

native species. Thus, shifts to invasive species dominance may alter wildlife habitat by eliminating native foods, altering physical structure of an area, and destroying bird nesting opportunities.

Invasive species are considered the second greatest threat to worldwide biodiversity after habitat loss (Marden, 2011). Most invasive plants in the U.S. were deliberately introduced. It is humans' decisions regarding species introductions and land use that led to the spread of these species. Conservation biologist Michael Klemens coined the term "subsidized species" to characterize invasive species that have attained population levels that have adverse effects on ecosystem function and human activities.

Considering the wealth and breadth of ecologically and historically significant features and recreational opportunities in Rye, invasive species management is worthwhile as it provides a suite of benefits, including the restoration of native land cover types, the improvement of recreational opportunities for town residents and visitors, and the improvement of access to historically significant sites.

Invasive species pose a considerable threat in Rye. Species with the greatest threat to wetlands include purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*). These two plants are known to spread rapidly, forming monocultures that outcompete native wetland species in a relatively short time. Best management practices require multiple approaches including inventory and mapping, control at ecologically important or vulnerable sites, local policy, and regional partnerships. Best management practices have been employed with the Rye Conservation Commission partnering with Rockingham County Conservation District on a multi-year invasive species treatment program in several sites including Awcomin and Wallis Marshes and the Town Forest.

Several non-native, invasive insect species are known to occur in New Hampshire including the emerald ash borer (*Agrilus planipennis*), hemlock wooly adelgid (*Adelges tsugae*), red pine and elongate hemlock scales (*Matsucoccus resinosae*, *Fiorinia externa*), winter moth (*Operophtera brumata*), and balsam wooly adelgid (*Adelges piceae*). Of these, only the emerald ash borer, hemlock wooly adelgid, and elongate hemlock scale have been documented in Rye. For more information on non-native, invasive insects, visit the NH Bugs website at <https://nhbugs.org/>.

3.5 WILDLIFE CONSERVATION PRIORITY AREAS

Areas of the town with the highest natural resource values were identified by the NHFGD through the 2020 Wildlife Action Plan. As mentioned above, areas of highest ranked habitat in both New Hampshire and in the biological region as well as their supporting landscapes have been identified as priority areas for wildlife conservation, using a co-occurrence model developed by the New Hampshire Fish and Game Department. These rankings were developed through a co-occurrence analysis by overlaying raster images in GIS. The raster images used in the co-occurrence analysis consisted of the town as a surface divided into a regular grid of cells. For each raster (e.g., wetlands, agricultural soil), each cell containing a given natural resource feature was assigned a value of one. Individual raster layers were then overlaid on top of one another to determine which areas of the town support the greatest number of significant natural resources. NHFGD has since replaced this original co-occurrence model with the New Hampshire Wildlife Action Plan Habitat Ranks (discussed in Section 3.2).

The 2020 WAP identified a total of 2,495 acres (29% of the town) as highest ranked habitat in New Hampshire. An additional 562 acres (7%) are identified as highest ranked habitat in the

biological region. Lastly, 1,680 acres (20%) are identified as supporting landscapes. The Nature Conservancy has studied wildlife action plans, regional conservation plans, state conservation plans, and spatial models to develop the Connect THE Coast publication and associated documents. Through this initiative, wildlife corridors have been identified which connect lands with important wildlife habitat features. If protected, these corridors will help wildlife move across the landscape through unfragmented areas.

Connect THE Coast has also identified blocks of prioritized habitat that represent where conservation efforts should be focused for the largest wildlife habitat benefit (Appendix A, [Map 9](#)). There are six blocks of prioritized habitat within Rye, all of which encompass priority ranked habitats and supporting landscapes from the WAP.

Bailey Brook: 577 acres in the southern portion of Rye between Grove Road, West Road, Central Road, and South Road.

Seavey Creek/ Fairhill Swamp/ Wallis Marsh: 873 acres extending from Odiorne Point State Park south to Washington Road while staying east of Brackett Road.

Lower Berry's Brook: 253 acres located between Upper Berry's Brook North and Seavey Creek/ Fairhill Swamp/ Wallis Marsh.

Packer Bog/Upper Berry's Brook South: 594 acres located in the most southeastern part of Rye, north of Washington Road and west of Lang Road.

Upper Berry's Brook North: 365 acres located west of Sagamore Road and Wallis Road.

Awcomin Marsh: 822 acres located in the drainage area to Rye Harbor and extends north to Washington Road, south to Cable Road, and west to Central Road.



3.6 WILDLIFE AND HABITAT THREATS AND RECOMMENDATIONS FOR ACTION

Rye faces a challenge of how to best balance prudent economic growth, land ownership, and responsible stewardship of its natural resources while accounting for climate change. A healthy functioning environment is often placed in opposition to economic growth and human quality of life. Clean air, clean water, and ecosystem services provided by natural systems are essential to maintaining a high quality of human life. If communities can disregard the oppositional model of environmental conservation vs. human progress, they can begin to have a broader discussion on how to achieve both (Klemens, Davison, & Oko, 2012).

3.6.1 CONSIDERATIONS AND CAVEATS

Priority conservation areas are not being mapped solely for land preservation— Preservation of entire Conservation Priority Areas is not feasible, nor do we recommend it. Much of the mapped areas are privately-owned lands that contribute, through taxes, to the economic stability of the town. Rather, a balanced approach to conservation and development which incorporates a suite of land use planning and conservation tools is recommended.

Development and other land-use activities outside of the Conservation Priority Areas need to remain mindful of environmental and land use issues— Regardless of location, all development proposals should receive careful review and consideration of potential environmental impacts and where they are positioned within Rye’s landscape.

Conservation opportunities may occur outside of the Priority Conservation Areas— Small or isolated areas outside of the Conservation Priority Areas may contain previously unknown significant species or natural communities that have high conservation value.

3.6.2 THREATS AND RECOMMENDATIONS FOR ACTION

Prime Wetlands: Rye is among the 33 towns in New Hampshire that have designated prime wetlands. Prime Wetland designation provides a means by which towns can provide additional protection to wetlands that are particularly unique or sensitive to disturbance by restricting construction or earthwork in or within 100 feet of these resources. While prime designation does offer additional protection to a subset of wetlands within the town, the Conservation Commission may wish to first spearhead a town-wide inventory of vernal pools (see following section). Information obtained during the vernal pool inventory may be useful for the Prime Wetland designation process should the town wish to pursue it in the future.

Vernal Pools: New Hampshire’s Nongame and Endangered Wildlife Program within NHFGD encourages citizens to document the locations of vernal pools using a downloadable form and/or through their New Hampshire Wildlife Sightings website, a web tool for reporting wildlife observations throughout the state. More information regarding documenting and reporting New Hampshire Vernal Pools can be found in the NHFGD report, “Identifying and Documenting Vernal Pools in New Hampshire” (Marchand, 2016).

Though NHFGD likely has some vernal pool information for Rye, it is recommended that vernal pools be formally documented throughout the entire town. Hiring consultants to document pools throughout the entire town would be unnecessary and not cost-effective. Instead, the work could be carried out by trained citizen scientists, as has been accomplished in numerous towns in Maine through the Maine Municipal Vernal Pool Mapping Project. In addition to the financial advantages

of using volunteers, engaging local citizens also increases awareness of natural resources, instills a sense of place and community pride, and encourages local control over quality of life through participation in planning for the future (Morgan & Calhoun, 2012). More information regarding the use of citizen scientists to map vernal pools can be found in the Morgan and Calhoun's (2012) *Maine Municipal Guide to Mapping and Conserving Vernal Pool Resources*. The authors mention that while the focus of their publication is to provide guidance to Maine municipalities, their methodology is appropriate for any region interested in local, collaborative conservation planning and is applicable at a variety of scales.

Lastly, Morgan and Calhoun (2012) mention that interpretation of aerial photography is the best available method for remotely identifying potential vernal pools at the municipal scale. While aerial imagery is the “gold standard,” the use of LiDAR data is becoming increasingly common. LiDAR is a form of remote sensing that uses laser light pulses to help reveal highly detailed information about a landscape. While interpretation of aerial imagery involves the use of paired 9 x 9-inch stereo contact prints viewed under a mirror stereoscope or viewing digitized images in 3-D on a specialized computer screen, LiDAR requires the use of sophisticated computer modeling. Sean MacFaden of the University of Vermont Spatial Analysis Lab has developed a very accurate method of remotely sensing vernal pools with LiDAR data using Object-based Image Analysis and eCognition software.

Peatlands: Threats to peatland habitats are development, altered hydrology (amount and flow of water), and unsustainable forest harvesting. NPS pollutants, such as road salt, lawn fertilizers, and pesticides, also threaten this habitat by altering the acidity and nutrient concentrations. Establishing vegetated buffers around this habitat is one conservation strategy that will help minimize the threats to peatland habitats by slowing stormwater runoff, promoting groundwater recharge, and filtering nutrients and sediment from runoff.

Salt Marshes: By building up more peat, salt marshes can gain elevation and even keep pace with rising sea level, unless the rate of sea-level rise becomes too great. An estimated 30-50% of New Hampshire's original salt marsh habitat has been lost to development. Mosquito control efforts have also sometimes resulted in negative impacts to salt marshes through poorly designed drainage ditches or other attempts to drain marshes (Rye Conservation Commission, 2017). Effective conservation strategies for salt marshes include restoring and protecting the remaining salt marsh habitat and the surrounding upland buffer habitat.

Coastal Habitats: As beachgoers, we can all help by staying off dune habitats and obeying restricted area signs and fences. Habitat protection, education, and enforcing laws and regulations are a few of the conservation strategies for dunes.

Inland Habitats: Inputs of sediment, pesticides, and fertilizers are sources of pollution that threaten temperate swamp habitats. Actions to conserve temperate swamps include supporting the Division of Forests and Lands in the implementation of the hemlock woolly adelgid action plan and working with foresters to use Best Management Practices outlined in the document “Good Forestry in the Granite State.”

Incorporating habitat conservation into local land use planning, protecting unfragmented blocks, and adopting sustainable forestry are a few examples of conservation strategies for Appalachian Oak-Pine forests.

Invasive Plant Species: Many resources currently exist for the maintenance and eradication of common invasive species found in New Hampshire’s coastal communities. The Rockingham County Conservation District (RCCD) has developed and implemented a *Phragmites* control program and created management practices for Japanese knotweed and glossy buckthorn removal (Rockingham County Conservation District, n.d.). The Odiorne Point State Park Invasive Plant Management Plan is another invaluable resource which presents management strategies that can be applied throughout Rye (FB Environmental, 2010).

Promote the use of native plant species in Rye. Review of development proposals should include the promotion of native plantings in landscaping plans. Public education and outreach about invasive species through garden clubs and other civic groups is another effective strategy.

Improve habitat diversity through land management. Reducing lawns and mowing of fields, planting of field edges with trees and shrubs with deep strong roots, and creating small forest openings all provide opportunities for increasing biodiversity on small as well as large parcels.

