levels and timing are sufficient for at-risk birds that may be nesting at specific sites (e.g., pied-billed grebe).

(H) Feasibility

Altering existing drawdown schedules for lakes and ponds may be challenging in some cases due to local support for the action. Incorporating biodiversity considerations into state-managed impoundments should be possible in most cases, especially where waterfowl considerations are maintained. Future proposed drawdowns should be carefully evaluated by NHDES and NHFG for potential impacts to at-risk wildlife or system functions.

4.2 Conservation Action Research

- Restoration efforts will be prioritized according to likelihood of success. Degree of success will be incorporated in Ecological Response Monitoring.
- Model existing and landscapes where beaver flowages are likely in the future.

ELEMENT 5: REFERENCES

5.1 Literature

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250 m marsh buffer (hatched bars) and the percent of each buffered marsh complex that was protected by fee acquisition or easement for each ecoregion subsection (solid bars).

5.2 Data Sources:

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ELEMENT 6: LIST OF FIGURES

Figure 1. Marsh & Shrub Wetlands are distributed throughout New Hampshire. For the distribution of natural communities in each Ecoregion subsection, see Sperduto and Nichols (2004).

Figure 2. Area (ha) of marsh, shrub, and mixed (marsh and shrub) wetland habitats in each Ecoregion subsection of New Hampshire, USA.

Figure 3. Percent of each ecoregion subsection area in New Hampshire that was mapped as a marsh or

Distribution of Marsh & Shrub Wetlands in New Hampshire

Distribution
■ Known



0 10 20 40 Miles

